OPERATIONAL STRUCTURES FORMING COMPLEX FEEDBACK LOOPS IN
HEALTH SYSTEM / ACCOUNTABLE CARE PARTNERSHIPS –
A MULTIPLE-CASE STUDY INVESTIGATION TO ENABLE
SYSTEM DYNAMICS SIMULATION

By
Richard J. Pro

Dissertation
Submitted in Partial Fulfillment
Of the Requirements for the Degree of
Doctor of Business Administration

Liberty University, School of Business
May 2022
Abstract
The Patient Protection and Affordable Care Act of 2010 introduced accountable care organizations as a critical component in the transformation of the United States healthcare industry to a value-based care model. It also triggered an ongoing series of health system consolidations consistent with the theory of transaction cost economics. Consolidations included the alignment of health systems with accountable care organizations despite the assertions of some researchers that competing economic models rendered such partnerships financially unviable. The academic literature is silent on this issue, without any published studies of the effects of health system / accountable care organization interactions. The purpose of this qualitative study was to document the nature of health system / accountable care organization interactions to support the future construction of a system dynamics model. The research uncovered five themes demonstrating the absence of consideration for the effects of inter-organizational interactions among healthcare expert participants due to a lack of awareness of the presence of feedback loops and nonlinearity. The results of the research study demonstrated for the first time the presence of feedback loops in health system / accountable care organization interactions, the necessary presence of nonlinear behaviors governing those interactions, and the requirement to employ system dynamics models to accurately project future firm performance in health system / accountable care organization partnerships.

Keywords: Accountable care organization, causal links, complex systems, complexity, feedback loop, health system, nonlinearity, system dynamics modeling
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Dedication

First, and foremost, I dedicate this dissertation to my wife, Jennifer Pro, and daughters Angela, Christina, Alyssa, Isabella, and Gianna. Each has endured many sacrifices of time and attention throughout my professional and academic careers. Yet, each understood my drive to rise above my humble origins to be all that I could be. I pray that I set an example for them to do the same. Each bore their sacrifices with grace and good humor, releasing me from the guilt that I surely would have felt otherwise. Isabella and Gianna experienced the sacrifices associated with this dissertation most directly. It is my hope that my dedication to this achievement later in my life will serve as an inspiration for lifelong learning as they work toward achieving their dreams.

There is no question that I would not have returned to school and completed the rigors of a doctoral degree without the boundless love, encouragement, and support of my wife, Jennifer. I cannot overstate the importance of your contribution to this work. At times, you took on the role of mother and father so that I could make progress in my studies and research. You reminded me of what this goal means to me when long days, long nights, and lack of sleep clouded my thinking. More than all else, it was you that helped me to overcome all doubts and fears that stood in the way of achieving this lifelong goal. For that, you have my undying love and appreciation.

Finally, to panic disorder, my relentless adversary for thirty-six years…I won.
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Many family members, friends, and colleagues deserve recognition for their contributions to this work. If I overlooked your name for the sake of limited space, please know that I know who you are, you are appreciated, and I am in your debt.

I want to thank my dissertation chair, Dr. Terrence Duncan, and dissertation committee member, Dr. Renita Ellis, for their devotion to ensuring that my dissertation rose to the high academic standards expected at the doctoral level. I also want to acknowledge their collegiality and thoughtfulness throughout the review and editing processes.

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Section 1: Foundation of the Study

Introduction to the Study

The dissertation research project had the goal of deriving the major structural components necessary to construct a health system / accountable care organization (ACO) dynamic simulation model. Whether in a contractually defined strategic partnership or engaged in a joint ownership model, the complexities of health systems and ACOs each meet the requirements of a complex, dynamic system (Cassidy et al., 2019; Chang et al., 2017; Ganzarain et al., 2019; Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015). The added complexity of potential feedback loops associated with health system / ACO interactions makes it necessary to create a system dynamics model to accurately simulate the effects of changes in organizational strategy on operating margin (Cassidy et al., 2019; Chang et al., 2017; Cosenz & Noto, 2016; de Gooyert, 2019).

Prior to this research study there was a lack of research regarding the dynamic modeling of health system / ACO interactions (Cassidy et al., 2019). The research study used a multiple case study design to collect qualitative and quantitative data from a panel of subject matter experts from health systems and ACOs regarding critical operational and financial structures affected by health system / ACO interactions. The researcher analyzed the data qualitatively and quantitatively. The purpose of the analysis was to determine the structural components that subject matter experts identify as necessary in a system dynamics model of interactions across the health system / ACO boundary.

Background of the Problem

For decades, the United States faced a “health care paradox” (Bradley et al., 2017, p. 61). The United States spent 17.8% of its gross domestic product (GDP) on healthcare services in
The United States Centers for Medicare and Medicaid Services estimated that healthcare expenditures would reach $6.2 trillion by 2018 (National health expenditure projections 2019-2028: Forecast summary, 2019). This spending level represents the highest per capita spending on healthcare among industrialized countries (Baicker & Chandra, 2018; Penn & Chi, 2018). However, despite spending more on healthcare than other industrialized nations, the United States ranked among the worst in terms of healthcare outcomes for many conditions, including average life expectancy, infant mortality, heart disease, obesity and diabetes (Baicker & Chandra, 2018; Bradley et al., 2017; Penn & Chi, 2018).

Publication of the seminal report Crossing the Quality Chasm: A New Health System for the 21st Century in 2001, which quantified and drew attention to the quality crisis in U.S. healthcare, marked the beginning of significant healthcare reform efforts in the United States (Committee on Quality of Health Care in America, 2001). Subsequently, Berwick et al. (2008) articulated a new strategic goal for U.S. healthcare—the achievement of the so-called triple aim. The triple aim concept stated that the U.S. healthcare system should undergo reform that results in the simultaneous achievement of cost reduction, quality improvement, and increased access to care for all (Berwick et al., 2008). Michael Porter, an esteemed professor of strategy at Harvard University, united these concepts under the banner of value-based care, which outlined disruptive changes needed in the U.S. healthcare system to achieve the triple aim (Porter, 2009; Porter & Teisberg, 2006). Together, these works led to the passage of the Patient Protection and Affordable Care Act of 2010 (ACA) to reform the U.S. healthcare system (Collins & Saylor, 2018; Obama, 2016).

The ACA introduced the concept of the accountable care organization (ACO), intended to be the critical, disruptive entity needed to achieve the triple aim and return U.S. healthcare to
financial sustainability; the final rule for ACOs followed in 2011 (Berwick, 2011). The ACO model enables organizations to receive financial incentives, or shared savings, by demonstrating success in containing healthcare costs while increasing access to high-quality care (Collins & Saylor, 2018; Gray, 2017; Hillary et al., 2016; Lewis, Tierney, et al., 2017). The ACA did not, however, stipulate organizational or ownership structures for ACOs; instead, the ACA allowed flexibility to encourage innovation in ACO models (Comfort et al., 2018). In the decade since the passage of the ACA, firms adopted many different ACO ownership and partnership models, with most models involving physician ownership, hospital ownership, or health system ownership (Comfort et al., 2018; Lewis et al., 2018). Financial performance varied among ownership and partnership models, with health system owned ACOs generally achieving substantially lower gains than other models (Lewis, Fisher, & Colla, 2017). Blackstone and Fuhr (2016) asserted that health system ownership of an ACO creates a conflict between competing business models. Blackstone and Fuhr (2016) cited as a source of conflict that ACOs seek to reduce the hospital-based services that produce health system margin. This organizational complexity renders leaders unable to quantify a strategic partnership’s effects without the aid of business simulation models (Cosenz & Noto, 2016; Freebairn et al., 2016; Greenhalgh & Papoutsi, 2018; Monauni, 2017).

Among the business challenges for health system owned ACOs is the complexity of estimating the financial impact of strategic decisions on the joint business entity, as confirmed in this study. This challenge arises from the interactions between the ACO and health system under a single parent owner; some interactions benefit both business models, while others benefit one at the expense of the other. Sterman (2000) outlined difficulties of this type in his seminal book on system dynamics modeling theory and technique, *Business Dynamics: Systems Thinking and*
Modeling for a Complex World. Both health systems and ACOs satisfy Sterman’s (2000) definition of complex, dynamic systems. The fact that two complex systems also interact through feedback loops that link business models adds complexity (Sterman, 2000). In the case of a health system-owned ACO, feedback loops form because health systems earn most income by treating patients in health system facilities (Feldstein, 2015; Sloan & Hsieh, 2016) and ACOs earn most income by keeping patients out of hospitals. The ACOs reduce healthcare costs for health insurance payers with which they contract, reducing health system revenue (Blackstone & Fuhr, 2016; Vogus & Singer, 2016). Cosenz and Noto (2016), in a literature review of the application of system dynamics modeling to strategic management problems, noted that failure to account for the nonlinear effects of dynamic complexity is a fundamental problem preventing effective strategic decision-making in complex, multi-component businesses.

Cosenz and Noto (2016) examined the application of system dynamics to strategic management problems across industries. Cassidy et al. (2019) conducted a systematic review of system dynamics and agent-based modeling methods in healthcare. While both literature reviews uncovered the application of dynamic modeling methods to problems faced by either health systems or ACOs, neither paper uncovered models of the dynamic effects between ACOs and health systems (Cassidy et al., 2019; Cosenz & Noto, 2016). Thus, no mathematical model based on dynamic modeling methods currently exists for health system leaders to use to inform strategic decisions involving owned or partner ACOs.

Crown et al. (2017) asserted that such a mathematical model must reasonably represent reality to create value. Recent systematic literature reviews also failed to uncover research identifying those components of either health system or ACO business models believed by subject matter experts to cause feedback behaviors (Cassidy et al., 2019; Cosenz & Noto, 2016).
Therefore, a gap exists in the knowledge necessary to build a dynamic model that one may rely on as accurately representing reality.

This dissertation research sought to understand the health system / ACO interaction knowledge gap so that health system leaders can begin to simulate the effects of feedback loops on financial performance. Cosenz and Noto (2016) suggested that group model building (GMB) is the most effective approach to identifying the critical components to build into system dynamics models. This paper presents research exploring the basis for an accurate health system / ACO dynamic simulation model by articulating, through the engagement of subject matter experts in group model building, the critical health system / ACO interactions believed to create nonlinear feedback behaviors.

**Problem Statement**

The general problem to address is the inability of health system (HS) managers to model the effects that accountable care organization (ACO) subsidiary strategy has on combined health system / ACO margin, resulting in subjective assumptions about how ACO strategy impacts combined health / ACO financial viability. The Accountable Care Act of 2010 established ACOs as the primary structure to reduce healthcare costs while increasing the quality of care (Collins & Saylor, 2018; Lewis, Tierney, et al., 2017). As of 2018, more than 923 ACOs existed in the United States, with 561 Medicare Shared Savings Program (MSSP) ACOs generating $131 million in annual cost savings across 23 million insured individuals (Comfort et al., 2018; Lewis, Fisher, & Colla., 2017; Trombley et al., 2019). Only 30% of health system owned ACOs qualified for shared savings payments annually from 2015 to 2017 compared to 50% in other ownership models. Blackstone and Fuhr (2016) asserted that health system owned ACOs suffer a fundamental strategic disadvantage because of competing, internal business models. No research
exists in the literature to guide the construction of dynamic models that test the effects of business model conflicts (feedback) on health system owned ACO financial success (Cassidy et al., 2019). The specific problem to address is the inability of managers in a health system in the southeastern United States to model the effects that ACO subsidiary strategy has on combined health system / ACO margin, resulting in subjective assumptions about how changes in ACO strategy will impact combined health system/ACO financial viability.

**Purpose Statement**

The purpose of this qualitative multiple case study was to engage subject matter experts from affiliated health systems and ACOs in semi-structured interviews and Likert scale-based surveys to determine the operational structures through which health systems and ACOs interact. The selection of ACOs was from among the largest systems in the southeastern United States. The purpose of this study contributes to the body of knowledge by seeking to understand those operational functions present in health system and ACO organizations that researchers must include in dynamic simulation models to create a robust representation of health system / ACO interactions. Exploring interactive business functions that form feedback loops positions future researchers to leverage the results of this qualitative case study to inform the construction of system dynamics models. In turn, system dynamics models will allow leaders to quantitatively explore nonlinear impacts on health system / ACO joint operating margin, closing the research gap identified by Cassidy et al. (2019).

**Research Questions**

The specific problem statement addresses the inability of health system managers to model the effects of ACO strategy on combined health system / ACO margin. The result of this problem is that leaders must make subjective assumptions about the ultimate effect of strategic
decisions on joint margin. The subjectivity of assumptions, and the associated uncertainty of effects on margin, creates concerns about financial viability for the joint entity, which some authors suggested results in a business model with conflicting interests (Blackstone & Fuhr, 2016). Following are the research questions relevant to the study of this specific problem.

RQ1. What do health system and ACO managers believe are the feedback loops that exist in a health system / ACO partnership model and that affect joint margin?

RQ2. Which ACO strategic operational variable changes do health system and ACO leaders believe create nonlinear changes in health system or ACO margin?

RQ3. What are the factors that health system and ACO managers would quantitatively model to reduce uncertainty about health system or ACO financial viability in a health system / ACO partnership model?

Research questions 1, 2, and 3 bring focus to the identification of specific operational components that health system and ACO leaders deem as critical for inclusion in a system dynamics model of health system / ACO interactions. Specifically, RQ1 sought to identify those interactions between health system and ACO operations that subject matter experts believed link the organizations through feedback loops. The RQ2 sought to differentiate between interactions that health system and ACO leaders subjectively believed lead to linear and nonlinear effects on joint health system / ACO operating margin, respectively.

Marshall, Burgos-Liz, Ijzerman, Crown et al. (2015) noted that strategic decisions in health systems often result in unanticipated outcomes due to failure to account for complex interactions and nonlinear responses. The authors credited nonlinearity with the result that the behavior of multi-component systems is often different than the sum of the behavior of its individual parts (Marshall, Burgos-Liz, Ijzerman, Osgood et al., 2015). As a result, it was
important to determine, through RQ2, which factors in a mathematical model of an organization lead to nonlinear behaviors, which is the ultimate goal of system dynamics modeling (Marshall, Burgos-Liz, Ijzerman, Crown et al., 2015). The authors contended that nonlinear behaviors are the result of feedback loops between the components of an organization and, therefore, that system dynamics modeling is the appropriate dynamic modeling methodology to simulate such organizations (Marshall, Burgos-Liz, Ijzerman, Crown et al., 2015).

The ACOs frequently partner with other types of healthcare organizations, including health systems, on the theory that joint operations bring complementary capabilities that improve financial performance (Lewis, Tierney et al., 2017). While Lewis, Fisher, and Colla (2017) asserted that such partnerships result in improved financial performance, Blackstone and Fuhr (2016) contended that inherent business model conflicts place limits on the ability of integrated health system / ACO organizations to achieve financial success. Cassidy et al. (2019) demonstrated a lack of research applying dynamic modeling to identify nonlinear behaviors in health system / ACO partnerships, so that available research does not provide insight into those variables associated with nonlinear behavior.

Crown et al. (2017) summarized the challenge of building a meaningful model of a health system / ACO system when asserting that a mathematical model must reasonably represent reality. To build such dynamic mathematical models, Cosenz and Noto (2016) suggested that group model building (GMB) is the most effective approach to identifying the critical components to build into system dynamics models, as discussed further in the methodology section, below. The RQ3 sought, through the GMB process, to understand those variables that subject matter experts believed have the greatest direct bearing on financial performance and to
determine whether the variables are associated with feedback loops identified through RQ1 and RQ2.

**Nature of the Study**

The purpose of this qualitative multiple case study was to engage subject matter experts from affiliated health systems and ACOs, selected from among the largest systems in the southeastern United States, in semi-structured interviews and Likert scale-based surveys to determine the operational structures through which health systems and ACOs interact. Derivation of this information fills a gap in the literature regarding the interactions between health systems and ACOs that form the feedback loops found in a robust system dynamics model of such systems. Knowledge of the source(s) of feedback loops will enable the creation of a system dynamics model capable of simulating health system / ACO interactions under varying strategic conditions. The formulation of this work followed Cosenz and Noto (2016) and Shannon-Baker (2016), who asserted that, before one can construct a robust system dynamics model, one must first engage subject matter experts to determine the feedback mechanisms that exist within a given system, a concept known as group model building.

To achieve its purpose, the research employed a flexible, qualitative research method in a pragmatic research paradigm, emphasizing the identification of a solution to a real-world problem that exists in health system / ACO interactions (Creswell & Poth, 2018; Davies & Fisher, 2018). According to Creswell and Poth (2018), qualitative research facilitates a detailed description of complex problems by eliciting the feedback of subject matter experts. Given variations in possible health system / ACO business models, the researcher queried health system and ACO leaders from multiple systems, each with its own structure and dynamics, to identify common themes regarding health system / ACO feedback loops independent of partnership
structure. Hence, this research represents a multiple case study design using semi-structured interviews with thematic coding and triangulation based on quantitative analysis of Likert scale survey data (Creswell & Poth, 2018; Pope & Mays, 2020).

**Review of Research Paradigms**

The selection of a research paradigm clarifies the researcher's beliefs about the world and how to interpret observations of phenomena subject to study (Creswell & Poth, 2018; Halcomb, 2018; Shannon-Baker, 2016). The chosen research paradigm represents the researcher’s beliefs about what is essential to understand and what represents truth and knowledge in the observed phenomenon's context (Creswell & Poth, 2018; Davies & Fisher, 2018). Such beliefs consequently influence the research questions of interest to the researcher and the methods and designs to answer those questions (Shannon-Baker, 2016). Multiple research paradigms exist, and a summary of five of the most commonly used paradigms (Creswell & Poth, 2018; Davies & Fisher, 2018; Shannon-Baker, 2016) appears below.

**Positivist.** The positivist research paradigm reflects the researcher’s assumption that a single, immutable truth exists regarding the answer to a research question (Creswell & Poth, 2018; Davies & Fisher, 2018). For this reason, positivism has been the preferred research paradigm in the physical sciences, where researchers seek to understand the fundamental laws of nature (Creswell & Poth, 2018; Davies & Fisher, 2018). Positivism demands that the researcher detaches from the research to maintain absolute objectivity in interpreting results to the extent that is humanly possible (Davies & Fisher, 2018). The positivist paradigm is well-suited to experimental designs intended to collect quantitative data subject to statistical analysis (Davies & Fisher, 2018). Researchers use deductive reasoning to answer research questions, through hypothesis testing, based on the quantitative analysis of data (Creswell & Poth, 2018). Critics of
positivism argue that one cannot achieve absolute objectivity in interpreting data due to inherent biases present in human nature (Creswell & Poth, 2018).

**Post-positivist.** The post-positivist research paradigm recognizes that researchers carry biases based on lived experience and personal beliefs (Creswell & Poth, 2018; Davies & Fisher, 2018). Because of inherent human biases, researchers can only claim to know a single, immutable truth within the limits of a certain degree of uncertainty (Creswell & Poth, 2018; Davies & Fisher, 2018). For this reason, the post-positivist paradigm is known as a realist paradigm (Creswell & Poth, 2018). After adopting a post-positivist paradigm, which assumes that absolute truth is unachievable, researchers attempt to minimize the results’ uncertainty. Researchers may reduce uncertainty using multiple data sources or multiple experimental designs to triangulate results (Davies & Fisher, 2018). Despite the recognition of potential biases inherent in the researcher, the post-positivist paradigm faces criticism for its adherence to the need for carefully controlled experiments, rendering it unsuitable for most social science research that occurs under real-world rather than laboratory conditions (Creswell & Poth, 2018).

**Constructivist.** The constructivist paradigm deviates from the positivist and post-positivist paradigms. It rejects the notion of a single, immutable truth or natural law and adopts the perspective that reality forms as people interact with other people (Robson & McCartan, 2016). Therefore, perceptions of reality may change as people continue to interact and develop new lived experience (Robson & McCartan, 2016). People may also experience a different reality due to differences in perceptions (Shannon-Baker, 2016). The need to capture variations in human perceptions leads researchers to use qualitative data collection techniques such as interviews. Quantitative analysis of data gives way to or complements qualitative analysis techniques such as thematic coding (Creswell & Poth, 2018; Shannon-Baker, 2016). Data
collection and analysis that fails to achieve saturation or the capture of all varying viewpoints will lead to an incomplete, or potentially incorrect, interpretation of the answer to a research question. Constructivism also recognizes the researcher’s potential biases concerning the topic under investigation, which is why the researcher needs to disclose biases they are aware of (Creswell & Poth, 2018). Questions of saturation and bias challenge the rigor and validity of constructivist research and are potential pitfalls in using the constructivist paradigm (Anderson, 2017).

**Critical.** The critical research paradigm carries a social transformation agenda that advocates for reforms that improve the lives of marginalized people (Creswell & Poth, 2018). Researchers that adopt a critical research paradigm believe that the circumstances in which people live influence the knowledge they have about the world and how relationships occur in the world (Creswell & Poth, 2018). The goal of transforming marginalized people’s lives through a research-based agenda gives rise to the critical research paradigm’s recognition as an emancipation paradigm (Shannon-Baker, 2016). Through their beliefs, the researcher assumes the existence of underlying social structures that result in social injustice or inequity (Creswell & Poth, 2018). Therefore, adopting a transformative research paradigm is most appropriate when addressing research problems focused on marginalized groups’ needs or experiences (Creswell & Poth, 2018; Shannon-Baker, 2016). Subcategories of critical theory focus on specific marginalized groups such as queer theory, feminist theory, disability theory, or critical race theory (Creswell & Poth, 2018).

**Pragmatic.** The pragmatic research paradigm focuses on the need to solve real-world problems and leaves open the use of one or more data collection methods and data analysis techniques to achieve this goal (Creswell & Poth, 2018). By allowing the possibility of mixing
data collection methods and data analysis techniques, pragmatism rejects the narrower constructs associated with the choice of methods and designs associated with other research paradigms (Davies & Fisher, 2018). Davies and Fisher (2018) characterized this approach as moving away from a debate over the philosophical underpinnings of other research paradigms and replacing it with a focus on using whatever means necessary to arrive at a solution that works to solve a real-world problem. By adopting this position, researchers that choose a pragmatic research paradigm may use quantitative, qualitative, or mixed methods to address research questions (Creswell & Poth, 2018; Davies & Fisher, 2018). Researchers with positivist or post-positivist leanings may criticize the pragmatic research paradigm for insufficient rigor and failure to divine an immutable truth (Creswell & Poth, 2018; Davies & Fisher, 2018). Researchers that adopt critical theory or constructivist paradigms may see the pragmatic paradigm as failing to fully account for the variety of realities experienced by different individuals or marginalized groups. A focus on social circumstances and institutional biases represent axiological differences in the choice of a research paradigm (Halcomb, 2018).

**Selection of Research Paradigm**

This author chose a pragmatic research paradigm, emphasizing identifying a solution to a real-world problem in health system / ACO interactions (Creswell & Poth, 2018; Davies & Fisher, 2018). There is no single model for partnerships between health systems and ACOs (Comfort et al., 2018). Instead, each partnership is subject to the terms of individually negotiated agreements. Further, the executives within each organization experience the interactions between a health system and ACO within the context of their organization’s partnership agreement. Therefore, the researcher assumes the lack of a single, underlying behavioral law that governs the nature of health system interactions with ACOs. This assumption rendered the positivist and
post-positivist paradigms unsuitable for the proposed research project. The research project’s objective was to understand the nature of health system interactions with ACOs to enable the future construction of a simulation model of those interactions. The work did not focus on the impact of interactions on marginalized groups; hence a critical theory research paradigm was not applicable. Similarly, the proposed research project did not seek to understand how perceived reality changes through the ongoing interactions of people but, instead, sought to study organizations’ interaction under the terms of partnership agreements. Thus, a constructivist research paradigm was also inappropriate for this study.

**Review of Qualitative Research Designs**

The research conducted in support of this doctoral dissertation attempted to understand the sources of health system / ACO interactions. The lack of a standard ACO ownership model (Comfort et al., 2018; Lewis, Tierney et al., 2017) introduces variations in health system / ACO interactions, resulting in the potential for multiple perspectives regarding such interactions. Also, research by Cassidy et al. (2019) failed to uncover a theoretical model of health system / ACO interactions upon which to build a dynamic simulation model. The lack of a theoretical model inhibited the ability to develop hypotheses to test via quantitative analysis (Robson & McCartan, 2016).

The purpose of this research project and its associated research questions was to explore through interviews and surveys the opinions of subject matter experts regarding the sources of health system / ACO interactions relevant to financial outcomes and to formulate a consensus regarding the most important interactions to include in future dynamic modeling efforts. This work, as described, was both inductive and interpretive (Pope & Mays, 2020). Given the limitations cited above regarding the applicability of a quantitative research method and
following the advice of Creswell and Plano Clark (2010) that the researcher must align the research design with the research problem and associated questions, the author selected a qualitative research method employing a multiple case study design.

The qualitative research method may employ any of five basic interpretive approaches (Creswell & Poth, 2018). Selection of an approach from among the five major interpretive approaches, narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research, was guided by the nature of the research questions that arose from the research problem (Creswell & Poth, 2018; Pope & Mays, 2020). To make the appropriate selection, one had to understand the nature and limitations of each approach.

**Narrative Research.** Narrative research captures the lived experience of the research subject or subjects (Creswell & Poth, 2018). The narrative stories are interpreted in the context of the “social, cultural, familial, linguistic, and institutional” factors under which the subject experienced his or her life (Creswell & Poth, 2018, p. 68). Narrative research seeks an in-depth, highly-detailed account of the life of the subject, so that it is common for researchers to focus on one or two research subjects (Pope & Mays, 2020). As the research presented herein was not concerned with the life experience of research subjects but with opinions regarding health system / ACO interactions, narrative research was not an appropriate approach.

**Phenomenological Research.** Phenomenological research seeks to understand the shared meaning, or essence, of a phenomenon experienced by multiple individuals (Creswell & Poth, 2018). The size of the phenomenological research subject pool is typically about 10 individuals (Pope & Mays, 2020). It is the similarity of the phenomenon that is central to phenomenological research, and research subjects must each experience the same phenomenon (Creswell & Poth,
2018). While the interpretation of phenomenological research may lend itself to inductive reasoning (Pope & Mays, 2020), it was the lack of a shared phenomenological experience that made this approach unsuitable for the research explored herein. Each of the subject matter experts interviewed and surveyed in this research reported on the basis of health system / ACO interactions as they occurred in their native system, which differed substantially from other systems.

**Grounded Theory Research.** Grounded theory research seeks to develop a theory that explains the outcome of “a process or an action” (Creswell & Poth, 2018, p. 82) based on observational data provided by research subjects (Pope & Mays, 2020). This approach represents the opposite of the approach typified by quantitative research in which one begins with a theory and tests hypotheses based on that theory (Creswell & Poth, 2018; Robson & McCartan, 2016). In order to construct a grounded theory, researchers commonly include more than 30 research subjects (Pope & Mays, 2020). The current doctoral research presented the opportunity to develop a grounded theory of health system / ACO interaction; however, the intent was to stop short of theory development. Instead, the current research attempted to articulate the business processes through which health systems and ACOs interact. One may use this information to attempt development of a grounded theory of health system / ACO interaction, but the author proposed delaying such theory development until such time as results from a dynamic simulation model based on the findings of the author’s research are available to contribute to theory development.

**Ethnographic Research.** Ethnographic research seeks to understand the shared culture, language, values, or beliefs of a group of research subjects that interact regularly and in close proximity (Creswell & Poth, 2018). Researchers commonly become immersed in the culture
under observation, requiring researchers to state explicitly the impact of such immersion on
collection and interpretation of data (Creswell & Poth, 2018; Pope & Mays, 2020). The goal of
ethnographic research is to extract common or shared patterns of beliefs, values, language, or
other cultural components of a population group. The research in this dissertation did not focus
on cultural attributes, but on the interaction of business functions across the health system / ACO
boundary. Therefore, ethnography was not an applicable research method for this work.

**Case Study Research.** Case study research involves the detailed observation of “an
individual, a small group, an organization, or a partnership” as defined by explicit parameters or
boundaries (Creswell & Poth, 2018, p. 96). The parameters define the nature of the case by
specifying the place and time over which observation and comparison takes place (Creswell &
Poth, 2018; Pope & Mays, 2020). A single case study focuses on one entity, such as a single
company. A multiple case study assesses multiple entities, such as a group of companies within a
shared industry grappling with a common business problem (Creswell & Poth, 2018; Pope &
Mays, 2020). Common data collection instruments in case study research include structured,
semi-structured, and unstructured interviews and surveys (Pope & Mays, 2020; Robson &
McCartan, 2016).

**Selection of Qualitative Research Design**

This author chose a multiple case study design to seek to understand common features of
health system / ACO interactions across multiple ownership or partnership models. By doing so,
the author sought to derive knowledge of health system / ACO interactions that are broadly
generalizable rather than applicable only to the business model of a single system (Creswell &
Poth, 2018). The research presented herein employed semi-structured interviews and survey
instruments for data collection. The researcher favored semi-structured interviews due to the
likely variations in health system and ACO business models (Comfort et al., 2018; Lewis, Tierney et al., 2017) and, as a result, the nature of interactions between the entities. Semi-structured interviews present broad-based questions concerning health system / ACO interactions without constraining the research subjects by assumptions based on any particular health system / ACO partnership model (Robson & McCartan, 2016). In this study, the objective was to allow the conversation regarding health system / ACO interactions to develop within the context of each subject matter expert’s experience with his or her own health system or ACO. Thematic coding of interview responses provided the mechanism by which to extract themes that are common to health system / ACO interactions regardless of details of specific health system / ACO partnership models (Robson & McCartan, 2016).

Survey instruments allowed for data collection based on a standardized set of Likert scale-based variables that explore specific aspects of health system / ACO interactions. Survey questions added a structured dimension to data collection from subject matter experts. By using a Likert scale to rate the importance of features of health system / ACO interactions, the author obtained quantitative data to supplement qualitative interview data. Quantitative analysis of Likert scale data served to triangulate the results obtained from thematic coding of unstructured interview data (Pope & Mays, 2020; Robson & McCartan, 2016). Because quantitative analysis served to triangulate analysis and was not of equal importance to qualitative analysis in reaching conclusions, the research design was not considered a mixed-methods design (Creswell & Plano Clark, 2010; Robson & McCartan, 2016).

**Review of Research Methods**

**Quantitative Method.** Research methods applicable to doctoral studies are of a quantitative or qualitative nature, or may include each in approximately equal measures in
mixed-methods research (Creswell & Poth, 2018; Davies & Fisher, 2018; Pope & Mays, 2020; Robson & McCartan, 2016; Shannon-Baker, 2016). Quantitative methods support studies in which the researcher explores existing theory and seeks to quantify the responses of individuals or groups to changes in variables of interest (Robson & McCartan, 2016). Thus, the use of quantitative methods has been the preferred approach for research in the physical sciences, which adopt a positivist or postpositivist paradigm (Davies & Fisher, 2018). Quantitative methods best serve the needs of a positivist paradigm due to its assumption of a single, underlying, fundamental truth to be discovered (Davies & Fisher, 2018; Robson & McCartan, 2016).

Application of statistical analysis methods to quantitative data contributes to both the validity and reliability of results (Robson & McCartan, 2016). Results that demonstrate through quantitative analysis a cause-and-effect relationship support internal validity (Robson & McCartan, 2016). Controlled experiments contribute to consistency in quantitative findings and increase internal validity (Robson & McCartan, 2016). However, strict control of experimental or quasi-experimental conditions decreases the researcher’s ability to generalize findings to populations outside of the experiment, thus reducing external validity (Robson & McCartan, 2016). That investigation of real-world business problems often renders impossible the use of strict experimental controls means that quantitative analysis of business problems may fall short of the level of internal validity acceptable in quantitative research studies (Davies & Fisher, 2018; Robson & McCartan, 2016).

**Qualitative Method.** While quantitative methods have been the preferred methods for research in the physical sciences, the social sciences traditionally make use of qualitative methods (Pope & Mays, 2020). The reason for the dominant application of qualitative methods to problems in the social sciences is adoption of paradigms other than the positivist approach, as
discussed in a previous section of this paper (Davies & Fisher, 2018; Robson & McCartan, 2016). Whereas research in the physical sciences often relies on experiments conducted under carefully controlled laboratory conditions, research in the social sciences commonly seeks to understand problems in their natural, uncontrolled contexts and is, therefore, of a more pragmatic nature (Creswell & Poth, 2018; Pope & Mays, 2020; Shannon-Baker, 2016). In addition, social science researchers acknowledge the potential presence of personal beliefs in the interpretation of results and that interaction between the researcher and research subjects may influence the results obtained (Creswell & Poth, 2018).

Pope and Mays (2020) noted that, while qualitative analysis often relies on data collected through interviews, surveys, or behavioral observations, it still provides the ability to measure the relative contributions of underlying drivers of processes or behaviors, including those that may not be evident through quantitative research. One such advantage of qualitative research arises through the notion that the reality, or meaning, of a situation or phenomenon may differ for different research subjects due to each subject’s personal experiences, beliefs, and values (Creswell & Poth, 2018; Pope & Mays, 2020). This idea runs counter to the notion of a single, universal truth common to the positivist paradigm upon which the physical sciences generally operate (Robson & McCartan, 2016).

**Mixed-Methods.** A mixed methods approach contains both quantitative and qualitative methods in approximately equal shares (Creswell & Plano Clark, 2010; Robson & McCartan, 2016; Shannon-Baker, 2016). As a result, researchers conducting mixed-methods research must be fluent in the use of both quantitative and qualitative research methods (Creswell & Plano Clark, 2010; Robson & McCartan, 2016). The use of mixed-methods recognizes the subjective choices of the researcher in constructing even what is intended to be a controlled laboratory
experiment (Robson & McCartan, 2016). Therefore, adoption of mixed-methods moves the researcher from a strict positivist paradigm to a pragmatic paradigm (Creswell & Plano Clark, 2010; Robson & McCartan, 2016). This shift toward pragmatism creates better alignment of mixed-methods with the intent of social research to study subjects in an uncontrolled, real-world setting (Robson & McCartan, 2016).

The added complexity of using mixed-methods, given its reliance on both quantitative and qualitative research methods, extends the timeframe necessary to conduct and interpret research and requires greater resources (Robson & McCartan, 2016). These factors place constraints on the practicality of adopting mixed-methods for research in a doctor of business administration program aimed at timely completion of a real-world research investigation (Robson & McCartan, 2016). Robson and McCartan (2016) cautioned that “a multi-strategy [mixed-methods] design is not to be selected lightly, particularly by a lone and/or new researcher” (p. 186).

**Discussion of Triangulation**

The researcher used survey data to triangulate the results obtained from the thematic coding of semi-structured interviews. The purpose of triangulation was to use analysis of one or more secondary sources of data to validate the findings derived from the analysis of the principal data source (Creswell & Poth, 2018). In the proposed study, the researcher used quantitative analysis of Likert scale survey data to triangulate findings derived from qualitative analysis of semi-structured interviews subjected to thematic coding. Fusch et al. (2018) asserted that triangulation serves to enrich research data by including additional data sources. Further, critics questioned the credibility and validity of qualitative analysis due to its acceptance of the researcher’s potential biases (Creswell & Poth, 2018; Noble & Heale, 2019; Robson &
McCartan, 2016). Triangulation offers a technique to mitigate the effects of underlying biases on interpreting research results (Fusch et al., 2018). By mitigating bias and demonstrating consistency in findings derived using multiple data sources and data analysis techniques, triangulation increases the confidence that readers have in research findings (Noble & Heale, 2019).

The research project’s primary data source was semi-structured interview transcriptions subjected to thematic coding, a qualitative analysis technique. Additionally, the researcher collected quantitative data relating to health system interactions with ACOs through an online survey following a Likert scale construct (Pope & Mays, 2020). The use of a Likert scale placed respondents’ replies on a consistent, five-point scale that was amenable to statistical analysis (Pope & Mays, 2020; Robson & McCartan, 2016).

The researcher intended to collect survey responses equal to the number of interviewees but augmented results with two additional surveys from qualified healthcare executives to boost statistical performance. Descriptive statistical analysis of each survey question’s responses determined the mean response value, representing the average opinion regarding the importance of a contributor to health system interactions with an ACO. Assessment of the standard deviation quantified the variation in responses. Operational factors with minimal standard deviation indicated broader agreement regarding the mean value as the group consensus (Morgan et al., 2013). The researcher developed statistical significance measures for differences observed between the Likert scale values obtained for different survey questions to determine whether differences were statistically meaningful. Additionally, descriptive statistics applied across each survey provided, in aggregate, a perspective regarding perceptions of the degree to which respondents recognized interactions between health system operations and ACO operations.
Given the subjectivity associated with the rating assigned to each survey question, the researcher applied statistical analysis to assess the intraclass correlation coefficient (ICC) (Morgan et al., 2013). Each survey respondent rated each survey question, each applying their own subjective judgment. Quantification of the ICC enabled an assessment of measurement reliability. Cronbach’s alpha provided a measure of internal consistency reliability (Morgan et al., 2013). Fleiss’ kappa served to measure the extent to which respondents agreed on answers to survey questions. The researcher used Fleiss’ kappa in place of Cohen’s kappa due to the presence of three or more respondents (How to calculate Fleiss’ Kappa in Excel, 2021).

**Summary of Nature of the Study**

The researcher elected to adhere to a pragmatic paradigm, emphasizing identifying a solution to a real-world problem in health system / ACO interactions. In this context, the researcher conducted qualitative research using a multiple case study design. The selection of a qualitative method derived from a desire to understand the research problem in its natural, uncontrolled context. Further, as an executive in the health system industry, the researcher acknowledged the potential impact of personal beliefs on interpreting results. A multiple case study design provided the framework to compile data from a group of health systems and ACOs faced with a common business problem, potentially increasing research findings' generalizability. Given the additional scrutiny faced by qualitative research concerning reliability and validity, the researcher performed statistical analysis on Likert scale survey data to triangulate the findings derived from thematic coding of interview data.

**Conceptual Framework**

The research framework for the dissertation project derived from the author’s identification of three major concepts that support the need for this research: competing ACO
structural models, competing health system and ACO economic models, and the complex, dynamic system nature of health system interactions with ACOs. Four theories served as lenses through which to inform the data gathering and analysis associated with the pragmatic, multiple case study design. Organizational learning theory and resource-based theory informed the approach to rationalizing competing ACO models. Resource-based theory and transaction cost economics provided rationales by which to examine competing health system and ACO economic models. Transaction cost economics and organizational learning theory informed the instrument selection and data analysis necessary to identify the major components of the health system / ACO complex, dynamic system.

**Concepts**

**Competing ACO Models.** There were three concepts upon which the researcher built the proposed research framework. The three concepts formed the outer ring that appears on the left side of the research framework diagram in Figure 1. The first concept was that of competing ACO models. The Patient Protection and Affordable Care Act of 2010 (ACA) introduced the ACO concept (Blumenthal et al., 2015; Shaw et al., 2014). While the ACA introduced the ACO concept, it left open details of ACO structure and ownership models (Blackstone & Fuhr, 2016). To-date, there remains no generally agreed upon best model for ACO ownership (Berwick, 2011; Comfort et al., 2018; Doulgeris & Bonvicino, 2014; Shaw et al., 2014). The literature demonstrated that different ACO models show variations in financial performance (Comfort et al., 2018; Lewis, Tierney et al., 2017; Lewis et al., 2018; Murray et al., 2018).

**Competing Economic Models.** The second concept serving as a basis for the proposed research project was that of competing economic models. As noted earlier, ACO ownership may take many forms, including direct ownership by a health system or independent ownership
involving strategic partnerships with health systems (Blackstone & Fuhr, 2016). Health systems earn most income by treating patients in health system facilities (Feldstein, 2015; Sloan & Hsieh, 2016). The ACOs earn most income by keeping patients out of hospitals, reducing the cost of care for health insurance payers with which they contract (Blackstone & Fuhr, 2016; Vogus & Singer, 2016). Therefore, some authors asserted that health systems owning hospitals and ACOs are at a disadvantage because of competing, internal business models (Blackstone & Fuhr, 2016).

**Health Systems and ACOs are Complex, Dynamic Systems.** The third concept informing the proposed research project was that health systems and ACOs are complex, dynamic systems and, therefore, require specialized simulation techniques to derive accurate predictions regarding financial outcomes in response to strategic changes. The ACO ownership models involve partnerships, either within a parent organization or across independent organizations (Lewis, Tierney et al., 2017; Lewis et al., 2018). Partnerships commonly display feedback loops characteristic of complex systems (Gary et al., 2008; Morecroft, 2015; Sterman, 2000). Feedback loops are known to cause nonlinear behaviors that make business predictions difficult (Gary et al., 2008; Morecroft, 2015; Sterman, 2000). It is because of the presence of nonlinear responses to stimuli that prediction of outcomes in complex systems requires dynamic simulation models (Cassidy et al., 2019; Cosenz & Noto, 2016). While independent researchers may construct dynamic simulation models based on personal knowledge, research suggested that system dynamics models work best when co-designed with business stakeholders (Cosenz & Noto, 2016).

**Theories**

The inner portion of the diagram on the left side of Figure 1 illustrates the intersection of four theories that informed this author’s proposed research. In addition, the concepts outlined in
the previous section served to link the four theories associated with the proposed research project. All three concepts relate to considerations derived from organization theory. In addition, organizational learning theory and resource-based theory are relevant to the selection of a specific ACO model that best serves a potential health system / ACO partnership. Resource-based theory and transaction cost economics theory provide frameworks in which to reconcile or optimize the competing economic models associated with health systems and ACOs. Finally, recognition of health system / ACO partnerships as complex, dynamic systems implies a requirement for dynamic simulation methods to fully understand transaction cost economics between the two entities and to generate insights that enable the two organizations to optimize financial performance through organizational learning. Figure 1 illustrates how the four proposed theories intersected to serve as the foundation for the creation of the content of semi-structured interviews and Likert scale surveys that led to group model building, which was the basis for data collection in this research.
Figure 1

Research Framework Concepts, Theories, Variables, Actors, and Outcomes
**Organization Theory.** Organization theory provided a basis by which to understand why some ACO models have seen financial success while others have not (Vogus & Singer, 2016). Researchers recognize ACOs as a new type of organization (Vogus & Singer, 2016) without specifying a required organizational structure or ownership model (Comfort et al., 2018). As a new type of organization, organization theory provided a framework by which to interpret decisions related to organization ownership, structure, implementation, and resultant performance (Vogus & Singer, 2016). Shortell (2016) asserted that an organization theory perspective, informed by research conducted on hospitals, suggests the need for ACOs to organize with extensive vertical integration rather than to depend on partnerships to achieve quality and financial goals. Shortell (2016) cited Weick’s and Sutcliffe’s (2007) description of the principle of mindful organizing as a component of organization theory by which ACOs can determine the most appropriate organizational structure and implementation plan to achieve their goals. Shortell (2016) further asserted that the application of organization theory to ACO organizational structure encompasses the theories of transaction cost economics and organizational learning (see Figure 2).
Organizational Learning Theory. The principal tenet of organizational learning theory holds that organizations can improve performance through the process of learning over time (Nembhard & Tucker, 2016). Learning may take place through the accumulated knowledge gained through experience over time or through deliberate learning in which process changes occur with the intention of testing the potential for performance improvements (Nembhard & Tucker, 2016). Figure 3 illustrates the intentional learning process, which informs and challenges leaders’ notion of why the firm operates under certain strategic assumptions, potentially leading to revised strategies and tactical actions. Nembhard and Tucker (2016) asserted that many organizations fail because they are unable to learn in business environments that are complex and rapidly evolving. In this regard, the authors cited a lack of research regarding organizational
learning in ACOs (Nembhard & Tucker, 2016). Of concern to the authors, and relevance to the current research study, is the dependency that ACO success has on partnership with healthcare providers (Nembhard & Tucker, 2016). Yukl (2009) asserted that the ability to discover new business model insights to support organizational learning is critical for organizational success. A critical assertion by Yukl in this regard was that a shortcoming of organizational learning has been failure to apply methods that support the derivation of insights where “complex, dynamic processes” exist (p. 52). Berends et al. (2016) added that the implementation of business model adaptations derived from organizational learning is particularly difficult for businesses operating under an established business model.

**Figure 3**

*Feedback Loops Inform Organizational Learning*

![Feedback Loops Diagram](image)

*Note. Bertram-Elliott (2015).*

**Resource-based Theory.** In resource-based theory of organizations, the way stakeholders cooperate determines the productivity of the firm (Conner & Prahalad, 1996), as illustrated in Figure 4a. Conner and Prahalad (1996) asserted that resource-based theory
recognizes different levels of cooperation among stakeholders within a firm versus stakeholders connected to the firm through contracts or partnerships and that the former results in greater productivity. Thus, even if a firm is successful in applying the tenets of organizational learning theory, the application of learned knowledge will be less efficient in the case of organizations that rely on contracts or partnerships with stakeholders as compared with fully-integrated stakeholders (Conner & Prahalad, 1996). Following Conner and Prahalad (1996), Murray et al. (2018) noted the instability of partnership arrangements involving ACOs as a destabilizing effect in ACO success. Kim et al. (2015) proposed the need to incorporate a dynamic capabilities approach in resource-based theory to recognize the added complexity of competing in dynamic business environments. The approach of Kim et al. (2015) introduced the need to analyze organizations using modeling or simulation approaches that can capture dynamic complexity and close the knowledge and strategy gaps illustrated by Figurska (2011) in Figure 4.

**Transaction Cost Economics.** Transaction cost economics theory recognizes that non-production costs exist and are non-zero (Mick & Shay, 2016). Expansion of this concept earned Oliver Williamson the Nobel Prize in Economics in 2009 (Dahlstrom & Nygaard, 2010). Health systems incur both internal and external non-production costs, as do ACOs, in transaction cost economics (Camilleri & Colville, 2016; Spithoven, 2012). Transaction cost economics have driven extensive consolidation of health systems since the introduction of ACA in 2010, as well as vertically integrated models such as health system / ACO joint ownership (Spithoven, 2012). In the theory of transaction cost economics, such behavior derives from the desire to create organizational governance structures that lead to improved performance and minimization of transactional costs to improve efficiencies (Williamson, 2016).
Actors

Actors in the proposed research project fell into one of two categories, one related to health systems and one related to ACOs. The first category of health system actors consisted of executive leaders accountable for strategic decision-making and the financial performance of the health system. These leaders also had the authority to enter into business agreements with ACOs, either through acquisition or contractually-driven strategic partnerships (Lewis, Tierney et al., 2017; Lewis et al., 2018). Executive leaders with system-wide decision-making authority included in the study held the titles of Chief Financial Officer, Senior Vice President for...
Network Development and Contracting, a former Chief Executive Officer, and Chief Clinical Executive for Care Transformation and Strategic Services.

The second category of relevant health system actors consisted of ACO executive leaders accountable for strategic decision-making and the ACO’s financial performance. Unlike their health system counterparts, ACO actors seek to earn operating margin by eliminating or finding lower-cost alternatives to costly health system services while simultaneously improving the quality of care (Blackstone & Fuhr, 2016). Therefore, ACO executives place great emphasis on care management effectiveness as it promotes cost reduction and quality improvement.

Executive leaders with system-wide decision-making authority included in the study held the titles of Chief Executive Officer, Chief Operating Officer, Senior Vice President for Managed Care, and two Executive Directors for ACO Operations.
Variables

As with actors, a model of health system / ACO interaction requires variables representing parameters associated with each organization type. With respect to health systems, the author anticipated that ACO interaction would have a direct impact on health system
financial analysis through contributions to the ACO operating budget and reimbursement rate discounts offered to ACO partners, by insurance payer designation. The extent to which the latter affects the health system is dependent upon the health system’s patient health insurance payer mix (commercial, Medicare, Medicare Advantage, Medicaid, and self-pay) and the health system’s market share, by payer. In addition, the average health system margin per case varies by health insurance payer. The impact of the ACO on health system operations occurs most directly through the ACO’s effect on health system inpatient case volume, by payer, as the ACO conducts population health management operations. The net effect of ACO volume- and reimbursement-related impacts is a direct impact on health system operating margin (Blackstone & Fuhr, 2016; Feldstein, 2015; Jones et al., 2007; Sloan & Hsieh, 2016). The analysis of research data in this study supported the researcher’s assumptions.

From the ACO perspective, the health system discounts noted above are also relevant variables. The ACO savings accrue according to its inpatient aversion percentage and average cost savings per averted inpatient, by payer. The ACO receives performance incentive payments based on a measure of its ability to save money for the health insurers with which it enters contracts. Performance incentives result in shared savings incentive payments per 1000 covered lives and vary according to the contractual terms associated with each insurance payer. To earn incentives, ACOs maintain population health management staff, resulting in expenses based on population health management staff per 1000 covered lives, by payer. Collectively, these sources of revenue and expenses determine ACO operating margin (Blackstone & Fuhr, 2016; Feldstein, 2015; Mick & Shay, 2016; Sloan & Hsieh, 2016). The interview statements analyzed by the researcher supported these assertions.
Summary of Conceptual Framework

The lack of a single, standard ACO organizing model, while theoretically promoting innovation, adds to the complexity of determining which forms of operating model result in the best financial outcomes for the ACO and its partner or owner. Operating models involving ACOs and health systems bring into conflict divergent economic models, with ACOs profiting from reducing hospital inpatient services that result in health system profits. Simultaneously, the removal of low acuity cases from the hospital inpatient environment may result in quality improvement incentive payments to the hospital. The competing economic incentives in ACO partnerships with hospitals are challenging to model because of the complex dynamics of operations within each entity and effects realized from interactions between the entities. Without a model to simulate the outcomes caused by complex interactions, health system and ACO leaders cannot apply principles of organization theory and organizational learning theory to develop better strategic plans for the partnership. Resource-based theory suggests failures in organizational optimization result in productivity losses. Leaders cannot rectify these losses due to a lack of ability to project how complex interactions create inefficiencies that leaders might minimize by applying transaction cost economics principles. Until a model exists that enables the modeling of the complex dynamics at work in health system interactions with ACOs, leaders have no quantitative basis for optimizing the economics of ACO partnerships with health systems.

Definition of Terms

Below are definitions for terms used throughout this dissertation so as to enable readers to have a clear and consistent understanding of the intended meaning of each term.
**Accountable Care Organization**

An accountable care organization is a group of health care providers, or a network of providers, who together are responsible for a patient population…These providers enter into contracts that reward them for improving quality of care and lowering costs over time. They also share in the risk if there is a lack of documented quality or an increased cost in the care. (Golden, 2015, p. 843)

**Agent-based Modeling**

Agent-based modeling (ABM) is a computational simulation technique in which stakeholders within a system, or agents, are assumed to behave according to presumed attributes. Different agents have different attributes. Macro behavior of the system evolves over time as agents interact according to their attributes. The ABM is the most appropriate dynamic simulation method when one seeks to model the behavior of individual stakeholders (Liu & Wu, 2016; Marshall, Burgos-Liz, Ijzerman, Crown et al., 2015).

**Complex System**

A complex system is one that adapts to changes in its environment as a result of dependent linkages with other systems. Complex system adaptations reflect nonlinear, emergent behaviors, which are behaviors that are not associated with any one system but result from the interactions between systems (Marshall, Burgos-Liz, Ijzerman, Osgood et al., 2015).

**Dynamic System**

A dynamic system is one which exhibits interdependence between two or more interacting stakeholders, so that an action by one stakeholder influences the behavior of another
stakeholder through a process known as feedback (Marshall, Burgos-Liz, Ijzerman, Crown et al., 2015).

**Dynamic Simulation Models**

Dynamic simulation models are a class of computational simulation models consisting of system dynamics modeling, agent-based modeling, and discrete-event simulation. Dynamic simulation models are mathematical constructs of real-world processes or systems that enable the user to gain an understanding of how the system will respond to parameter changes over time, especially when the system involves interacting stakeholders whose actions impact the outcomes for other stakeholders and evolve the values associated with key system parameters (Marshall, Burgos-Liz, Ijzerman, Osgood et al., 2015).

**Feedback Loop**

Feedback loops represent the ways in which stakeholders interact with each other in a system through their “operations, structures, and relationships” ((Marshall, Burgos-Liz, Ijzerman, Osgood et al., 2015, p. 10), thereby influencing outcomes for one another in ways that may not occur if a single stakeholder acted in isolation. Feedback loops are the source of nonlinear behaviors in systems (Marshall, Burgos-Liz, Ijzerman, Osgood et al., 2015; Morecroft, 2015).

**Group Model Building**

A construct in which the person responsible for construction of a complex, dynamic model, rather than undertaking model development based on personal knowledge, solicits the opinions of multiple subject matter experts regarding the key components that must appear in the model to adequately reflect reality (Cosenz & Noto, 2018).
**Health System**

In the context of this research, a health system is a collection of two or more hospitals, or hospitals, ancillary care facilities, and physician practices, under joint ownership that provide healthcare to a community or region. Health systems are hospital-led, or hospital-directed, entities. The use of the term health system herein is not to be confused with a reference to the full spectrum of healthcare delivery services and practitioners available in the United States, as used by some authors (Cassidy et al., 2019).

**Operating Margin**

Operating margin is the amount of revenue remaining after subtracting the cost of goods sold and operating expenses (Weil et al., 2012).

**Nonlinear Effects**

Nonlinear effects describe system responses in which changes in outputs are not proportional to changes in inputs. Mathematical representations of such effects, when possible to put into closed form, involve functions that include independent variables with exponents greater than one, exponential forms, and/or trigonometric forms (Marshall, Burgos-Liz, Ijzerman, Osgood et al., 2015).

**Patient Protection and Affordable Care Act**

The Patient Protection and Affordable Care Act, often referred to as PPACA or the ACA, is United States healthcare reform legislation passed into law in 2010. The objective of the ACA was to reform healthcare financing and delivery in the United States to achieve the triple aim. Among the provisions of the ACA was the introduction of ACOs as an organizational structure to reduce healthcare costs while improving access to high-quality care (Blackstone & Fuhr, 2016; Lewis, Tierney, et al., 2017; Obama, 2016).
**Shared Savings**

Shared savings in healthcare is a form of performance incentive. The ACOs receive a portion of the care cost savings that they generate through population health management activities performed on behalf of insurance company clients, provided that the ACO meets or exceeds healthcare quality metrics established by the client (Doran et al., 2017).

**System Dynamics Modeling**

System dynamics modeling (SDM) is a computational simulation technique that follows the accumulation of countable quantities of interest, called stocks, under the effects of feedback loops identified in the system. In this way, SDM enables researchers to study nonlinear behaviors of complex systems over time (Chang et al., 2017; Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015).

**Triple Aim**

The triple aim is a healthcare reform concept introduced in a seminal paper by Berwick et al. (2008) that espouses a three-pronged goal for healthcare in the United States: to simultaneously reduce the cost of healthcare services while increasing the quality of care and expanding access to high-quality care. Framers of the ACA legislation took the triple aim as a guiding principle.

**Value-based Care**

Value-based care is a care delivery and financing model in which healthcare providers are paid based on the quality of health outcomes experienced by patients. Value-based care, as a key component of healthcare reform legislation, is an alternative to the traditional U.S. healthcare payment model known as fee-for-service in which providers are paid on the basis of
the number of services provided rather than the quality of health outcomes (Gray, 2017; NEJM Catalyst, 2017).

**Assumptions, Limitations, and Delimitations**

**Assumptions**

An assumption for the research study was that the opinions rendered by the sample of health system and ACO subject matter experts queried for this work would provide a representative sample of opinions within the industry regarding the most critical interactions in health system / ACO partnerships. This assumption required that the sample size was large enough to be reliable as representative of the industry in the southeastern United States and that participants provided honest input free of external influences. The author expected that the sample chosen from within health systems and ACOs of similar size would reflect variations in partnership models, including direct ownership of the ACO by the health system. If this assumption was incorrect, then conclusions regarding the most critical operational factors and feedback loops to include in a system dynamics model of health system / ACO interactions would be incomplete. In this case, any SDM constructed on this research’s findings might lead to incorrect quantitative characterization of the impact of strategic decisions on the health system or ACO operating margin. However, the researcher’s assumption proved to be correct, alleviating concerns regarding incomplete characterization of interactions.

In qualitative research, the accepted standard for achieving a sufficient sample size is that the research achieves saturation of themes (Braun & Clarke, 2019; Hagaman & Wutich, 2017; Vasileiou et al., 2018). Saturation occurs when no new themes emerge with additional interviews (Astroth & Chung, 2018; Braun & Clarke, 2019; Hagaman & Wutich, 2017; Vasileiou et al., 2018). A systematic literature review of 15 years of qualitative research indicated that discussion
of adequate sample size was often missing from qualitative research but relied most heavily on the concept of saturation when discussed (Vasileiou et al., 2018). Hagaman and Wutich (2017) found that 16 interviews were sufficient to achieve saturation after interviewing 132 participants. Hennink et al. (2017), distinguishing between code saturation and meaning saturation, found that code saturation occurred with nine interviews. Meaning saturation required sample size of 16 to 24 participants. As this research aims to identify common themes for model development rather than to develop grounded theory, the researcher expected a sample size on the order of 10 interviews to produce saturation. In fact, the researcher achieved code saturation with nine interviews. Nonetheless, this research includes delimitations that acknowledge potential bias in research findings, with advice to proceed with caution when attempting to generalize these findings regarding interactions, particularly health system / ACO partnerships outside of the South Atlantic region.

As for the issue of honesty and candor among interviewees, Brunner and Ostermaier (2019) found that peers influence managers’ honesty. Managers exposed to peer reports that demonstrate more remarkable progress or success have an increased probability of fabricating information (Brunner & Ostermaier, 2019). Schwering (2017) corroborated this finding and determined that knowing one’s peer’s identity did not affect whether a manager was less likely to be dishonest in reporting their results. These findings argued for nondisclosure of research interview results to other participants in the interview process, since the disclosure, whether anonymous or not, is likely to influence interviewee responses (Schwering, 2017). The researcher maintained the anonymity of participants in the current study. The work of Rich and Zollman (2016) suggested that a researcher may elicit more honest responses from interviewees by establishing a relationship through multiple interactions before engaging in the interview or
offering a survey. The researcher in the current study attempted multiple pre-interview interactions, interviewee’s schedules permitting.

The researcher also assumed that common themes would emerge regarding the influence of operational parameters on feedback loops encountered in health system / ACO interactions irrespective of the partnership model. Research suggested that obtaining input from multiple sources through interviews aids in the derivation of common themes that more accurately reflect reality (Browne & Keeley, 2017). Variations in partnership model construction may result in substantial differences in the factors necessary to construct an accurate system dynamics model of health system / ACO interactions. If true, then the results obtained through interviews might be skewed toward the most predominant partnership model found among the selected subject matter experts. Evidence of such an outcome would arise in the thematic coding of unstructured interviews if coders failed to arrive at common themes regarding factors of importance in health system / ACO interactions. In this research, the researcher noted substantial agreement among interviewees and coders regarding the factors influencing health system / ACO interactions.

Carbone et al. (2019) found that groups made better decisions than individuals for problems that involved ambiguity, as is the case when neither legislation nor regulation stipulates the terms of health system partnerships with ACOs. Therefore, using thematic coding, by extracting beliefs common to the group of interviewees, mitigated the biases of individuals since common themes emerged. Interviewees represented three health system / ACO structures, but the researcher observed no evidence that modeling variables were highly sensitive to health system / ACO partnership structure. Triangulation using associated Likert score surveys lent support to these conclusions.
Limitations

Data obtained through this research represented subject matter experts’ opinions from a limited set of health systems and ACOs. Further, the contractual and operational details of health system / ACO partnerships varied among the subject matter experts involved. Given that legislation nor regulation currently prescribe details of ACO partnership models (Blackstone & Fuhr, 2016; Comfort et al., 2018), and that more than 900 ACOs existed in the United States as of 2018 (Comfort et al., 2018; Lewis, Fisher, & Colla., 2017; Trombley et al., 2019), the researcher cannot assert that the considerations identified by the limited set of subject matter experts represented all significant factors needed for a complete system dynamics model of health system / ACO interactions. Therefore, this study’s findings may not lead to a system dynamics model that accurately represents health system / ACO interactions that are generalizable to all existing partnership arrangements.

The use of thematic coding aided in the generalization of results by surfacing those broadly identified factors as contributors to health system interactions with ACOs. Final recommendations for factors relevant to a generalizable model of health system interactions with ACOs did not include factors identified by a minority of participants, such as interactions with physician groups or health insurers. Thus, while potentially not identifying all factors needed in the model, the recommended factors are those that are most likely to generalize across all partnership models.

Delimitations

The work presented in this dissertation was subject to certain boundaries and scope. The author selected a pool of health system and ACO subject matter experts from health systems and ACOs in the South Atlantic region of the United States (National Science Foundation, 2020),
corresponding to the region associated with the author’s health system and ACO. Further, consideration was given to ACOs ranked in the top 100 by the total number of Medicare-covered lives (Largest accountable care organizations: 2020, 2020). The selection of health system experts was from systems engaged in partnerships with the ACOs selected according to the criteria above. Selection of subject matter experts at health systems and ACOs was from among senior leaders with strategic decision-making responsibility related to health system / ACO partnership. A detailed accounting of these positions appeared earlier in the Actors description within the Conceptual Framework. Investigation of health system / ACO partnerships outside of the South Atlantic region was out of scope. Querying health system and ACO leaders below the executive director level or that had only indirect knowledge of health system / ACO partnership operations was also out of scope.

**Significance of the Study**

The researcher intended for this project to address a critical healthcare business problem that had not yet been addressed in the literature. Specifically, the research addressed the lack of knowledge necessary to construct a meaningful model of health system / ACO interactions given the complexity of such a system. Complex systems commonly exhibit nonlinear responses to changes in operating parameters made as a result of strategic decisions (Cassidy et al., 2019; Cosenz & Noto, 2018). The potential for nonlinear responses to relegate experience-based projections of outcomes to the level of certainty associated with random chance created the driving force for this research. Rather than experience-based projections, managers need simulation models, such as system dynamics models, that account for nonlinear behaviors in order to quantify the range of potential outcomes associated with strategic decisions (Cosenz & Noto, 2018). This research closed a gap in the existing research in this respect by extracting the
key parameters needed for construction of dynamic simulation models of health system / ACO interactions. As ACOs represent the current, best thinking with respect to population health management mechanisms designed to achieve the triple aim and restore financial viability to the U.S. healthcare system (Collins & Saylor, 2018; Obama, 2016), understanding how to accurately model the interactions that occur in health system / ACO partnerships, and their effects on financial outcomes, is critical to guide future healthcare strategy.

**Reduction of Gaps**

Marshall, Burgos-Liz, Ijzerman, Crown et al. (2015) and Marshall, Burgos-Liz, Ijzerman, Osgood et al. (2015) established that the complexity of healthcare delivery models requires the use of dynamic modeling methods for simulation purposes. Multiple, recent scholarly literature reviews summarized the current state of research regarding the application of dynamic modeling to problems in health system and ACO business model simulation (Cassidy et al., 2019; Chang et al., 2017; Cosenz & Noto, 2018). Scholarly research involving the application of dynamic modeling methods focused on understanding strategic or operational issues within health systems or ACOs, but omitted consideration of the effects of health system / ACO interactions (Cassidy et al., 2019; Chang et al., 2017). Construction of a meaningful system dynamics model of a complex system requires an understanding of the most relevant operational components of the system as identified by subject matter experts (Cosenz & Noto, 2018). A multiple case study involving subject matter experts from a collection of health system / ACO business partners can determine theoretically the most important operational interactions common to health systems / ACO partnerships irrespective of partnership model. An understanding of operational interactions that enables identification of health system / ACO feedback loops would provide the basis for construction of a system dynamics model of health system / ACO interactions, which
does not appear in the literature to date (Cassidy et al., 2019; Chang et al., 2017). The ability to simulate the effects of feedback loops in health system / ACO interactions will enable business leaders to quantify potential nonlinear effects that changes in business strategy may have on financial viability of either, or both, partners.

**Implications for Biblical Integration**

On its surface, the researcher’s study appears to have financial motivations in that a system dynamics model of health system / ACO interactions based on the findings of this research can improve operating margins for one, or both, entities. A biblical perspective caused the researcher to consider implications beyond the obvious financial benefits of this research and to recognize that biblical and financial motivations need not necessarily be in conflict (Keller & Alsdorf, 2012). Instead, in a biblical worldview, generation of financial value through business research takes on a greater meaning in that adding to financial value creates the potential to do greater good for people and not just for the firm. In so doing, the researcher participates not only in the secular economy, but in the divine economy (Hardy, 1990, 2004).

The business world requires many decisions for which there is not clear moral guidance. Keller and Alsdorf (2012) asserted that the Bible assigns the quality of wisdom to those that make good decisions in “the 80 percent of life’s situations in which the moral rules don’t provide the clear answer” (p. 215). The discipline of business research, when performed with integrity and competence, provides objective tools that enable the businessperson to make good decisions objectively in situations that lie outside the realm of legality or morality.

**Business Research in a Biblical Context.** God created the universe and placed humankind on Earth as stewards of His work, to cultivate His garden and improve upon it (Keller & Alsdorf, 2012). Business research is a vehicle to new knowledge that one can use to
improve business performance. The Bible speaks to the importance of seeking truth and knowledge, proclaiming, “An intelligent heart acquires knowledge, and the ear of the wise seeks knowledge” (*English Standard Version [ESV] Bible*, 2001, Proverbs 18:15). Through the application of sound business research practices, one obtains knowledge that is valid and reliable (Creswell & Poth, 2018), enabling leaders to base strategic decision-making on quantifiable information rather than on instinct. In this way, through research-based decision-making, God can proclaim, “I have no greater joy than to hear that my children are walking in the truth” (3 John 1:4).

By walking in the truth, business research allows business leaders to grow in their competence to lead the firm. Keller and Alsdorf (2012) stressed that a commitment to competence in work is necessary to adopt a biblical worldview since performing one’s work to the best of one’s ability is, in the truest sense, serving God through work. Paul admonished, “I therefore, a prisoner for the Lord, urge you to walk in a manner worthy of the calling to which you have been called” (*ESV Bible*, 2001, Ephesians 4:1). This principle guided the researcher to uphold the highest standards in engaging with research subjects, safeguarding confidentiality, and accurately representing collected data. Finally, a biblical worldview guided the researcher to demonstrate integrity in the collection, analysis, and presentation of information. Proverbs 10:9 warns that, “Whoever walks in integrity walks securely, but he who makes his ways crooked will be found out”, a result that would ruin the reputation of the business researcher.

**Biblical Context for Dissertation Research.** The objective of the proposed dissertation research project was to identify new information that enables the future development of a system dynamics model of health system / ACO interactions. In other words, the objective was to facilitate additional learning regarding the financial effects of health system / ACO interactions.
Given the insights derived from this research, health system and ACO leaders will acquire the knowledge to build a model that captures the complexity of health system / ACO interactions and creates insights to guide strategic decision-making. This goal was achieved through a research design that collected and analyzed insights from multiple subject matter experts in health systems and ACOs. Thus, the researcher’s design of shared model building followed the guidance of 1 Corinthians 1:10 (ESV Bible, 2001), as the implicit aspiration for research subjects was, “I appeal to you, brothers, by the name of our Lord Jesus Christ, that all of you agree, and that there be no divisions among you, but that you be united in the same mind and the same judgment.”

Given the human impact of decisions made in the healthcare industry a biblical worldview led the researcher to consider the impact of the proposed research beyond increasing profits. Philippians 2:4 (ESV Bible, 2001) reminds us to, “Let each of you look not only to his own interests, but also to the interests of others.” The researcher’s project will inform future development of a dynamic health system / ACO simulation model that contributes to the understanding of ACO business models. In this way, healthcare leaders can leverage the knowledge gained through this research to more efficiently design health system / ACO interactions that help to achieve the triple aim (Berwick et al., 2008) of cost reduction, quality improvement, and improved access to care.

**Relationship to Field of Study**

The ability to construct financially viable health system / ACO partnership models is central to the current model for healthcare transformation in the United States (Blackstone & Fuhr, 2016; Blumenthal et al., 2015; Collins & Saylor, 2018; Obama, 2016). The projected trend for healthcare expenditures in the United States is unsustainable and the Patient Protection and
Affordable Care Act of 2010 introduced ACOs as the mechanism by which to control rising healthcare costs while ensuring high quality, accessible healthcare (Blackstone & Fuhr, 2016; Collins & Saylor, 2018; National health expenditure projections 2019-2028: Forecast summary, 2019; Obama, 2016). To date, the multiple health system / ACO partnership arrangements have shown mixed results (Comfort et al., 2018; D’Aunno et al., 2018).

The complexity of health system / ACO interactions strongly suggests that reliable insight regarding partnership strategies relies on the ability to develop dynamic simulation models capable of modeling complexity through the use of feedback loops (Chang et al., 2017; Cosenz & Noto, 2018; Schiff, 2011). This study directly addressed a current gap in the literature that impeded progress with respect to dynamic simulation model development, which was the lack of consensus regarding the operational components of health system and ACO business models that lead to interaction and the feedback loops that result from such interactions (Cassidy et al., 2019). By filling this gap, the results of this current research will enable development of a health system / ACO interaction simulation model and provide healthcare leaders the ability to quantify the potential financial outcomes resulting from strategic partnership decisions in the face of complexity and nonlinear responses.

Summary of Significance of the Study

There is a gap in the academic research regarding the knowledge necessary to construct a reliable, dynamic model of health system / ACO interactions. This research project addressed that gap by engaging subject matter experts in unstructured interviews and Likert scale-based surveys to determine the critical components necessary to construct a system dynamics model of health system / ACO interactions. This research will position healthcare executives at health systems and ACOs to construct a system dynamics model of a health system / ACO partnership
that includes the effects of inter-organizational feedback loops, which are known to lead to nonlinear responses to changes in operational parameters driven by strategic decisions. The construction of such a model, based on the insights surfaced through thematic coding and quantitative triangulation performed in this research, provides a mechanism by which healthcare leaders can more accurately anticipate the financial impact of strategic decisions pertaining to health system / ACO partnerships at a time when such partnerships are central to healthcare reform efforts in the United States.

**Review of the Professional and Academic Literature**

The researcher conducted a comprehensive review of the academic and professional literature to establish the current state of research regarding health system and ACO interactions and identify gaps in the research. The literature review identified a substantial gap, which is a lack of research involving complex dynamic simulation models of health system interactions with ACOs, including the impact of interactions on both entities’ operating margins. The literature review consisted of 10 topics that developed the foundation for the dissertation research by reviewing (i) the current state of U.S. healthcare; (ii) the quality and economic drivers of healthcare reform; (iii) the introduction of ACOs as a structure to achieve the triple aim; (iv) options for ACO partnerships; (v) potential conflicts arising from ACO partnerships with health systems; (vi) the influence of complexity on strategy formulation; (vii) the definition of, and requirements for modeling, complexity; (viii) system dynamics as the preferred method for modeling dynamic complexity at the macro level; (ix) the current state of system dynamics modeling in healthcare; and (x) group model building as the preferred approach to system dynamics model development.
The Economics and Quality of U.S. Healthcare

History of U.S. Healthcare Economics and Unsustainability. Bradley et al. (2017) estimated that, by the year 2020, spending on healthcare services in the United States would represent 20% of gross domestic product (GDP). The authors noted that U.S. healthcare spending as a share of GDP was approximately twice that observed in similar, western industrialized countries (Bradley et al., 2017). Bradley et al. (2017) also reported that healthcare spending represented a double-digit share of GDP in the United States since the mid-1980s or a sustained trend of approximately twenty-five years before enacting the ACA. Adding to the concern regarding increasing healthcare costs, Antos and Capretta (2017) noted that, in 2016, healthcare expenditures (HCE) increased by 4.3% to an estimated $3.3 trillion while GDP grew at 2.8%. The HCE increased further to $3.65 trillion by 2018 (Antos & Capretta, 2020). The authors further noted that 2016 was the third year in a row in which HCE growth exceeded GDP growth, with HCE growth greater among private insurance members than among members of government-sponsored insurance programs (Antos & Capretta, 2017).

Given the size of the United States compared to most industrialized countries, research often cites healthcare spending on a per capita basis. Adjusting for population size, Penn and Chi (2018) noted that, in the period spanning 2013 through 2016, healthcare spending per capita in the United States ($9,403) was almost twice the average expenditure across 10 other industrialized countries ($5,419). Baicker and Chandra (2018) reported a continuing debate regarding the extent to which high healthcare expenditures in the United States were due to a higher quantity of services per capita, higher prices per healthcare service, or both. Importantly, understanding the relative contributions of price and quantity is critical for forming economic
policies, such as those embedded in the ACA, that can successfully mitigate healthcare costs (Baicker & Chandra, 2018).

Porter and Teisberg (2006), in the seminal work *Redefining Health Care: Creating Value-Based Competition on Results*, asserted that the rapidly escalating cost of healthcare represented an unsustainable, national economic crisis. Antos and Capretta (2017) asserted that the ACA developed because of this economic concern, with its reforms intended to slow HCE’s growth. However, follow-up analysis determined that the ACA did not slow the rate of HCE growth in the United States (Antos & Capretta, 2020). Adjusting for the economic slowdown resulting from the recession of 2007-2009, Antos and Capretta (2020) found that HCE grew 2.7% annually before enacting the ACA. The HCE growth was 2.8% in the years after enacting the ACA (Antos & Capretta, 2020).

The ACA’s centerpiece, the introduction of ACOs, has met with mixed results (Antos & Capretta, 2020). The Medicare Shared Savings Program (MSSP) experienced savings of $1.7 billion in the two years of 2017 and 2018, while its successor, the Next Generation ACO Program (NextGen), resulted in $93 million in cost increases (Antos & Capretta, 2020). Thus, variation persists in the success attributed to different ACO models. As a result, the Centers for Medicare and Medicaid Services (CMS) projects that HCE will increase to $6.2 trillion by 2028, representing an annual increase of 5.4% beginning in 2019 (CMS, 2019).

**Crossing the Quality Chasm as a Trigger for Reform.** In addition to an emerging recognition of healthcare spending’s unsustainability as the United States entered the twenty-first century, questions arose regarding the quality of care received (Porter & Teisberg, 2006). In 2001, the Committee on Quality of Health Care in America published a seminal report entitled *Crossing the Quality Chasm: A New Health System for the 21st Century*, often abbreviated
*Quality Chasm.* *Quality Chasm* contained an in-depth analysis of the quality of healthcare services delivered in the United States, concluding the annual number of deaths due to medical errors was in the tens of thousands. The number of medical error-related injuries was in the hundreds of thousands (Committee on Quality of Health Care in America, 2001). Also, the authors of *Quality Chasm* estimated the number of Americans suffering from a chronic illness would exceed 130 million by 2020 (Committee on Quality of Health Care in America, 2001).

The *Quality Chasm* report also addressed the cost of poor quality care, noting that treating an adult with a single chronic condition was more than double the cost of treating a person with an acute illness (Committee on Quality of Health Care in America, 2001). Treatment of persons with more than one chronic illness cost nearly six times the cost of treating an acutely ill person (Committee on Quality of Health Care in America, 2001). Total healthcare expenditures for all persons with chronic illnesses, as published in *Quality Chasm*, exceeded $650 billion annually, including direct and indirect costs (Committee on Quality of Health Care in America, 2001).

Bradley et al. (2017) termed the association of high healthcare expenditures with poor quality outcomes in the United States a healthcare paradox. As recently as 2017, Bradley et al. reported lower life expectancy, higher infant mortality, and higher rates of heart disease, diabetes, obesity, and lung disease for Americans than for residents of other industrialized countries that spend approximately 50% of American per capita expenditures on healthcare. Penn and Chi (2018) also found that while the number of physicians per capita in the United States was similar to that of other industrialized countries, physician financial compensation in the United States was nearly double that of other countries. Stockwell (2018) included childhood mortality among the quality measures for which the United States ranked last among
industrialized countries nearly 20 years after the publication of *Quality Chasm*. Porter and Teisberg (2006) suggested a definition of healthcare value as the quality of the treatment outcome per dollar spent to receive the treatment. Given this definition and the previously noted findings that the United States has the highest cost per capita and the worst health outcomes among industrialized nations, led to the introduction of healthcare reform efforts, as described below, to remedy findings that Americans received low-value healthcare (Papanicolas et al., 2018).

**The Triple Aim: Defining the Goals of Healthcare Reform.** In response to the economic and quality crises identified in the early twenty-first century, Berwick et al. (2008) published a seminal paper proposing the triple aim as a new guiding principle for healthcare reform in the United States. The authors defined the triple aim as the simultaneous achievement of healthcare cost reduction, quality improvement, and increased access to high-quality healthcare services (Berwick et al., 2008). Berwick et al. further asserted that these three factors are interrelated, with changes in each exerting an influence on the other.

Whittington et al. (2015), reflecting on the first seven years following the triple aim’s introduction, looked beyond the theoretical construct of the triple aim to explore the operational components necessary for its successful execution. The authors included the existence of a population health management infrastructure, the ability to conduct population health management at scale, and the ability to translate lessons learned into improved, sustainable population health management over time as the critical operational structures necessary to achieve the triple aim (Whittington et al., 2015).

Despite the original definition of the triple aim by Berwick et al. (2008), Mery et al. (2017) identified inconsistencies in its definition as applying the triple aim concept evolved over
the decade following its introduction. Among the inconsistencies identified was applying the triple aim at the health system level, given its original application as a guiding principle for community healthcare organizations (Mery et al., 2017). Mery et al. asserted that the original triple aim concept relied upon a shift to a national integrator of healthcare services, which does not exist in the U.S. healthcare system. Instead, health service integration occurs at local health systems (Mery et al., 2017), consisting of hospitals and physicians, and, by extension, following the passage of the ACA, accountable care organizations. Translation of the triple aim principle to local healthcare entities resulted in research studying microsystems' organization to achieve the impact of the triple aim, such as primary care delivery (Obucina et al., 2018).

**The Affordable Care Act and the Introduction of ACOs**

**The Affordable Care Act as Health Care Reform Legislation.** By 2009, a three-decade trend of double-digit healthcare cost inflation, recognition of the need for substantial improvement in the quality of healthcare services, and the introduction of the triple aim concept led to a national debate on the topic of healthcare reform in the United States. (Obama, 2016). Strong political support for healthcare reform legislation, led by the Obama administration, leaders in the Democratic party, and a coalition of influential business leaders, resulted in enacting the Patient Protection and Affordable Care Act in 2010 (Collins & Saylor, 2018; Obama, 2016). From the beginning of his presidential campaign, President Obama left no doubt that the goal of his administration would be to introduce fundamental reforms into the U.S. healthcare system and the ACA was the culmination of this effort (Obama, 2016).

The ACA contained nearly one thousand pages of detailed provisions relating to healthcare reforms (Patient Protection and Affordable Care Act of 2010, 2010). Collins and Saylor (2018), Shaw et al. (2014), and Blumenthal et al. (2015), in reviews of the considerations
of primary importance in the formulation of the ACA, noted the direct parallels to the triple aim framework. The authors noted that the initial goal for new healthcare legislation was to expand access to healthcare insurance coverage to the uninsured population. This effort led to the formation of a national healthcare marketplace intended to increase competition among healthcare insurance products (Collins & Saylor, 2018). The ACA expanded to include provisions to improve the quality of healthcare services by penalizing providers for hospital-acquired infections and readmissions. Additionally, the ACA included provisions designed to contain escalating healthcare costs, among which were the hospital value-based purchasing accountable care organization frameworks (Collins & Saylor, 2018).

Provisions related to the expansion of the health insurance market to provide insurance coverage for all appear in Title I of the legislation, with Subtitle C, Part 1 outlining market reforms and Subtitle D, Parts 1 and 2 establishing healthcare exchanges (Patient Protection and Affordable Care Act of 2010, 2010). Title III, Part 1, Section 3001, established the Hospital Value-Based Purchasing Program as the mechanism through which to create financial incentives for quality improvements (Patient Protection and Affordable Care Act of 2010, 2010). Title II, Subsection I, Section 2706, refers the reader to modifications to the Social Security Act, Section 1899. Section 1899 contains the definition of accountable care organizations within the context of shared savings programs linking quality improvement to provider reimbursement (Patient Protection and Affordable Care Act of 2010, 2010; U.S. Social Security Administration, 2012).

In an early review of progress in the wake of the ACA, Shaw et al. (2014) asserted the legislation represented the most comprehensive overhaul of the healthcare system since the introduction of the Medicare program in 1965. The authors noted that all major provisions of the ACA were in effect as of 2014. However, political controversy and debate continued,
particularly concerning operational aspects of coverage for all provisions (Shaw et al., 2014). Shaw et al. called out the central role expected for ACOs in defining new models of clinical service delivery that would improve the coordination of care, eliminate waste, and reduce costs.

Béland et al. (2018) reported on the state of the ACA under the Trump administration. The authors noted the new administration began with a widely-publicized strategy to rip-and-replace the ACA (Béland et al., 2018). Early, adverse public sentiment regarding the effects of the ACA began to wane, however, and mitigated the political pressure to change drastically, or replace, the ACA (Béland et al., 2018). While some modifications to the ACA may occur during a Republican administration, the authors did not note any likely changes that would alter the importance of either ACOs or value-based purchasing programs in the foreseeable future (Béland et al., 2018).

**Value-based Care.** Porter (2009), building on the triple aim concept, introduced the principle of value-based care. Work by Porter (2009) and Porter and Teisberg (2006) resulted in introducing a concept for the determination of the value of healthcare services. Porter and Teisberg (2006) introduced a framework for assessing value in healthcare, asserting that value is the ratio of the quality of a healthcare outcome to the cost of the services resulting in the outcome. In this formulation, low quality, high cost, or both can lead to low perceived value for the consumer/patient (Porter & Teisberg, 2006).

Porter (2009) articulated six fundamental changes required of the U.S. healthcare system to produce higher value for consumers of healthcare services by reducing health insurance costs, the denominator in the value equation. Porter’s (2009) requirements for high value included

- the creation of a competitive market for health insurance,
- the inclusion of employers in the health insurance system,
• health insurance for people without access to coverage through an employer,
• creation of large insurance risk pools for individual insurance products,
• income-based subsidies to enable low-income individuals to afford health insurance,
and
• a mandate that all individuals, both sick and healthy, must participate in the health insurance system.

The concept of value-based purchasing (VBP) speaks to the value equation numerator, which references the quality of services received and resulting outcomes (Ryan et al., 2017). The VBP introduced changes in healthcare provider reimbursement structures that linked provider compensation to the quality of patients’ outcomes based on predefined quality measures (NEJM Catalyst, 2017; Ryan et al., 2017). Achievement of quality measures resulted in increased compensation to providers. Providers that failed to achieve quality thresholds faced withholding of quality incentives (upside risk only) or the requirement that providers repay a portion of compensation as a penalty for unsatisfactory quality performance (upside and downside risk) (Ryan et al., 2017).

Rather than the traditional fee-for-service provider reimbursement system in which providers receive compensation for each service provided, VBP compensates providers for providing services that result in improved outcomes at a lower cost (Ryan et al., 2017). The inclusion of quality measures in VBP programs prevents the creation of perverse incentives in which providers may withhold necessary services to reduce costs (Porter & Teisberg, 2006; Ryan et al., 2017). Given that VBP models offload to healthcare providers a portion of the financial risk for care traditionally held by health insurance companies, providers face incentives to
consolidate practices to diversify and share risk (NEJM Catalyst, 2017). Among the emerging structures to coordinate and manage risk under VBP models were ACOs (NEJM Catalyst, 2017).

**ACOs as the Vehicle to Achieve Value-based Care.** The Patient Protection and Affordable Care Act of 2010, through modifications to the Social Security Act Section 1899, introduced the concept of the ACO into law. The Social Security Act outlined general provisions for ACOs but avoided detailed specifications for ACO structures (Patient Protection and Affordable Care Act of 2010, 2010; U.S. Social Security Administration, 2012). To qualify for participation in shared savings programs, an ACO must consist of

- ACO professionals in group practice arrangements,
- networks of individual practices of ACO professionals,
- partnerships or joint venture arrangements between hospitals and ACO professionals, or
- hospitals employing ACO professionals ((U.S. Social Security Administration, 2012).

Further, an ACO must

- be willing to become accountable for the quality, cost, and overall care of the Medicare fee-for-service beneficiaries assigned to it;
- include primary care ACO professionals that are sufficient for the number of Medicare fee-for-service beneficiaries assigned to the ACO;
- define processes to promote evidence-based medicine and patient engagement;
- report on quality and cost measures and coordinate care; and
- meet quality performance standards [to be] eligible to receive payments for shared savings. (U.S. Social Security Administration, 2012)
The Social Security Act did not contain specifications regarding the organizational nor ownership structures of ACOs (U.S. Social Security Administration, 2012).

Berwick (2011) summarized the initial requirements outlined in the Medicare Proposed Rule regarding the quality metrics that ACOs had to meet to be eligible for shared savings payments in keeping with the triple aim and value-based purchasing tenets. The Proposed Rule established two objectives for quality metrics: improve care and improve health (Berwick, 2011). The purpose of care improvement metrics was to measure patient experience, care coordination transitions, information systems, and patient safety (Berwick, 2011). Health improvement metrics focused on preventive care services and management of chronic conditions, including diabetes, congestive heart failure, coronary artery disease, hypertension, chronic obstructive pulmonary disease, and the health of the frail elderly (Berwick, 2011).

Five years after the adoption of the ACA and introduction of ACOs, Blumenthal et al. (2015) reported observed improvements in 33 quality indicators among the 405 ACOs participating in the MSSP. Estimated care cost savings associated with ACO population health management was $700 million greater than that of a control group during the same period (Blumenthal et al., 2015). Despite evidence of success for some ACOs, Golden (2015) reported financial challenges for most ACOs. Of the 114 ACOs participating in the MSSP as of 2016, only 29 qualified for shared savings payments based on performance against quality metrics (Golden, 2015). As a result, the MSSP lost one-third of its participating ACOs after the program’s first year (Golden, 2015).

Shami (2016), in a review of ACO performance since the enactment of the ACA, asserted that bending the healthcare cost curve consistent with the triple aim was a significant objective of the ACA. Additionally, Shami (2016) identified bending the cost curve as the principal driver of
the mission of ACOs and that cost containment relies heavily on an ACO’s ability to shift providers from traditional fee-for-service payment to a value-based purchasing model. Thus, ACOs facilitate care quality enhancement by partnering with physicians and hospitals through value-based purchasing contracts (Shami, 2016). By ensuring that participating physicians and hospitals meet pre-determined quality metric thresholds, ACOs ensure that providers achieve cost savings without rationing or omitting the care necessary to achieve favorable health outcomes for patients (Shami, 2016).

Complicating the assessment of ACO performance is a growing concern that the triple aim must address disparities in delivering healthcare services and the resulting outcomes (Wilkinson et al., 2017). The result is that ACO strategies must increasingly focus on identifying populations that experience inequities in the delivery of high-quality healthcare services (Wilkinson et al., 2017). As the reimbursement of hospitals and physicians participating in ACOs depends upon achieving quality standards established by the ACOs, both administrators and clinicians must identify disadvantaged populations. The purpose is to understand the financial impact of treating patients with more substantial disease burdens in the context of potentially more generous reimbursements achieved by meeting additional quality thresholds (Wilkinson et al., 2017).

The Structure and Economics of ACOs

Major Business Objectives for ACOs. Shami (2016) associated with ACOs a fiduciary responsibility on behalf of the patients served by its participating providers. Shami’s definition attaches this fiduciary responsibility to all participants in the coordinated care of patients, including hospitals and physicians. The result is a shift of fiduciary responsibility and associated financial risk traditionally held by health insurance companies to the provider community.
In accomplishing fiduciary responsibilities, ACOs are accountable under the ACA for driving the transition of provider reimbursement methods from fee-for-service to value-based purchasing models (Shami, 2016). The shift to VBP models, in turn, places a burden on ACOs to ensure that providers achieve satisfactory performance against the quality of care metrics established by private and governmental insurers (Shami, 2016). Shortell et al. (2015) noted that, by 2015, half of the existing ACOs served the private sector, while half served the Medicare population. Thus, the business objectives for ACOs are to ensure the delivery of high-quality, accessible healthcare services to attributed patients while controlling healthcare costs through the implementation of value-based provider reimbursement models (Shami, 2016).

Shortell et al. (2015) addressed the many business challenges faced by ACOs attempting to achieve these business objectives. As organizations comprised of participating physicians and, in some cases, hospitals, ACOs faced the challenge of cultural adaptation to new models of population health management and reimbursement (Shortell et al., 2015). The ability to measure quality and react to the need for quality improvement increased the need for robust information sharing infrastructure (Shortell et al., 2015). The development of sophisticated care coordination infrastructure also becomes paramount for ACO business model success (Shortell et al., 2015). The authors introduced the concept of complexity into the ACO business model, concluding that the business objectives of ACOs are not independent but result in complex interactions that complicate strategic decision-making so that ACOs need tools to ensure mitigation of factors that adversely affect performance (Shortell et al., 2015). The results of the current research study supported the assertion of Shortell et al. (2015).

The ACO Economic Model. Blackstone and Fuhr (2016) studied the economics of ACOs serving the Medicare population six years after passage of the ACA. The authors cited
Berwick et al. (2008) and Porter and Teisberg (2006) when asserting that healthcare value produces the highest quality outcomes for the lowest cost to the consumer and acknowledged that ACOs were early in the journey toward ultimately realizing the triple aim (Blackstone & Fuhr, 2016). Economic factors remained a substantial barrier to increased consumer value (Blackstone & Fuhr, 2016).

The underlying driver of ACO economics in a VBP model is the ACO’s ability to reduce the cost of care for insurance companies, on whose behalf ACOs coordinate care for insured members (Blackstone & Fuhr, 2016; Phelps & Parente, 2018). This statement was supported by multiple interviewees’ comments in the current research study. The ACO clients pay the ACO a lump sum of money to cover the projected cost of care for the member population. To the extent that the ACO manages the care for covered members to less than the budget allotted by its insurer-customer, it shares in the savings achieved provided that it has met quality metric thresholds (Phelps & Parente, 2018). Physicians and hospitals participating in the ACO program as partners, and that have also met or exceeded quality thresholds, subsequently receive a share of the realized savings based on performance (Phelps & Parente, 2018). For the ACO, such a shared savings arrangement results in net income so long as it exceeds the cost of rendering population health management, or care coordination, services (Blackstone & Fuhr, 2016; Phelps & Parente, 2018).

Among the economic barriers noted by Blackstone and Fuhr (2016) was resistance among physicians to the practice pattern changes needed to earn revenue in a value-based system rather than a fee-for-service system. In a fee-for-service model, physicians earn more money by performing more services. In a value-based system, physicians earn more money by performing only the services necessary to achieve good health outcomes, as measured by a set of quality
metrics (Blackstone & Fuhr, 2016; Phelps & Parente, 2018). Adding to resistance is the shift of healthcare dollars from specialists to the primary care physicians that act as the managers of care coordination and, in turn, receive a more significant share of physician performance incentives for quality improvements (Blackstone & Fuhr, 2016).

Hospitals participating in ACOs must balance the potential economic benefits of sharing in ACO savings with the potential for loss of services due to ACO population health management efforts (Blackstone & Fuhr, 2016). Interviewees serving as health system executives particularly expressed agreement with Blackstone’s and Fuhr’s (2016) sentiment. Care coordination may direct services away from more costly hospital inpatient settings in favor of less expensive outpatient settings (Blackstone & Fuhr, 2016). An example would be using a free-standing surgical facility instead of a hospital-based operating suite. Despite this potential for economic conflict on the part of hospitals, D’Aunno et al. (2018) cited ACO collaboration with hospitals as a significant factor in the financial success of high-performing ACOs. The authors noted that the highest performance levels resulted from the creation of strong ACO physician relationships with hospitals before the formation of the ACO. These relationships enabled physicians to have more rapid access to the data needed to effectively coordinate patients’ care and improve the quality metrics associated with shared savings programs (D’Aunno et al., 2018).

Doran et al. (2017) expressed doubt that healthcare provider incentives based on extrinsic motivators, such as participation in a shared savings program, showed improvement in performance against healthcare quality metrics in a sustainable manner. The authors’ research demonstrated only modest effects on quality metrics, leading the authors to assert that financial incentives did not improve health outcomes (Doran et al., 2017). Also, the authors asserted that
quality improvements were temporary when observed (Doran et al., 2017). Incentives that do not foster sustainable quality improvement put the ACO’s financial performance at risk, especially when the ACO accepts downside risk in its contracts with insurers. Participating physicians and hospitals may see revenues decrease without compensation through shared savings (Doran et al., 2017).

**Options for ACO Partnerships.** The ACA did not specify required or allowable ACO partnership or ownership structures (Patient Protection and Affordable Care Act of 2010, 2010). Instead, the framers of the ACA permitted ACO organizers the flexibility to be creative with organizational structure to enable innovation in the ACO model and test which models worked best (Lewis, Fisher, & Colla, 2017). The lack of strict guidelines regarding ACO structure resulted in a wide variety of ACO models (Lewis, Fisher, & Colla, 2017).

Shortell et al. (2015), in a review of ACO development in the United States, found that physician groups owned 51% of ACOs, while hospital-physician partnerships owned 33% of ACOs. Lewis, Fisher, and Colla (2017) distinguished between two types of ACOs involving hospitals: those ACOs in which physicians and hospitals remained independent but affiliated under the ACO governance structure and ACOs formed by integrated delivery systems; the latter represented approximately 32% of all ACOs. The researcher’s analysis of interview data revealed three ACO models:

- ACOs owned by health systems,
- ACOs owned by a physician group collaborative and partnering with a health system, and
- ACOs owned by a joint health system / physician group collaborative.
Shortell et al. (2015) also found that half of the ACOs had contracts only with private insurance companies. Thirty-six percent contracted only for Medicare business; sixteen percent contracted with both Medicare and private insurers.

From an economics perspective, Mick and Shay (2016) asserted that capabilities, rather than organizational form, are prerequisites for a successful ACO. The authors pointed to the ability to provide services across the continuum of care, experience managing fixed, prospective health services budgets, and scale sufficient to produce meaningful performance statistics across many clinical service lines as necessary capabilities for the formation of a successful ACO (Mick & Shay, 2016). The first prerequisite cited by Mick and Shay spoke to vertical integration, leading the authors to suggest that integrated health systems hold an advantage in this regard. However, the authors noted the lack of a fully-integrated healthcare system in the United States suggests the need for diversity in ACO models to accommodate local variations in health service integration (Mick & Shay, 2016).

Lewis et al. (2018) discussed the emergence of non-clinical management companies as partners in ACOs. The authors found that more than a third of ACOs included a non-provider management partner as of 2015, approximately two-thirds of which assumed financial risk under the ACOs’ shared savings risk programs (Lewis et al., 2018). Management partners commonly provided administrative or information services, primarily for ACOs that lacked sufficient scale to directly support such services (Lewis et al., 2018). D’Aunno et al. (2018) reported using advanced information systems as among the factors that distinguished high-performing ACOs from low-performing ACOs. A partner that provides information systems is necessary if the ACO is unable to do so internally.
Murray et al. (2018) reported that non-provider management partners could collect a large share of an ACO’s shared savings incentives, leading to conflict within the ACO regarding goals and decision-making. This conflict led to the ACO partnership’s failure in cases where governance failed to establish trust among provider and non-provider partners (Murray et al., 2018). D’Aunno et al. (2018) included trusted physician leadership and relationships with hospitals as crucial success factors for high-performing ACOs, highlighting the potential for reduced ACO performance when management partnerships disrupt trusted relationships.

Comfort et al. (2018), reporting on the financial performance of ACOs, found that ACOs of varying partnership structures achieved comparable quality and financial performance. No ACO partnership model stood above the others concerning performance (Comfort et al., 2018). The authors concluded that the CMS should continue to allow ACOs to innovate partnership models to identify, if possible, an ACO model that results in superior quality and financial performance (Comfort et al., 2018).

The Structure and Economics of U.S. Health Systems

Definition of a Health System. The term health system appears in multiple contexts in the academic and professional literature. For example, before enacting the ACA in 2010, Porter spoke of health systems in the macro sense when proposing strategies for U.S. healthcare reform (Porter, 2009; Porter & Teisberg, 2006). Porter’s proposed strategies reflected the need for reforms across the whole of the national healthcare network, including hospital and physician practices, reimbursement methods, incentives, and quality measures (Porter, 2009; Porter & Teisberg, 2006). Similarly, Christensen et al. (2009) proposed the need for disruption of the U.S. healthcare system’s fundamental structure to change incentives from volume-based reimbursement to value-based reimbursement to improve health outcomes.
Conversely, Johnson and Frakt (2020) reviewed the evolution of health systems as defined in this paper. The authors studied the phenomenon of hospital consolidation during the period 2007 through 2017, defining the resultant groups of hospitals operating within a single parent corporation as health systems (Johnson & Frakt, 2020). Johnson and Frakt further noted that health systems might include ambulatory and rehabilitation facilities in addition to hospitals. Through a greater scale created by consolidation, health systems enjoy greater market power than individual hospitals because more hospital services become concentrated in fewer corporate entities (Johnson & Frakt, 2020). As of 2017, 64.3% of hospitals in the United States belonged to a health system, representing more than 75% of all hospital beds (Johnson & Frakt, 2020).

The concentration of market power raises potential anti-trust concerns as health system formation reduces the number of competing hospital-based organizations (Blair et al., 2016; Neprash & McWilliams, 2019). This concern increases when health systems acquire physician practices to integrate vertically (Greaney et al., 2016). Johnson and Frakt (2020) noted that 90% of markets in the United States now meet the federal Herfindahl-Hirschman Index (HHI) criterion for a highly concentrated market, a standard metric used to trigger an anti-trust review. This percentage is up from 50% in 2014 (Xu et al., 2015).

Proponents of health system formation argue that consolidation results in greater efficiency and increased ability to improve care quality and reduce costs (Blair et al., 2016; Neprash & McWilliams, 2019; Xu et al., 2015). Currently, available evidence does not support this contention. Hospitals acquired during health system formation have not demonstrated statistically significant differences in costs than independent hospitals (Neprash & McWilliams, 2019). There is evidence that increased concentration of market power in health systems raises healthcare services’ local cost while quality decreases (Johnson & Frakt, 2020). For this reason,
Singer (2018) recommended the best criterion for judging the appropriateness of hospital consolidation into a health system should be the health system’s success in realizing the triple aim.

**Traditional Business Objectives for Health Systems.** Wright et al. (2018) identified three categories of hospitals that may exist within a health system: for-profit, not-for-profit, and charity and government-sponsored. Each hospital category has different objectives concerning care delivery. For-profit hospitals provide care delivery services to realize a financial return for shareholders (Wright et al., 2018). Not-for-profit hospitals commonly serve as local community hospitals or academic teaching centers, providing services to the insured and uninsured populations (Wright et al., 2018). Charity hospitals provide care to those unable to pay for services, while government-sponsored hospitals provide services to designated populations; Veterans Administration hospitals are an example of the latter (Wright et al., 2018). Hospital-based services accounted for $1.1 trillion, or 31%, of healthcare spending as of 2017 (Johnson & Frakt, 2020).

While not-for-profit hospitals do not distribute dividends to shareholders, they, like for-profit hospitals, must attempt to maintain positive profit margins to stay in business; this is the concept of no margin, no mission (Beaton, 2019). Historically, hospitals and health systems earned income by treating patients in hospitals; more patients translated to more revenue (Clack, 2017; Johnson & Frakt, 2020). Health systems increasingly include affiliated outpatient clinical facilities and physician practices among revenue-generating sites (Johnson & Frakt, 2020). As traditional health system models create income through inpatient admissions, the primary business objective is to sustain inpatient bed occupancy rates, known as the inpatient census, as high as possible (Johnson & Frakt, 2020).
The Evolving Health System Economic Model. Eastaugh (2015) reported that, since the enactment of the ACA, it has become more difficult for independent or health system-affiliated hospitals to generate positive profit margins. The causes cited included pressure to reduce inpatient admissions, reduced reimbursement for inpatient services, and lower payments associated with treatment in outpatient settings. The author attributed the increased financial pressure on hospitals to health insurance companies’ policies as they move from volume-based reimbursements to value-based payments in a population health model (Eastaugh, 2015). Saag et al. (2016) demonstrated this effect in the wake of the ACA’s health exchange marketplace, noting that contribution margins for hospital services decreased by amounts ranging from 19% to 37% to treat health exchange members that left employer-sponsored commercial insurance plans.

The result of downward pressure on hospital margins caused multiple impacts on the healthcare industry. First, reports included significant increases in closures of regional and rural hospitals (Wright et al., 2018). Second, the healthcare industry experienced substantial numbers of hospital mergers and acquisitions to form health systems that hoped to reduce costs and increase margins through economies of scale (Blair et al., 2016; Wright et al., 2018). Finally, the advent of value-based purchasing principles, combined with the introduction of ACOs to manage down the cost of healthcare services, forced the health system industry to reconsider business objectives and organizational structures through the lens of disruptive innovation (Christensen et al., 2009; Wright et al., 2018).

Disruptive innovation drove hospitals and health systems to reimagine service models to support the cost and quality components of value-based purchasing arrangements (Clack, 2017; Eastaugh, 2015). Service model innovation includes the organization of health system services around services lines, or medical specialties, each of which operates as a profit/loss (P&L) center
Health systems increasingly adopted models of specialization in which they dropped unprofitable service lines in favor of margin-producing services (Eastough, 2015). In the VBP model, in addition to revenue derived from treating hospital inpatients, health systems may face penalties for readmissions or hospital-acquired infections, as well as penalties or incentive payments for meeting cost and quality targets established by health insurers or ACOs.

**Joint Health System / ACO Economics and Strategy**

**ACO Partnerships with Health Systems.** The enactment of the ACA increased the rate of health system and healthcare provider consolidation (Singer, 2018). Of primary importance under the ACA was the implementation of VBP models that required health systems and providers to reduce the cost of healthcare service delivery while simultaneously improving the quality of care (Lewis, Tierney, et al., 2017; Patient Protection and Affordable Care Act of 2010, 2010). The requirements of the ACA imposed new operating costs on health systems and providers, increasing the difficulty of maintaining operating margins due to the inability to pass on additional costs to consumers under the provisions of VBP models (Lewis, Tierney, et al., 2017; Singer, 2018). As a result, the achievement of a larger scale through consolidation became a mechanism by which health systems and providers attempted to spread the costs associated with ACA requirements (Lewis, Tierney, et al., 2017; Singer, 2018).

Consolidation did not, however, always involve mergers or acquisitions (Lewis, Tierney, et al., 2017). Lewis et al. (2018) found that 37% of ACOs involved partnerships with management organizations as of 2018. Among the services provided by management partners to ACOs were administrative, data, and care coordination services, eliminating the need for the ACOs to bear the cost of such services internally (Lewis et al., 2018). Analysis comparing the
operating costs of ACOs with partners to those not leveraging service partnerships showed, however, that service partnerships did not result in cost savings for ACOs (Lewis et al., 2018). Murray et al. (2018) found that the dissolution of ACO partnerships with management organizations was not uncommon once the ACO acquired the ability to provide similar services internally.

Harrison et al. (2018) found that joint hospital / ACO partnerships occurred more frequently in urban areas and in cases in which hospitals belonged to a health system. The hospitals involved also demonstrated higher acuity patient panels, as measured by the case mix index (Harrison et al., 2018). The authors asserted that a key to ACO success was the ability to redirect high acuity patients to lower-cost treatment settings, suggesting diversion away from the hospital inpatient setting and creating a financial conflict for the partner health system (Harrison et al., 2018).

Partnerships between ACOs and health systems, physician groups, or both emerged as all parties attempted to achieve the triple aim goals set forth by the ACA (Colla et al., 2016). As of 2016, approximately 63% of ACOs included at least one hospital or health system partner (Colla et al., 2016). ACOs are expensive to implement, and partnerships with large hospitals or health systems provided a means to acquire capital (Colla et al., 2016). All interviewees in the present research study acknowledged an infusion of capital into an ACO by a health system start-up, with many health systems continuing to subsidize partner ACOs through cash or shared services. Theoretically, health systems viewed ACO partnerships as a means to achieve cost reductions and quality improvements better, though subsequent analysis failed to consistently demonstrate the desired effect (Colla et al., 2016).
Concern for increased operational scale and the ability to integrate and better coordinate hospital and physician activities also led to increased hospital or health system acquisition of physician practices (Post et al., 2018). As ACOs principally consist of affiliated physician practices, a health system’s acquisition of a physician practice may indirectly tie the health system’s financial performance to ACO performance (Blackstone & Fuhr, 2016). While research regarding the cost-effectiveness of health system acquisition of physician practices remains limited, some early evidence suggested healthcare delivery costs may increase under such vertical integration arrangements (Post et al., 2018). Other research cited a reduction of healthcare costs associated with the economies of scale realized through vertical integration of health systems and physician practices (Singer, 2018).

The Problem of Conflicting Business Models. Doulgeris and Bonvicino (2014) proclaimed in an opinion piece that ACOs led by hospitals were a flawed concept. The inherent conflict between the business models of ACOs and hospitals prevented the joint venture from succeeding financially. Blackstone and Fuhr (2016) subsequently explored this idea through academic research. The ACOs earn a portion of the healthcare cost savings they achieved on behalf of health insurance customers, a concept known as shared savings (Blackstone & Fuhr, 2016). The ACOs then pass on a portion of earned shared savings to participating health systems and physicians (Blackstone & Fuhr, 2016). However, this arrangement comes at a cost to health systems. Healthcare cost savings often arise from reducing hospital inpatient services resulting from the ACO’s population health management activities (Blackstone & Fuhr, 2016).

Therefore, if the revenue realized by the health system through shared savings does not exceed the revenue lost through ACO population health management activities, the health system experiences a net loss, as acknowledged by multiple interviewees in this research study. In the
case of a hospital-owned or hospital-led ACO, whether the enterprise as a whole achieves a net positive margin depends on whether the total shared savings earned by the ACO exceeds losses incurred by the health system (Blackstone & Fuhr, 2016). Blackstone and Fuhr concluded that health systems might take the lead in ACO ownership to regain some control over the extent to which ACOs reduce hospital-based care, which would improve the health system’s financial performance and exert negative financial pressures on the ACO.

**Performance of Health System / ACO Partnerships.** Lewis, Fisher, and Colla (2017) observed that most ACOs struggled to achieve care cost savings, regardless of the ownership model. Also, hospital-led systems, referred to by the authors as integrated delivery systems, demonstrated the worst financial performance among the three types of ACO models (Lewis, Fisher, & Colla, 2017). Approximately 50% of physician-owned ACOs, and ACOs consisting of affiliated, independent, physician practices, earned shared savings bonuses after the first three years of ACO operation (Lewis, Fisher, & Colla, 2017). However, only 30% of health system led ACOs earned shared savings payments (Lewis, Fisher, & Colla, 2017), lending support for the assertion by Blackstone and Fuhr (2016) that conflicting business models reduce the financial viability of health system led ACOs.

The findings of Lewis, Fisher, and Colla (2017) concerning variations in financial performance across ACO ownership models appear to be contradicted by the subsequent work of Comfort et al. (2018). Comfort et al. (2018) found no significant difference in the quality of care or cost savings achieved across different ACO ownership models, including health system owned ACOs. The authors concluded that their findings suggested the need for continued experimentation with ACO ownership structures to determine which structure results in optimal quality and financial performance (Comfort et al., 2018).
D’Aunno et al. (2018) studied the factors associated with high-performing ACOs. Among the authors’ findings was that physician collaboration with hospitals was significantly correlated with ACO success (D’Aunno et al., 2018). This result does not directly conflict with the assertion of Blackstone and Fuhr (2016) and the findings of Lewis, Fisher, et al. (2017) and Comfort et al. (2018) regarding the effect of health system ownership of ACOs. However, it suggests that arrangements that facilitate better collaborative relationships between physicians and hospitals enhance the ACO’s performance. The authors offered no conclusions regarding whether such relationships had reciprocal, positive effects on hospital performance (D’Aunno et al., 2018).

The performance of the Triad Healthcare Network (THN) in Greensboro, North Carolina, offers an example of a health system-owned ACO in which the ACO achieved significant, positive financial results (Joyce, 2018). The THN earned $13.2 million in shared savings payments based on its performance in 2017, making it one of the most successful Medicare ACOs in the United States that year (Joyce, 2018). This finding is consistent with a report that North Carolina is at the leading edge of healthcare financing transformation (McClellan et al., 2019). Thus, it is difficult to determine whether the THN’s result was solely due to the strategy for operating its joint hospital / ACO ownership model, state healthcare reimbursement reforms, or both.

**Formulating Strategy in a Time of Healthcare Reform**

**Strategy Formulation Challenges in Complex Organizations.** The unresolved question of whether health system partnerships with ACOs can result in favorable financial outcomes for both organizations is difficult to answer because healthcare organizations are complex systems functioning in a complex industry (Cassidy et al., 2019; Marshall, Burgos-Liz, Ijzerman,
Osgood, et al., 2015). Weissenberger-Eibl et al. (2019) defined a complex system as a system consisting of multiple entities, each with behavioral dynamics of its own, that interact with each other in ways that cause the system, in total, to exhibit behaviors not associated with any of the individual entities. The authors argued that firms’ strategies often fail due to management’s failure to view the firm as a complex system, instead of treating the firm as though it is unaffected by the actions of partners or other entities in its environment (Weissenberger-Eibl et al., 2019). This approach to strategy formulation, in which firms view themselves in isolation from their environment, is known as linear thinking and is thought to be out of date in the modern business environment, according to Weissenberger-Eibl et al. (2019).

Weissenberger-Eibl et al. (2019) also argued that industry disruption renders strategies obsolete more quickly than when industries are in a state of equilibrium or slow change. Hassert (2019) and Weissenberger-Eibl et al. (2019) asserted that firms must be able to rapidly anticipate the impacts of industry change and react quickly with adaptations of the firm’s strategy to maintain or build market share. Static strategy development methods do not facilitate the ability to anticipate the effects of potential industry disruptions on current strategy as dynamic strategy development tools allow (Hassert, 2019).

Business simulation is a useful tool for modeling the effects of system complexity so that managers can determine the most likely outcome of a strategic decision (Kazakov & Kunc, 2016; Monauni, 2017). Kazakov and Kunc (2016) suggested managers make strategic decisions based on mentally anticipating various decision options’ future outcomes. The authors referred to this anticipatory process as a mental rehearsal of possible future states, which is inadequate in the face of system complexity due to limitations on human cognitive processing of complexity (Kazakov & Kunc, 2016). As a result of the ACA-driven disruption of the healthcare industry, a
rapidly changing business environment adds to humans’ difficulty anticipating the effects of strategic decisions (Hassert, 2019). Hassert (2019) distinguished this human-driven approach to strategy from an approach based on business simulation, referring to the former as static strategy development and the latter as dynamic strategy development.

Monauni (2017) described a dynamic strategy for complex systems as a process that first involves modeling a business through a collection of parameters representing the business’s vital operating features. Once established, the parameters serve as the basis for a business simulation model that enables leaders to compare the outcomes of multiple potential strategies (Monauni, 2017). Analysis of the business’s operational parameters enables identifying feedback loops formed by the interaction of parameters associated with different entities in the complex system (Weissenberger-Eibl et al., 2019). A simulation that includes feedback loops allows managers to determine the extent to which one parameter affects all other parameters in the model (Weissenberger-Eibl et al., 2019). The presence of feedback loops enables the simulated effects of strategic decisions to evolve with time, creating a dynamic view of a strategy (Hassert, 2019).

One of the significant advantages of a business simulation approach is that simulation allows strategic experimentation without implementing a strategy to observe its effects, thereby reducing risk for the firm (Monauni, 2017).

Kazakov and Kunc (2016) found business managers exposed to business simulation capabilities identified more possible strategies than did managers left to experience alone; this expanded the firm’s strategic options. Torres et al. (2017) obtained a similar result when exposing CEOs to business simulation tools. When asked to anticipate potential strategic options, CEOs identified fewer options when not exposed to system dynamics simulation capabilities (Torres et al., 2017). Further, when faced with unanticipated market changes one year later,
CEOs with prior business simulation experience generated more strategic response options than CEOs with no previous exposure to simulation modeling. Therefore, both short- and long-term benefits accrue from simulation modeling access in complex business environments (Torres et al., 2017).

**Additional Strategy Considerations in Healthcare.** Before the enactment of the ACA, the eminent Harvard University strategist Michael Porter (2009) argued that healthcare reform would require the reinvention of the existing U.S. healthcare system. While citing the increasing calls for health insurance coverage for all Americans, which later became a central provision of the ACA, Porter asserted that restructuring the healthcare delivery system would present a more significant challenge. Porter envisioned a new delivery system that aligned preventive care and wellness programs with sick care to create patient value across the continuum of care. This concept became embedded in the ACO concept as put forth in the ACA (Shaw et al., 2014; Whittington et al., 2015)

Following the ACA’s adoption, with its attendant requirements to transform the U.S. healthcare system to one based on patient value rather than service volume, Hilligoss et al. (2017) cited the need for strategies that would create alignment within the system to improve quality and reduce cost. By making ACOs accountable for both quality and cost, the ACA created incentives for new strategies that would realign health systems and healthcare providers’ incentives to engage in value-based purchasing and population health management (PHM) (Hilligoss et al., 2017). Nonetheless, health systems and healthcare providers, the latter being the primary participants in most ACOs, represent different stakeholders in the healthcare delivery system, and each developed its expectations regarding the best strategies to achieve the goals of VBP and PHM (Steenkamer et al., 2019).
Steenkamer et al. (2019) noted hospital systems’ strategies developed around the idea that high-acuity patients would continue to receive care through hospital-based services, while ACOs would manage low-acuity care to low-cost locations through bundled payments. In other words, hospitals faced the threat of loss of low acuity patient volumes as a direct result of ACOs’ population health management efforts, an assumption supported by Harrison et al. (2018) and the researcher’s coding of interview data. Blackstone and Fuhr (2016) cited the potential loss of business due to ACO PHM efforts as a motivating factor for health systems to adopt a strategy of partnering or owning ACOs to reduce case diversion to competing health systems.

Lewis et al. (2019) noted a continued lack of a consistent, research-based understanding of ACO strategies for cost mitigation and quality improvement as recently as 2019. Exploring this problem led the authors to conclude that ACOs broadly focused on physician-oriented care modification strategies, with no mention of collaborative strategies undertaken with health systems (Lewis et al., 2019). Unstructured interviews with 16 leading ACOs led to consistent foci on disease management, improving transitions of care between treatment venues, increased access to primary care physician services, and addressing social determinants of health such as lack of transportation or housing (Lewis et al., 2019). These findings were corroborated by Millenson et al. (2019). None of the ACO strategies at the top of the priority list identified by the authors included direct collaboration with owned or affiliated health systems, suggesting a siloed approach to strategy development that failed to account for the effects of health system / ACO interactions (Lewis et al., 2019; Millenson et al., 2019). All of the interviewees that participated in the current research study acknowledged that neither they nor their health system or ACO routinely considered the effects of health system / ACO interactions.
Anderson and Chen (2019) found hospitals associated with ACOs were more likely to include enhanced population health management programs as part of the health system strategy than were hospitals not affiliated with an ACO. Mora’s and Walker’s (2016) findings that ACO affiliated health systems demonstrated more high-quality measures than non-ACO affiliated health systems support this conclusion. This result indicates the ACO operating model influences health system strategies to some degree when the health system directly collaborates with an ACO. Anderson and Chen (2019) found affiliation with an ACO increased the data sharing between health systems and ACOs. The research did not reference any findings of strategic coordination of population health management programs between health systems and ACOs to optimize interrelated strategies (Anderson & Chen, 2019; Mora & Walker, 2016). The work of Kaufman et al. (2019) demonstrated the need for consideration of the effects of interrelated health system and ACO strategies. The authors, studying the effects of ACOs on care delivery, found two of the significant impacts of ACO strategies included reductions in inpatient hospital admissions and emergency department visits, both important sources of health system revenue (Kaufman et al., 2019).

**Mathematical Modeling and Simulation of Complexity**

**Introduction of Complex Dynamic Systems as a Construct.** In 1961, Jay Forrester of the Massachusetts Institute of Technology wrote a seminal book, *Industrial Dynamics*, that defined system dynamics modeling of complex systems (Forrester, 1961). Forrester asserted business managers faced tremendous challenges concerning decision-making due to the complexity and nonlinearity of business system interactions. Researchers acknowledged Forrester’s work as establishing the science of management decision making (Lane & Sterman, 2018; Sterman, 2018).
Forrester (1961) asserted computational models of complex systems allowed experimentation that could reveal the effects of interactions between variables in ways that would be difficult or impossible to study in the business environment. Forrester considered complex systems to involve large numbers of variables that interact with one another to produce outcomes that vary with time, typically in nonlinear ways. The concept of externalities represents the idea that variables may influence other variables’ behavior, or that variables are interdependent (Morecroft, 2015). Traditional business modeling approaches ignore externalities when constructing models of business processes and strategies, leading to incomplete representations of the business problem (Morecroft, 2015). All interviewees in the current research project acknowledged the failure to consider externalities associated with partnerships.

**Modeling Complex Dynamic Systems.** The variation in outcomes with time when externalities are present distinguishes complex static systems from complex dynamic systems (Forrester, 1961). The behaviors of dynamic complex systems are not readily understood through observation because they are beyond the human capacity for mental analysis, cannot be represented in closed mathematical form, and may be highly sensitive to initial conditions (Forrester, 1961). Forrester maintained that businesses, as social systems, represented higher complexity systems than those found in physical science or engineering.

Given the complexity of social systems, Forrester asserted, controversially, the need to account for both quantitative data and qualitative data when creating models of complex, dynamic systems (Sterman, 2018). Forrester’s rationale for the inclusion of qualitatively-derived data was that, “To omit such variables is equivalent to saying they have zero effect – probably the only value that is known to be wrong!” (Sterman, 2018, p. 23). Forrester maintained the preferred method for collecting qualitative data to inform model development was interviews
with subject matter experts engaged in the system in question, such as business leaders (Sterman, 2018).

Subsequent research has shown that, among the qualitative data collected through interviews, subjects’ assessments of how systems function are generally accurate, contributing valuable insights to guide model construction (Sterman, 2018). On the other hand, subjects’ beliefs about how the system should work and its resulting outcomes are low due to human mental limitations in processing complexity, emphasizing the importance of simulation modeling to assist strategic decision-making (Sterman, 2018). Monauni (2017) advocated for the importance of business simulations to inform strategic decision-making. The objective is to translate business models into mathematical models that capture the business’s critical operating parameters as they apply to a specified business problem (Monauni, 2017).

A mathematical model allows business leaders to simulate the outcomes of various strategic decisions without incurring the risk associated with implementing the strategies in the real world (Freebairn et al., 2016; Monauni, 2017). Sterman (2018) cited Forrester’s insight that business simulation enables managers to visualize the nonlinear effects of parameter interactions, as found, by definition, in complex systems. This allows managers to break free of traditional assumptions of linear outcomes resulting from parameter independence (Sterman, 2018).

Weissenberger-Eibl et al. (2019) extended this concept to include variables from a firm’s external environment in the modeling process. The authors, while acknowledging the value of simulation model construction based on the parametrization of a firm’s internal operating model, advocated for viewing the firm as a complex system operating under the influence of an external, complex system (Weissenberger-Eibl et al., 2019). An example of this idea relevant to this research is a dynamic model of a health system operating in the presence of an ACO, and vice
versa. The approach put forward by Weissenberger-Eibl et al. (2019) requires the modeler to account for interactions between internal business model parameters and external environment parameters to simulate the effects of strategic decisions fully. The researcher’s findings confirmed the presence of internal and external interactions involving health systems and ACOs.

**System Dynamics Modeling as a Tool for Complex System Simulation**

**Introduction to System Dynamics Modeling.** Forrester first established the concept of system dynamics modeling (SDM) in the 1950s and established SDM as a new discipline with his seminal book *Industrial Dynamics* (Forrester, 1961). Speaking in 1997, Forrester offered the following description of system dynamics:

> System dynamics deals with how things change through time. It uses modeling and computer simulation to take the knowledge we already have about details in the world around us and shows why our social and physical systems behave the way they do. System dynamics demonstrate how most of our decision-making policies are the cause of the problems that we usually blame on others, and how to identify policies we can follow to improve our situation. (Morecroft, 2015, p. 388)

Marshall, Burgos-Liz, Ijzerman, Crown, et al. (2015) offered a more formal definition of SDM as a technique for modeling complex systems by first creating a mathematical representation of a system’s structure that captures its principal components, then simulating the behavior of the system as it evolves. Central to the SDM concept is the idea that system behaviors emerge directly as a result of the structure of the system; by accurately representing the structure of a system, one can use computational simulation to determine how a system will react to a given stimulus (Cosenz & Noto, 2016; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). The SDM leverages system structure to capture nonlinear behaviors that result from the

It is the ability to capture nonlinear behaviors that distinguishes SDM from the abilities of most simulation techniques, which do not account for variable interactions and, therefore, fail to reflect the influence that one element of the system may have on all other elements (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015; Morecroft, 2015). As most real-world systems involve interactions between variables within the system or between internal variables and variables in the external environment, SDM results are more reflective of real-world behaviors (Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). The researcher demonstrated conclusively in the current research study that interactions occur within health systems and ACOs and between them. Cosenz and Noto (2016) added to the advantages of SDM the ability to capture emergent behaviors revealed over time. Cosenz and Noto (2016) and Torres et al. (2017) reviewed the advantages of SDM as a tool to support business strategy development, citing as a critical feature its ability to capture the time-dependent effects of system complexity.

dé Gooyert and Größler (2018), investigating applications of SDM, concluded that SDM played a substantial role in understanding the behaviors of real-world systems and in the development of grounded theories. Thus, SDM represents a valuable research methodology in both the business and academic environments (de Gooyert & Größler, 2018). The authors distinguished the value in the two domains by asserting that business applications of SDM serve to inform changes in policies or strategies. In contrast, academic applications seek to explain behaviors and develop, confirm, or refute theories (de Gooyert & Größler, 2018).
de Gooyert (2019), exploring this issue in greater detail, identified applications of SDM for grounded theory development, using SDM as a conceptual virtual laboratory to evolve theory and derive causal drivers of observed phenomena that either support or refute an existing theory. The dual ability of SDM to contribute to both business and academic contexts makes it a potentially relevant tool for dissertation research in an applied Doctor of Business Administration (DBA) program. The DBAs emphasize academic research into real-world business problems (DBA in healthcare management, 2019; Liberty University School of Business, 2018).

**Critical Concepts in SDM.** Several critical concepts characterize the development and construction of system dynamics models. These concepts affect data collection objectives before model construction and the interpretation of results derived from the model (Jolly, 2015; Morecroft, 2015).

**Causal Loops.** Thirty-nine years after Forrester’s landmark work on the modeling of complex systems, Sterman (2000) published a seminal work on the practical development and application of SDM to problems exhibiting dynamic complexity. Central to the construction of system dynamics models is understanding the interrelationships among variables in a system (Cosenz & Noto, 2018; Sterman, 2000). Causal loop diagrams are visual representations of the relationships between variables and illustrate potential cause-and-effect influences exerted by each variable on the others (Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015; Morecroft, 2015; Sterman, 2000).

Sterman (2000) pointed to the presence of causal loops as the primary distinguishing factor when explaining the difference between static modeling and dynamic modeling. The SDM experts consider causal loops to be visual representations of the mental model of how a system
works (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). Figure 6 illustrates that, in static models, a problem arises from a gap between goals and the current situation, leading to a decision designed to correct the problem. The decision leads linearly to new results (Sterman, 2000). However, in complex systems, decisions, results, and actions taken by other participants in the business environment, either internal or external to the firm, affect the gap between goals and the situation. Besides, other participants simultaneously attempt to achieve their goals, which may align with or conflict with those of the firm (Sterman, 2000). That results alter inputs in ways that may lead to new decisions reflects the process of feedback, as illustrated in Figure 7. Feedback creates nonlinear behaviors in complex systems, and nondynamic modeling methods do not capture these nonlinearities (Groesser & Jovy, 2016; Sterman, 2000). The current research study demonstrated the presence of 21 causal loops, 12 of which involved a combination of health system and ACO parameters.

**Figure 6**

*Cause-and-effect in Static Business Models*

Feedback creates nonlinear behaviors in complex systems, and nondynamic modeling methods do not capture these nonlinearities (Groesser & Jovy, 2016; Sterman, 2000). The current research study demonstrated the presence of 21 causal loops, 12 of which involved a combination of health system and ACO parameters.

**Feedback Loops and Nonlinearity.** Feedback loops represent the relationships between complex system variables and the nature of each variable’s effect on the other variables (Morecroft, 2015; Radzicki, 2020; Šviráková & Bianchi, 2018; Torres et al., 2017). Positive, or
reinforcing, feedback loops represent the case in which an increase in one variable causes an increase in another variable. Negative, or balancing, feedback loops represent the case in which an increase in one variable causes a decrease in another variable (Jolly, 2015; Morecroft, 2015; Sterman, 2000).

**Figure 7**

*Cause-and-effect in Dynamic Business Models with Feedback*

![Feedback Loops Diagram](image)

*Note.* Sterman (2000).

Figure 8 presents an example containing a positive feedback loop and a negative feedback loop, each affecting the value of the variable chickens. In this example, as the number of chickens increases, so does the number of eggs, as indicated by the plus sign above the arrows connecting eggs and chickens. As eggs increase, so does the number of chickens. This reinforcing behavior leads to both variables’ exponential growth (Jolly, 2015; Morecroft, 2015). Exponential growth is characteristic of all positive feedback loops in SDM (Jolly, 2015; Morecroft, 2015).

However, real-world systems do not exhibit sustained exponential growth (Jolly, 2015; Morecroft, 2015). In Figure 8, as the number of chickens increases, so does the number of
chickens that cross the road. As more chickens cross the road, more accidents occur, reducing the number of chickens, as indicated by the negative sign on the arrow showing the effect of road crossings on chickens. This negative feedback loop, taken alone, would result in the extinction of the chicken population. When combined with the reinforcing loop, however, the balancing loop offsets the chicken population's exponential growth, resulting in alternating, nonlinear growth and decline or eventual equilibrium in the population over time, consistent with observations of real-world systems (Sterman, 2000). The researcher’s coding analysis of interviewee data and assignment of positive or negative polarities resulted in articulating 21 feedback loops.

**Figure 8**

_The Offsetting Effects of Reinforcing and Balancing Feedback Loops_

*Note.* Sterman (2000).

**Stocks and Flows.** As described above, causal loop diagrams and feedback loop diagrams provide visual representations of the developer’s mental model of the relationships between a complex system’s variables. Quantities of interest in system dynamics models, which are those whose amounts vary with time under the influence of system variables, are termed stocks. Stocks are countable entities, such as the number of eggs, chickens, or road crossings (Jolly, 2015; Morecroft, 2015). In SDM jargon, the rates at which stocks increase or decrease are flows (Jolly, 2015; Morecroft, 2015). System dynamics models may also contain ancillary
variables that are neither stocks nor flows, but that contribute to the value of stocks or flows. Figure 9 illustrates the use of stocks and flows in a system dynamics model of medical workforce planning (Morecroft, 2015).

**Applications of System Dynamics.** Multiple, recent systematic literature reviews pointed to diverse applications of SDM in business, clinical, and academic settings. de Gooyert (2019), reviewing the academic literature for SDM applications from 1990 through 2016, identified published research in which SDM contributed to theory development, theory testing, and identification of causal drivers of outcomes. Kunc et al. (2018), using thematic coding of data obtained in a systematic literature review, identified 51 unique topics studied using SDM methods spanning multiple industries in the period from 1974 through 2017. Among the 51 topics, seven explicitly related to healthcare issues:

- health complexity,
- health improvement,
- health policymaking,
- psychological aspects of behavior,
- health services,
- population aging, and
- health epidemics. (Kunc et al., 2018)

At least 10 additional topics identified by Kunc et al., though not restricted to healthcare, have relevance to the healthcare industry’s analysis.

Torres (2019) reviewed publications from the leading system dynamics professional journal, *System Dynamics Review*, and related journals from 1985 through 2017. The primary categories of research interest identified by were group model building (10% of papers), dynamic
problem analysis from multiple disciplines (57% of papers) and establishing model validity (32% of papers). The top five cited authors during the analysis period were Sterman, Barlas, Homer, Forrester, and Vennix (Torres, 2019).

Figure 9

*Stocks and Flows in a Model of Chronic Disease Prevention*

Note. Chang et al. (2017b).

Cosenz and Noto (2016) reviewed the applications of SDM to problems in strategic management. The authors noted research supporting applications of SDM to problems in strategic management, climate change, the physical sciences and engineering, and economics, among others (Cosenz & Noto, 2016). Cosenz and Noto defined the goal of SDM in the field of strategic management as understanding how a firm dynamically relates to its environment to inform firm actions in support of its goals. This goal aligns with the previously stated goal of this dissertation relative to understanding the dynamic relationship between health systems and ACOs to inform the strategic decisions of each. The application of SDM to strategic
management problems dates to the 1970s, exhibiting slow growth from 1990 through 2005 and reaching equilibrium in terms of research articles per year on this topic (Cosenz & Noto, 2016). The authors characterized the application of SDM to inform strategic decision-making as a relatively new subdiscipline of SDM research, which helps to explain existing gaps in the research literature (Cosenz & Noto, 2016).

**SDM as the Preferred Method for Macro System Simulation.** The SDM is not the only technique available to analyze complex, dynamic systems (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). Agent-based modeling (ABM) and discrete event modeling (DEM) are two methods that also fall within the class of models known as dynamic models (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). Marshall, Burgos-Liz, Ijzerman, Crown, et al. (2015) asserted the choice of modeling technique depends on the research problem’s nature. For models that seek to understand individual agents’ behaviors within a system, ABM or DEM are appropriate techniques (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). When one seeks to understand the aggregate behavior of a system at a macro level, then the most appropriate choice for the researcher is SDM (Cassidy et al., 2019; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015).

**System Dynamics for Strategic Business Model Simulation**

Gary et al. (2008) first reviewed the contributions of SDM to the development and testing of business strategy. The primary emphasis in SDM studies of business strategy lay in understanding profitability variations among similar firms (Gary et al., 2008). Ganzarain et al. (2019) later restated this objective as using SDM to evaluate a firm’s market competitiveness based on its value creation. In this context, the authors asserted the essential value-producing factors to understand are those that exhibit dynamic complexity involving feedback loops and
nonlinear behaviors and, therefore, require analysis by SDM to inform decision-making at the business leadership level (Ganzarain et al., 2019). Rather than examining variation in profitability or competitiveness at a fixed point in time, researchers recognized the potential for SDM to dynamically simulate changes in financial performance over time (Gary et al., 2008). This ability positions managers to base strategic decisions on data rather than relying on instinct or experience in the absence of quantitative simulation (Ganzarain et al., 2019).

Radzicki (2020) reviewed the application of SDM to the evaluation of economic models to assess firms’ economic strategies. The author’s research demonstrated the ability to improve several longstanding, well-respected economic models by applying SDM, despite a radically different approach to model construction than found in traditional economics modeling (Radzicki, 2020). This work illustrated the power of SDM for providing insight into complex financial processes at the level needed to support strategic decision-making, as is the goal of this dissertation research project (Gary et al., 2008).

Cosenz and Noto (2018) outlined a methodology for analyzing alternative business model strategies in new businesses. This work parallels the new business models established through the creation of health system partnerships with ACOs. The authors criticized traditional approaches to business model design because new businesses often base models on a static view of the business (Cosenz & Noto, 2018), as confirmed through the present researcher’s interview analyses. Instead, Cosenz and Noto (2018) recommended using SDM to incorporate a dynamic perspective of a proposed new business strategy’s implications. The principal advantage of the authors’ approach is the ability to experiment with business model design with no risk, leading to more significant business model innovation and enhanced competitive advantage (Cosenz & Noto, 2018).
System Dynamics Modeling of Health Systems and ACOs

Healthcare Systems are Complex Systems. The former secretary of the U.S. Department of Health and Human Services, Sylvia Burwell, asserted that healthcare is among the most complex industries in terms of policy and, therefore, strategic decision-making (Burwell, 2018). Burwell based her assertion on the realities of the healthcare industry’s current state, which is simultaneously undergoing significant reforms related to quality improvement, increasing access to care, and restructuring the care delivery system, including payment models. Burwell maintained delivery system restructuring would, itself, require extensive experimentation to arrive at optimal care delivery models that lead to the achievement of the triple aim and financial sustainability, critical tenets of current healthcare strategy. Nevertheless, Roberts (2015) asserted that, despite the applicability of dynamic simulation methods to healthcare’s complex problems, the industry lagged other industries by nearly a half-century in its use of such methods.

Greenhalgh and Papoutsi (2018) also noted limited progress in applying complex systems simulation methods in healthcare despite growing recognition of the power of such methods. Instead, the authors asserted that healthcare leaders continue to use analytical methods that ignore variables’ interdependence when formulating strategy and making business decisions (Greenhalgh & Papoutsi, 2018). Freebairn et al. (2016) echoed this disconnect between available complex systems research methods and decision-making practices in the healthcare industry. Interviewees in the current research study universally acknowledged the continued use of linear modeling methods conducted in spreadsheets as their approach to strategic business modeling. Greenhalgh and Papoutsi (2018) argued the healthcare industry is now too complex to ignore three critical considerations: “uncertainty, unpredictability, and emergent causality” (p. 1). The
rationale behind this assertion was that healthcare now involves multiple types of entities, such as health systems, physician practices, and ACOs, that interact dynamically and reflect the characteristics of complex, dynamic systems, including nonlinearity in outcomes (Greenhalgh & Papoutsi, 2018).

Freebairn et al. (2016) cited complex system simulation model development as a means to document the critical components of health system business models and to identify how those components interact internally and with external entities. Leveraging simulations creates for health systems the advantage of allowing identification of unexpected outcomes resulting from strategic decisions without assuming the risk of real-world implementation (Freebairn et al., 2016). Simulation modeling also allows healthcare managers to rapidly change strategic assumptions and observe resultant outcomes, facilitating the discovery of optimal strategic solutions (Freebairn et al., 2016).

**Selection of SDM for Health System and ACO Simulation.** The modeling of complex, multi-business interactions in enterprises such as a joint health system / ACO requires the use of dynamic simulation methods to quantify potentially nonlinear outcomes (Cosenz & Noto, 2016). Machine learning (ML) is now pervasive in the health system setting, where it uncovers patterns contributing to organizational performance. The ML does not, however, enable dynamic business simulation involving feedback loops (Panch et al., 2018). The ABM, a dynamic simulation technique that does account for feedback interactions, appears in the literature as a means to simulate ACO operations, but independent of health system considerations (Liu & Wu, 2016). The ABM is not appropriate for modeling health system / ACO interactions based on macro-level behavior, as it focuses on micro-level interactions (Cassidy et al., 2019). A recent systematic literature review by Cassidy et al. (2019) demonstrated system dynamics, with its
focus on macro interactions, has been used to model complex, dynamic interactions within health systems. System dynamics has not yet been a tool to investigate the interactions between health systems and ACOs, leaving health system leaders without a proven dynamic simulation model of health system / ACO interactions.

Also, ACO partnerships have taken on multiple structures, each of which defines the financial relationship between the ACO and its partner organizations differently, including the sharing of ACO performance incentives (Lewis et al., 2018). D’Aunno et al. (2018) identified several factors that contributed to a differentiation between high-performing and low-performing ACOs. However, the authors did not evaluate the impact of variations in these ACO factors on health system partner performance, leaving the matter to speculation. Given the variety of factors identified by D’Aunno et al., health system leaders may differ regarding the priority of quantitative modeling factors, requiring a qualitative assessment to determine prioritization as part of the research effort. de Gooyert (2019) asserted the SDM process guides leaders to build organizational theory by identifying subjective assumptions and selecting factors to include in quantitative organizational models. Atkinson et al. (2015) suggested a systems modeling approach facilitates stakeholders’ participation in model development and provides a platform for a clearer understanding of underlying assumptions for which modeling is appropriate to quantify and validate.

Crown et al. (2017) asserted a mathematical model must reasonably represent reality and that health systems lend themselves to simulation through mathematical modeling. Marshall et al. (2015) noted health systems’ strategic decisions often result in unanticipated outcomes due to failure to account for complex interactions and nonlinear responses. The authors credited
nonlinearity with the result that multi-component systems’ behavior is often different from the sum of the behaviors from its parts (Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015).

As a result, it is essential to determine which factors in an organization’s mathematical model lead to nonlinear behaviors, which is the ultimate goal of system dynamics modeling (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). The authors contended nonlinear behaviors result from feedback loops between the components of an organization and, therefore, that SDM is the appropriate dynamic modeling methodology to simulate such organizations (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). The ACOs frequently partner with other types of healthcare organizations on the theory that joint operations bring complementary capabilities that improve financial performance (Lewis, Tierney, et al., 2017). Cassidy et al. (2019) demonstrated a lack of research to identify nonlinear behaviors in joint health system / ACO organizations, calling into question the support for the hypothesis put forward by Lewis, Tierney, et al. (2017) that health system / ACO partnerships result in improved financial performance. Cosenz and Noto (2016) suggested GMB is the most effective approach for identifying the critical components to build into system dynamics models, as discussed in the methodology section below.

**Current State of Healthcare System Dynamics Modeling.** Chang et al. (2017) studied the application of SDM to the problems experienced by health systems. The authors cited increasing demand for dynamic modeling tools that shed light on the operational functioning of health systems and strategic decisions associated with healthcare reforms (Chang et al., 2017). Chang et al. identified three categories of SDM studies involving health systems:

- **analysis of inputs:** organizational structure, interactions among operational functions
- **analysis of outputs:** access to care and quality of care
- **analysis of outcomes**: effects on population health measures and financial risk.

Of the 1,868 research papers reviewed by the authors, none studied the interactions that occur between health systems and ACOs (Chang et al., 2017). Instead, all articles presented results based on a health system-only perspective, addressing business or clinical management issues within health systems.

Liu et al. (2018), in a systematic review of healthcare research related to population health management issues and involving dynamic simulation methods during the period 1972 through 2014, noted that the application of SDM focused primarily on understanding chronic, non-communicable diseases. The authors also observed the U.S. National Institutes of Health had increased support for using dynamics simulation methods in healthcare, including SDM, in the 10 years from 2008 to 2018 (Liu et al., 2018). The authors’ research suggested most published research focused on individual agents’ interactions rather than on the macro behavior of systems, leading to more significant growth in agent-based models’ application compared with system dynamics models (Liu et al., 2018). However, to study the behaviors of health systems, ACOs, or their interactions requires the use of modeling methods applicable to the study of macrosystem behaviors, for which SDM is more appropriate than ABM (Cassidy et al., 2019; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015).

Cassidy et al. (2019) completed a systematic review of health system applications of SDM, with findings that showed the analysis of emergency care, acute care, elderly, and long-term care as primary focus areas. Cassidy et al. emphasized the applicability of SDM for health system analysis, asserting that health systems meet the criteria for complex adaptive systems due to the number of interactive relationships involved in health system operations. The authors asserted the need for dynamic simulations to analyze the complexity of health system operations.
because of the presence of “[s]ystems phenomena of massive interdependencies, self-organizing and emergent behavior, nonlinearity, time lags, feedback loops, path dependence and tipping points [which] make health system behavior difficult and sometimes impossible to predict or manage” (Cassidy et al., 2019, p. 2). As with the findings of Chang et al. (2017), the work of Cassidy et al. (2019) did not reveal a single example of SDM analysis of the interactions between health systems and ACOs, indicating a gap in knowledge in the academic literature.

**Group Model Building to Ensure Validity**

Individuals face a multitude of inherent biases when making decisions (McRaney, 2012). Among the common biases applied while contemplating complex decisions are:

- **confirmation bias**: seeking information that confirms one's beliefs and discarding the rest,
- **the argument from authority**: allowing the position of a person expressing an opinion to influence the weight given to that opinion,
- **groupthink**: adhering to the shared opinion developed within a group that does not consider contradictory, external opinions, and
- **the anchoring effect**: allowing first impressions to dictate future decisions despite subsequent evidence. (McRaney, 2012)

Therefore, decision-making benefits from asking questions that challenge the basis of common cognitive biases, whether held by individuals or by groups that share a common experience (Browne & Keeley, 2017). Poor decisions may result from a lack of objective evidence, failure to consider rival causes, failure to discern association from causation, or a preference for one set of values over another (Browne & Keeley, 2017). Obtaining input from multiple sources through
interviews aids in the derivation of common themes that more accurately reflect reality (Browne & Keeley, 2017).

Carbone et al. (2019) studied the effects of individual versus group decision-making. The authors found individuals made decisions with better results than groups for problems that involved risk to the firm. Groups made better decisions than individuals for problems that involved ambiguity (Carbone et al., 2019). In the healthcare industry, which is undergoing extensive reforms, both risk and ambiguity exist. The work of Carbone et al. suggests the use of group decision-making for modeling healthcare problems will benefit from GMB.

The GMB attempts to overcome model builders’ biases by engaging other experts in the discussion of which are the critical variables needed for a model to represent reality accurately (Cosenz & Noto, 2016). By relying on data obtained from multiple subject matter experts, the modeler can derive shared beliefs about how a business process operates and how best to represent it in a quantitative model (Cosenz & Noto, 2016). These beliefs include insights regarding how members of the group perceive relationships among system variables and how they expect variables to interact (Freebairn et al., 2016).

Similarly, modelers can vet results obtained from models derived from GMB with the group members to gain consensus regarding interpretation and validity (Freebairn et al., 2016). Freebairn et al. assert that, through the GMB process, group members develop a “shared mental model” of how the system functions (p. 4). Further, a group offers the opportunity to anticipate dynamic behaviors under various strategic assumptions that may not emerge from any individual participant (Freebairn et al., 2016). Freebairn et al. noted that, despite the advantages of GMB, the methodology had not seen broad application to healthcare system modeling problems as of 2016. Homer (2019) identified the use of GMB as among the best practices for modeling
complex systems, as defined by twenty subject matter experts convened in a systematic study of best practices.

**Summary of Section 1 and Transition**

Accountable care organizations (ACOs) have become an integral component of the U.S. healthcare infrastructure since the passage of the Accountable Care Act in 2010. While mandating a transition to value-based care facilitated by ACOs, the ACA did not mandate ACO organizational or ownership structures. As a result, multiple ACO partnership arrangements exist, including health system ownership of ACOs. The researcher interviewed healthcare executives representing three different ACO partnership models, including health system ownership. Health system ownership of ACOs is believed by some researchers to result in financial disadvantages arising from competing business models for the two organization types.

Given the complexity of health systems and ACOs, dynamics models are necessary to accurately simulate the impact on financial outcomes of interactions resulting from strategic decisions in health system / ACO partnerships, including direct ownership models.

A gap exists in the literature regarding quantitative simulation of health system / ACO interactions. Multiple, recent literature reviews failed to uncover examples of dynamic models involving health system / ACO interactions despite the presence of research applications of dynamic models to either health systems or ACOs as individual entities. The research questions associated with the present study addressed this gap by seeking to discover, through a qualitative research design, the principle operational functions that one must account for in a system dynamics model to accurately represent health system / ACO interactions. The research process employed group model building (GMB) to elicit the opinions of subject matter experts with regard to those aspects of health system and ACO operations that lead to feedback loops between
the two organizations. The GMB process relied on qualitative analysis of unstructured interviews using thematic coding, with quantitative analysis of Likert scale survey results providing triangulation of findings.

Section 2 of the dissertation examines in detail the study design, sample selection, data collection instruments, and data analysis methods. Section 2 includes a discussion of the role of the researcher in sample identification, solicitation for participation, data collection, and analysis. The discussion also includes potential biases acknowledged by the researcher that had the potential to biased data analysis or interpretation through personal experience or interaction with research subjects. Finally, Section 2 includes a discussion of reliability and validity from the perspective of a qualitative research design.
Section 2: The Project

Introduction

Accountable care organizations (ACOs) continue to engage in multiple forms of partnership with healthcare organizations, including those involving health systems (Comfort et al., 2018; Lewis, Tierney, et al., 2017; Lewis et al., 2018; Murray et al., 2018). Research suggests partnerships between health systems and ACOs, particularly those involving a health system’s ownership of an ACO, cannot sustain financial success because of competing internal business models (Blackstone & Fuhr, 2016). Methods exist to enable simulation modeling of complex dynamic systems. However, there is a gap in the academic literature regarding applying such methods to studying the effects of health system interactions with ACOs on each entity’s financial performance (Cassidy et al., 2019; Chang et al., 2017).

Section 2 articulates the details of the research project design, methodology, and data analysis in greater depth. The research project used a qualitative research design and, therefore, required collecting critical information to ensure adequate rigor. Given the purpose of the project, Section 2 includes a discussion of (i) the role of the researcher; (ii) the research design and methodology; (iii) the approach to population selection, sampling, and engagement; (iv) data collection, including instrument selection, data collection technique, and data organization; (v) data analysis, including the coding process; and (vi) procedures for ensuring qualitative reliability and validity.

Purpose Statement

The purpose of this qualitative multiple case study was to engage subject matter experts from affiliated health systems and ACOs in semi-structured interviews and Likert scale-based surveys to determine the operational structures through which health systems and ACOs interact.
The selection of ACOs was from among the largest systems in the southeastern United States. The purpose of this study contributes to the body of knowledge by seeking to understand those operational functions present in health system and ACO organizations that researchers must include in dynamic simulation models to create a robust representation of health system / ACO interactions. Exploring interactive business functions that form feedback loops now positions future researchers to leverage this qualitative case study’s results to inform the construction of system dynamics models. In turn, system dynamics models will allow leaders to quantitatively explore nonlinear impacts on health system / ACO joint operating margin, closing the research gap identified by Cassidy et al. (2019).

**Role of the Researcher**

**Researcher Actions**

The researcher established a list of health systems and ACOs representing suitable prospects for participation in the study. Criteria for selection included location in the South Atlantic region of the United States and a ranking of top 100 in terms of Medicare Advantage enrollees (*Largest accountable care organizations: 2020*, 2020; National Science Foundation, 2020). The researcher engaged the health system and ACO leaders responsible for managing the health system and ACO partnership to participate in semi-structured interviews and complete a Likert scale-based survey. The researcher developed the questions included in the semi-structured interviews and the survey to correspond with the research questions (Robson & McCartan, 2016). As is customary in qualitative research, the researcher conducted semi-structured interviews and administered the surveys to collect data (Creswell & Poth, 2018; Robson & McCartan, 2016). The researcher was responsible for the preservation and confidentiality of the collected data. The researcher transcribed the semi-structured interviews
and developed a codebook that elicited the themes embedded in the interviews (Creswell & Poth, 2018; Robson & McCartan, 2016).

Acknowledging potential bias in the coding of results due to the researcher’s role as a healthcare executive in a health system that owns an ACO, the researcher engaged two professional subject matter experts to code results, creating a panel of three independent coders. The researcher analyzed the resulting codes for consistency and the presence of emergent themes. The researcher also conducted a quantitative analysis of the Likert scale surveys to triangulate results obtained from the thematic coding of the semi-structured interviews.

**Summary of Role of the Researcher**

The researcher served as an instrument of data collection and analysis in this qualitative research project. Data collection responsibilities included the design of an interview guide, facilitation of semi-structured interviews with healthcare executives from health systems and ACOs, and design and distribution of surveys to the same group of executives to collect data for triangulation. The researcher conducted data analysis in two stages. In part one, the researcher performed a qualitative analysis of interview data using thematic coding. Acknowledging potential bias in the researcher’s interpretation of data stemming from his position as an executive in the healthcare industry, he enlisted additional coders to provide evidence of reliability and validity. In part two, the researcher conducted a statistical analysis of survey data to triangulate the interview analysis results.

**Research Methodology**

**Research Method**

The proposed research project invoked a qualitative research method. The nature of the research questions that arose from the research problem and the study’s purpose guided research
method selection (Creswell & Poth, 2018; Pope & Mays, 2020). The purpose of this research project and its associated research questions was to explore through interviews and surveys the opinions of subject matter experts regarding the sources of health system / ACO interactions relevant to financial outcomes and formulate a consensus regarding the most critical interactions in future system dynamics modeling efforts. As noted by Pope and Mays (2020), researchers need to understand experts’ perceptions regarding system interactions in the absence of explanatory theory. Only then can researchers develop an accurate quantitative model of a system. The lack of an existing theoretical model of health system and ACO interactions inhibits the ability to develop hypotheses to test via quantitative analysis without first gathering insights from subject matter experts (Robson & McCartan, 2016). The interpretation of data obtained from experts required inductive reasoning to determine research subjects’ perspectives regarding critical elements for model development (Pope & Mays, 2020).

Qualitative research is better suited than quantitative research to explore research questions for which existing theory does not anticipate the answers (Korstjens & Moser, 2017). While controlled laboratory experiments derived from theory are most amenable to quantitative research, the domain of real-world business problems, as studied in this dissertation project, offers no such controls and is best explored through qualitative research methods (Creswell & Poth, 2018; Korstjens & Moser, 2017). In health systems’ interactions with ACOs, each organization’s unique complexity creates a high probability of complexity in the organizations’ interactions. The academic literature does not contain research that articulates the nature of these interactions. Therefore, a study of subject matter experts’ opinions regarding operational contributors to health system interactions with ACOs provides insight regarding this problem (Cassidy et al., 2019). The requirement to gather insight from subject matter experts rather than
to derive data from laboratory experiments makes the qualitative research method the best fit for this research (Creswell & Poth, 2018; Pope & Mays, 2020).

Quantitative research, with its application of robust statistical analysis to numerical data, provides direct, accepted measures of reliability and validity. Qualitative research lacks direct statistical measures of reliability and validity, leading researchers to develop alternative approaches to assess and support assertions of reliability and validity (Anderson, 2017; Astroth & Chung, 2018; Creswell & Poth, 2018). Anderson (2017) and Astroth and Chung (2018) each articulated the importance of techniques to ensure reliability and validity of qualitative research results, including review by research subjects, triangulation, and peer review. In the present case, quantitative analysis of survey data provided insight regarding the triangulation of results. Although triangulation involved the statistical analysis of survey data, quantitative methods played a substantially smaller role in this research than qualitative methods. As a result, the method did not meet the threshold of approximately equal contributions from qualitative and quantitative methods required in mixed methods research (Creswell & Plano Clark, 2010; McCusker & Gunaydin, 2015).

**Research Design**

The researcher employed a multiple case study design for this research project. Case studies require boundaries that clearly define the parameters by which case selection will occur (Creswell & Poth, 2018). In this research study, case boundaries included the selection of

- ACOs listed among the top 100 based on Medicare-eligible lives (Largest accountable care organizations: 2020, 2020) and engaged in a partnership with at least one health system;
• health systems conducting business through ownership or partnership with the selected ACOs; and
• a presence in the South Atlantic geographic region (National Science Foundation, 2020).

These parameters established the basis for a purposive sample of healthcare organizations that are most likely to have the experience necessary to establish the critical, real-world operational sources of dynamic interactions between health systems and ACOs (Korstjens & Moser, 2018a). As the ACA does not specify allowable structures for health system partnerships with ACOs, the study included multiple health system partnerships with ACOs to ensure complete discovery of contributors to dynamic interactions, as detected by saturation of findings (Creswell & Poth, 2018; Korstjens & Moser, 2018a).

Data collected for each case under consideration consisted of two sources. First, the researcher conducted semi-structured interviews with representatives of each health system and ACO. Selection of representatives was from among senior health system and ACO executives with direct knowledge and decision-making authority regarding operational or financial management of a health system partnership with an ACO (Robson & McCartan, 2016). At this level, representatives are elite informants, given their access to exclusive information about the firm and their influence concerning strategic decision-making (Aguinis & Solarino, 2019). In a systematic literature review of qualitative research involving interviews of elite informants, results pointed to the heightened importance of transparency regarding the research method and design to ensure replicability of results compared with interviews of non-elite informants (Aguinis & Solarino, 2019).
The selection of a semi-structured interview format enabled the researcher to adapt subsequent questioning based on the answers provided to broad-based, initial questions (Creswell & Poth, 2018). This researcher anticipated the need for semi-structured interviews given the high probability of differing health system partnership models with ACOs, leading interviewees to vary in their experiences and perceptions of critical interactions. Semi-structured interviews allowed the researcher greater flexibility to explore these variations when they occurred (Creswell & Poth, 2018). Interviews were recorded and transcribed by the researcher. The researcher developed a codebook to guide the thematic coding of interview transcripts and engaged two subject matter experts to supplement the researcher’s coding. The purpose of engaging additional coders was to reduce the potential for bias introduced by the researcher, who works in the health system and ACO partnership industry, thus providing enhanced validity to coding results (Pope & Mays, 2020). The researcher used the coding results to develop themes identifying the critical sources of health system interactions with ACOs through partnership arrangements.

The researcher supplemented data collected in semi-structured interviews with data obtained in Likert scale-based surveys administered to the participating interviewees. Likert scale surveys provided quantitative data regarding the relative importance of various potential sources of interaction by including questions related to the potential health system and ACO interactions. Statistical analysis of the resulting numerical data allowed the researcher to quantify associations identified by survey participants. The quantitative analysis of associations provided a means for the researcher to triangulate the results obtained through semi-structured interviews, adding to the validity of identified themes (Korstjens & Moser, 2018b; Pope & Mays, 2020). Korstjens and Moser (2018b) caution that, while critics of triangulation accept its value to ensure
completeness of findings, they question the assumption that triangulation necessarily ensures validity.

**Summary of Research Methodology**

The primary consideration in selecting a research method and design for this proposed research was to explore a real-world business problem plaguing the healthcare industry today. Creswell and Poth (2018) and Pope and Mays (2020) pointed to qualitative analysis as the preferred vehicle for investigating real-world research problems. Further, Korstjens and Moser (2017) asserted that, given the absence of a theory in the literature upon which to conduct hypothesis testing, as is the case regarding health system interactions with ACOs, qualitative analysis is the preferred method for academic research.

Additionally, when investigating real-world problems, Pope and Mays (2020) emphasized the need to gather and understand subject matter experts’ opinions regarding the topic under investigation. Semi-structured interviews, in which the researcher can react to the information presented and adapt questioning accordingly, serve as a primary tool for collecting subject matter experts' opinions (Creswell & Poth, 2018; Pope & Mays, 2020). Given the variety of health system partnership arrangements with ACOs permitted under the ACA, the multiple case study design presents a vehicle for collecting expert opinions about health system interactions with ACOs across a spectrum of operating models (Creswell & Poth, 2018). Therefore, the researcher adopted a qualitative research method leveraging a multiple case study design to explore the nature of interactions between health systems and ACOs.

**Participants**

Participants were executive-level subject matter experts in the operations or financing of health system partnerships with ACOs. With the passage of the ACA and its mandates for
transformation to value-based purchasing, senior executives involve themselves in the details of business and clinical operations to a greater extent than in the past, providing them with an increased understanding of the implications of strategic and tactical decisions (Belasen & Belasen, 2016). Ayadi and Love (2015) suggested the ACA’s passage ushered in a new set of skill set requirements for senior business and clinical leaders. Among the critical, new skills cited by the authors were in-depth knowledge of quality improvement mechanisms, population health management, and advanced data analytics, previously middle managers’ domains (Ayadi & Love, 2015). Walsh et al. (2020) reported substantial competencies regarding hospital management, the healthcare environment, and financial analysis as critical success criteria for executives operating in the VBP era. These represent the critical knowledge sets necessary to provide insight into interactions between health systems and ACOs as they engage in value-based purchasing. No authors cited the requirement for executives to understand the concepts of system thinking, complex systems, feedback loops, or mathematical nonlinearity.

To ensure adequate knowledge of both business and clinical operations and associated interactions, healthcare organizations frequently adopt a dyad leadership model that pairs a business leader with a clinical leader (Chazal & Montgomery, 2017). The scope of knowledge and accountability varies between business and clinical leaders depending on the particular problem under consideration. However, the pair together provides a complete understanding of the operational challenges (Oostra, 2016). It is for this reason that the researcher included both business and clinical leaders as participants. Interview participants included two physicians, four executives with advanced degrees in healthcare administration, and four business experts including three with Master of Business Administration (MBA) degrees. Lewis et al. (2019), in a
study of care transformation strategies of ACOs, followed the same selection criteria, interviewing executive leaders to obtain strategic-level insights into ACO decision-making.

Participants had their name and their organization’s name withheld as a condition to ensure privacy in the research project. The researcher asked participants before participation if they had firmly held beliefs concerning health system and ACO partnerships that may create bias when answering questions on the topic; the researcher encouraged participants to answer truthfully and completely. The research project participants agreed to respond candidly and honestly to questions asked during semi-structured interviews and Likert scale surveys. Additionally, participants agreed to complete both the semi-structured interview portion of the research and the survey portion. Completion required a time commitment of approximately 70 minutes. The interview session required approximately 60 minutes, while the respondents completed the survey in an average of seven minutes. All participants were unclear about the meaning of a feedback processes and nonlinearity. The researcher provided clarifying explanations to ensure thoughtful and accurate responses (Robson & McCartan, 2016). Participants had the right to request a copy of the dissertation upon its publication and all expressed interest in receiving a copy.

**Population and Sampling**

A significant consideration when conducting qualitative research involving semi-structured interviews is selecting subject matter experts with direct experience in the subject of interest (Cosenz & Noto, 2018; Robson & McCartan, 2016; Shannon-Baker, 2016). As the performance of health systems and ACOs depends upon the intersection of business and clinical operations, a robust pool of study participants must include representatives from both domains (Chazal & Montgomery, 2017). The sample size must be sufficient to capture all relevant themes
through the semi-structured interview process. The researcher entered the interview process with a list of 20 prospective research subjects, which research suggested would be sufficient to achieve thematic saturation (Braun & Clarke, 2019; Hagaman & Wutich, 2017). Participants were deleted as a review of primary codes indicated the achievement of code saturation after seven interviews, with two additional interviews confirming this finding (Braun & Clarke, 2019; Hagaman & Wutich, 2017).

**Discussion of Population**

The population of interest in this research project consisted of administrative managers at health systems and ACOs. Specifically, the researcher derived a population sample from leaders with accountability for decision-making in matters that impact operating margins through interactions between health systems and ACOs. Therefore, participant selection was from among senior health system and ACO executives with direct knowledge and decision-making authority regarding operational or financial management of a health system partnership with an ACO (Robson & McCartan, 2016). At this level, representatives were elite informants, given their access to exclusive information about the firm and their influence concerning strategic decision-making (Aguinis & Solarino, 2019). Population selection followed Cosenz and Noto (2016) and Shannon-Baker (2016). They asserted that, before one can construct a robust system dynamics model, one must first engage subject matter experts to determine the feedback mechanisms within a given system, a concept known as group model building.

This research project’s population of interest fell into one of two categories, one related to health systems and one related to ACOs. The first category consisted of health system executive leaders accountable for strategic decision-making and the firm’s financial performance. These senior leaders had the authority to enter into business agreements with
ACOs, either through acquisition or contractually-driven strategic partnerships (Lewis, Tierney, et al., 2017; Lewis et al., 2018). Executive leaders with system-wide decision-making authority included in the study held the titles of Chief Financial Officer, Senior Vice President for Network Development and Contracting, a former Chief Executive Officer, and Chief Clinical Executive for Care Transformation and Strategic Services.

As with health systems, the second category consisted of ACO executive leaders accountable for strategic decision-making and the ACO’s financial performance. Unlike their health system counterparts, ACO executives seek to earn operating margin by eliminating or finding lower-cost alternatives to costly health system services (Blackstone & Fuhr, 2016). Executive leaders with system-wide decision-making authority included in the study held the titles of Chief Executive Officer, Chief Operating Officer, Senior Vice President for Managed Care, and two Executive Directors for ACO Operations.

**Discussion of Sampling**

The researcher applied a purposive sampling approach to select participants from healthcare organizations that were most likely to have the experience necessary to establish the critical, real-world operational sources of dynamic interactions between health systems and ACOs (Korstjens & Moser, 2018a). Purposive sampling relied upon the researcher’s judgment to select research subjects. Chosen subjects were those most likely to have the experience and expertise most relevant to the research topic (Korstjens & Moser, 2018a). This project’s research questions determined the requisite experience and expertise needed by participants (Pope & Mays, 2020). Purposive sampling is useful for capturing perspectives when substantial variation may exist among research subjects’ opinions (Pope & Mays, 2020).
The researcher began with a list of prospective interviewees including representatives of five ACOs and five affiliated health systems, with the intent to interview at least two executive representatives from each, for a total of 20 interviews. The intent of creating a sample of this size was to ensure diversity of perspectives regarding significant health system interactions with ACOs since multiple ACO / health system partnership structures are known to exist (Lewis, Fisher, & Colla, 2017). As the ACA does not specify allowable structures for health system partnerships with ACOs, the study included multiple partnerships between health systems and ACOs to ensure complete discovery of contributors to dynamic interactions, as detected by saturation of findings (Creswell & Poth, 2018; Korstjens & Moser, 2018a).

The researcher reviewed the codes and themes extracted from interviews to determine whether saturation occurred, as identified by the failure to extract new codes and themes from additional interviews (Korstjens & Moser, 2018a; Pope & Mays, 2020). In qualitative research involving interviews with research subjects, the most commonly used indicator of adequate sample size, and the corresponding validity and reliability of results, is saturation in the data (Braun & Clarke, 2019; Hagaman & Wutich, 2017). The researcher continued interviews with pairs of health system and ACO representatives until saturation occurred. Research suggested that saturation may occur with 8-24 interviews of individuals within the same industry and subjected to the same research problem, though as many as 50 interviews were necessary to achieve saturation in some studies (Baker & Edwards, 2012; Hennink et al., 2017; Pope & Mays, 2020). The researcher achieved and confirmed code saturation with nine interviews.

**Summary of Population and Sampling**

The researcher began with a purposive sample of 20 healthcare executive leaders as prospective interviewees equally divided between ACOs and associated health systems. The
healthcare executives selected had direct decision-making authority regarding health system partnerships with ACOs or accountability for such partnerships’ financial outcomes. Twenty interviews represented the estimated sample size needed to achieve saturation during the thematic coding of semi-structured interviews (Baker & Edwards, 2012; Hennink et al., 2017; Pope & Mays, 2020). The researcher adjusted the number of interviews based on an ongoing assessment of thematic saturation. The researcher confirmed code saturation with nine interviews.

Data Collection and Organization

Data collection and analysis provide the insights that a researcher needs to answer research questions and derive insights that contribute to the body of knowledge in a field of study. In qualitative research, the researcher is the primary instrument for collecting and analyzing data (Robson & McCartan, 2016). As a result, the researcher must apply reflective thinking and acknowledge biases that may affect the collection, analysis, and interpretation of data so the research will stand up to reviews of reliability and validity (Alase, 2017; Clark & Vealé, 2018). In the proposed research project, the researcher employed semi-structured interviews and Likert scale surveys to collect qualitative and quantitative data, respectively. The researcher captured, organized, and cataloged all data in the NVivo® computer-assisted qualitative analysis software tool (Woods, Macklin, et al., 2016; Yakut Çayir & Saritas, 2017). Qualitative analysis applied thematic coding techniques involving open, axial, and selective coding (Korstjens & Moser, 2018a; Williams & Moser, 2019). Quantitative analysis consisted of statistical analysis of survey data to triangulate the results obtained through qualitative analysis (Anderson, 2017; Astroth & Chung, 2018; Creswell & Poth, 2018; Korstjens & Moser, 2018b; Pope & Mays, 2020). The researcher concluded the analysis by inferring meaning from the final
set of themes developed from the analysis (Korstjens & Moser, 2018a; Richards & Hemphill, 2018). A comprehensive set of visualizations represents the process of code and thematic development, triangulation, and relationship to the research questions and conceptual framework (Clark & Vealé, 2018; Creswell & Poth, 2018; Korstjens & Moser, 2018a; Yin, 2018).

**Data Collection Plan**

The researcher solicited participation in the proposed case study research project by providing prospective participants with a letter of introduction (Yin, 2018). The letter of introduction briefly described the nature and purpose of the proposed research. Additionally, the letter outlined the participant’s role and the expectation to complete both a recorded, semi-structured, sixty-minute interview and a subsequent survey expected to require a 15-20 minute effort (Yin, 2018). The researcher followed the solicitation letter with a brief introductory telephone call to establish a direct relationship with the interviewee. Establishing a direct relationship helps alleviate any sense of power imbalance between the interviewer and interviewee, reducing interviewee stress and leading to more candid and detailed responses (Creswell & Creswell, 2018).

Given the travel and socialization restrictions created by the COVID-19 pandemic, the researcher used video conferencing technology to conduct individual face-to-face interviews. The use of individual interviews rather than focus group interviews offered the advantage of surfacing more explicit and candid opinions regarding the participants' experiences (Guest et al., 2017). The scheduling of interviews coincided with the availability of interview participants within their regular work context to minimize inconvenience. The COVID-19 pandemic resulted in significant delays in scheduling due to extraordinary demands placed on executives’ time as
they confronted business and clinical issues associated with the novel disease. Nonetheless, the researcher ultimately succeeded in scheduling all necessary executive interviews.

The researcher captured participants’ views regarding health system interactions with ACOs by digitally recording the audio from semi-structured interviews. The researcher recorded interviews, with permission from each participant, using three technologies: the recording capability embedded in WebEx video conferencing technology, a stand-alone digital audio recording device, and an iPhone® voice recording application. The researcher employed WebEx video conferencing software to conduct virtual face-to-face interviews. WebEx enabled the recording of video conferences, with the capability to export audio .mp4 files. The researcher used WebEx’s built-in artificial intelligence (AI) algorithms to automatically produce transcripts from the .mp4 files, reducing manual transcription (Cisco, 2019). The researcher produced a second set of transcriptions through Otter.ai. The AI transcription algorithms do not produce error-free transcriptions. Therefore, the researcher reviewed both sets of AI-generated transcripts and made edits that ensured complete and accurate transcription of each interview (Robson & McCartan, 2016). The researcher produced two backup copies of each interview using a digital audio recording device. Backups proved invaluable due to two instances of corrupted recordings due to unanticipated technological failures. All recordings were stored on a password-protected personal computer and in a secure, cloud-based database to guard against data loss (Creswell & Creswell, 2018).

Each interview began with an opening statement by the researcher, reiterating the research project’s nature and purpose. The researcher sought permission to record the interview and stated the intent to deidentify interview participants once the interview transcriptions were complete, thus ensuring privacy and confidentiality. The researcher also offered a copy of the
completed dissertation to each participant. In this way, participants may benefit directly from participation in the research. Transparency regarding the researcher’s intent and willingness to share findings fueled trusted relationships with executives that qualify as elite participants (Lancaster, 2017).

Yin (2018) asserted interviews are a common source of data in case study-based research. The most useful interviews follow a conversational format rather than a rigidly-constructed set of closed-form questions (Yin, 2018). The researcher avoided leading questions that might anchor the respondent to the researcher’s point of view and, instead, phrased questions that elicited the interviewee’s perspective on the topic (Creswell & Creswell, 2018; Creswell & Poth, 2018). The researcher adopted the use of a standard interview guide to avoid this potential pitfall. Creswell and Creswell (2018) cited this principle as the law of non-direction for qualitative interviews. Instead, each interview’s goal was to ask non-directive questions and allow the interviewee to describe their lived experience in their terms (Creswell & Creswell, 2018; Creswell & Poth, 2018). Creswell and Creswell (2018) also advised the researcher to disrupt the interview process as little as possible. Following this protocol avoided distractions for the respondent and reduced the potential to inadvertently bias responses.

As the interview questions developed for the proposed research project were semi-structured, each provided general direction aligned with a research question while also allowing the interviewee the flexibility to answer based on his or her interpretation of the question within his or her lived experience (Robson & McCartan, 2016). Additionally, the researcher composed ad hoc follow-up questions to investigate new ideas emerging from participants’ responses (Robson & McCartan, 2016). The interviewer focused on the research questions of interest, with limited use of ad hoc questions, and redirected questioning as needed to prevent the interviewee
from straying toward irrelevant discussion (Alase, 2017). Simultaneously, the researcher avoided allowing personal biases to guide the discussion and, instead, allowed the interviewee an appropriate degree of latitude to express beliefs related to the interview question (Clark & Vealé, 2018). Interviews continued with additional research subjects until the researcher determined that saturation of themes occurred (Braun & Clarke, 2019; Creswell & Poth, 2018; Hagaman & Wutich, 2017; van Rijnsoever, 2017).

Once the researcher completed the thematic coding of interviews, the results informed the revision of a Likert scale-based survey. The final Likert scale survey based on the proposed research questions and literature review appears in Appendix B. Research participants received a link to the online survey via email using SurveyMonkey®, a commonly available survey tool that does not require the participant to access specialized software. The survey data collection process was automated through the SurveyMonkey® platform and made available for download by the researcher to an Excel® spreadsheet.

**Instruments**

The researcher served as the primary instrument for the proposed qualitative research project, given the responsibility to collect and analyze data (Alase, 2017; Clark & Vealé, 2018). The qualitative research method recognizes the need for researchers to become embedded with research subjects, unlike the quantitative method's detachment (Clark & Vealé, 2018; Robson & McCartan, 2016). The researcher’s direct involvement in the interview process allowed for the possibility to change the direction of inquiry depending on the responses of research subjects, contributing to richer data collection (Alase, 2017; Robson & McCartan, 2016). The researcher’s direct involvement with research subjects and the researcher’s experiences, values, and beliefs can lead to the introduction of biases that result in inappropriate filtering of data (Alase, 2017;
Robson & McCartan, 2016). The researcher reflected on potential biases and acknowledged them where appropriate in the published research, enabling the reader to evaluate the potential impact that biases may have had on conclusions drawn from the research, an exercise that contributes to reliability and validity (Alase, 2017; Clark & Vealé, 2018; Tufford & Newman, 2012).

The researcher employed two data collection instruments in the proposed study. The primary research instrument was transcriptions derived from semi-structured interviews of research subjects. The selection of a semi-structured interview format enabled the researcher to adapt subsequent questioning based on the answers provided to broad-based, initial questions (Creswell & Poth, 2018). Given the large number of health system partnership models with ACOs, the researcher anticipated the need for semi-structured interviews to capture variations in research subjects’ experiences and perceptions of critical health system / ACO interactions. Semi-structured interviews allowed the researcher to explore variations in responses when they occurred (Creswell & Poth, 2018).

Creswell and Creswell (2018) cited the work of Miles and Huberman (1994) when recommending that interview guides should include a maximum of 12 prepared questions, including both primary questions and subquestions. The authors noted that interviewees’ responses to these 12 questions are likely to lead the researcher to ask additional questions during the interview (Creswell & Creswell, 2018). Each interview should begin with an opening statement informing the research subject of the interview’s purpose and privacy and security protocols and end with a closing statement that includes any additional instructions for the interviewee (Creswell & Creswell, 2018). In the proposed research project, the closing statement included a reminder of the interviewee’s commitment to complete a Likert scale survey as a critical component of the research study. The interview guide used in the research project
appears in Appendix A. Each interview question related to one of the research questions articulated in the study (Creswell & Creswell, 2018; Creswell & Poth, 2018).

A second instrument, a Likert scale-based survey, served as the basis for the triangulation of results derived from the primary instrument (Creswell & Poth, 2018). Creswell and Creswell (2018) noted one function of surveys is to help researchers understand how variables relate to one another, consistent with the primary goal of this research project. A Likert scale provided the researcher with a numerical scale from one through five with consistent meaning attached to each value. By employing a Likert scale in the survey, the researcher compiled quantitative data that was amenable to statistical analysis. Creswell and Creswell (2018) pointed to the short timeframe required to collect survey data as an advantage of surveys as a research instrument. As identified through statistical analysis, the strength of relationships between variables enabled the researcher to triangulate results obtained through the thematic coding of interviews (Creswell & Poth, 2018; Korstjens & Moser, 2018b; Pope & Mays, 2020).

**Data Organization Plan**

The researcher’s data organization plan included leveraging computer-based technology to collect, store, organize, and analyze data. Recent researchers cited the widespread use of such technology and identified computer-assisted qualitative data analysis software, or CAQDAS, as commonplace in modern qualitative research (Woods, Macklin, et al., 2016; Yakut Çayir & Saritas, 2017). Among the advantages of using CAQDAS was the relative ease of adapting and reorganizing data as codes and themes developed. Making such changes within a software system was faster and less cumbersome than performing the same tasks in paper notebooks (Yakut Çayir & Saritas, 2017). While the transition to CAQDAS from traditional methods may require a period of adaptation for seasoned researchers, adaptive challenges were few for the
researcher as a new user of qualitative research tools not yet entrenched in a particular data organization and analysis paradigm (Woods, Macklin, et al., 2016).

The researcher stored the interview .mp4 audio files produced by WebEx and the external digital audio recorders on a local, password-protected computer and uploaded the files to a secure, cloud-based environment for redundancy purposes (Alase, 2017). Storage of interview transcripts was also on a password-protected computer and a secure, cloud-based platform. Analysis of interview data occurred within NVivo®, a commonly-used CAQDAS package used in qualitative research (Phillips & Lu, 2018; Woods, Macklin, et al., 2016; Woods, Paulus, et al., 2016; Yakut Çayir & Saritas, 2017). Yin (2018) asserted data must be complete and well-organized into categories that facilitate access during the analysis process; NVivo® is a tool commonly used for this purpose.

After uploading .mp4 audio files and transcripts into NVivo®, the researcher stored them in audio and transcript folders created to store raw research data. This approach was in line with the recommendation of Yin (2018) to organize data in separate folders for raw data, analysis, and summary documents. By following Yin’s (2018) approach, the researcher leveraged a CAQDAS system’s advantages to organize data for efficient retrieval electronically (Woods, Macklin, et al., 2016; Yakut Çayir & Saritas, 2017).

The researcher developed a codebook to guide the thematic coding of interview transcripts and engaged two subject matter experts to supplement the researcher’s coding. The researcher implemented the codebook in NVivo® for documentation purposes and to guide the coding process. NVivo® captured the output from the coding process conducted by each independent coder (Feng & Behar-Horenstein, 2019). The purpose of engaging additional coders was to reduce the potential for bias introduced by the researcher, who works in the health system
and ACO partnership industry, thus providing enhanced validity to coding results (Pope & Mays, 2020; Tufford & Newman, 2012).

Implementation of the codebook in NVivo® promoted each code’s consistent use during the thematic coding process. The engagement of additional coders also allowed the researcher to engage in a recursive, or nonlinear, review of the coding process to enrich the initial codebook and subsequent extraction of themes (Williams & Moser, 2019). Leveraging CAQDAS technology also allowed the researcher to capture and store results from all coders in a consistent format within a single, secure location. Backing up computer-based NVivo® files to a secure, cloud-based platform protected against data loss.

The second component of the proposed research involved collecting Likert scale survey data to triangulate the results obtained through the thematic coding of interviews. The researcher employed the SurveyMonkey® platform to organize survey questions and collect quantitative data from a Likert scale-based survey (Robson & McCartan, 2016). The use of the SurveyMonkey® platform provided a convenient method for survey deployment and data collection that does not require respondents to maintain specialized software (Vaughn & Turner, 2016). The researcher used the built-in SurveyMonkey® data import function in NVivo® to capture quantitative survey data directly in NVivo® on a password-protected personal computer with a backup in a secure, cloud-based storage platform to protect against loss of data (Creswell & Creswell, 2018).

The researcher added the extracted SurveyMonkey® raw survey data to a survey folder located in the raw data section of NVivo®. This practice follows Yin’s (2018) guidance that all research data should reside within an organized file structure within the primary analysis tool. Extracted data included only responses to survey questions. Data did not include respondent
identifiers such as names, IP addresses, or email addresses that may pose privacy and confidentiality threats (Story & Tait, 2019). After extracting and organizing the survey data in a password-protected Excel® spreadsheet, the researcher deleted the SurveyMonkey® survey tool from the SurveyMonkey® platform to ensure the privacy and confidentiality of respondents’ replies (Robson & McCartan, 2016; Story & Tait, 2019).

As an additional safeguard to ensure privacy and confidentiality, the researcher replaced respondents’ personal and organizational names, when present, with anonymous keys produced through a random number generator. The researcher password protected the master key list that enables re-identification of participants and stored the list on a password-protected personal computer, in a secure, cloud-based storage platform, and NVivo®. The master key list enabled the researcher to follow up with participants for clarifying questions based on data analysis but proved unnecessary. The researcher will destroy the master key list upon publication of the dissertation.

**Summary of Data Collection and Organization**

The researcher employed an interview guide to ensure consistent questions across all semi-structured interview participants. WebEx video recordings and a digital audio recorder used the SurveyMonkey® platform to administer Likert scale surveys to study participants. All raw data captured through interviews and surveys resided in a categorized file structure created by the researcher within NVivo®, a CAQDAS tool commonly used by qualitative researchers. Data analysis results also resided within NVivo®. The researcher removed participant identifiers from raw data by replacing identifiers with password-protected, anonymous keys produced by a random number generator. The identification key enabled the possibility for researcher to contact participants with clarifying questions. Upon publication of the research project, the researcher
will destroy the identification key. The researcher stored raw data, NVivo® files, and the identification key on a local, password-protected computer and in a secure, cloud-based platform to guard against data loss.

**Data Analysis**

The primary source of data in the proposed research project was a collection of interview transcripts. The transcripts contained text responses to semi-structured interviews, following an approach to data collection common in qualitative research (Creswell & Creswell, 2018; Creswell & Poth, 2018; Yin, 2018). Thematic coding is a standard tool for analyzing interview data (Belotto, 2018; Creswell & Poth, 2018; Vaughn & Turner, 2016; Williams & Moser, 2019). Triangulation of results obtained through the thematic coding of interviews required using a secondary data source and analysis method (Creswell & Poth, 2018). The secondary data source in the research project was a Likert scale survey presented online to all participants. With consistent use of a one-through-five scoring system for responses, Likert scale surveys lent themselves to quantitative statistical analysis (Creswell & Poth, 2018; Robson & McCartan, 2016).

**Emergent Ideas**

Creswell and Poth (2018) divided the interview data analysis process into five sequential stages:

1. Managing and organizing data
2. Reading and memoing emergent ideas
3. Describing and classifying codes into themes
4. Developing and assessing interpretations
5. Representing and visualizing the data (p. 186).
Each subsequent stage of the data analysis process results in the aggregation of information through the application of inductive reasoning (Creswell & Poth, 2018). Vaughn and Turner (2016) cited data management and storage as a significant challenge in quantitative research. Creswell and Creswell (2018), Woods, Macklin, et al. (2016), and Yakut Çayir and Saritas (2017) recommended the use of a CAQDAS tool to aid in data collection and management. This researcher used NVivo® software for this purpose.

Addressing the analysis of interview data, Vaughn and Turner (2016) and Roberts et al. (2019) identified consistency in thematic coding as a significant challenge for qualitative researchers. Alase (2017) noted the coding process often leads to stalled progress for researchers. Williams and Moser (2019) proposed a framework to address coding consistency in which researchers pass through three stages of thematic coding: open coding, axial coding, and selective coding. Korstjens and Moser (2018a) also endorsed this approach in reviewing practical approaches to qualitative data analysis. This researcher followed the protocol proposed by Williams and Moser (2019), Korstjens and Moser (2018a), and Saldaña (2021) and conducted a thematic coding analysis of semi-structured interview data captured in transcription form.

In open coding, the researcher read through each interview’s text and made notes regarding critical words, phrases, or concepts (Williams & Moser, 2019). Creswell and Poth (2018) described the process of code development as consisting of reading the text of interview transcripts and writing notes, or memoing, in the transcript as ideas emerge from the text. Codes allow the researcher to summarize, in abbreviated form, the content of an extended interview response (Belotto, 2018). Korstjens and Moser (2018a) recommended asking questions similar to the following to aid in the derivation of codes:

- What is this?
• What does it stand for?
• What else is like this?
• What is this distinct from? (p. 16)

The CAQDAS software effectively organizes words, phrases, and concepts to detect similarities and differences across multiple transcripts (Williams & Moser, 2019). The researcher used NVivo® software to capture applied codes, or standardized terms, to describe the concepts emerging from the open coding process. Following Belotto (2018) and Saldaña (2021), the researcher developed codes related to the research questions and produced a matrix that identified each time a code applied within each interview. Belotto (2018) referred to this matrix as a content analysis table. NVivo® assisted the researcher with the visualization of code application through its coding stripes capability. The resulting codes formed an initial interview codebook (Belotto, 2018; Creswell & Poth, 2018; Korstjens & Moser, 2018a; Williams & Moser, 2019; Yin, 2018). The researcher updated the codebook iteratively by returning to the codes for revision following the coding of each new interview.

In axial coding, the researcher worked with the codes identified through open coding and attempted to align terms that appeared to have a conceptual relationship (Belotto, 2018; Korstjens & Moser, 2018a; Saldaña, 2021; Williams & Moser, 2019). Identifying relationships among codes led to new, higher-level codes representing the relationships (Saldaña, 2021; Williams & Moser, 2019). The emergence of higher-level codes was a step toward developing the primary themes present in each interview and across interviews (Saldaña, 2021; Williams & Moser, 2019). Whereas one may think of open coding as describing each interview’s content, axial coding began the process of ordering the concepts put forward in the interviews (Korstjens & Moser, 2018a). The researcher again followed the method used by Belotto (2018) and Saldaña
(2021), who identified patterns within the content analysis table. As in Belotto’s (2018) work, the researcher labeled each pattern as a new category of information. The categories served as a refinement to the codebook (Belotto, 2018; Creswell & Poth, 2018; Korstjens & Moser, 2018a; Williams & Moser, 2019; Yin, 2018).

**Coding Themes**

In the selective coding process, the researcher coded and linked major themes to form a cohesive picture of the insights gained from the collective interviews (Creswell & Poth, 2018; Saldaña, 2021; Williams & Moser, 2019). In keeping with the proposed research questions, the researcher used the axial coding results to develop themes identifying critical findings relevant to health system / ACO feedback when connected through partnership arrangements. Themes adopted during selective coding were the most specific of all codes derived throughout the thematic coding process (Korstjens & Moser, 2018a). The selective coding process enabled the researcher to derive meaning from the collective content of the multiple cases studied through interviews (Vaughn & Turner, 2016; Williams & Moser, 2019).

By again adhering to the thematic development methodology of Belotto (2018) and Saldaña (2021), the researcher evaluated the categories emerging from axial coding and formed clusters of related categories. Once formed, the category clusters gave rise to unifying themes (Belotto, 2018; Saldaña, 2021). Belotto (2018) noted relationships might exist between identified themes, which led the researcher to establish primary themes with one or more associated secondary themes. The author also asserted the importance of discussing themes that do not align with primary themes, as transparency regarding contradictory themes helps establish the reliability and validity of the analysis (Belotto, 2018).
While the thematic coding analysis process previously described appears to proceed linearly from open through selective coding, Williams and Moser (2019) emphasized the nonlinearity of the thematic coding process when appropriately conducted. The authors noted the stages of open, axial, and selective coding form nonlinear feedback loops (Williams & Moser, 2019). In other words, the work in each stage of coding informs the other stages through a recursive process (Yin, 2018). Codes identified through axial or selective coding may, for example, lead the researcher to revisit the open coding process, as shown in Figure 10. Figure 11 illustrates the coding process leading to emerging themes. The outcome of the researcher’s application of this process was a final codebook representing the content of all semi-structured interviews (Creswell & Poth, 2018).

**Figure 10**

*The Nonlinear Feedback Loop Process in Thematic Coding*

![Nonlinear Feedback Loop Process in Thematic Coding](image)

*Note.* Williams and Moser (2019, p. 48).

An additional layer of complexity existed in the thematic coding process for the researcher’s project. The researcher engaged two subject matter experts as additional coders. The multi-rater approach helped to minimize the effects of researcher bias and bolster reliability (Belotto, 2018; Robson & McCartan, 2016). The use of multiple coders required the researcher to discuss and negotiate codes and theme development to arrive at a final codebook (Richards &
Richards and Hemphill, in Figure 12, provided an outline of the modified thematic development process in the presence of a multi-rater approach.

**Figure 11**

*The Development of Themes in the Thematic Coding Process*

![Diagram of Thematic Coding Process](image)

*Note.* Adapted from Williams and Moser (2019, p. 54).

**Interpretations**

Interpretation required the researcher to relate the themes derived through thematic coding to the research questions and the proposed research's conceptual framework (Creswell & Poth, 2018). In the researcher’s project, the goal was to interpret, based on themes derived from the coding of interviews, how interaction and feedback work between health systems and associated ACOs (Korstjens & Moser, 2018a). Specifically, the researcher attempted to derive the operational functions and processes that subject matter experts deemed most critical to health system / ACO interactions that affect operating margins through feedback.
Gaining Thematic Consensus when Using a Multi-rater Coding Process

**Collaborative Qualitative Analysis**

1. **Preliminary Organization and Planning**
   In an initial team meeting, preliminary decisions are made about the theoretical framework, target journal, and anticipated authorship. Research questions are discussed and a flexible timeline for data analysis is established.

2. **Open and Axial Coding**
   Open and axial coding are used to identify patterns in the data and form connections between those patterns. Team members write memos overviewing generative themes, and then discuss these memos during team meetings.

3. **Development of a Preliminary Codebook**
   Following several iterations of open and axial coding, the research team meets to discuss initial Coding. During this process, they formalize generative themes into a preliminary codebook.

4. **Pilot Testing the Codebook**
   The preliminary codebook developed in the previous step is pilot tested against previously uncoded data. The researchers independently code the same transcripts and then meet regularly to discuss and amend the codebook.

5. **Final Coding Process**
   The research team applies the adjusted codebook to the entire dataset using consensus coding or split coding. During weekly meetings they continue to discuss and make adjustments to the codebook.

6. **Review the Codebook and Finalize the Themes**
   All of the coded data is reviewed and discussed by the research team. A thematic structure is developed to concisely describe the results of the study. This structure is reviewed and critiqued by team members.

*Note.* Adapted from Richards and Hemphill (2018, p. 227).

Qualitative research, by its nature, is interpretive (Clark & Vealé, 2018). The interpretation of themes in the context of the conceptual framework, literature review, and research questions transforms words and concepts into meaning in the absence of quantitative analysis (Creswell & Poth, 2018; Korstjens & Moser, 2018a; Vaughn & Turner, 2016). The goal
of objective interpretation is to understand research subjects’ perspectives through their lived experiences without altering those perspectives based on the researcher’s experiences and biases (Clark & Vealé, 2018). The researcher remained acutely aware of personal biases during the analysis phase (Clark & Vealé, 2018). To aid with reliability and validity, the researcher disclosed biases understood through reflective thinking and any instances in which the researcher recognized the potential impact of personal beliefs on interpreting results (Clark & Vealé, 2018; Creswell & Poth, 2018).

Articulating clear linkages back to the conceptual framework, literature, and research questions helped the researcher maintain interpretive objectivity and establish reliability and validity (Creswell & Poth, 2018; Korstjens & Moser, 2018a). These linkages helped establish the pathway through which the researcher used inductive reasoning to arrive at interpretations of meaning (Korstjens & Moser, 2018a). As in code development, the researcher discussed and negotiated with additional coders regarding differing interpretations of themes to arrive at a consensus (Richards & Hemphill, 2018).

**Data Representation**

Researchers use data representation to communicate research findings and concepts to readers in tabular or graphical form (Creswell & Poth, 2018). In a qualitative analysis based on thematic coding of interviews, visual representations can effectively convey code development, the process of extracting themes from text and codes, and the relationships between themes (Creswell & Poth, 2018; Korstjens & Moser, 2018a). Similarly, visual representations can convey the relationships of themes to research questions and components of the conceptual framework (Creswell & Poth, 2018). Clark and Vealé (2018) suggested approaches to visualization such as listing the top-10 themes that best reflect the content emerging from the
case study or showing the three primary themes uncovered through analysis. Korstjens and Moser (2018a) cited tree diagrams as a useful tool to visualize the evolution from open coding to theme development. Such approaches to visualization, which illustrate the objective development of themes, provide a safeguard against highlighting those themes that align most closely with the researcher’s biases (Clark & Vealé, 2018).

The researcher used tabular visualizations of open and axial codes, with results appearing in Appendix C of the dissertation. The researcher also used hierarchical tree diagrams to visualize the thematic coding process’s results (Creswell & Poth, 2018). A hierarchical tree provides the reader with a complete view of each coding analysis layer, beginning with open coding (Creswell & Poth, 2018). Hierarchical tree branches, or links, from open codes to axial codes demonstrate the use of code clusters in forming axial codes or categories (Yin, 2018).

Similarly, links from multiple categories to a single tree leaf illustrate the researcher’s inductive thought process regarding the emergence of themes (Creswell & Poth, 2018; Korstjens & Moser, 2018a; Williams & Moser, 2019). The researcher illustrated supporting evidence for theme development by including example statements from interviews in a tabular matrix extracted from the final codebook (see Appendix K). Figure 13 illustrates the excerpt extraction process (Richards & Hemphill, 2018). The researcher also produced graphical depictions of the linkages between emergent themes and related concepts and theories in the conceptual framework. Finally, the researcher produced a map demonstrating the relationship of themes to the research questions to support the discussion of how the themes contribute to each research question’s resolution (Vaughn & Turner, 2016).
**Analysis for Triangulation**

Given the lack of statistical measures associated with qualitative analysis, triangulation of results becomes critical to support the reliability and validity of data and conclusions (Anderson, 2017; Astroth & Chung, 2018; Creswell & Poth, 2018; Korstjens & Moser, 2018b; Pope & Mays, 2020). Triangulation results when conclusions drawn from the independent analysis of one or more secondary data sources corroborate the findings extracted from the primary data source using the primary analytical method (Creswell & Poth, 2018; Korstjens & Moser, 2018b). The researcher conducted a quantitative analysis to triangulate the qualitative analysis themes.

**Figure 13**

*Illustration Visualizing Interviewee Statements to Support Thematic Development*

<table>
<thead>
<tr>
<th>Themes</th>
<th>Subthemes</th>
<th>Supporting Transcript Excerpts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject Marginalization</td>
<td>Lack of Communication</td>
<td>“My stressful day, um probably when things pop up that are not...If the school calls me and says now they have to...they have kids that are not coming, they change times, or I have a different schedule....”</td>
</tr>
<tr>
<td></td>
<td>Lack of Time and Resources</td>
<td>“I don’t have a classroom I’m in the gym balcony where the bleachers are at. I don’t have space the kids complain....”</td>
</tr>
<tr>
<td></td>
<td>Lack of Support</td>
<td>“I think the colleagues, it wouldn’t matter either way outside of the P.E. teachers, and I think the administration wouldn’t care either way....”</td>
</tr>
</tbody>
</table>

**Note.** Adapted from Richards and Hemphill (2018).

The researcher utilized a survey instrument administered through SurveyMonkey® to collect triangulation analysis data (Vaughn & Turner, 2016). Each interview participant received
a link to the online survey tool in a single-stage survey design without stratification (Creswell & Creswell, 2018). The survey instrument used a Likert scale with values one-through-five to produce quantitative data amenable to statistical analysis (Creswell & Poth, 2018). The researcher designed the survey based on the proposed research questions and preliminary results from thematic coding to probe the importance of, and the relationship between, business functions identified as creating interactions between health systems and ACOs. Using this approach to the formulation of survey questions, the researcher helped ensure content validity and construct validity since the results will speak to the themes of importance as identified through interviews with the survey participants (Creswell & Creswell, 2018). Given that code saturation occurred with only nine interviews, the researcher extended the survey to additional healthcare executives, obtained two additional survey responses.

Visualization of the statistical analysis of survey results appeared in the discussion of triangulation. A summary of responses to each survey question appears in tabular form. The tabular visualization includes descriptive statistics such as the mean response and standard deviation, enabling the reader to assess the degree of agreement regarding the importance of the business interaction in question (Morgan et al., 2013). A second tabular visualization presents statistical significance measures for differences observed between the Likert scale values obtained for various survey questions. This visualization enables researchers to determine whether differences between responses to independent survey questions are statistically meaningful (Morgan et al., 2013).

Given the subjectivity associated with the rating assigned to each survey question, the researcher applied statistical analysis to assess the intraclass correlation coefficient (ICC) (Morgan et al., 2013). Eleven research participants rated each survey question, each applying
their subjective judgment. Quantification of the ICC enabled an assessment of measurement reliability. The researcher also calculated Cronbach’s alpha, an accepted measure of each survey question's internal consistency (Creswell & Creswell, 2018). Finally, the researcher computed Fleiss’ Kappa to assess the agreement between survey respondents in the case of three or more respondents.

**Summary of Data Analysis**

The primary source of data for the proposed qualitative analysis was a collection of transcriptions of semi-structured interviews. With the assistance of two independent subject matter experts, the researcher conducted open and axial coding to summarize interview content into abbreviated form (codes) and identify emergent ideas (Creswell & Poth, 2018; Korstjens & Moser, 2018a; Williams & Moser, 2019). The researcher and secondary coders proceeded with selective coding, aggregating axial or categorical codes into primary and secondary themes aligned with the research questions (Belotto, 2018; Creswell & Poth, 2018; Williams & Moser, 2019). Coding and theme development proceeded iteratively until all codes and themes were characterized by the researcher and agreed upon by negotiation in a multi-rater model (Richards & Hemphill, 2018; Williams & Moser, 2019). Triangulation proceeded through the quantitative analysis of Likert scale survey data collected in an online survey via SurveyMonkey® (Vaughn & Turner, 2016). The complete record of data collection and analysis captured in NVivo® included the raw survey data and statistical analysis supporting reliability and validity (Creswell & Creswell, 2018). The dissertation includes multiple result visualizations in tabular, association diagram, and tree diagram formats illustrating the theme development process, relationships of themes to the conceptual framework and research questions, and triangulation of results (Creswell & Poth, 2018; Richards & Hemphill, 2018; Yin, 2018)
Reliability and Validity

For research to have value in the academic community’s eyes, the researcher must demonstrate the reliability and validity of the work (Roberts et al., 2019; Robson & McCartan, 2016; Yin, 2018). Satisfying the conditions that demonstrate reliability and validity leads academic researchers to a sense of the research report’s trustworthiness (Creswell & Poth, 2018; Roberts et al., 2019). Reliability, in this context, refers to whether research results are replicable when conducted by other researchers under the same conditions that were present during the original research (Creswell & Poth, 2018; Yin, 2018). The purpose of validity assessment is to ensure that results are accurate. In qualitative research, using secondary data sources and analytical methods to determine whether the researcher reaches conclusions similar to those obtained using primary data sources and analytical methods promotes validity (Creswell & Creswell, 2018; Yin, 2018). A detailed discussion of the approaches proposed to ensure reliability and validity in this research follows.

Reliability

Yin (2018) asserted that transparency regarding all research procedures is critical to establishing reliability. Mendes-Da-Silva (2019) described this high level of transparency as the gold standard by which researchers should document and publish research. Despite the assertions of researchers including Yin (2018) and Mendes-Da-Silva (2019), Aguinis and Solarino (2019) found transparency and, by extension, replicability lacking in a review of qualitative research papers. The authors emphasized the importance of transparency to achieve reliability when conducting interviews with elite informants, described as senior-level business executives, as intended in this research project (Mendes-Da-Silva, 2019).
The researcher employed purposive sampling to conduct the proposed research. The selection of research participants was from a pool of elite informants represented by senior executives from ACOs and affiliated health systems with financial or operational responsibility for aspects of the health system / ACO relationship. Purposive sampling draws upon the researcher’s knowledge of the research topic to select participants with knowledge relevant to the research questions (Cosenz & Noto, 2016; Etikan, 2016; Shannon-Baker, 2016). Given the researcher’s reliance on their judgment to select the research sample, purposive sampling is also known as judgment sampling (Etikan, 2016; Robson & McCartan, 2016). The researcher limited the selection of research participants to those in senior executive roles, including Executive Directors, Vice Presidents, Senior Vice Presidents, and Executive Vice Presidents in C-level positions. Depending on the structure of an ACO and its relationship to a health system, the most senior ACO title ranged from Executive Director to President/CEO. A sample consistently selected from among this set of elite informants was required to ensure expert opinions from similar perspectives regarding health system / ACO interactions that result in feedback between the organizations (Etikan, 2016; Wu Suen et al., 2014).

The researcher used the interview guide found in Appendix A to conduct all semi-structured interviews. Following a standard interview guide promoted consistency in research subjects’ questions, contributing to reliability (Arsel, 2017; Lancaster, 2017; Yin, 2018). The researcher opened each interview with the same prepared opening statement introducing the research project’s purpose and outlining the interview process. Transparency regarding the interview process was critical for eliciting complete and candid responses when conducting interviews with elite informants (Aguinis & Solarino, 2019; Lancaster, 2017). All interviews took place on the WebEx video conferencing platform so that respondents experienced the same
interview conditions. The process outlined above aligns with Arsel’s (2017) recommendation to adhere to a predefined interview protocol for all interviewees to achieve consistent outcomes.

The researcher solicited survey responses through the SurveyMonkey® platform, which delivered the same Likert scale survey to all interviewees. All interviewees responded to the same set of 31 survey questions based on their lived experience and without asking clarifying questions of the researcher. In this way, survey conditions were the same for all respondents. The researcher refined the codebook following each successive interview. A comparison of results allowed the researcher to comment on intra-rater reliability (Robson & McCartan, 2016). By employing additional independent coders, the researcher compared the outcomes from multi-rater coding. An assessment of the similarities and differences in results enabled the researcher to evaluate inter-rater reliability (Belotto, 2018; Robson & McCartan, 2016).

Thorough documentation of data collection and analysis processes, constituting an audit trail, occurred (Amankwaa, 2016). The researcher organized and cataloged all thematic coding procedures and results in the NVivo® CAQDAS program. The resulting codebook appears in Appendix C of the dissertation to guide others to replicate the dissertation work. In addition to the codebook, the resultant codes, the interview guide, and the standard survey appeared in the dissertation’s NVivo® catalog and appendices. This information, along with the sample selection and interview protocol descriptions contained herein, provides the information needed for other researchers to replicate the data collection process proposed for this research project (Aguinis & Solarino, 2019; Amankwaa, 2016; Arsel, 2017; Mendes-Da-Silva, 2019; Roberts et al., 2019; Yin, 2018).
Validity

To ensure the research’s trustworthiness, the researcher evaluated three forms of validity: construct validity, internal validity, and external validity (Yin, 2018). The construct validity concept speaks to whether the research measures reflect the information needed to answer the research questions posed by the researcher (Robson & McCartan, 2016). Further, construct validity results in insights that relate to the conceptual framework believed to underpin the research (Fusch et al., 2018). Fusch et al. (2018), Yin (2018), and Amankwaa (2016) endorsed three practices that establish construct validity:

- triangulation of results using multiple data sources,
- preservation of the chain of evidence from data collection through the extraction of research findings, and
- sharing results with participants for confirmation or rebuttal.

This author used the following procedures to promote construct validity. First, the researcher employed multiple coders and evaluated the results obtained for consistency. Second, interviews continued until further interviews failed to uncover new code information. Interviews ceased when analysis revealed code saturation after nine interviews (Fusch & Ness, 2015; Robson & McCartan, 2016; Saunders et al., 2018; van Rijnsoever, 2017; Weller et al., 2018). Third, the researcher quantitatively analyzed responses to Likert scale surveys. Quantitative analysis sought to triangulate the themes identified through the multi-rater thematic coding process. Finally, the researcher preserved all research assets, from raw data through research results, in an organized catalog created in NVivo®, with backups stored in a secure, cloud-based platform.
Internal validity reflects an assessment of the potential causal link between an identified factor and an outcome (Robson & McCartan, 2016; Yin, 2018). In this sense, the conclusions asserted by the researcher must have a direct connection back to the data from which the conclusions are allegedly derived (Yin, 2018). To achieve internal validity, the researcher clearly articulated the data collection and analysis process, the path from open to axial to selective coding, and illustrated each step in this process for the reader. The description of these processes employed a thick description that provided sufficient descriptive detail to immerse the reader in the data collection and analysis process (Creswell & Creswell, 2018).

The use of thick description helps the reader develop a sense of participation in the research (Creswell & Poth, 2018). Additionally, the thick description provided an opportunity for the researcher to acknowledge personal biases and address the means through which bias mitigation prevented biases from impacting data analysis and conclusions drawn from the data (Creswell & Poth, 2018; Yin, 2018). Acknowledging personal biases will enable the reader to visualize more clearly the research process and remove concerns regarding the effects of researcher bias or methodological flaws (Creswell & Creswell, 2018).

The researcher employed an additional technique to enhance the research’s internal validity: the statistical determination of Cronbach’s alpha for questions in the Likert scale survey. Cronbach’s alpha is an accepted statistical measure of internal validity in the presence of quantitative data (Morgan et al., 2013). Cronbach’s alpha provided a quantitative measure of whether the five available responses in each question’s Likert scale were independent or internally consistent (Morgan et al., 2013).

external validity indicates that a research study’s findings are generalizable to cases beyond those directly studied in the research project (Robson & McCartan, 2016; Yin, 2018). In
this regard, the researcher avoid extrapolating results to external settings that do not bear a strong relationship to the settings directly studied in the research (Creswell & Creswell, 2018). Yin (2018) suggested the research questions’ content guides the extensibility of research findings to other settings. Amankwaa (2016) and Creswell and Creswell (2018) pointed to a thick description as an essential technique for establishing external validity. The detail provided in thick description enables readers to more clearly envision the circumstances under which the researcher conducted research, the people and organizations informing the research, and the path to conclusions derived through the research (Creswell & Creswell, 2018). This detail enables readers to judge a generalizations’ reasonableness or whether the results transfer to additional settings (Creswell & Creswell, 2018).

As in the case of internal validity, the researcher articulated the research process’s details, including the purposive sample inclusion criteria, the nature of the relationships between health systems and ACOs participating in the research, and any anomalies discovered regarding health system / ACO interactions. The details of these aspects of the research provide the reader with sufficient knowledge of the research project’s boundaries to evaluate the extensibility of research findings to other settings (Amankwaa, 2016; Creswell & Creswell, 2018).

**Bracketing**

As acknowledged above, the qualitative researcher recognizes that life experiences may, and almost certainly do, result in inherent biases. Biases have the potential to impact data collection by, for example, influencing the nature and delivery of interview questions, the interpretation of research data, and the conclusions derived from analysis of the research (Creswell & Creswell, 2018; Fusch et al., 2018; Yin, 2018). As the researcher is the primary instrument of qualitative research, accounting for the researcher’s biases was of paramount
importance for ensuring reliability and validity of results (Creswell & Creswell, 2018; Fusch et al., 2018; Tufford & Newman, 2012; Yin, 2018).

Bracketing requires the researcher to acknowledge biases through the process of reflectivity (Arsel, 2017; Creswell & Creswell, 2018; Creswell & Poth, 2018). Reflectivity challenges the researcher to acknowledge biases, then strive to suspend biases or be intentional about how they allow biases to impact the research process (Arsel, 2017; Creswell & Creswell, 2018; Creswell & Poth, 2018). Failure to recognize biases before conducting research can result in corruption of the research process. Similarly, new biases may arise during research, so that the researcher must be vigilant to recognize this phenomenon when it occurs (Tufford & Newman, 2012). By employing the technique of reflectivity beginning at the point of research design, the researcher can make better decisions regarding research questions, population sampling, interview questions, survey questions, and other qualitative research aspects (Tufford & Newman, 2012).

Bracketing and reflectivity are essential considerations for the researcher leading the proposed research project. The research has more than thirty years of experience working in the healthcare industry. The researcher’s current executive position is with a health system with an ownership interest in an ACO. Further, the researcher is responsible for business and clinical analytics supplied to both the health system and the ACO. Therefore, the researcher has insight regarding the interactions between a health system and an owned, top-100 ACO. This experience can create preconceptions regarding the operational functions within a health system that affect ACO financial performance and vice versa.

To mitigate the effects of biases stemming from the researcher’s experiences in the health system and ACO industries, the researcher engaged two subject matter experts to vet the
proposed research questions. Additionally, the researcher engaged two subject matter experts to code the transcripts of semi-structured interviews, ensuring that the researcher was not solely responsible for code development. As described in previous sections, the researcher employed thick descriptions in the discussion of research procedures and results so that external readers can judge the potential impact of biases on published results.

**Summary of Reliability and Validity**

Providing satisfactory evidence of reliability and validity is critical for the acceptance of research work as trustworthy. A thick description must provide sufficient detail regarding the processes of data collection, organization, and analysis to enable readers to envision their involvement in the research and to judge both reliability and validity. Bracketing, or the reflective awareness of the researcher’s potential biases, must appear in the thick description of the research so that readers can assess the extent to which the researcher’s biases influenced data collection, data analysis, or inferred conclusions. The researcher adopted methods endorsed in the research literature to demonstrate reliability and validity. The use and description of purposive sampling inclusion criteria, a consistent interview guide, codebook, and standardized survey instrument contribute to reliability. The use of NVivo®, a recognized CAQDAS program, for storage, organization, and cataloging of research data and results provides evidence of reliability. This preserved chain of evidence, combined with triangulation of thematic coding results, supports the case for construct validity. When combined with thick description, the chain of evidence contributes to internal validity. Using statistical analysis to generate Cronbach’s alpha for survey questions provides quantitative evidence of internal validity for the survey questions. The use of a thick description combined with the explicit bracketing of the
researcher’s biases, allowing readers to evaluate the generalizability of research conclusions, provides support for external validity.

**Summary of Section 2 and Transition**

The researcher was the primary instrument for data collection and analysis in this qualitative research project. Qualitative analysis is the preferred method for investigating real-world research problems as found in the proposed research project. Given the ACA permits multiple ACO partnership arrangements, a multiple case study design presented a vehicle for collecting expert opinions across a spectrum of operating models. Data collection included the design of an interview guide, facilitation of semi-structured interviews with healthcare executives from health systems and ACOs, and design and distribution of surveys to the same group of nine executives to collect triangulation data. The researcher extended the survey to two additional executive subject matter experts to enhance the statistical analysis of survey data. The researcher conducted semi-structured interviews with a purposive sample of nine healthcare executives and performed qualitative analysis using thematic coding until achieving saturation. The use of additional coders supported reliability and validity by minimizing bracketed biases’ impact on the researcher’s data interpretation.

Statistical analysis of survey data provided evidence to triangulate interview analysis results. All raw data captured through interviews and surveys, data analyses, and visualizations resided in a categorized file structure created by the researcher within NVivo®, a CAQDAS tool commonly used by qualitative researchers. Preserving the chain of evidence, combined with the triangulation of thematic coding results, supported the case for construct validity. Adding thick description contributed to internal validity. The inclusion of explicit bracketing of the
researcher’s biases, allowing readers to evaluate the generalizability of research conclusions, supports external validity.

Section 3 of the dissertation examines in detail the research study’s findings. Included is an in-depth discussion of the major themes that emerged from the thematic coding of interview transcripts. The researcher explores the relationship of the themes to the research problem, research questions, conceptual framework, and literature review. Also presented are the results of a statistical analysis of survey data used to triangulate the results of coding analysis. The researcher describes application strategies designed to improve general business practice and includes recommendations for future research. Finally, the author assesses the results in a biblical context and reflects on personal and professional growth derived from the research.
Section 3: Application to Professional Practice

Overview of the Study

The qualitative multiple case study reviewed here investigated the inability of health systems and ACOs in a partnership to model the effects on performance caused by inter-organizational interactions accurately. As a premise for the study, the researcher documented the current state of analyses conducted by health systems and ACOs engaged in a partnership. The researcher also extracted a series of 158 primary codes from semi-structured interviews describing the nature of health system / ACO organizational structures and interactions. The 158 primary codes, documented in the codebook provided in Appendix C, supported 13 unique code categories and 29 code subcategories. Of the 13 code categories, category 3 contained 57 causal link codes established from the analysis of interview data. The researcher subcategorized causal links into ACO-driven links and health system-driven links. Of the 57 causal link codes, 29 were ACO-driven links, and 28 were health system-driven links.

An analysis of causal links resulted in the formation of 21 causal loops. Analysis of the polarities of the causal loops resulted in the documentation of 21 feedback loops. Nine feedback loops involved only ACO parameters (3) or health system parameters (6). The researcher designated these loops, which represented feedback processes within a single organization, as intra-organizational loops. Similarly, the researcher identified the 12 feedback loops containing combinations of ACO and health system parameters as inter-organizational feedback loops.

Confirming the existence of inter-organizational feedback loops had significant implications for the nature of the effects resulting from health system / ACO interactions. Mathematical analysis dictates that a feedback loop results in nonlinear relationships among the parameters involved in the loop. The confirmed presence of inter-organizational feedback loops
thus proved that health systems and ACOs create nonlinear effects on the other through operational interactions. This finding proved critical given the findings associated with one of the themes identified in the research, which stated that neither health systems nor ACOs:

- currently consider the potential effects of inter-organizational interactions,
- attempt to model nonlinear behaviors arising from interactions, or
- deploy tools capable of modeling nonlinear effects.

Therefore, the researcher determined that health systems and ACOs must modify current business practices and engage in system dynamics modeling, using the results generated in this study, to produce accurate projections of organizational behaviors in the presence of confirmed feedback loops.

The following sections document the research findings in detail. The researcher presents the results of the thematic coding of nine semi-structured interviews conducted with five ACO and four health system executives. Included is an in-depth analysis of the formation of causal links, causal loops, and feedback loops. The researcher presents details of the composition of each link and loop in tabular and visual form. The researcher also presents the results obtained from the quantitative analysis of a 31-question Likert scale-based survey used to triangulate the results of thematic coding. Also provided is a discussion of the reliability and validity of the data to ensure its trustworthiness. The presentation concludes with a discussion of the application of the results to business practice, strategies for applying the results to business practice, and reflections on personal and professional growth resulting from engaging in the research project.
Presentation of the Findings

Introduction

The researcher conducted nine semi-structured interviews among research subjects consisting of four health system executives and five ACO executives at organizations in the southeastern United States. Each interviewed executive held a leadership role in a function with direct accountability for at least one operational or financial aspect of a health system / ACO partnership. In seven of the nine cases, the executive cited an ACO formed as a wholly-owned subsidiary of a health system. Two executives cited an ACO owned in a joint venture between a health system and an independent physician group. These relationships were consistent with models previously identified in the literature (Colla et al., 2016; Harrison et al., 2018). The research guide used to conduct the semi-structured interviews consistently appears in Appendix A.

Each interviewee also completed a Likert scale survey distributed via email through the SurveyMonkey® application. The survey, designed to require fifteen minutes to complete, consisted of 31 questions developed from the analysis of the semi-structured interviews. Each question required a single answer selected from five choices: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. The consistent assignment of these choices to the numbers one through five enabled subsequent statistical analysis of the survey results. The 31 survey questions appear in Appendix B.

Coding and thematic analysis of the nine semi-structured interviews with health system and ACO executives produced 159 codes summarized into 13 code categories. The researcher identified five themes and seven sub-themes from the 13 code categories. Each primary code represents a unique concept expressed by one or more interviewees (Saldaña, 2021). The
researcher undertook an iterative approach to creating codes, with five review cycles leading to the production of the final codebook (Saldaña, 2021). The complete codebook appears in Appendix C. References to the codebook will appear throughout the presentation of findings.

Upon completing the coding process, the researcher aggregated related codes into 13 code categories. Categories represent collections of codes that relate to one another conceptually to reveal a pattern of interviewees’ significant lines of reasoning related to the nature of health system / ACO interactions (Saldaña, 2021). Just as with unique codes, creating a code category did not require a unanimous contribution from interviewees. Instead, the researcher formed a category when a preponderance of evidence supporting the category became apparent. Additionally, some categories contain one or more subcategories that differentiate lines of reasoning within a category. The codebook found in Appendix C records all categories and subcategories.

Analysis of code categories resulted in the formation of five themes. Each theme represents a significant concept extracted from relationships within and among code categories (Saldaña, 2021). In the researcher’s analysis, the emergent themes represented new insights regarding the current state of business simulation modeling in health systems and ACOs. Also surfaced were the operational functions that healthcare executives believe are necessary for a realistic system dynamics model of health system / ACO partnership interactions. A detailed discussion of the identified themes and interpretation of each theme in the context of the research problem, research questions, conceptual framework, and academic literature appears in the following sections.
Themes Discovered

The researcher developed five themes by analyzing the qualitative data obtained through coding 10 semi-structured interviews. Three of the five themes have at least one associated sub-theme. A summary of identified themes and sub-themes follows, with in-depth discussion and interpretation of each theme and sub-theme provided in the following section.

Theme 1: Dynamic Simulation Models Are Not Common in Health Systems or ACOs. Interviewees unanimously confirmed their organizations do not use any forms of dynamic modeling to simulate the effects of interactions between health systems and ACOs. The majority of interviewees also confirmed their organizations do not use any methods to simulate the effects of health system / ACO interactions.

Subtheme 1A: Health Systems and ACOs Do Not Use Dynamic Models Capable of Modeling Nonlinearity. Interviewees expressed a universal lack of awareness of dynamic modeling techniques. Additionally, only two of the ten interviewees expressed a working knowledge of the mathematical concept of nonlinearity related to cause-and-effect relationships. Health system and ACO executives did not consider using dynamic modeling techniques to produce accurate simulations of outcomes in systems displaying nonlinear behaviors due to the lack of familiarity with the causes and effects of nonlinearity in business systems.

Subtheme 1B: Excel Spreadsheets and Traditional Linear Finance Approaches are the Norms. When asked about current methods for simulating the impact that health system operational changes may exert on an ACO, or vice versa, most interviewees indicated their organizations do not simulate the impact of organizational interactions. Among those that acknowledged the presence of some attempts at interaction modeling, all referred to spreadsheet-based approaches rooted in traditional finance methods such as pro forma development. All
references to modeling involved using Excel spreadsheets, and none mentioned accounting for feedback loops between the health system and ACO.

**Subtheme 1C: Executives Support the Introduction of Dynamic Models Once Aware of Nonlinearity.** Neither health system executives nor ACO executives expressed an awareness of the mathematical concept of nonlinearity. Since the executives interviewed were not familiar with nonlinearity in the mathematical sense, they were unaware of its implications for predicting outcomes in nonlinear systems. The researcher needed to provide a brief explanation of nonlinearity to interviewees. The explanation enabled interviewees to respond to questions in the interview guide related to the sources of nonlinearity in health system / ACO partnerships. The interview process enabled interviewees to understand the potential effects of nonlinearity on accurately predicting the performance of health systems or ACOs engaged in a partnership. Afterward, all interviewees expressed that using dynamic models capable of simulating nonlinear effects would add value to their respective organizations.

**Theme 2: Healthcare Executives can Identify Health System / ACO Interactions.** Interviewees often expressed difficulty when first asked to conceptualize the interaction points between health systems and ACOs. This finding reflected a typical behavior among executives, whereby interviewees tended to focus on operations within their organization. Even when engaged in a partnership with an organization with a competing business model, this behavior was present. In this way, interviewees described limiting their business analyses to an intra-organizational perspective that did not recognize the potential impacts of inter-organizational interactions. This finding was consistent with the information cited in Theme 1, that health systems and ACOs were not engaged in considering or simulating interactions between the two partner organizations.
Subtheme 2A: System Thinking Promotes Discovery of Causal Links Among Executives Unfamiliar with System Dynamics Modeling Concepts. A causal loop connects two variables that have a causal influence on one another (Morecroft, 2015; Sterman, 2000). In the causal loop, an arrow connects variable A to variable B, indicating that variable A influences the value of variable B. A second arrow closes the loop to indicate that variable B, in turn, influences the value of variable A (Morecroft, 2015; Sterman, 2000). Additional variables may serve as intermediary influencers between the two variables of interest, with arrows denoting the order of influence among variables (Morecroft, 2015; Sterman, 2000). An example of causal loops appears in Figure 8. Each pair of variables connected by an arrow represents a causal link in the causal loop (Morecroft, 2015; Sterman, 2000).

The results identified through Subtheme 2A and Subtheme 2B represent the discovery of causal links in the health system / ACO interaction. Each pair of health system / ACO functional interactions identified in this manner represented a potential segment, or link, in a causal loop. Healthcare executives did not initially display an awareness of the concepts of system dynamics, nonlinearity, or causal loops. The discussion of potential impacts of one organization type on the other, orienting interviewees to a system thinking view of the health system / ACO partnership, resulted in the articulation of causal loop links.

Subtheme 2B: ACO Business Functions Affect Health Systems. Anticipating the possibility that healthcare executives might struggle to view the health system / ACO relationship in systems thinking terms, several interview questions provided a mechanism to test executives’ awareness of such interactions. When explicitly asked to imagine which ACO operations potentially posed threats to health system performance, health system executives began to identify ACO operations and relate them to health system functions that might be
adversely affected. For example, ACO executives often cited utilization management as a threat to health system inpatient volumes. After establishing this line of thinking, the researcher asked health system executives also to consider ACO operations that had the potential to improve health system performance. One example cited was the ACO’s potential to reduce health system inpatient length of stay through effective ACO utilization management.

**Subtheme 2C: Health System Business Functions Affect ACOs.** A similar approach used with ACO executives articulated health system operations that threatened ACO performance. For example, ACO executives commonly cited health system initiatives to increase emergency department use as a threat to ACO care cost savings. Reversing the line of questioning led to insights such as health system investment in increasing the staffing ratio (clinical staff members per patient) can potentially improve ACO quality metric performance through improved patient satisfaction scores in the health system.

After establishing this line of reasoning, interviewees were able to reverse the process and identify those functions through which their organization might impact the partner organization. This exercise required each executive to theoretically place themselves in an executive role within the partner organization and imagine the strategic considerations of the health system / ACO partnership from an unfamiliar, competing perspective. Given the experience of first identifying interactions based on their current roles, executives could identify interactions from the partner's perspective.

**Theme 3: Connecting Causal Links Confirms Complete Causal Loops in Health System / ACO Partnerships.** The activities associated with Theme 2, identifying causal links, led to a set of 57 links. Seven categories comprised of 29 links represented causal links in which an ACO function was the influencer or causal agent. Of the 29 ACO-initiated causal links, 15
(52%) were ACO-to-ACO links, while 13 (45%) were ACO-to-health system links. One link (3%) involved ACO influence on physician groups. Similarly, a health system function influenced 28 links, of which 17 (61%) were health system-to-health system links, while nine (32%) were health system-to-ACO links (see Appendix C).

The 57 identified causal links involved 41 unique business functions or performance indicators. Fourteen (34%) business functions or performance indicators were internal to ACOs, while 25 (61%) were internal to health systems. The remaining two (5%) belonged to payers and physician groups.

Joining the causal links through shared business functions or performance indicators resulted in 21 causal loops. The researcher identified three (15%) identified causal loops that involved only ACO functions or performance indicators and five (25%) causal loops that involved only health system functions or indicators. The remaining 12 (60%) causal loops were hybrid loops consisting of both health system and ACO functions or performance indicators.

**Theme 4: Feedback Loops Linking Health System and ACO Functions Exist.** The existence of causal loops involving business functions and performance indicators from both health systems and ACOs referred to here as hybrid causal loops proved that partnerships between health systems and ACOs result in feedback loops as defined by Morecroft (2015) and Sterman (2000). Analysis revealed a combination of reinforcing and balancing feedback loops, as expected in a real-world business model (Morecroft, 2015; Sterman, 2000). Sterman (2000) and Morecroft (2015) demonstrated the presence of feedback loops in a system mathematically dictates the presence of nonlinear relationships among feedback loop variables.

**Subtheme 4A: Feedback Loops between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes.** The mathematics of feedback loops proves that
parameters present in feedback loops must exhibit nonlinear response behaviors (Sterman, 2000). The researcher demonstrated through analysis of coded interview data that hybrid feedback loops exist, with parameters from both health systems and ACOs. The hybrid feedback loops contain financial parameters, often from the health system and the ACO. Parameters present in feedback loops must mathematically exhibit nonlinear behaviors. The research cited here demonstrated hybrid health system / ACO feedback loops containing financial parameters exist and must necessarily, result in nonlinear financial behaviors for both health systems and ACOs engaged in a partnership.

**Theme 5: Accurate Simulation of Interactions between Health Systems and ACOs**

**Requires Dynamic System Models.** Theme 4 has important implications for determining whether traditional financial analysis methods are sufficient for simulating the performance of a health system and an ACO engaged in a partnership. Theme 4 confirms the effects of a health system on an ACO’s performance, and vice versa, must necessarily be nonlinear due to the presence of feedback loops (Morecroft, 2015; Sterman, 2000). The presence of positive or reinforcing feedback loops leads to exponential growth among the variables associated with the loop. The presence of negative, or balancing, feedback loops leads to exponential decreases in the values of feedback loop variables. The presence of both types of loops in the same system, as in real-world systems, leads to complex, nonlinear behavior often involving both periods of growth and decline among variables over time (Morecroft, 2015; Sterman, 2000). The research presented in this dissertation demonstrates the necessity of nonlinear behavior among multiple health system and ACO variables, including operating margin, given the presence of feedback loops. As Theme 1 illustrates that neither health systems nor ACOs presently accounts for nonlinear behaviors resulting from mutual interaction, neither organization can be said to possess
the ability to accurately project the impacts of its partner’s strategic actions on its operating margin. The solution to this problem requires the implementation of a system dynamics model capable of simulating nonlinear feedback loop behavior generated by health system / ACO interactions (Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015; Morecroft, 2015; Sterman, 2000).

**Interpretation of the Themes**

**Theme 1: Dynamic Simulation Models Are Not Common in Health Systems and ACOs.** Health system and ACO executives expressed universal agreement with the idea that health system actions may affect ACO performance and vice versa. For example, health system interviewee H-817982 responded to this line of questioning by stating, “Very much so. Yeah, clearly our performance impacts, you know, the [ACO] plan’s ratings, their star ratings, their performance, and which, you know, basically translates into their revenue potential from CMS.”

ACO executive A-257898 expressed a similar viewpoint, stating, “I agree. Obviously, the strategic decisions of the health system, because the health system entities are part of the [ACO network], do affect our performance overall, those on the quality side and on the financial side.”

An ACO president, A-410514, with dual accountability to a health system and an ACO, provided insight into mutual impacts across the health system / ACO boundary:

Yeah, I agree with that. So, if I put my hospital hat on, obviously, the financial decisions that are made at the hospital system, i.e., managed care contracts, termination of contracts, bringing on new services, etc. … that financial impact, that financial decision-making on the hospital side impacts the ACO. Because as, as negotiations are done with payers, and increases are put in place, the ACO’s costs go up. And so that impacts the ACO’s performance overall.
On the flip side, how the ACO affects the hospital system is if we, if … in a couple different ways. If we don’t perform, then nobody gets shared savings, including the hospital system. If we have leakage out of the ACO, into other hospitals, other non-contracted providers, etc., that’s a financial impact to the hospital, because that’s money that is potentially coming out of the hospital system.

Despite general agreement that health systems and ACOs can mutually affect performance, interviews with health system and ACO executives demonstrated unequivocally that neither the health systems nor ACOs represented in the research case studies currently use dynamic simulation models. In addition to a general lack of awareness of the availability of dynamic modeling methods, executives were not aware of the mathematical concept of nonlinearity or potential implications in the case of health system / ACO interactions. Excel® spreadsheets incorporating traditional, linear financial forecasting methods incorporating actuarial trends remain the norm in the industry for projecting the impact of strategic decisions. Even the Excel®-based methods, however, do not attempt to account directly for health system / ACO interactions. This finding is consistent with the researcher’s literature review results, which found no examples of dynamic modeling methods used to study the effects of health system / ACO interactions on either health system or ACO financial performance.

**Subtheme 1A: Health Systems and ACOs Do Not Use Dynamic Models Capable of Modeling Nonlinearity.** In interviews, research subjects universally expressed the sentiment that their organizations did not employ dynamic simulation models. Further, interviewees unanimously acknowledged that their organizations did not attempt to simulate the impacts, financial or operational, caused by interaction with a partner health system or ACO. For example, when asked whether their ACO employed any form of dynamic modeling to simulate
the impact of interactions between the ACO and partner health system, mainly to understand nonlinear effects, subject A-410514 responded consistently with other interviewees: “We don’t. Okay, yeah, we really don’t. Our financial decisions are made … I would think that the hospital, when they make financial decisions or strategic decisions, they do consider the ACO. But I don’t think anything we do does.”

Research subject A-480306, responding to the same question, echoed a similar sentiment, stating that, “Well, no, I feel like we don’t have models in place [to simulate health system / ACO interactions].” Additional support for the lack of dynamic modeling capabilities came from research subject A-930463, who holds a role with dual accountability within an ACO and its health system owner. A-930463 confirmed a lack of simulation capability with the statement: 

So, we really don’t, we really don’t today. We, we do some modeling around, you know, our performance and our benchmark, and how we’re doing related to that benchmark. But we don’t we really don’t bring it down to how any specific ACO initiatives are then translating into loss of … services on the healthcare side, on the hospital side.

A-930463 further asserted the difference in size between the health system and the ACO, from a revenue perspective, led leaders to believe that simulation was unnecessary, assuming the potential impact of the ACO on health system finances was minimal: “They’re not. Part of it’s because again, the magnitude of the ACO versus the overall organization. And, yeah, so. So, they're not, they're not simulating that today.”

Interviewee H-872436 offered a different perspective, suggesting health system leaders often do not understand the ACO business model. The lack of understanding leads to failure to anticipate the consequences of health system actions on the ACO:
So, the thing about ACO global cap, or even a hospital owned health plan, is that usually the hospital people don't understand it at all. And so, they don't know when they’re doing something that has an adverse consequence. And … the ACO is kind of last in line because it’s just out there on its own. And most people inside the hospital don’t know how to spell ACO, let alone do anything related to it. So, yeah … the hospital certainly can create some nonlinear disruptions.

Addressing the impact of not having simulation modeling employed to understand health system / ACO interactions, health system leader H-591837 described two gaps in knowledge that persist in his health system. His health system operates a wholly-owned ACO subsidiary. While the ACO has a history of financial success, the drivers of success remain unknown: “I understand the question [and] I’ll tell you what the dilemma is. So, let me articulate that. The challenge is that, and [ACO leader AA] will admit this, we don’t know why we’re achieving those savings.” The lack of understanding regarding the source of financial success in the health system-owned ACO creates operational challenges. When leaders cannot pinpoint successful operations, they cannot identify operations that diminish success. To address this problem, health systems and ACOs often turn to external consultants in the absence of internal simulation capabilities:

And so, in my interview with Consultant 2, I said, I’m as interested in what we should stop doing. And what we should do more of to really have an impact on patients and this whole issue of how do we move upstream most effectively?

The Chief Financial Officer (CFO) of a midsize health system summarized the importance of developing the ability to simulate health system interactions with ACOs. As CFO of a health system that wholly owns an ACO subsidiary, this research participant had a firsthand understanding of the finances of both organizations. As the ACO continues to grow and realize
success, the CFO recognized the potential for ACO financial success to breed health system financial failure eventually. According to this source, success hinges on the ability to identify an optimal operating model that preserves the financial viability of both organizations, thereby maximizing the financial performance of the parent corporation.

You know, I think what’s challenging for the hospital and ACO relationship are the reimbursement models for all the various payers that may run through the ACO, occurring at a pace where…the tipping point doesn’t get out of balance. And so that’s sort of the subcontext of your question. I think, for me, we’re at this tipping point where you can really impact health system utilization through the ACO; the ACO can really impact health system utilization. And that has a negative impact on the hospital potentially.

Elaborating on the tipping point concept in the context of nonlinearity, the interviewee added:

If the risk-based contracts are such that the ACO is getting enough revenue by doing that and sharing it with the hospital, then that equilibrium stays right. But if that tipping point gets out of balance, and the ACO moves too quickly, for lack of a better term, and things start to really occur at a greater pace than anticipated through the reimbursement models or the funds flow model from the ACO, then that is more detrimental to the hospital. I think … you can certainly have an exponential impact on one side or the other really. And that’s, that’s sort of what becomes difficult to model. Yeah. And, you know, the reality is that things move slowly. If you implement a program that’s managing utilization or managing care in a certain way, the change is typically incremental, but it’s not impossible for something to just sort of take off. And then you’ve got this huge, unexpected, nonlinear impact.
Subtheme 1B: Excel Spreadsheets and Traditional Linear Finance Approaches are the Norms. In the absence of dynamic modeling capabilities, the researcher queried participants regarding current simulation or modeling capabilities used to account for interactions between health systems and ACOs. Most participants referred to spreadsheet-based modeling as the source for understanding firm performance, albeit without the potential impacts of interactions. Further, the descriptions of models employed indicated linear modeling, i.e., if one assumes a change in variable X at the ACO, it may result in a proportional change in variable Y in the health system. No interviewee descriptions included the concept of a feedback loop in which changes in the variable Y directly or indirectly impacted the value of the variable X, which, in turn, influenced the variable Y. For example, interview participant A-257898 articulated a common perspective regarding current approaches to simulation modeling:

Yeah, my boss now is an accountant. So, he’s a big pro forma guy. So, I do build actual pro formas for him. I did build a pretty detailed financial model that could toggle in lots of different areas, depending on the variables like, you know, what amount were we able to negotiate in a particular contract? How is attribution under those plans actually going to flesh out? You know, we, we had a staffing model that was built based on what we believe the needs were going to be there. There are certain clinical staff members that you must have in that model.

Linear approaches, as described above, in which changes in variables have a uni-directional impact (see Figure 6), appear to meet the expectations of senior leaders that are unfamiliar with the limitations of such methods when nonlinear responses are possible.

If it’s in a spreadsheet, I can usually get buy-in from, from my current boss, who is also managing the finances of the whole health system. [W]e have gotten a lot of yeses simply
because, you know, we’re able to say, if this particular thing is not working, we will dial this other thing back.

In addition to Excel® spreadsheet-based models, two participants cited the use of actuarial modeling techniques. In the context of the discussion, the interviewee, A-738746, an executive at an ACO associated with health system owner, linked the idea of understanding the relationship between ACO value-based contracts and health system fee-for-service (FFS) contracts with the concept of nonlinearity. When asked how the ACO attempted to simulate or predict these types of nonlinear financial effects today, if at all, A-738746 cited the following example:

We do try to do it. I think we’re trying to do that at Health System X when we look at the contract. We keep our fee-for-service contracts and value contracts together. So when we're doing actuarial analysis of how that contract is going to perform, we, we look at it from both a fee-for-service perspective, as well as the value perspective. In systems that separate those two, where the value contract is done separately from the fee-for-service contract, I think those systems are often not looking at the total collective uptick of both of those.

The statement above provided the closest description obtained from the 10 interviewees of a potential feedback loop process. The statement described that ACO value-based contracts impact health system FFS contracts and vice versa. However, the actuarial process described as the source of analysis appeared only to account independently for the revenue generated for the health system and ACO under their respective contracts. The actuarial analysis process cited was carried out using spreadsheet models and involved determining trend factors to use in the independent projection of revenue for each organization:
Yeah, it [spreadsheet modeling] absolutely is [used]. You have our traditional contracting people who are trying to say the value of that on a fee-for-service basis is straight math, but the actuarial components come in where you're trying to predict what the trend is likely to be…They are more done on an Excel® spreadsheet of…[ICD-10] codes and what the reimbursement is.

Nothing in the description of the actuarial analysis above hinted at the potential feedback effects through which one contract may impact the negotiated terms of the other. This concept would appear in multiple interviews as interview questions guided interviewees through the systems thinking process, as described in Theme 3.

Finally, interviewees cited the use of external consultants to generate projections regarding financial performance for jointly-owned health systems and ACOs. Interviewee H-591837 provided an example of the modeling work that external consultants did to understand health system and ACO finances in a joint ownership model:

I’ll tell you that the closest we’ve come is we did engage Consultant A, a kind of a boutique analytics and modeling company that’s an offshoot of Consultant B, to help support our work on alignment. And they did…look at ER avoidance, network fidelity…like five categories, and they actually modeled side by side, what the opportunity is for ACO or improvement, but then what the offsetting impact is on Health System. I’m often a skeptic of some of our consultants, but to their credit, they dug into the Health System and the ACO side. They worked with [Finance] on the flow of funds to be sure they understood how the savings on the ACO side flow into Health System to offset the reduced demand or reduced utilization and net that all together.
Unlike the internal modeling described by interviewee A-738746, statements from H-591837 described the first step toward a system thinking approach to interaction modeling. H-591837’s description recognizes a relationship between incentive revenue generated through ACO savings and the resultant cash flow to the health system partner:

[Regarding the emergency department], they [the consultant] didn’t capture some things, they just said, well, it’s a profitable line of business. If we drop 100 emergency department visits per 1000, we’re going to lose so many emergency department visits, and therefore we’re going to lose so much margin. And, the ACO will gain this much, but Health System will gain that much [through a share of ACO gains].

This statement by H-591837 describes a feedback process. In the process, a reduction in emergency room visits reduces health system margin and increases ACO shared savings. A portion of ACO shared savings is returned to the health system through a sharing arrangement. Therefore, health system margin impacts ACO shared savings, which, in turn, impacts health system margin. This relationship forms a closed feedback loop. Unfortunately, the modeling approach described was a static one in that it assumed a fixed change in emergency department visit rate. The consultant’s modeling assumed a simple, linear trade-off in case volume but failed to account for dynamic changes over time due to feedback interactions. In a dynamic model, changes in model parameters over time, driven by feedback processes, surface longitudinal variations in parameters such as ACO shared savings and health system margin. Nonetheless, this example was the only feedback process encountered before introducing questions to guide the systems thinking process.

**Subtheme 1C: Executives Support the Introduction of Dynamic Models Once Aware of Nonlinearity.** Health system and ACO executives required an explanation of nonlinearity, a
mathematical concept, before responding to related questions. Further, the researcher had to explain the potential implications of nonlinearity. For example, interviewees did not realize that nonlinearity is sensitive to initial conditions, making predicting outcomes difficult. The researcher also described the potential applicability to complex systems if analysis of interview results led to the finding that a health system / ACO partnership represented a complex system with feedback loops. In the extreme, complex, dynamic systems may exhibit chaos, which leads to stochastic behavior that varies with initial conditions (Sterman, 2000).

Upon learning about the meaning and potential implications of nonlinearity, executive interviewees supported introducing simulation methods capable of representing nonlinear behaviors. Given an appreciation for the mathematical concept of nonlinearity and its implications, health system leader H-817982 expressed an appreciation for the complexity of modeling accurately the health system / ACO interaction:

Yeah, I’m curious. There’s so many interactions. And the sort of connectivity between them. Right? But it's, it's my God … it's just yeah. I’m just thinking … the behavioral influencers and financial influencers are significant, and I would think that most, I mean … how would they not be looped? I would say most of them, you know, there’s some sort of feedback loop because it’s, it’s a partnership. And that part of the part of that complexity is that some of these factors are…much more influential than others. Right?

So, there’s a weighting.

An ACO executive A-930463 expressed concern about the current inability to align ACO and health system strategies without a dynamic model:

I think my biggest concern, and it’s probably more of a concern on ACO side again because of magnitude, but it’s my biggest concern from both perspectives, is the lack of
alignment and understanding and the lack of connection between what’s happening in the ACO versus what’s happening in the system…And, so, that’s one of the things I think that we’re still working on is how do we create the right touchpoints, interactions across the system so that that all become we can get that more aligned? That’s probably my biggest concern is that those discussions aren’t necessarily happening. And so therefore, as the ACO president, those consequences kind of can bleed into my results. And I might won’t even know it until after the fact.

When asked whether this concern implied difficulty in predicting the impact of health system decisions on ACO performance without a dynamic simulation model, A-930463 responded affirmatively:

I do, I think that where there’s some real value from a model like what you’ve described. Because again, going back to sort of my vision, which is the ACO is not a standalone thing, but it’s really who we are and what we do and how we deliver care. In order for us to ultimately get to that vision, there has to be a lot more alignment, communication and interaction between the health system side and the ACO.

Of primary concern was the elimination of subjective assumptions about behaviors:

And so, I think that where a model like you’re describing could be really valuable is in driving, helping to drive those discussions. So that as you line up on stuff, you can, you can model the impact on both entities, right? And what both entities can expect to be the pluses and where they can expect there to be some minuses. And, then, how do we work through those minuses? So, that’s where I see it as extremely helpful; it could be really utilized to further drive and create that alignment. Yeah, I think…facts and data, instead
of people just thinking, well, this is what could happen, or that could happen, or so that’s where I see some real value in something like this.

From the health system perspective, executive H-591837 identified the potential applicability of a dynamic simulation model to a concept referred to as a dynamic flow of funds between the health system and partner ACO. This idea represents a move away from a traditional, linear cash flow analysis and relies upon, instead, upon a dynamic representation of cash flows that fluctuate over time, as one would anticipate in a dynamic simulation model.

What he [the ACO partner president] had hoped is that we would have what he calls a dynamic flow of funds. So, we take the enablement work we’re working with in terms of Consultant 1 and Consultant 2, on prioritizing the use cases. We would then predict or project the economic impact of those initiatives. And then we would go back and model what the impact is on the health system. So, depending upon what that impact is, the flow of funds would be variable or dynamic, depending upon the particular initiative.

So, for example, for hospital-at-home, we would look at, if we increase our census, for hospital-at-home to say 20 or 30 patients a day, that’s a loss on the health system side. But then it gets into how are the savings shared? Are they savings to the ACO and then flow back through? Or is it a three-way contract with the health system, ACO, and the third party who may be involved in creating those savings?

Executive A-930463 expressed a similar concept from an ACO perspective. A-930463 noted the potential for an increased ability to ensure delivery of the proper care to patients in the right care setting, in addition to citing the financial benefit of a dynamic model that includes both health system and ACO functions:
If you really believe that your goal is to not provide care that patients don’t need and to make sure that you do provide the care that they do need, and the ACO is working to do that, and you find that that negatively impacts your facility side [health system side] or some other part of your system, then that suggests that that need is not there for that. And that trying to protect that [health system-based utilization] you’re really not serving the best interests of the patient. So, you know, ultimately, the goal is to get to the other side of that, where you’re serving the best needs of the patients. And if that means you have less hospital beds, then you just have less hospital beds. It’s that in-between pay part, the tipping point when you’re trying to move across that, that it’s hard.

In the opinion of A-930463, the solution would be to use the modeling process to understand the potential for growth in health system services. Services must be medically appropriate, serve the patient’s best interests, and enable the health system to recover revenue lost to the ACO’s ability to reduce inappropriate care:

But I think that has to be, at least in our system, we would want that then put into the context of what additional growth would you need to bring in? That was as opposed to just saying, hey, you’re going to lose, you know, a million dollars, because we’re going to…do some initiative that’s going to decrease duplicate scans. Well, the right thing is to decrease the duplicate scans. And that does have a financial impact if that's been your run, right.

But, then, what do you need to do to grow that volume to offset that? And then what’s the system strategy to do that? Because you know, in advance, that’s projected to happen. And so I think, you know, those are the kind of linkages that I think you have to look at
is, yeah, it's going to have this impact on one side or the other, but then what are they going to do [about it]? What’s their strategy going to be to appropriately address that?

**Theme 2: Healthcare Executives Can Identify Health System / ACO Interactions.**

That health system and ACO executives initially indicated that their respective organizations did not consider or model the interactions between a health system and an ACO led to concerns regarding their abilities to identify potential points of interaction between the partner entities. However, the questions in this portion of the interview guide proved to facilitate a system thinking perspective among the executive interviewees. The researcher began by asking interviewees whether they believed their partner health system or ACO could impact their organization’s performance. Interviewees unanimously answered yes to this question. Interviewees universally acknowledged their organizations did not model health system / ACO interactions. However, they also unanimously answered in the affirmative when asked whether they agreed with the statement that strategic and operational decisions made by an ACO or a health system have the potential to impact the operating margin of its partner health system or ACO.

The ACO executives cited impacts that health systems have on the ACO’s ability to meet cost savings and quality improvement targets under value-based care contracts. One challenge identified was that health systems continue to operate under FFS payment arrangements with health insurers, incentivizing the provision of more services to increase revenue. Interviewee A-738746 summarized this idea as follows:

I agree that…they do impact each other. In our current healthcare environment, we’re still pretty dependent on fee-for-service. [Our health system is] still very dependent on fee-for-service. And so often, the majority of their margins and business model is on a
fee-for-service basis. In the value contract, it’s a very different business model. And sometimes those two things can be in contradiction to each other. So there have been times in my life where the CMO of the hospital has a goal that is in complete opposition [to the goal of the ACO], so only one of us is going to be able to achieve that goal.

So the key in all of this is trying to set common goals, and then both understanding what it takes in order to get to those. I’m sure you’re well aware of all the research around how independent ACOs that are not part of health systems have historically performed better. And I think part of that is because they can set their goals solely to be about for just them, and they don’t have to take in consideration the goals of the health system.

Interviewee H-872436 offered the following as a mechanism by which a health system impacts an ACO negatively:

The first one is the propensity of the hospital to slam people inpatient. That could be, you know, direct admits from the ER, lack of use of observation status, otherwise using the marketing influence to kind of be a magnet for seriously ill patients and discharging patients to really crappy SNFs. So, all those things can hit the ACO hard.

Similarly, interviewee A-930463 cited a health system’s care delivery efficiency, including the manner and site of care delivery, as a factor impacting the ACO’s ability to contain the cost of healthcare. A-930463 also noted an example of how the ACO might impact health system performance:

I agree with that statement. I think from the ACO perspective, you know, clearly, in addition to improving quality and patient interaction and satisfaction, one of the major goals of the ACO is to bend the cost curve. And so, to the extent that the [health] system
is not effective and efficient in terms of how it provides care, and where it provides care, that has implications on the ACO’s results. And then, vice versa, depending on the different initiatives that the ACO decides to focus on, that could potentially also have impact on the health system.

Interviewee A-480306 also asserted that the ACO has an impact on health system finances:

I agree because the strategic decisions that we make do impact the finances of the hospital…So, we're trying to improve quality and lower the cost of health care for our patients, and in doing that we want to better coordinate care for our patients. And we want to make sure that we’re getting their care in a timely manner that is not caught up with duplication of service and, so, we want to reduce waste. So, we have the ability to impact utilization on the health system.

Executive H-872436 supported the idea that ACOs impact health systems’ finances, providing examples of positive and negative mechanisms:

The ACO can redirect leakage. The things that the ACO can do to hurt the hospital, are to destroy ER visits. Because, you know, 70, or 80% of the hospitals admits come through the ER, and about 15% of the ER visits resulted in an admission. So, lower traffic, lower activity, that’s the first thing. The second thing is really speculative. But if the ACO incentivizes good care and provides good care management for these patients who have polychronic situations, and that stuff works, then there are fewer admits. I mean, the ER visits are down, which means the admits are down. So, both by redirecting the ER visit and by actually taking care of patients in a better manner that works more effectively, it can really isolate the hospital.
Interviewee A-410514 provided additional insight into the mechanisms through which an ACO may impact the performance of a partner health system. Comments by this executive focused on the benefits of the ACO helping to keep care delivery services within the partner health system rather than in a competing health system, which represents network leakage. Mutual benefit is achieved, according to A-410514, when the ACO meets its shared savings incentive goals and a portion of shared savings accrues to the partner health system as revenue. In the scenario offered by A-410514, network leakage reduction results in revenue enhancement for the health system and care cost savings for the ACO, with the latter adding to the ACO’s ability to achieve cost reduction targets established by health insurance clients.

How the ACO affects the hospital system is…in a couple different ways. If we don’t perform, then nobody gets shared savings, including the hospital system. If we have leakage out of the ACO into other hospitals, other non-contracted providers, etc., that’s a financial impact to the hospital, because that’s money that is potentially coming out of the hospital system. We like to believe that the [partner] health system is the value leader. But when you have leakage out, then that also hurts the hospital.

Given a belief that the partner organization impacted their organization’s performance, the researcher asked interviewees to identify the functions or activities of the partner entity that impacted the interviewee’s organization. Interviewees initially expressed uncertainty about how to respond, citing difficulty in directly linking health system operational functions with ACO operational functions. However, when prompted by questions framed by the researcher in a system thinking context (Chang et al., 2017; Greenhalgh & Papoutsi, 2018; Jolly, 2015; Kapp et al., 2017; Weissenberger-Eibl et al., 2019), both health system and ACO executives were able to identify functions through which health systems and ACOs interact in ways that impact
organizational performance (Chang et al., 2017; Greenhalgh & Papoutsi, 2018; Jolly, 2015; Kapp et al., 2017; Weissenberger-Eibl et al., 2019). By following this line of reasoning, each interviewee began to identify their partner’s operational functions or activities they believed impacted the interviewee’s organization and the functions impacted. Once practiced in this line of thinking, interviewees were able to reverse this process and offer opinions about which functions within their organizations were most likely to impact the performance of a partner organization and the mechanisms through which impacts occurred.

This finding implies that health system and ACO executives can contribute to formulating a system dynamics model if guided to think about health system / ACO interactions through questions that implicitly invoke a system thinking lens. Executives can contribute successfully despite the lack of familiarity with system dynamics modeling.

**Subtheme 2A: System Thinking Promotes Discovery of Causal Links Among Executives Unfamiliar with System Dynamics Modeling Concepts.** Causal loop diagrams are a visualization tool to represent the feedback loops that exist in a complex system (Morecroft, 2015). As depicted in Figure 7, causal loops consist of system parameters connected by lines with arrows at one end; the lines represent the cause-and-effect relationship between the variables (Morecroft, 2015; Sterman, 2000). The variable at the base of the line is the causative agent. The causative agent elicits an effect in the variable at the arrow end of the line. Each set of two variables connected by an arrow is a causal link (Sterman, 2000). Causal links are the building blocks of complete causal loops and, therefore, feedback loops (Sterman, 2000).

The concepts of causal links, causal loops, and feedback loops are well-known among those familiar with representations of complex systems (Morecroft, 2015; Sterman, 2000). Given the results discussed in Theme 1, i.e., the lack of familiarity with dynamic systems and nonlinear
behavior among healthcare executives, it was unclear whether executives would have the conceptual framework necessary to discover causal links. Without discovering causal links, it would not be possible to construct causal loops or feedback loops to support the subsequent development of a system dynamics model of health system / ACO interactions.

Lack of familiarity caused interviewees to struggle to discuss organizational interactions as feedback loops in the mathematical sense. However, interviewees related well to the feedback concept when framed more simply as interactions between healthcare operations. The researcher asked interviewees to think through their respective health system or ACO operations and consider how their health system or ACO partner might affect those operations, either directly or indirectly. While this line of questioning directed interviewees to consider inter-organizational interactions, the ensuing discussions often led to the discovery of intra-organizational causal links.

For example, interviewee A-410514 identified that increased ACO operating expenses also increased health system operating expenses through health system subsidization of the ACO. However, in describing this inter-organizational interaction, the interviewee also linked increased ACO expenses to a decrease in ACO shared savings, as follows:

If we went crazy on operating expenses and…then started lots of new initiatives that were expensive or hired more people or things like that, then obviously, that hits operating expenses, which comes out of [shared] savings, which then also hits the hospital system.

This single comment results in the identification of two causal links:

- ACO operating expenses influence health system operating expenses, and
- ACO operating expenses influence ACO shared savings.
Interviewee A-480306 addressed the influence of the availability of health system services on the ability of the ACO to keep its attributed patients in-network to seek care from hospitals and physicians within the health system / ACO contracted network. In the course of the conversation of this inter-organizational interaction, the interviewee cited the ACO’s influence on network leakage through its efforts to control patient churn. To the extent that out-of-network utilization occurs, it is commonly more expensive to the ACO than is comparable in-network care. Therefore, the result of network leakage is an increase in the ACO’s total cost of care for its attributed patients:

So yeah, it’s a great question and, and very current topic right now, because the big push is keeping care local. And the goal is to keep care within our network, theoretically so that we can better coordinate the care. We can capture the revenue for the hospital side and we don’t get into a bunch of unnecessary churn for our patients once they leave our network. Typically, it is true that if a patient leaves our network and goes particularly to [an] academic medical center, then the cost of care is going to be higher there and it’s going to cost us more money. And, like I said, for the most part, particularly on hospitalizations, most places are going to end up costing more money because we’re surrounded by academic medical centers.

Through this comment, two causal links became apparent, one of which directly addressed the question of inter-organizational influences on ACO performance and led to the identification of a second, intra-organizational causal link. The links discovered through this comment were:

- Health system service availability influences ACO network leakage, and
- ACO network leakage influences the ACO’s total cost of care.
The researcher found that comments, even those that appeared brief and simplistic, required careful parsing to uncover all potential causal links referenced within. For example, interviewee A480306 made a one-sentence reference to the impact of hiring to support ACO utilization management operations: “The strategic and operational decisions about hiring, that has the ability to impact our ACO operation and, ultimately, impact our performance.” By understanding this comment in the context of the entire conversation, as well as through coding established from other interviews, the researcher identified two causal links:

- ACO utilization management personnel cost influences ACO total personnel operating cost, and
- ACO utilization management personnel cost influences ACO shared savings (the measure of ACO performance).

The identification of intra-organizational causal links also occurred when interviewees considered partner organizations’ operations. For example, interviewee H-681700 represented a health system but was able to identify a potential causal link within a partner ACO. H-681700 began by considering the impact of the ACO’s management of its revenue budget, as determined by value-based contracts with health insurance customers, on the health system’s revenue. In the process, the interviewee noted that an ACO’s efforts to manage its revenue budget ultimately impacted its total revenue, which included shared savings incentive payments. ACO shared savings then connected to health system revenue through a revenue-sharing mechanism.

You know, I think what’s challenging for the hospital and ACO relationship is, are the reimbursement models for all the various payers that may run through the ACO, occurring at a pace where we’re, the tipping point doesn’t get out of balance. I think, for me, we’re at this tipping point where you can really impact health system utilization
through the ACO; the ACO can really impact health system utilization. And that has a negative impact on the hospital potentially. If the risk-based contracts are such that the ACO is getting enough revenue by doing that and sharing it with the hospital, then that equilibrium stays right. But if that tipping point gets out of balance, and the ACO moves too quickly, for lack of a better term, and things start to really occur at a greater pace than anticipated through the reimbursement models or the funds flow model from the ACO, then that’s more detrimental to the hospital.

Embedded within this single comment were multiple inferences regarding inter-organizational and intra-organizational causal links:

- ACO utilization management effectiveness influences health system patient volume,
- Health system patient volume influences health system revenue,
- ACO value-based contract terms influence ACO total revenue, and
- ACO shared savings influences the health system's total revenue.

Thus, while not an ACO executive, interviewee H-681700 was able to develop inferences regarding the interplay of functions within the ACO operational environment in addition to causal links within the health system environment and across the ACO / health system boundary.

The researcher concluded that the investigation of inter-organizational causal links led indirectly to discovering numerous intra-organizational causal links (see Table 1). The presence of intra-organizational causal links created the possibility of identifying intra-organizational causal loops. Additional intra-organizational causal loops, if discovered through further analysis, would create, through feedback, complex, nonlinear behavior within health systems and ACOs independent of their interaction with each other (Marshall, Burgos-Liz, Ijzerman, Osgood, et al.,

**Subtheme 2B: ACO Business Functions Affect Health Systems.** As demonstrated in Subtheme 2A, health system and ACO executives provided examples of situations in which they believed ACO operational functions influenced health system operations and performance, including:

- ACO operating expenses influence health system operating expenses,
- ACO utilization management effectiveness influences health system patient volume, and
- ACO shared savings influences the health system’s total revenue.

Further examination of coded interviews revealed additional ACO influences on health system performance.

Interviewee A-410514 cited an example in which the health system subsidized the operating expenses of the ACO, thereby reducing the ACO’s direct cost burden while increasing the health system’s operating cost:

We’re in a very different position here, one that I’ve never been in before, because I’ve always worked for ACOs that were owned 100% by the hospital. If the hospital is going to take on the [ACO] operating expense, if it benefits the ACO, it will benefit the hospital.

This relationship implied two new ACO-driven, inter-organizational causal links:

- ACO operating expense influences health system total operating expense, and
- ACO operating expense influences health system ACO subsidy cost.
### Table 1

**Identified Intra-Organizational Causal Links**

<table>
<thead>
<tr>
<th>Code Subcategory</th>
<th>Causal Link</th>
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<tbody>
<tr>
<td>ACO Network Leakage Rate</td>
<td>ACO Network Leakage Rate to ACO Care Cost Savings</td>
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<tr>
<td></td>
<td>ACO Network Leakage Rate to ACO Utilization Management Effectiveness</td>
</tr>
<tr>
<td>ACO Payer Contracts</td>
<td>ACO Payer Value-Based Budget to ACO Total Revenue</td>
</tr>
<tr>
<td></td>
<td>ACO Payer Value-Based Budget to ACO Care Cost Savings</td>
</tr>
<tr>
<td>ACO Quality Metric Performance</td>
<td>ACO Quality Metric Performance to ACO Shared Savings</td>
</tr>
<tr>
<td>ACO Utilization Management</td>
<td>ACO Utilization Management Effectiveness to ACO Network Leakage</td>
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<td>ACO Attributed Patient Volume to ACO Shared Savings</td>
</tr>
<tr>
<td>ACO Shared Savings</td>
<td>ACO Care Cost Savings to ACO Shared Savings</td>
</tr>
<tr>
<td>Health System Patient Mix</td>
<td>Health System Patient Mix to Health System Payer FFS Payment Rate</td>
</tr>
<tr>
<td>Health System Site of Service</td>
<td>Health System Site of Service to Health System Total Revenue</td>
</tr>
<tr>
<td>Health System Cost</td>
<td>Health System Fixed Cost to Health System Total Cost</td>
</tr>
<tr>
<td>Health System Market Share</td>
<td>Health System Market Share to Health System Site of Service</td>
</tr>
<tr>
<td>Health System Patient Volumes</td>
<td>Health System Total Patient Volume to Health System Claims Revenue</td>
</tr>
<tr>
<td></td>
<td>Health System Emergency Room Volume to Health System Inpatient Volume</td>
</tr>
<tr>
<td></td>
<td>Health System Emergency Room Volume to Health System Patient Satisfaction</td>
</tr>
<tr>
<td></td>
<td>Health System Inpatient Volume to Health System Cost of Care Delivery</td>
</tr>
<tr>
<td>Code Subcategory</td>
<td>Causal Link</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Health System Inpatient Volume to Health System Payer FFS Payment Rate</td>
</tr>
<tr>
<td></td>
<td>Health System Ancillary Service Volume to Health System Market Growth Investment</td>
</tr>
<tr>
<td></td>
<td>Health System Ancillary Service Volume to Health System Market Growth Investment Readmissions</td>
</tr>
<tr>
<td></td>
<td>Health System Inpatient Volume to Health System Ancillary Service Volume</td>
</tr>
<tr>
<td></td>
<td>Health System Payer FFS Payment Rate to Health System Claims Revenue</td>
</tr>
<tr>
<td></td>
<td>Health System Readmission Rate to Health System Emergency Department Volume</td>
</tr>
<tr>
<td></td>
<td>Health System Readmission Rate to Health System Inpatient Volume</td>
</tr>
</tbody>
</table>

The ACO network leakage was the focus of comments by interviewee A-480306, who noted that the ACO’s efforts to prevent network leakage as a means to reduce the total cost of care for its attributed patients led to increased patient volumes and, therefore, revenue for the partner health system:

The goal is to keep care within our network, theoretically so that we can better coordinate the care [and] we can capture the revenue for the hospital side …. However, and typically, it is true that if a patient leaves our network and goes particularly to another academic medical center, then the cost of care is going to be higher there and it’s going to cost us more money.

Health system executive H-681700 expressed related concerns regarding the effects on the health system of ACO network leakage. This interviewee also cited the difficulty in understanding the impact of network leakage in the case when out-of-network care is cheaper than in-network care, thereby benefiting the ACO while simultaneously hurting the health system:
If the direction, or steerage for lack of a better word, of patients under the ACO care is to sites that are owned by the health system, or sites outside of the health system at a lower reimbursement level … okay. Now, to the extent that all that’s planned and coordinated, and you know, everybody's on the same page, I think that you're staying sane. But I think your question is more about the modeling difficulty and not necessarily … knowing or understanding the behavior…ahead of time to be able to model it.

In this case, the link established by the interviewee was between ACO network leakage and the health system’s ability to plan for related changes in patient volumes and associated claims revenue. The comments by A-480306 and H-681700 led to the establishment of two previously undefined causal links driven by ACO operations:

- ACO network leakage influences health system total claims revenue, and
- ACO network leakage influences health system patient volume.

Interviewees A-410514 and H-591837 referenced a dependency between the ACO’s negotiated value-based contracts with its health insurance clients and the health system’s FFS contracts with those same health insurers. These executives described opposite strategies for obtaining the best terms for FFS and value-based contracts. A-410514’s organization seeks to dissociate the two contracts and negotiate each independent of the other. By contrast, H-591837’s organization finds value in maintaining the relationship between the two contracts and negotiating the pair in tandem. The strategy proposed by interviewee A-410514 was:

Right now the fee-for-service contracts and the value-based contracts for the physicians sit in [the] ACO and for the hospital it sits in [the] ACO. And what we’re considering is splitting the fee-for-service contracts out to the two entities so that [the] health system would negotiate its fee-for-service contracts for both hospital and physicians. And
physician group would negotiate its own fee-for-service contracts for the physician group providers [and] keep their value-based contracts in [the] ACO. I’m trying to … talk to the payers about their ideas and I’m not sure that it’s going to be successful.

Alternatively, H-591837 saw an opposite approach beneficial, in which the terms of FFS and value-based contracts remain linked:

This is called the H-591837 policy. [W]hat I say to payers is, I say carefully, if you want us to be in-network, then not only do we need to reach agreement on the fee-for-service side, but we must have a meaningful value-based contract with a reasonable probability of earning savings, and of a certain savings opportunity level. And if we can't have that, then we will not contract or fee-for-service only. And, therefore, we will be out of network. So, what I am doing is I’m using our market position to get ACO contracts that produce significant savings.

These comments, stated as causal links, refer to:

- ACO value-based budget influences health system fee-for-service payment rate, and
- Health system fee-for-service payment rates influence ACO value-based budget.

A complete summary of causal links originating from an ACO function’s influence on its partner health system, as identified through the coding of interview data, appears in Table 2.
Table 2

Identified ACO-Driven Causal Links with Health System Functions

<table>
<thead>
<tr>
<th>Code subcategory</th>
<th>Causal link</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACO Network Leakage Rate</td>
<td>ACO Network Leakage Rate to Health System Total Patient Volume</td>
</tr>
<tr>
<td></td>
<td>ACO Network Leakage Rate to Health System Total Revenue</td>
</tr>
<tr>
<td>ACO Payer Contracts</td>
<td>ACO Payer Value-Based Budget to Health System Payer FFS Payment Rate</td>
</tr>
<tr>
<td>ACO Utilization Management</td>
<td>ACO Utilization Management Effectiveness to Health System Ancillary Svc Volume</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Claim Denials</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Emergency Department Volume</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Inpatient Volume</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Personnel Operating Costs</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Patient Acuity Mix</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Cost of Care Delivery</td>
</tr>
<tr>
<td></td>
<td>ACO Utilization Management Effectiveness to Health System Non-Personnel Operating Costs</td>
</tr>
<tr>
<td>ACO Shared Savings</td>
<td>ACO Shared Savings to Health System Revenue</td>
</tr>
</tbody>
</table>

Subtheme 2C: Health System Business Functions Affect ACOs. Both health system and ACO executives provided examples in which health system operations could affect ACO performance. An ACO executive A-738746 identified the impact of a health system’s efforts to increase its market share on ACO cost containment efforts. By increasing the utilization of health system services, the health system also increases the total cost of care managed by the ACO:

[W]ell, the things that they do to drive their volumes, and the probably the best example there is the emergency department (ED) utilization and what they do to drive ED utilization. So, our health system happens to have a lot of freestanding emergency departments. So, their strategy to expand those strategies in the past around putting wait
times up on billboards, everything they do to try to drive people into the emergency
departments, would impact the work we’re trying to do, which is we’re trying to get
people to lower cost of care sites, decrease ED utilization, decrease inpatient utilization.
So everything they do to increase those volumes impacts what we’re trying to do [at the
ACO].

The statement by A-738746 speaks to the inter-organizational relationship:

- Health system market growth investment influences ACO total cost of care.

Another ACO executive, A-738746, also related that the health system’s efforts to
increase utilization counter ACO total cost of care management efforts. In this case, however, A-
738746 suggested that, rather than continuing to drive inefficient, high-cost cases into the
hospital, both the health system and the ACO would benefit by reducing network leakage to
higher-cost competitors. Recapturing network leakage would increase service volumes for the
partner health system while simultaneously reducing the total cost of care for those services due
to lower in-network treatment costs:

One component is understanding the impact on volumes. So while we know that we want
to overall decrease the total cost of care within the population that we’re managing, how
you can find the win, win is by actually increasing volume to your own network [i.e.,
reducing network leakage], and capturing more of that total cost of care, while overall
decreasing the total cost of care. So, some of the predictions that need to be made, or
what are the efforts that we’re doing that will actually end up increasing the volume, and
estimating how that impacts along with overall decreasing the total cost of care.
This statement reflects the link identified by A-738746. However, it adds an intra-organizational link within the ACO, thereby creating a connection between two causal links through the ACO total cost of care:

- Health system market growth investment influences ACO total cost of care.
- ACO network leakage influences the ACO's total cost of care.

Health system executive H-591837 cited the relationship between health system FFS reimbursement contracts with health insurers and the total cost of care managed by ACOs under the terms of value-based care contracts with the same insurers. In this example, the terms of the health system FFS reimbursement contract determine total health system claims payment, the primary source of health system revenue. Those same claims costs become the cost of care that the ACO is responsible for managing under the terms of value-based care contracts with health insurers.

There are smaller examples, there are things that we do on the fee-for-service side that raise the cost of claims and impact the margin of the ACO, and there’s no question about it. Seeking a different region related to our labor costs from Medicare filing is one example. When we do hospital-based reimbursement, that impacts the cost of the Medicare and Medicare Advantage claims. And it negatively impacts the margin of the ACO.

This statement suggests three causal links driven by the health system, one of which is an intra-organizational link, while the other two are inter-organization links between the health system and the ACO:

- Health system fee-for-service reimbursement influences health system revenue,
- Health system revenue influences the ACO’s total cost of care.
• Health system revenue influences ACO operating margin.

When health systems experience readmission of a patient previously discharged from an inpatient stay, the readmission increases the cost of care delivery for the health system. It reflects poorly on the quality of care metrics. Under the terms of ACO value-based care contracts, quality of care metrics balance attempts to reduce the cost of care by eliminating necessary services. Therefore, the ACO’s eligibility for shared savings and the amount paid in shared savings incentives provided by a client health insurer depends on cost of care reduction and quality outcomes metrics. An ACO executive A-738746 identified the effect of health system readmissions on ACO shared savings:

Readmissions is probably the one that the health system controls the most and is the most challenging. [T]hat impact there is both in what happens within the emergency department…If someone gets hurt, they're much more likely to be readmitted [as a result of] the transitions of care and what they [the health system] are doing as patients get discharged. So, I think the health system impacts readmissions [and] probably that’s our quality metrics that they influence most.

This brief statement, when combined with the standard mechanism through which ACOs obtain shared savings through ACO value-based contracts, implies two causal links:

• Health system readmissions influence ACO quality metric performance,
• ACO quality metric performance influences ACO shared savings.

The primary coding of subject matter expert interviews led to ten causal links in which experts cited an operation, activity, or contractual consideration within a health system that influenced a function or outcome within the partner ACO. These links are inter-organizational since one organization influences outcomes in a partner organization. The discussion of these
links often led to the description of secondary causal links that did not originate within the health system. The health system-initiated causal links identified through coding of interview data appear in Table 3.

Table 3

Identified Health System-Driven Causal Links with ACO Functions

<table>
<thead>
<tr>
<th>Code subcategory</th>
<th>Causal link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health System Payer FFS Payment Rate</td>
<td>Health System Payer FFS Payment Rate to ACO Payer Value-Based Budget</td>
</tr>
<tr>
<td>Health System Revenue</td>
<td>Health System Total Revenue to ACO Care Cost Savings</td>
</tr>
<tr>
<td></td>
<td>Health System Total Revenue to ACO Utilization Management Effectiveness</td>
</tr>
<tr>
<td>Health System Staffing Level</td>
<td>Health System Staffing Ratio to ACO Network Leakage</td>
</tr>
<tr>
<td>Health System Patient Satisfaction</td>
<td>Health System Patient Satisfaction to ACO Quality Metric Performance</td>
</tr>
<tr>
<td>Health System Market Share</td>
<td>Health System Market Share to ACO Total Claims Cost</td>
</tr>
<tr>
<td></td>
<td>Health System Market Growth Investment Readmissions to ACO Quality Metric Performance</td>
</tr>
<tr>
<td>Health System Patient Volumes</td>
<td>Health System Inpatient Volume to ACO Care Cost Savings</td>
</tr>
<tr>
<td></td>
<td>Health System Emergency Room Volume to ACO Utilization Management Effectiveness</td>
</tr>
<tr>
<td></td>
<td>Health System Ancillary Service Volume to ACO Care Cost Savings</td>
</tr>
</tbody>
</table>

Theme 3: Connecting Causal Links Confirms Complete Causal Loops in Health System / ACO Partnerships. Given the causal links identified with Theme 2, the researcher began connecting related causal links to determine whether any series of connections resulted in complete causal loops (Morecroft, 2015; Sterman, 2000). The researcher formed connections between causal links that shared either health system or ACO parameters to begin this process. To illustrate this concept, consider two hypothetical causal links:

- Parameter A influences ACO shared savings, and
• ACO shared savings influences Parameter B.

A visual representation of these two causal links appears in Figure 1. The parameter ACO shared savings appears in both causal links, which allows the links to be combined, as seen in Figure 15, to create an extended causal link chain. From the diagram in Figure 15, one can infer that Parameter A indirectly influences Parameter B through shared interaction with ACO shared savings. So, while the data that resulted in forming the independent causal links found in Figure 14 did not directly speak to a relationship between Parameter A and Parameter B, the ability to connect causal links through shared parameters enables the researcher to identify new, more complex relationships between parameters.

Figure 14

Two Causal Loop Links Sharing a Common Parameter

![Image of Figure 14](image1.png)

Figure 15

Combining Causal Links through a Shared Parameter

![Image of Figure 15](image2.png)

As a next step in the current research project, the researcher connected all causal links captured in Tables 1, 2, and 3. The resultant complete causal link diagram appears in Figure 16.
Blue arrows indicate causal relationships that begin with an ACO parameter, while red arrows indicate causal relationships with a health system parameter. Figure 16 illustrates only the form taken by connected links. The researcher will enhance and discuss details of various sections of the complete causal link diagram in subsequent sections. Figure 16 illustrates that the integration of simple, two-parameter causal links identified through the coding of interview data resulted in a complex causal link representation of health system / ACO interactions. The complexity derives from connections made through parameters shared by two or more causal links.

In the simplest case identified in the diagram found in Figure 16, two variables each influence the value of the other with no intermediary parameters. For example, through the coding of interview data, the researcher determined that multiple subject matter experts identified ACO utilization management personnel cost as influencing ACO utilization management effectiveness. The principle behind this causal link was that an investment in more utilization management staff enabled improved utilization management outcomes. Experts also implied that improvements in utilization management outcomes provided an incentive to carry out additional utilization management activities through investment in more staff. A representation of this relationship, in which two related causal links form a causal loop, appears in Figure 17.

The causal loop in Figure 17 is an example of an intra-organizational causal loop, or a loop involving only variables within a single organization, in this case involving only ACO parameters. This simple loop provides evidence that causal links identified through the coding of healthcare executive interview data can form causal loops. The significance of this finding is that healthcare executives unfamiliar with the concepts of dynamic systems and causal loops can contribute expert knowledge that enables system dynamics modelers to capture causal
relationships within, in this case, an ACO. Three, two-variable ACO intra-organizational causal loops were derived from the coding of interview data, as discussed in detail in the description of Theme 4.

**Figure 16**

*Complete Health System / ACO Causal Link Connection Diagram*
Figure 17

A Simple ACO Causal Loop Formed from Two Related ACO Causal Links

Figure 18 provides an example of causal loop formation derived from two causal links identified within health system operations. In this example, experts indicated the number of patients readmitted to the health system was related to the number of patients discharged from the health system inpatient setting. Conversely, readmissions to the health system contributed to the number of inpatient cases. As in the ACO example illustrated in Figure 17, Figure 18 demonstrates the ability of healthcare executives to identify causal loop behavior through consideration of, in this case, health system operations without familiarity with causal loop concepts. The researcher derived five health system intra-organizational causal loops of varying complexity from the coding of interview data. A detailed review of these loops appears in the discussion of Theme 4.

Figure 18

A Health System Causal Loop Formed from Two Health System Causal Links
While demonstrating the ability to form causal loops from independent causal links is an important finding, intra-organizational loops do not demonstrate whether inter-organizational causal loops exist across the health system / ACO boundary. The causal loop example in Figure 19 addresses this issue. Figure 19 illustrates a simple, inter-organizational causal loop involving one health system parameter and one ACO parameters. This example arose from interviewees’ discussion of the relationship between health system FFS reimbursement rates negotiated with health insurers and value-based cost of care budgets negotiated by partner ACOs with the same health insurers. Interviewees identified that negotiations of these two types of reimbursement arrangements often occur in parallel, with each contract influencing the terms agreed to in the other contract. Health systems and ACOs must compromise to come to mutually agreeable terms with health insurers, an interdependency represented by the causal loop in Figure 19. The presence of red and blue arrows indicates a hybrid causal loop comprised of health system and ACO parameters.

**Figure 19**

*A Hybrid Causal Loop with Both Health System- and ACO-Driven Causal Links*

Theme 2 enumerated multiple intra-organizational causal links. The presence of these links makes possible the formation of complex causal loops. The causal loop shown in Figure 20 is the most straightforward representation of this concept. In this example, derived from causal links identified through interview coding, ACO shared savings influences health system total
revenue through a health system / ACO revenue-sharing agreement. In turn, the health system’s total revenue influences the potential for ACO care cost savings. These causal links represent interactions between the health system and the ACO. Figure 20 also shows, however, a relationship between ACO care cost savings and ACO shared savings. ACO care cost savings influence ACO shared savings potential through the ACO’s value-based care contract. This link between ACO care cost savings and ACO shared savings is an intra-organizational causal link. Without the presence of intra-organizational causal links like those described by interviewees and discussed in Theme 2, it would not be possible to discover complex links like the one illustrated in Figure 20.

**Figure 20**

*A Hybrid Causal Loop with Intra-Organizational Causal Links*

The researcher identified 12 complex, hybrid causal loops resulting from the connection of the complete set of causal links captured in Tables 1, 2, and 3. The interpretation of Theme 4 includes a detailed discussion of these complex, hybrid causal loops. The most complex hybrid loops discovered included 10 parameters. An example of one of the two 10-parameter loops appears in Figure 21. Figure 21 includes six consecutive intra-organizational links within the health system and a single intra-organizational ACO link.
Figure 21

*A Complex, Hybrid Causal Loop with Ten Health System and ACO Parameters*

![Causal Loop Diagram](image)

Figure 22 contains an illustration of the second 10-parameter causal loop. Inspection of this causal loop reveals it is nearly identical to the loop found in Figure 21. The sole difference between the loops in Figure 21 and Figure 22 is the exchange of the parameter health system cost of care delivery for health system non-personnel operating cost as a connecting parameter between ACO utilization management effectiveness and health system total cost. This type of parameter substitution in a causal loop is possible when a parameter is associated with multiple causal links that share parameters. In this case, the parameters of health system total cost and ACO utilization management effectiveness were components of causal links with health system cost of care delivery and health system non-personnel operating cost.

What is essential to understand from the creation of complex, multi-parameter causal loops in this way is that none of the executives interviewed directly articulated the complete set of connections contained within a complex causal loop. Instead, executives described simple, two-parameter causal links by applying their knowledge of business operations. The finding that
healthcare executives did not directly describe fully-formed complex causal loops, consistent with Kazakov and Kunc’s (2016) findings. They cited human cognitive processing of complexity limitations as a driving force for the need for dynamic simulation models. Nonetheless, the current research project demonstrated that connecting a robust set of causal links established through interviews of subject matters experts makes possible the formation of complex health system / ACO causal loops. Subject matter experts were previously unaware of the contributions of causal loops discovered in this way to the performance of their respective organizations.

**Figure 22**

*Modified Complex, Hybrid Causal Loop with Parameter Substitution*

**Theme 4: Feedback Loops Linking Health System and ACO Functions Exist.** Causal loops illustrate the potential for cause-and-effect relationships in which one variable influences the values of other variables in the loop (Cosenz & Noto, 2018; Morecroft, 2015; Sterman, 2000). Feedback loop diagrams add information to causal loops (Morecroft, 2015; Sterman, 2000). When constructing a feedback loop from a causal loop diagram, one must determine the polarity of each causal link and use this information to determine the net polarity of the loop. Polarity indicates whether an increase in one variable results in an increase or a decrease in the variable to which it connects via a causal link (Morecroft, 2015; Sterman, 2000).
Returning to the example shown in Figure 14, assume that as Parameter A increases, it causes an increase in ACO shared savings (positive polarity). Conversely, assume that an increase in ACO shared savings causes a decrease in Parameter B (negative polarity). The polarity of each causal link appears as in Figure 23. A plus sign represents a link with positive polarity, while a minus sign represents negative polarity.

When joining causal links, the net polarity of the resulting multi-parameter link is the product of the polarities assigned to the individual causal links (Morecroft, 2015; Sterman, 2000). Given the polarity assumptions made in Figure 23 and joining the related links as shown in Figure 15, one arrives at the causal link chain in Figure 24 with net negative polarity since the product of a positive polarity (+) and negative polarity (-) is negative (Sterman, 2000).

When causal link chains close on themselves to form causal loops, the loops take on a net polarity. The net polarity determines whether the effect of the loop is growth or decline and represents the nature of feedback occurring in the system. Suppose one starts with any variable appearing in the feedback loop and traces the polarity of the loop until returning to the starting point. In that case, the net polarity determines whether the value of that variable will grow or decline over time (Morecroft, 2015). If tracing the feedback loop implies growth, the feedback loop is a reinforcing loop. Alternatively, if the net result is a decrease in the value of the starting variable, the feedback loop is a balancing loop (Morecroft, 2015; Sterman, 2000).
Starting with the complete causal link diagram shown in Figure 16, the researcher identified all closed causal loops embedded in the diagram. Causal link diagram analysis resulted in the discovery of 21 closed causal loops. Three causal loops only involved ACO parameters, and six involved only health system parameters. An additional 12 causal loops were hybrid loops involving health system and ACO parameters. As one of the research project’s goals was to identify whether inter-organizational feedback loops existed as a result of health system / ACO interactions, the researcher focused on the analysis of hybrid causal loops.

To illustrate the process of analyzing hybrid feedback loops, consider the causal loop identified in Figure 19. The analysis of the feedback properties of the causal loop appears in Figure 25. As inferred from healthcare executive interviews, as health insurers agree to higher health system FFS payment rates for hospitals, they put downward pressure on ACO value-based budgets. Reduced ACO budgets incentivize ACOs to seek more significant total cost of care reductions. Therefore, the polarity of the health system-driven link shown in red is negative.

Similarly, as health insurers agree to higher ACO value-based budgets, they attempt to negotiate lower health system FFS payment rates to reduce the total cost of care. The result is a negative polarity for the ACO-driven causal link shown in blue in Figure 25. The net polarity of
the loop, applying the principle that individual polarities multiply, is a positive or reinforcing loop, as indicated by the purple R polarity indicator. The polarity indicator is purple to reflect the loop’s hybrid red/blue nature. The loop’s direction, as it occurs in the complete causal link diagram, is clockwise.

**Figure 25**

*Assigning Polarity to a Two-Parameter Hybrid Feedback Loop*

![Diagram showing a two-parameter hybrid feedback loop with nodes labeled "Health System Payer FFS Payment Rate" and "ACO Payer Value-Based Budget".]

The researcher carried out a similar analysis for all identified feedback loops. The results of the analysis of intra-organizational feedback loops appear in Table 4. The analysis results of hybrid or inter-organizational feedback loops appear in Table 5. Each of the three ACO-only feedback loops contained two causal links and were reinforcing in nature. The six health system-only feedback loops had between two and five causal links. Two of the feedback loops were reinforcing, while three displayed a balancing nature.

The researcher identified 12 hybrid health system / ACO feedback loops. The two most straightforward feedback loops involved only two links, one originating with the health system and the other originating with the ACO. Both loops displayed a reinforcing character, as illustrated in Figure 25. The two most complex feedback loops contained 10 links; both displayed a balancing loop character. An example of a 10-link hybrid feedback loop derived from the causal loop in Figure 21 appears in Figure 26.
Of the 12 hybrid loops identified, five displayed reinforcing behavior, and seven displayed balancing behavior. That the researcher discovered both reinforcing and balancing loops was consistent with the nature of real-world complex systems in which the exponentially increasing character of reinforcing loops is offset, or balanced, by the exponentially decreasing character of balancing loops (Jolly, 2015; Morecroft, 2015; Sterman, 2000). The competing behaviors of exponentially increasing and decreasing loops create nonlinearity in the outcomes of complex systems (Morecroft, 2015; Radzicki, 2020; Šviráková & Bianchi, 2018; Torres et al., 2017). A complete set of feedback loop diagrams appears in the Representation and Visualization of the Data section.
Table 4

Components and Polarities of Identified Intra-Organizational Feedback Loops

<table>
<thead>
<tr>
<th>Feedback Loop</th>
<th>Loop 1</th>
<th>Loop 2</th>
<th>Loop 3</th>
<th>Loop 4</th>
<th>Loop 5</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Loop Character</td>
<td>ACO</td>
<td>ACO</td>
<td>ACO</td>
<td>Health System</td>
<td>Health System</td>
</tr>
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<td>Loop Polarity</td>
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<td>Reinforcing</td>
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<td>Parameter 1</td>
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<td>ACO Utilization Management Effectiveness</td>
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<td>ACO Network Leakage</td>
<td>ACO Care Cost Savings</td>
<td>Health System Readmission Rate</td>
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</tr>
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<td>Parameter 3</td>
<td>ACO Utilization Management Effectiveness</td>
<td>ACO Utilization Management Effectiveness</td>
<td>ACO Network Leakage</td>
<td>Health System Inpatient Volume</td>
<td>Health System Emergency Department Volume</td>
</tr>
<tr>
<td>Parameter 4</td>
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<td></td>
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<td>Health System Inpatient Volume</td>
</tr>
<tr>
<td>Feedback loop</td>
<td>Loop 6</td>
<td>Loop 7</td>
<td>Loop 8</td>
<td>Loop 9</td>
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</tr>
<tr>
<td>Number of Links</td>
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<td>5</td>
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<td>5</td>
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<td>Loop Character</td>
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<td>Health System</td>
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</tr>
<tr>
<td>Loop Polarity</td>
<td>Balancing</td>
<td>Balancing</td>
<td>Balancing</td>
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Table 5

Components and Polarities of Identified Hybrid Feedback Loops

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Parameter 1
- ACO Utilization Management Effectiveness
- Health System Payer FFS Payment Rate
- ACO Care Cost Savings
- ACO Utilization Management Effectiveness
- ACO Utilization Management Effectiveness

Parameter 2
- Health System Emergency Department Volume
- ACO Payer Value-Based Budget
- ACO Shared Savings
- ACO Quality Metric Performance
- Health System Claim Denial Rate

Parameter 3
- ACO Utilization Management Effectiveness
- Health System Payer FFS Payment Rate
- Health System Total Revenue
- ACO Shared Savings
- Health System Claims Revenue

Parameter 4
- ACO Care Cost Savings
- Health System Total Revenue
- Health System Total Revenue
- ACO Utilization Management Effectiveness
- ACO Utilization Management Effectiveness

Parameter 5
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</table>

Subtheme 4A: Feedback Loops Between Health System and ACO Functions Must

Produce Nonlinear Financial Outcomes. Analyzing the data obtained by coding the interviews conducted with health system and ACO executives led to the discovery of 12 feedback loops
involving interactions between health systems and ACOs. Additionally, the researcher identified nine feedback loops existing within either health systems or ACOs. The significance of this finding is rooted in the mathematics of feedback loops.

Sterman (2000) presented a summary of the mathematics of feedback loops. Feedback loops consist of a collection of causal links. In the case of a causal link with positive polarity, the link’s behavior is governed mathematically by the integral $Y = \int_{t_0}^{t}(X + \cdots)ds + Y_{t_0}$, where $dy/dx > 0$. The variable $X$ represents the parameter at the start of the causal link, and $Y$ represents the parameter at the end of the link (Sterman, 2000). Thus, the value of parameter $Y$ is a function of the series of values of parameter $X$ as time varies from $t_0$ to $t$. The mathematical outcome of this integral is an exponential accumulation, or increase, in the variable $Y$ over time.

Similarly, in the case of a causal link with negative polarity, link behavior is governed by the integral $Y = \int_{t_0}^{t}(-X + \cdots)ds + Y_{t_0}$, where $dy/dx < 0$ (Sterman, 2000). The value of $Y$ is a function of the series of values of $X$ as time varies from $t_0$ to $t$. Since the values of $X$ are negative in this integral, the result is an exponential decrease in $Y$ over time.

A feedback loop that contains causal links of both positive and negative polarity combines the characteristics of the two integrals given above, or

$$Y = \sum_{a=1}^{n} \left[ \int_{t_0}^{t}(X + \cdots)dr \right] + \sum_{b=1}^{m} \left[ \int_{t_0}^{t}(-X + \cdots)ds \right] + Y_{t_0}$$

where $n$ is the number of positive polarity links in the feedback loop and $m$ is the number of negative polarity links. Therefore, this equation represents a system of nonlinear equations and is nonlinear (Ariyaratne et al., 2019; Cenci et al., 2020; Madhu & Jayaraman, 2017; Waseem et al., 2016). Thus, the mathematical nature of parameters associated with feedback loops is nonlinear. Put another way, the presence of a feedback loop in a complex system dictates that nonlinear equations will govern outcomes in the system (Morecroft, 2015; Sterman, 2000). Systems of
nonlinear equations do not have closed-form mathematical solutions and require the use of advanced numerical methods to estimate outcomes under a given set of initial conditions (Ariyaratne et al., 2019; Cenci et al., 2020; Madhu & Jayaraman, 2017; Waseem et al., 2016).

The researcher presented tables in Theme 4 that contained 12 hybrid feedback loops detailing the nature of interactions between a health system and a partner ACO as identified through case studies of nine health system and ACO executives. Nine of the twelve hybrid feedback loops contain parameters associated with health system finances, ACO finances, or both. Sterman’s (2000) mathematical analysis of feedback loop behavior proved that feedback loops must result in nonlinear outcomes. Therefore, the presence of nine financial performance-related hybrid feedback loops in the representation of health system interactions with ACOs proves that the financial outcomes of both health systems and ACOs must be nonlinear. The nonlinearity directly results from the effects of health system / ACO interactions.

Theme 5: Accurate Simulation of Interactions Between Health Systems and ACOs Requires Dynamic System Models. Multiple papers published in the academic literature (Crown et al., 2017; Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015; Monauni, 2017; Sterman, 2018; Weissenberger-Eibl et al., 2019) discussed the inadequacy of applying linear modeling techniques to complex, nonlinear systems, beginning with the work of Forrester (1961). These authors identified the presence of feedback loops as a defining characteristic of complex systems. Further, the authors asserted the mathematics underlying feedback loops is necessarily nonlinear. A critical implication from these works was that the behavior of any variable involved in a feedback loop is also necessarily nonlinear. As traditional modeling methods employed in finance and business simulation, such
as Excel’s Solver® tool, assume mathematical linearity, they cannot capture and simulate the nonlinear effects associated with complex systems.

The analysis of health system / ACO interactions presented in Themes 2, 3, and 4 demonstrated that such interactions involve multiple feedback loops with both health system and ACO parameters. A portion of the identified feedback loops was of a reinforcing behavior, while the remainder exhibited balancing behavior. Real-world complex systems require a combination of reinforcing and balancing loops (Morecroft, 2015; Sterman, 2000). The presence of multiple feedback loops renders inescapable the conclusion that nonlinear behaviors govern health system / ACO interactions.

The researcher noted in Theme 4 that nine of the discovered feedback loops included at least one financial parameter. Additionally, the researcher observed that financial parameters from health systems and ACOs appeared in the nine feedback loops, and parameters from each organization were often present in the same feedback loop. The researcher concluded that health system / ACO interactions must necessarily reflect nonlinear behaviors due to the presence of feedback loops. The researcher also observed nine feedback loops included financial parameters from health systems and ACOs. Given this evidence, the researcher concluded that:

- health system and ACO finances must react in a nonlinear manner,
- changes in parameters present in finance-related feedback loops are responsible for nonlinear financial behaviors, and
- health systems or ACOs can induce nonlinear financial behaviors in partner ACOs or health systems by changing the values of parameters in hybrid, finance-related feedback loops.
Representation and Visualization of the Data

The researcher pursued two instruments for data collection: interviews and surveys. Analysis of qualitative interview data proceeded via thematic coding, as illustrated in Figure 27. Once the researcher obtained a list of qualified health system and ACO executives, the researcher contacted the prospective research subjects to enroll them in the study. The researcher deidentified each interview and began the process of primary coding (Saldaña, 2021). The first seven interviews yielded new codes. The researcher iteratively refined the emerging codes, arriving at a preliminary codebook following four coding revisions. The researcher reviewed the codes and defined 13 unique code categories. Assessment of the resultant final codebook in the context of the research problem, research questions, conceptual framework, and literature review led to the development of five themes and seven subthemes. Tree diagrams illustrating theme development appear in Appendix J, and Appendix K presents examples of interview statements supporting theme development.

Figure 28 provides a representation of the triangulation process. The researcher collected quantitative data from each interviewee through a 31-question Likert scale-based survey. Upon extracting summary data for each survey question, the researcher performed statistical analysis to evaluate reliability, content validity, and construct validity. The researcher then compared the survey results with the results of thematic coding to determine the extent to which survey responses validated the conclusions obtained from thematic coding.
Figure 27

Data Collection and Theme Development Process

Identification of Qualified Interview Prospects:
Health System and ACO Executives

Enrollment of Interviewees

Individual Semi-Structured Interviews

Interview Transcription and Deidentification

I-1  I-2  I-3  I-9

Primary Interview Coding by Researcher

Codebook Development and Refinement

Multi-Rater Coding

Final Codebook

Assignment of Code Categories

Analysis based on: Research problem, research questions, conceptual framework, literature

Emergence of Themes
Figure 28

Thematic Coding Triangulation Process

Individual Triangulation Surveys

31 questions informed by coding results.
Deployed online via SurveyMonkey.

S-1  S-2  S-3  ...  S-11

Export of Summary Results, by Survey Question

Statistical Analysis

- Descriptive Statistics (Mean, standard deviation, median, mode)
- Intraclass correlation coefficient (ICC) (Inter-rater Reliability)
- Cronbach’s Alpha (Internal Consistency)
- Fleiss’ Kappa (Agreement Between Raters)

Comparison of survey analysis and thematic coding

Triangulation Summary Findings

- 158 Codes
- 13 Code Categories
- 5 Themes 7 Subthemes
**Codes and Code Categories.** A complete list of codes and associated code categories appears in Appendix C. The final codebook contained 158 unique codes, and Table 6 summarizes the 13 code categories derived from the codebook. The researcher identified two mechanisms that served as the basis for inter-organizational interactions. First, executive interviewees identified ACO functions or activities (levers) that, in their opinions, could affect health system performance.

Similarly, interviewees also identified health system functions or activities (levers) believed to affect ACO performance. Identifying such functions or activities did not necessarily coincide with a specific reference to a causal link generating effects. Executives also made references to various components of the health system and ACO operating structures. The researcher used this information to form categories representing health system and ACO levers and operating structures.

The most impactful code category was the identification of causal links. The researcher identified causal links in three subcategories:

- ACO functions that impact health system operations (ACO-driven linkages),
- health system functions that impact ACO operations (health system-driven linkages),
- and
- payer functions that impact either health system or ACO operations (payer-driven linkages).

The causal link category contained 57 (36.1%) of the 158 codes in the codebook. Only a limited discussion of payer-driven linkages occurred, resulting in two codes. The researcher included these codes in the codebook and included one code representing payer levers and six codes representing physician group levers based on relevance to future research. The remaining
code categories represented executive and organization characteristics, including partnership models and historical approaches to simulation modeling.

Table 6

Summary of Code Categories with Subcategories

<table>
<thead>
<tr>
<th>Code Category Level</th>
<th>Code Category Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code category 1</td>
<td>ACO levers affecting health system</td>
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<td>ACO revenue levers</td>
</tr>
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<td>ACO quality levers</td>
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<td>Subcategory level 2</td>
<td>ACO contract negotiation levers</td>
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<td>Subcategory level 2</td>
<td>ACO business strategy levers</td>
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<td>Physician group levers</td>
</tr>
<tr>
<td>Code category 13</td>
<td>Historical approaches to simulation modeling</td>
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</tbody>
</table>

Figure 29 is a partial treemap summarizing the code category hierarchy as measured by coding references. The size of each rectangle corresponds to the number of coding references associated with the rectangle. The color of each rectangle corresponds to the number of items coded within the rectangle. For example, the causal links rectangle, one of 13 coding categories, is dark gray and the largest treemap rectangle. Its dominant size indicates the largest number of coding references among all coding categories. The ACO-driven linkages subcategory within the causal links category is larger than the health system-driven subcategory, revealing a higher count of coded references.
Figure 29

*Distribution of Coded References by Code Category*
Finally, at the most granular level of detail, the treemap shows the 13 codes found within the ACO utilization management subcategory (codes 39-61 in Appendix C). The ACO utilization management has the most references among the ACO linkages. Its color is darker than all other ACO-driven linkage subcategories because it contains 13 codes, the largest number among all subcategories. By comparison, ACO leakage rate contains four codes and has lighter shading.

Treemaps provide a convenient visual aid to rapidly assess the relative contributions of interviewee references to the research analysis. A review of Figure 29 reveals that interviewees provided more references associated with causal links than any other information category. The next-largest categories, ACO levers affecting health system, health system levers affecting ACO, and ACO operating structure, supplied critical and abundant information to support the development of causal links and the formation of causal loops. The treemap also reveals substantial references from interviewees regarding traditional approaches to business modeling and support for the introduction of dynamic modeling.

The researcher’s most significant risk of applying personal bias occurred during the code development process. Interviewees frequently made indistinct references defining causal links. Instead, interviewees discussed the effect that one business function or activity might cause for another in multi-sentence descriptions. Therefore, the researcher had to rely on personal knowledge of health systems’ and ACOs’ operations to parse interviewees’ comments and identify the causal links referenced therein. Similarly, the researcher occasionally recognized the possibility for causal links not explicitly described but known through personal experience to relate to the links under discussion. The researcher recognized the potential for personal bias to
impact thematic coding and exercised care to avoid infusing personal knowledge into formulating codes and causal links, especially in the absence of anticipated links.

**Operating Structures.** The analysis of interactions between health systems and ACOs demonstrated that the entities, individually and in partnership, represent complex, dynamic systems. However, the categorization of codes derived from interviews with health system and ACO executives yielded a simple representation of the primary functions through which the two entities interact, as shown in Figure 30. The representation of each organization, to understand the most influential sources of inter-organizational interaction, involves only two functions.

Interviewees described the influence of health systems on ACOs primarily in terms of funding provided to the ACO. The ACO operations focused primarily on achieving shared savings incentive payments. According to interviews, shared savings performance is a function of the effectiveness of utilization management operations and the achievement of care cost savings. ACO utilization management operations, in turn, affect health system care delivery operations through impacts on the volume of patients and site of service utilized for service delivery. Care delivery operations generate revenue and margin under the management of financial operations. Interviewees universally referenced a contribution to health system revenue resulting from ACO shared savings allocated to the health system. Interviewees identified additional refinements to the interaction model involving other health system and ACO functions, as discussed in the representation of causal links section. However, the functions shown in Figure 30 represent those through which each organization most directly impacts the other.
**Business Levers.** The researcher asked which functions or operations cause a health system to influence ACO performance or vice versa. In response, healthcare executive interviewees discussed numerous examples of ways in which the actions of one entity might affect the outcomes of the partner entity. The researcher assigned the term business levers to the functions or operations that one entity may use to influence the outcomes of a partner entity. The researcher analyzed the interview content to derive 24 codes associated with ACO-controlled levers and 28 codes associated with health system-controlled levers. The researcher further associated the ACO-controlled levers with six subcategories.

Similarly, the researcher identified five subcategories of health system-controlled levers. A summary of the resulting lever categories appears in Table 7. The significance of business
levers is that they represent the operational functions or activities through which causal links form between a health system and an ACO.

Table 7

**Dominant Business Levers Affecting Health System / ACO Interactions**

<table>
<thead>
<tr>
<th>Code Category Level</th>
<th>Code Category Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>ACO levers affecting health system</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>ACO volume levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>ACO cost levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>ACO revenue levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>ACO quality levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>ACO contract negotiation levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>ACO business strategy levers</td>
</tr>
<tr>
<td>Code category 5</td>
<td>Health system levers affecting ACO</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>Health system revenue levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>Health system cost levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>Health system contract negotiation levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>Health system quality levers</td>
</tr>
<tr>
<td>Subcategory level 2</td>
<td>Health system business strategy levers</td>
</tr>
</tbody>
</table>

**Causal Links.** Tables 1, 2, and 3 contain the causal links identified by the researcher. The complete set of causal links also appears in category 3 of the codebook found in Appendix C. Figure 30 contains a basic illustration of the causal link concept (Sterman, 2000). One may consider a chicken as the cause for the existence of an egg, as shown on the left side of Figure 31, with the arrow representing the direction of the cause-and-effect relationship. Conversely, the presence of an egg can, at a point in the future, cause the existence of a chicken. The opposite arrow on the right side of Figure 31 illustrates the reversal of cause-and-effect.
Figure 31

Illustration of Causal Links

Figure 32 replaces the chicken and egg example with health system and ACO causal links uncovered through analysis of interview data. The first causal link asserts that the amount of care lost from the ACO network to a competing health system impacts the total patient volume of the partner health system. No representation is yet made in this diagram to indicate whether increasing network leakage positively or negatively affects health system patient volume. This link represents a link connecting ACO operations and health system operations (an inter-organizational, or hybrid, link), where changes in the ACO function affect the linked health system function. The second link is an intra-organizational link citing cause-and-effect between two ACO functions. In this link, the ACO's performance against its quality metric targets affects the amount of shared savings earned by the ACO from its payer customers.

The third causal link is an example of a health system function impacting the performance of an ACO function. In this case, the health system’s market share, which defines the number of patients treated by the health system, partially determines the total claims cost that the ACO is responsible for managing on behalf of its health insurance customers. This causal link is also a hybrid link. Finally, the fourth causal link illustrates that the ratio of health system staff to patients has a causal effect on patient satisfaction. The four links shown in Figure 32 are illustrative of the 57 links discovered by the researcher and articulated in Appendix C.
Causal Loops – Connecting Causal Links. Upon identifying the 57 causal links that emerged through the coding of interview data, the researcher discovered that multiple causal links often shared a parameter. An example of this phenomenon, in which four causal links contain the parameter ACO_network_leakage, appears in Figure 33. The researcher recognized that sharing a parameter enabled the connection of independent causal links, as illustrated in Figure 34.

In Figure 34, the four causal links associated with ACO network leakage form a single node with ACO network leakage at the center. The existence of nodes like the one in this example makes possible the formation of causal loops. The researcher integrated all causal links through shared parameters to develop the visual representation of health system / ACO causal interactions shown in Figure 16.
Figure 33

Examples of Multiple Causal Links with a Shared Parameter

Figure 34

Connecting Causal Links through AOC Network Leakage
Analysis of the complete causal link diagram in Figure 16 by the researcher revealed that the diagram consisted of a small number of nodes centered on the prominent health system and ACO functions as shown in Figure 35 and Figures 36-43. Each of these figures appears in greater detail in Appendix N. ACO utilization management is a critical node through which 17 causal links connect, as seen in Figure 35. Two direct links from ACO utilization management effectiveness in Figure 35 connect to health system functions. The researcher identified four 2-parameter causal loops, three of which formed through causal links to ACO utilization management effectiveness, as shown in Figure 36.

**Figure 35**

*Causal Relationship Node – ACO Utilization Management Effectiveness*

Figures 37 through 40 illustrate the remaining central causal link nodes identified by the researcher. Figure 37 illustrates the causal link node centered on the health system’s total patient population. This diagram contains four health system-only causal loops, each containing health
system inpatient volume as a parameter. The parameters contained in each causal loop appear in Table 8. Missing from the analysis of this data are the causal links connecting health system inpatient volume, ancillary service volume, and emergency room volume to total patient volume. In principle, if individual service line volumes increase, the total patient volume will increase. These relationships were not identified during causal link discussions in healthcare executive interviews and did not appear in the researcher’s findings. Figure 38 displays the causal link node centered on ACO care cost savings. While a meaningful node in terms of the number of causal links associated with ACO care cost savings (9), the node does not contain any new causal loops.

**Figure 36**

*Causal Loops from a Single Causal Link Node*
Figure 37

*Causal Relationship Node - Health System Patient Population*

Figure 39 illustrates the causal link node formed around health system claims revenue, a critical component of health system margin. Health system claims revenue is a parameter in seven causal links. However, only one causal loop exists in the health system claims revenue node. The causal loop reflects the relationship often discussed among interviewees: the health system’s FFS reimbursement contract terms and the ACO’s value-based budget, both negotiated
with the same health insurers. This linkage of a health system parameter and an ACO parameter renders this a hybrid causal loop.

**Figure 38**

*Causal Relationship Node – ACO Care Cost Savings*
Figure 39

*Causal Relationship Node - Health System Claims Revenue*
Table 8

Causal Loops in the Health System Patient Population Node

<table>
<thead>
<tr>
<th>Loop number</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Parameter 2</td>
<td>Health system inpatient volume</td>
<td>Health system inpatient volume</td>
<td>Health system inpatient volume</td>
<td>Health system inpatient volume</td>
</tr>
<tr>
<td>Parameter 3</td>
<td>Health system readmission rate</td>
<td>Health system readmission rate</td>
<td>Health system market growth investment</td>
<td>Health system market growth investment</td>
</tr>
<tr>
<td>Parameter 4</td>
<td>Health system inpatient volume</td>
<td>Health system inpatient volume</td>
<td>Health system total patient volume</td>
<td>Health system total patient volume</td>
</tr>
<tr>
<td>Parameter 5</td>
<td>Health system emergency department volume</td>
<td>Health system inpatient volume</td>
<td>Health system emergency department volume</td>
<td>Health system inpatient volume</td>
</tr>
</tbody>
</table>

The researcher identified a final intra-organizational causal loop by examining the complete causal link diagram in the health system staffing ratio node (see Figure 40). The health system staffing ratio appears in four causal links. The staffing ratio, which describes the ratio of care delivery personnel to patients, represents a cost to the health system and impacts operating margin. The staffing ratio is also critical to maintaining high levels of patient satisfaction, as low staffing ratios result in less time available for care providers to attend to each patient. The health system staffing ratio belongs to a three-parameter health system causal loop involving health system operating margin and health system personnel operating cost, as shown in Figure 40.
Figure 41 represents the causal links associated with the health system operating margin. Operating margin is a traditional financial measure of corporate performance reflecting the difference between a firm’s revenue and operating costs (Brealey et al., 2011). As seen in Figure 41, revenue and cost have multiple inflowing causal links. An analysis of the health system operating margin node led the researcher to uncover one new, five-parameter health system causal loop, as shown in Table 9.

**Figure 40**

*Causal Relationship Node - Health System Staffing Ratio*

![Diagram showing causal relationships](image)

**Table 9**

*Parameters in Final Health System Operating Margin Causal Loop*

<table>
<thead>
<tr>
<th>Causal Loop Parameter Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causal loop parameter description</td>
<td>Health system operating margin</td>
<td>Health system staffing ratio</td>
<td>Health system personnel operating cost</td>
<td>Health system total operating cost</td>
<td>Health system operating income</td>
<td>Health system operating margin</td>
</tr>
</tbody>
</table>
The researcher could not derive additional causal loops from the review of the remaining causal link nodes. The remaining central causal link nodes appear in Figures 42 and 43. These nodes represent the parameters contributing to the ACO operating margin and joint health system / ACO operating margin. As these quantities are terminal calculations, all parameters in the nodes are inflowing. The lack of outflowing parameters forestalls the occurrence of closed causal loops.

The researcher’s review of individual causal link nodes resulted in the discovery of 11 causal loops. Three causal loops involved only ACO parameters, six involved only health system parameters, and two involved a combination of health system and ACO parameters. The researcher derived the remaining 10 hybrid causal loops by analyzing the complete causal link diagram (see Figure 16). The connection of causal link nodes resulted in additional closed, hybrid causal loops.
Figure 42

*Causal Relationship Node - ACO Operating Margin*

![ACO Operating Margin Diagram](image)

Figure 43

*Causal Relationship Node - Joint Health System / ACO Operating Margin*

![Joint Health System / ACO Operating Margin Diagram](image)

**Feedback Loops.** The visual form of feedback loops is identical to that of causal loops. The information conveyed in a feedback loop differs from that conveyed in a causal loop through the inclusion of loop polarity (Morecroft, 2015; Sterman, 2000, 2018). Loop polarity describes
whether the net result of feedback loop interactions is an increase or a decrease in the values of loop parameters. Feedback loops that increase the value of loop parameters are positive or reinforcing, and feedback loops that decrease the value of loop parameters are negative or balancing loops (Morecroft, 2015; Sterman, 2000, 2018). Real-world, complex, dynamic systems contain reinforcing and balancing loops to prevent the exponential increase or decrease of any system parameter (Morecroft, 2015; Sterman, 2000, 2018).

The researcher reported in Appendix D a table listing the composition and polarity of 21 feedback loops resulting from the thematic coding of healthcare executive interviews. Of the 21 feedback loops discovered, twelve were hybrid loops involving health system and ACO operational parameters. The presence of hybrid feedback loops, the most important finding of this research study, confirmed several critical characteristics of health system / ACO partnerships:

- health system and ACO operations interact through hybrid feedback loops (theme 4),
- parameters involved in hybrid feedback loops exhibit nonlinear behaviors (theme 4A), and
- health system / ACO partnerships are complex, dynamic systems requiring dynamic simulation techniques to project future outcomes (theme 5).

**Intra-Organizational Loops.** The researcher undertook this study, in part, to determine whether feedback loops existed between health systems and ACOs. Discussion of health system / ACO interactions also led to the emergence of data that defined feedback loops that are internal to health systems or ACOs. In addition to reflecting the internal complexity of health systems and ACOs, these intra-organizational feedback loops play an important role in extending the parameters associated with hybrid feedback loops.
Figure 44 illustrates the composition and polarity of the three internal ACO feedback loops that emerged from the analysis of interview data. Each of the parameter links contained in a feedback loop represents a causal link described by executive interviewees. All of the feedback loops shown in Figure 44 have reinforcing polarity. As real-world systems have both reinforcing and balancing feedback loops to prevent exponential growth or decline, this system of feedback loops cannot be a complete representation of internal ACO operational feedback loops. Thus, a system dynamics model of ACO operational performance based solely on the feedback loops identified in the current analysis would demonstrate unrealistic exponential growth. Before building an ACO simulation model, one must collect more data to identify additional, balancing feedback loops associated with internal ACO operations.

**Figure 44**

*Internal ACO Feedback Loops*
Figure 45 provides the composition and polarity of the two reinforcing health system feedback loops that emerged from causal links identified through interview data. The lower diagram in Figure 44 shows the first example of a feedback loop involving more than two causal link parameters. The reinforcing loop reflects the connection of three causal links extracted from interview data. Figure 46 completes the presentation of internal health system feedback loop data. The four feedback loops in Figure 46 are balancing loops with three to five parameters. The complete set of internal health system feedback loops can theoretically exhibit realistic behavior in which exponentially increasing reinforcing loops counter exponential declines driven by balancing loops (Morecroft, 2015; Sterman, 2000, 2018).

**Figure 45**

*Internal Health System Reinforcing Feedback Loops*

**Inter-organizational (Hybrid) Feedback Loops.** Figures 47 through 50 provide visual representations of the 12 hybrid feedback loops identified by the researcher. The hybrid feedback loops consist of four reinforcing loops and eight balancing loops. The presence of reinforcing and balancing loops suggests the possibility of realistic behavior arising from a simulation model based on this set of feedback loops.
Figure 46

*Internal Health System Balancing Feedback Loops*

- Health System Staffing Ratio
- Health System Personnel Operating Cost
- Health System Operating Margin
- Health System Inpatient Volume
- Health System Market Growth Investment
- Health System Total Patient Volume
- Health System Market Share
- Health System Emergency Department Volume
- Health System Staffing Ratio
- Health System Personnel Operating Cost
- Health System Operating Margin
- Health System Operating Income
- Health System Total Cost
Figure 47

*Hybrid Reinforcing Feedback Loops*

- **Health System Payer FFS Payment Rate** → **ACO Payer Value-Based Budget**

- **ACO Utilization Management Effectiveness** → **ACO Payer Value-Based Budget**

- **Health System Patient Satisfaction** → **ACO Quality Metric Performance**

- **Health System Staffing Ratio** → **ACO Quality Metric Performance**

- **Health System Total Revenue** → **ACO Shared Savings**

- **ACO Shared Savings** → **Health System Total Revenue**

- **Health System Patient Satisfaction** → **Health System Operating Margin**

- **Health System Staffing Ratio** → **Health System Operating Margin**
Figure 48

*Hybrid Balancing Feedback Loops*
Figure 49

*Hybrid Balancing Feedback Loops, Cont’d.*
The simplest of identified feedback loops consists of two-parameter causal links. The researcher identified two feedback loops of this type involving one parameter each from the health system and its partner ACO (see Figure 47). The most complex feedback loops contained 10 parameters (Figures 49 and 50). The distribution of parameter types (ACO or health system) by feedback loop size appears in Table 10. What is evident from Table 10 is that substantial interaction occurs between ACO functions and health system functions. This finding is important for two reasons. First, the finding confirms multiple sources of nonlinear behavior in the operations of health systems and ACOs when engaged in a partnership. Second, Table 10 calls attention to a critical gap in business practice since theme 1 confirmed that healthcare executives do not currently consider or model health system / ACO interactions when projecting or evaluating organizational performance.

**Figure 50**

*Hybrid Balancing Feedback Loops, Cont’d.*
Table 10

*Summary of Feedback Loop Characteristics*

<table>
<thead>
<tr>
<th>Number of feedback loop parameters</th>
<th>Total feedback loops</th>
<th>Feedback loop character</th>
<th>Number of feedback loops</th>
<th>ACO</th>
<th>Health system</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>ACO</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health system</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hybrid</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Health system</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hybrid</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Health system</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hybrid</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Health system</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hybrid</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>Hybrid</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>Hybrid</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>Hybrid</td>
<td>2</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

**Triangulation.** The researcher employed a 31-question survey to triangulate the results obtained from the thematic coding of healthcare executive interviews. The survey employed a Likert scale with the following five ratings:

1. Strongly agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly disagree.
The use of a Likert scale resulted in the capture of consistent, quantitative ratings to which the researcher applied statistical analysis methods. The research survey appears in Appendix B. Eleven respondents completed the survey, including seven interviewees and four independent healthcare executives with similar credentials.

**Descriptive Statistics.** Descriptive statistics derived from the survey responses appear in Table 11. Population-level statistics reflected a mean response across 31 questions of 2.9 and a median response of 3.0, indicating the absence of skewness. The mean response value for each of the 11 respondents was within 0.5 points of 3.0. These results imply that the average response was indecisive, given that a value of 3.0 corresponded to neither agree nor disagree.

**Table 11**

*Descriptive Statistics from the Likert Scale Triangulation Survey*

<table>
<thead>
<tr>
<th>Survey respondent number</th>
<th>Respondent mean rating</th>
<th>Respondent standard deviation</th>
<th>Respondent median rating</th>
<th>Respondent modal rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.1</td>
<td>1.0</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>2</td>
<td>2.5</td>
<td>0.9</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>2.8</td>
<td>1.2</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>4</td>
<td>2.8</td>
<td>0.9</td>
<td>3.0</td>
<td>2.0</td>
</tr>
<tr>
<td>5</td>
<td>3.2</td>
<td>1.2</td>
<td>3.0</td>
<td>2.0</td>
</tr>
<tr>
<td>6</td>
<td>3.4</td>
<td>1.2</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>7</td>
<td>2.5</td>
<td>1.3</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>2.7</td>
<td>1.1</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>9</td>
<td>2.7</td>
<td>0.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>2.8</td>
<td>0.7</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Population value</td>
<td>2.9</td>
<td>1.1</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

A histogram of the mean survey response to each survey question appears in Figure 51. The histogram visually reflects symmetry around the value 3.0 (neither agree nor disagree) based on the averages of 11 responses to 31 questions or 341 individual responses. Fourteen research questions received an average response, \( R \), of \( 2.5 \leq R < 3.5 \). Respondents expressed visually in
Figure 52. Through analysis of the data in Appendix E and Figure 52, the researcher noted little difference between the mean and median responses to each question, with the average difference between mean and median across all questions equal to 0.26. This result indicates an overall lack of skewness in the distribution of average responses, with symmetry around the population’s mean value of 2.9.

**Figure 51**

*Histogram of Mean Triangulation Survey Responses*

Additionally, the researcher stratified the survey results according to executives’ affiliation with a health system or an ACO to explore whether statistically significant differences existed between responses from the two cohorts (see Appendix I). The ACO cohort consisted of six survey respondents, while the health system cohort had five respondents. To determine whether survey responses from the two cohorts differed, the researcher applied a two-sample t-test assuming unequal variances. The researcher performed Levene’s test to validate the
assumption of unequal variances. After computing the absolute residuals for each survey question, by cohort, the researcher applied a one-way ANOVA to test the null hypothesis that no difference in variance existed between the cohort means. The results appear in Table 12. The resulting p-value < 0.01 allowed the researcher to reject the null hypothesis of no difference and assume unequal variances.

**Figure 52**

*Mean and Median Responses by Survey Question*
Table 12

Levene’s Test: Assessment of Variance Differences

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Sum</th>
<th>Average</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column 1</td>
<td>31</td>
<td>20.9710</td>
<td>0.6765</td>
<td>0.2085</td>
</tr>
<tr>
<td>Column 2</td>
<td>31</td>
<td>86.8</td>
<td>2.8</td>
<td>0.8373</td>
</tr>
</tbody>
</table>

ANOVA: Single factor

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>69.8945</td>
<td>1</td>
<td>69.8945</td>
<td>133.6566</td>
<td>0.0000</td>
<td>4.0012</td>
</tr>
<tr>
<td>Within Groups</td>
<td>31.3765</td>
<td>60</td>
<td>0.5229</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>101.2710</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 13 shows the results of applying a two-sample t-test assuming unequal variances. The underlying null hypothesis for this test was no difference in survey responses from the health system and ACO executive cohorts. As shown in Table 13, p = 0.56. Given that p > 0.05, one cannot reject the null hypothesis. The conclusion is that, in the aggregate, across all survey questions, health system and ACO executives provided similar responses.

To explore this issue in greater detail, the researcher examined the differences between the health system and ACO executives’ responses at the level of individual survey questions. The researcher posed a null hypothesis of no difference in the mean values of responses from the health system and ACO cohorts. The p-values associated with the analysis of differences in means by survey question appear in Figure 53. Twenty-six questions exhibited p-values substantially greater than 0.05. From this result, the researcher concluded that health system and ACO executive responded similarly to these 26 questions, as shown in blue in Figure 50.
Table 13

Testing Health System vs. ACO Executive Agreement: Two-Sample t-Test

<table>
<thead>
<tr>
<th>t-Test: Two-sample assuming unequal variances</th>
<th>Health System Execs</th>
<th>ACO Execs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.9215</td>
<td>2.8</td>
</tr>
<tr>
<td>Variance</td>
<td>0.6814</td>
<td>0.8373</td>
</tr>
<tr>
<td>Observations</td>
<td>31.0000</td>
<td>31</td>
</tr>
<tr>
<td>Hypothesized Mean Difference</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>59.0000</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>0.5490</td>
<td></td>
</tr>
<tr>
<td>P(T&lt; =t) one-tail</td>
<td>0.2926</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.6711</td>
<td></td>
</tr>
<tr>
<td>P(T&lt; =t) two-tail</td>
<td>0.5851</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>2.0010</td>
<td></td>
</tr>
</tbody>
</table>

Five survey questions, numbers 3, 4, 20, 23, and 30, showed statistically significant differences (p-value < 0.05) in the responses generated by the health system and ACO executives. Three additional questions, numbers 16, 26, and 31, did not show statistically different responses but may provide valuable, practical information relevant to this investigation, given low p-values (0.10 < p-value < 0.15) (Morgan et al., 2013; Robson & McCartan, 2016). The p-values associated with questions 16, 26, and 31 reflect substantially different viewpoints between the health system and ACO executives regarding the impacts of health system patient satisfaction, ACO population health management policies, and ACO inpatient aversion. In each case, health system leaders understated the effects on the ACO of health system-driven actions relative to ACO leaders’ opinions. Similarly, ACO leaders were uncertain regarding the effects of ACO-driven health system volume changes, while health system leaders expressed certainty.
Reliability. No standardized survey instrument exists to investigate opinions regarding the nature of health system / ACO interactions. Therefore, the researcher constructed a survey based on a literature review, the research questions, and observations from the thematic coding of semi-structured interviews of healthcare experts. An essential step toward accepting the results gleaned from the survey is to establish the trustworthiness of the survey instrument through the demonstration of reliability and validity (Cypress, 2017; Leung, 2015; Robson & McCartan, 2016). A reliable survey renders consistent results and addresses the relationships under question (ontologically similar) despite the presence of variability (Leung, 2015). The
researcher chose to triangulate the findings of thematic coding through the quantitative analysis of survey data collected on a five-point Likert scale.

**Table 14**

*Reliability Measures*

<table>
<thead>
<tr>
<th>Reliability Measure</th>
<th>Empirical Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cronbach's Alpha</td>
<td>0.74</td>
<td>Acceptable Internal Consistency</td>
</tr>
<tr>
<td>Intraclass Correlation Coefficient</td>
<td>0.5</td>
<td>Moderate Reliability</td>
</tr>
<tr>
<td>Fleiss' Kappa</td>
<td>0.14</td>
<td>Poor Rater Agreement</td>
</tr>
<tr>
<td>Fleiss' Kappa - Balancing Relationships</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Fleiss' Kappa - Reinforcing Relationships</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Fleiss' Kappa - General Relationships</td>
<td>0.09</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* As there is not an accepted standard scale for interpreting Fleiss' Kappa, the researcher relied upon the interpretation scale associated with Cohen's Kappa (used to judge agreement in the case of two raters).

Table 14 contains three reliability measures evaluated by the researcher. Cronbach’s alpha measures internal consistency (Morgan et al., 2013). Internal consistency indicates that multiple items, survey questions, in this case, measure the same thing (Morgan et al., 2013; Robson & McCartan, 2016). The researcher considered the evaluation of internal consistency of high importance when using a non-standard survey instrument. As seen in Table 14, the measured value of Cronbach’s alpha for the survey instrument constructed for this research was 0.73. As a general rule, a value for Cronbach’s alpha of 0.70 or greater indicates an acceptable level of internal consistency (Morgan et al., 2013). Therefore, the survey used in this research
demonstrated an acceptable level of internal consistency. Details of the calculation of Cronbach’s alpha appear in Appendix F.

The intraclass correlation coefficient (ICC) indicates the extent to which multiple respondents agreed on the answers to questions within a given survey (Morgan et al., 2013; Robson & McCartan, 2016). By assessing the ICC, one determines whether the answers to different survey questions are reliable (Morgan et al., 2013; Robson & McCartan, 2016). The researcher collected survey data from 11 independent respondents in the current research.

Each respondent’s results represented a group of 31 survey scores. The ICC, as computed in Appendix G, evaluates the similarities of responses gathered from the multiple groups (Morgan et al., 2013; Robson & McCartan, 2016). The accepted standard for the interpretation of the ICC is:

- ICC < 0.50 Poor reliability
- 0.50 ≤ ICC < 0.75 Moderate reliability
- 0.75 ≤ ICC < 0.90 Good reliability
- ICC ≥ 0.90 Excellent reliability (Koo & Li, 2016).

The calculation of ICC for the survey used in this study returned a result of ICC = 0.50 (see Table 14). Using the guidelines provided by Koo and Li (2016), the researcher concluded that the survey exhibited moderate reliability. Following Koo and Li, the researcher posits that a low number of respondents may result in moderate or poor reliability rather than genuinely disparate responses. The authors recommended a pool of at least 30 respondents to avoid this issue (Koo & Li, 2016). The researcher obtained moderate reliability with only 11 respondents, indicating the potential for improved reliability with a larger group of respondents.
The most problematic of the assessed reliability measures was Fleiss’ kappa. While Cohen’s kappa provides a measure of the agreement between two survey respondents, Fleiss’ kappa provides a measure of the agreement between more than two survey respondents (Cypress, 2017; *How to calculate Fleiss’ Kappa in Excel*, 2021; Leung, 2015). As the researcher collected survey results from 11 respondents, Fleiss’ kappa represents the appropriate measure in this case. However, no standard exists for the interpretation of values of Fleiss’ kappa, so the researcher applied the rules that pertain to Cohen’s kappa (*How to calculate Fleiss’ Kappa in Excel*, 2021):

- \( \kappa < 0.20 \) Poor interrater agreement
- \( 0.21 \leq \kappa < 0.40 \) Fair interrater agreement
- \( 0.41 \leq \kappa < 0.60 \) Moderate interrater agreement
- \( 0.61 \leq \kappa < 0.80 \) Good interrater agreement
- \( 0.81 \leq \kappa < 1.00 \) Moderate interrater agreement

The calculation of Fleiss’ kappa appears in Appendix H (*How to calculate Fleiss’ Kappa in Excel*, 2021). The result of applying the Fleiss’ kappa calculation methodology to the survey data in this study was Fleiss’ kappa = 0.14, indicating poor interrater agreement.

The researcher attempted to identify potential variations in Fleiss’ kappa’s value based on variations in survey question type. The survey asked questions that explored whether respondents agreed with general statements about the relationships between health systems and ACOs (e.g., X affects Y). The survey also offered questions about the specific direction of cause-and-effect relationships. Examples of relationships posed in such questions are

- If X increases, then will Y decrease?
- If A increases, then will B increase?
Questions of this type explore the polarity of causal relationships, with the former demonstrating a balancing, or negative, relationship and the latter demonstrating a reinforcing, or positive, relationship.

Table 14 also contains values for Fleiss’ kappa obtained after stratifying survey questions according to the nature of the questions. Survey respondents demonstrated the greatest agreement about balancing relationship questions, with Fleiss’ kappa = 0.11. The agreement was poorer for reinforcing relationship questions, with Fleiss’ kappa equaling 0.07. General relationship questions exhibited kappa = 0.10, similar to balancing relationships. All kappa values were substantially below the fair agreement level of 0.21. An interpretation of the poor interrater agreement appears in the section relating triangulation results to themes.

Validity. Unlike quantitative research methods, qualitative research methods rely on evidence for validity based on a preponderance of evidence from subjective evaluations (Creswell & Poth, 2018; Cypress, 2017; Leung, 2015; Robson & McCartan, 2016). Leung (2015) described validity in qualitative research as selecting the appropriate research questions, research design, data collection, and data analysis so that conclusions are relevant to the research context. Additionally, valid research presents sufficient detail regarding the conduct of the research that other researchers can repeat the work to achieve similar results (Creswell & Creswell, 2018; Creswell & Poth, 2018).

In this study, the researcher undertook multiple steps to ensure the validity of the work. First, the researcher conducted interviews using the interview guide in Appendix A. The researcher ensured that all interviewees addressed the same questions asked in the same way by adhering to the interview guide. A published interview guide also enables other researchers to conduct similar interviews. The researcher also presented each interviewee with a standard set of
survey questions, as shown in Appendix B. All respondents answered the same questions using the same five-value Likert scale. Publication of the survey enables other researchers to employ the same survey or conduct additional research regarding the reliability of the survey instrument.

The researcher provided a discussion linking the results of thematic coding to the research problem, research questions, conceptual framework, and literature review. This discussion enabled the researcher to demonstrate the relevance of the research results to the research problem, research questions, conceptual framework, and literature review. Additionally, the researcher demonstrated the attainment of code saturation resulting from nine semi-structured interviews (Creswell & Creswell, 2018; Creswell & Poth, 2018; Fusch & Ness, 2015). Using a secondary source of research data, a Likert scale-based survey, provided a means for triangulating the results obtained from the thematic coding of interview data. Collectively, these efforts enabled the researcher to demonstrate construct validity (Fusch et al., 2018; Yin, 2018).

The researcher addressed the issue of internal validity by adhering to rigorous documentation of the thematic coding process using NVivo®, a CAQDAS application. Code development involved the manual assignment of codes within NVivo®, with codes cataloged for consistent application across multiple interviews. The researcher deidentified all interview transcripts to eliminate the possible introduction of coding bias based on the interviewee’s background knowledge. Similarly, the researcher methodically developed a standard set of code categories, with each code assigned uniquely to a single code category. The researcher published the resulting codebook in Appendix C for review and analysis by other researchers. The development of themes followed a similar, methodical approach, with codes and categories associated with a theme documented by the researcher.
Finally, the researcher also addressed the concept of external validity, which speaks to the generalizability of the research to health systems and ACOs beyond those directly interviewed in this research study. The researcher collected data from eight health systems and ACOs to ensure the diversity of opinions collected from interviewees. The researcher attempted to demonstrate a complete set of codes relevant to health system / ACO interactions by ensuring code saturation prior to data analysis. Results from survey data reflected uncertainty regarding the impact created on partner organizations. While not indicative of dissenting opinions, the implications of this finding appear in the discussion linking triangulation results to the themes.

The researcher also took care to acknowledge a personal association with a health system that owns an ACO. Because of this association with the industry under investigation, the researcher was careful to avoid the application of personal biases during the analysis process and to document any instances in which readers might have a concern that personal bias affected data analysis or interpretation (Creswell & Creswell, 2018; Creswell & Poth, 2018). To counter the possibility of personal bias affecting data analysis or interpretation, the researcher extensively used tables and figures to support all assertions and conclusions, enabling readers to assess the basis for all results (Yin, 2018).

Relationship of Triangulation Results to Interview Analysis. Analysis of the triangulation survey results revealed a general agreement with the insights gleaned from the thematic coding of interviews. Question 1 of the research survey asked whether the actions of a health system impact the financial performance of an ACO and vice versa. Healthcare executives unanimously responded in agreement with question 1. Of 11 survey respondents, seven responded “strongly agree” with the statement in question 1, and four selected “agree.” The average rating for question 1 was 1.4, with a standard deviation of 0.5 and a median of 1.0. This
finding supports the validity of the research problem and calls attention to the absence of academic research investigating the effects of interactions between health systems and ACOs.

As noted in the discussion of the research findings, health system and ACO executives described numerous causal links but failed to identify complete causal loops directly. Comments found during the analysis of interviews referenced the impact of one business function on another. However, they often failed to describe whether the impact would be of a positive or negative nature (positive or negative polarity). Using insight gained from the analysis of interviews, the researcher constructed survey questions to determine the extent to which interviewees held opinions regarding the polarity of causal links.

Table 15 contains the analysis results of mean responses to survey questions stratified by questions’ relationship to causal polarity. Respondents’ answers to survey questions reflecting polarity, either balancing or reinforcing, reflected that, overall, respondents neither agreed nor disagreed with the polarity proposed in the related questions. Respondents demonstrated mean population values of 2.7 and 3.5 for balancing and reinforcing polarity questions, respectively. The difference between these mean values was not statistically significant, with a p-value of 0.38. Thus, the researcher concluded that respondents expressed similar uncertainty regardless of positive or negative causal link polarity. Respondents provided no responses indicating strong disagreement with any proposed causal link, suggesting that no links discovered by the researcher through thematic coding were substantially invalid.

Questions of a general nature, suggesting a causal relationship but not an associated polarity, led respondents to an average response of 2.5 with a median of 2.0. This result suggests agreement with the causal links discussed in the general relationship questions, supporting the results obtained by the researcher through thematic coding. Table 15 reflects that respondents
expressed a statistically significant difference in mean response to general questions lacking inferences regarding polarity compared to questions with balancing or reinforcing polarity. The mean score for general questions compared with balancing or reinforcing questions exhibited p-values of 0.02 and 0.00, respectively.

**Table 15**

*Respondent Certainty Regarding Causal Polarity*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Balancing</td>
<td>2.7</td>
<td>1.0</td>
<td>3.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Reinforcing</td>
<td>3.5</td>
<td>0.9</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>General</td>
<td>2.5</td>
<td>1.1</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cohort comparison</th>
<th>p-Value P(T≤t) two-tail</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balancing and reinforcing questions</td>
<td>0.38</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Balancing and general questions</td>
<td>0.02</td>
<td>Significant</td>
</tr>
<tr>
<td>Reinforcing and general questions</td>
<td>0.00</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Respondents’ uncertainty regarding the polarity of causal links was consistent with interview results and findings reported with theme 1. Interviewees universally indicated a lack of familiarity with feedback loop concepts. Additionally, interviewees expressed that neither they nor their organizations considered the potential effects of inter-organizational interactions when projecting future financial performance. As a result, interviewees were unaccustomed to considering the nature of inter-organizational interactions, including whether those interactions were likely to result in positive or negative impacts (polarity) on partner organizations.

The lack of strong disagreement with survey questions supports the validity of causal links identified through thematic coding and presented in theme 2. The lack of strong disagreement is critical since the causal loops and feedback loops discussed in themes 3 through
4 arise directly from the identified causal links. Additionally, theme 5, the need for health systems and ACOs to adopt dynamic modeling methods, arose from the findings presented in theme 4, in which the researcher demonstrated the existence of health system / ACO feedback loops and nonlinear financial behaviors. As none of the findings of the triangulation analysis contradicted the presence of specific causal links, the thematic coding results arising from the causal links are also valid.

**Relationship of the Findings**

The researcher collected data through semi-structured interviews of nine healthcare executives, coded the interviews in a multi-stage process to extract themes, and compared the results with statistical analyses derived from Likert scale survey data. The researcher developed the interview guide and the associated survey questions in the context of the research problem and research questions proposed for this study. The research problem and research questions arose from an extensive review of the academic literature, which revealed an absence of research into the effects of inter-organizational interactions on organizational performance in health system / ACO partnerships. The literature revealed a limited number of examples of applying dynamic modeling methods to processes within a health system or an ACO. However, the researcher found no examples of applying dynamic modeling to study the interactions of health systems and ACOs, nor had any authors proposed the health system and ACO parameters needed to ensure the development of a representative model of such interactions.

The following discussion demonstrates the relevance of the research findings uncovered in the present analysis, as summarized in five themes, to the research problem, research questions, conceptual framework, and literature review. The researcher confirms, through this discussion, that the research project provided results that advanced the academic and industry
knowledge regarding health system / ACO partnerships. Additionally, the author’s research revealed that health system / ACO partnerships create complex dynamic systems that must exhibit nonlinear behaviors. The presence of nonlinear behaviors requires system dynamics models to ensure accurate projections of financial and other operational outcomes. The researcher found no evidence that health systems or ACOs currently employ system dynamics models, nor any other dynamic modeling method, to evaluate the effects of health system / ACO interactions on organizational performance.

**Relationship to the Research Questions.** The researcher derived the themes presented in this research paper from responses to a series of interview questions. The researcher formulated the interview questions to address a specific research problem and associated research questions (Creswell & Creswell, 2018; Creswell & Poth, 2018; Robson & McCartan, 2016). By following this approach to developing the interview questions, the researcher intended to focus the attention of interviewees on issues directly related to the research questions, while also allowing latitude in the semi-structured interview process to pursue related topics of interest uncovered during the interview process.

Analysis of coded interview responses produced information that addressed all three stated research questions. However, the absence among interviewees of any prior background in complex systems, feedback loops, and nonlinearity required the researcher to make frequent use of inductive reasoning to extract insights from the data and develop associations with the research questions. Examples of this process, such as inferring the structure of feedback loops from causal link references provided by interviewees, appear in the discussion of the relationships of themes to research questions. Visual representations of the relationships described between the research findings and research questions appear in Appendix L.
**Research Question 1.** The first research question asked, what do health system and ACO managers believe are the feedback loops affecting joint margin in a health system / ACO partnership model? Theme 1 captured the general lack of awareness among healthcare executives of the principle of system feedback and its implications regarding nonlinear behavior. Based on this knowledge gap among healthcare leaders, the research findings confirmed that health system and ACO managers do not consider feedback loops when projecting firm performance. Requests by interviewees for clarification regarding the concepts of feedback loops and nonlinearity revealed a lack of familiarity with these concepts, which are rooted in mathematics and the science of complex systems. Subtheme 1B summarized that healthcare executives rely on traditional finance methods, often expressed through Excel® spreadsheets, as the basis for financial modeling, but these methods do not capture feedback loop dependencies.

Despite the lack of familiarity with feedback loop principles, as summarized in Theme 2, the researcher found that health system and ACO executives successfully identified 57 two-parameter causal links. Causal links arose due to reflecting on interactions within health systems and ACOs and across the health system / ACO boundary. Analysis of coded interview data revealed both the ability of an ACO operation to impact health system performance (Theme 2B) and a health system operation to impact ACO performance (Theme 2C).

The causal links discovered formed the building blocks for discovering feedback loops. Theme 3 reported the integration of causal links through shared parameters produced the complex causal link diagram in Figure 16. Theme 4 captured that the researcher’s examination of Figure 16 revealed 21 feedback loops, 12 of which involved health system and ACO parameters. Thus, although executives could not directly identify feedback loops in health system / ACO
relationships, they could identify the components of causal loops that led to the discovery of multiple feedback processes, ultimately answering research question 1.

Executives uniformly acknowledged the effects that a partner health system or ACO might have on the interviewer’s organization were not a common consideration. This consensus was present despite the shared acknowledgment of a linkage between health system FFS reimbursement contracts and ACO value-based contracts with health insurers during negotiations. Without knowledge of feedback processes and the nonlinear responses that arise from feedback, executives did not express an awareness of the potential value of identifying feedback loops. Interviewees confirmed that neither health systems nor ACOs considered feedback loops internal to their organizations or related to relationships with partner organizations. As reported in Theme 1C, once executives understood the concept of feedback loops and their potential nonlinear impacts on health system and ACO performance, all expressed an interest in applying these concepts within their organizations.

**Research Question 2.** The second research question asked, to which ACO strategic, operational variable changes do health system and ACO leaders attribute nonlinear changes in health system or ACO margin? As noted in the discussion of the relationship of findings to research question 1, and as captured in Theme 1, health system and ACO leaders were uniformly unaware of the concepts of feedback loops and nonlinearity. The pool of interviewees consisted of senior executives in healthcare administration roles with educational backgrounds in healthcare administration, business, or medicine. Neither the interviewees’ educational background nor experience provided them with a mathematical understanding of nonlinearity or complex systems. Thus, when asked to provide perspectives on the health system or ACO parameters that might lead to nonlinear impacts on a partner’s organization, interviewees could
not respond without first receiving a basic explanation of the concept of nonlinearity from the researcher.

The researcher explained nonlinearity, its potential impact on health system or ACO performance, and the challenges of predicting performance in its presence. In response, one interviewee offered information directly relevant to research question 2. Interviewee A-257898 offered the following example:

Our strategy was to figure out some centralized way for our practices to either have access to a triage nurse who can help evaluate and set up an appointment for when the office would be open or would figure out how they could problem-solve if there was a way to avoid the E.D…What it ended up doing was creating more capacity in the health system’s E.D. for trauma patients and transfers from other hospitals that didn't offer the same services that we did in the emergency setting. And the hospital actually did much better those first two years having higher acuity cases in the scenario where they needed to be, and the number of transfers from other hospitals increased significantly as well.

In this example, interviewee A-257898 described how a new ACO strategy to avert unnecessary emergency department visits led to unexpected benefits for the partner health system. A linear consideration of the problem led to the assumption that an averted case would result in a loss of health system revenue. Instead, by creating additional health system emergency department capacity, the health system could capture a larger share of higher-acuity emergency cases and increase health system revenue. This example is consistent with the findings captured in Theme 2. The researcher demonstrated that executives commonly expressed operational impacts as causal links that connected two health system or ACO parameters. In the specific
example provided here, the executive described a series of causal links that potentially described a feedback loop in which,

- ACO ED aversion led to reduced health system E.D. patient volumes, which led to
- health system excess E.D. capacity, which enabled
- the growth of health system high-acuity E.D. market share, which led to
- increased health system E.D. volumes, with the ACO responding by
- placing additional focus on E.D. aversion, thereby closing the feedback loop.

So, while the interviewee was not aware of the concepts of feedback loops and nonlinearity they provided an example that described the presence of both concepts, consistent with the findings reported in Theme 3. This example also demonstrated interactions between a health system and an ACO within a single feedback loop, illustrating the inter-organizational feedback loop discoveries reported in Theme 4.

As in the analysis of research question 1, and citing Theme 1, individual interviewees were generally unable to provide examples that demonstrated nonlinearity directly. However, nonlinearity necessarily follows from the mathematics of feedback loops. Examples that demonstrated the presence of nonlinearity became apparent as the joining of causal links led to the formation of feedback loops, as captured in Theme 4.

The researcher discovered 21 feedback loops by linking the descriptions of interactions provided by interviewees. Three feedback loops involved only ACO parameters. Since all three feedback loops were reinforcing loops, and real-world complex systems must involve a combination of reinforcing and balancing loops, the researcher concluded that at least one ACO balancing loop remained undiscovered through the current research effort. Given that the mathematics of feedback loops necessitates nonlinear behaviors, the discovery of three ACO
feedback loops proved that ACOs are complex systems that exhibit nonlinear behaviors through at least three internal feedback mechanisms.

Similarly, the researcher uncovered five internal health system feedback loops. In the case of health systems, both reinforcing and balancing loops became apparent, as expected in real-world complex systems. The presence of multiple feedback loops demonstrated that health systems, like ACOs, are complex systems subject to nonlinear behaviors.

Finally, the researcher identified 12 hybrid feedback loops involving both health system and ACO parameters, as reported in Theme 4. The presence of multiple feedback loops proved that health system / ACO partnerships, with their attendant interactions, form complex systems and must, therefore, exhibit nonlinear behaviors. Additionally, since hybrid loops contain parameters from both organizations, variations within a health system create nonlinear outcomes in ACO parameters and vice versa. Interviewees were generally unable to identify feedback loops or examples of nonlinear behavior directly. However, their descriptions of causal links ultimately provided enough information to prove the existence of feedback loops and nonlinearity associated with health system / ACO interactions, thus addressing research question 2.

*Research Question 3.* The third research question asked, what are the factors that health system and ACO managers would quantitatively model to reduce uncertainty about health system or ACO financial viability in a health system / ACO partnership model? Both health system and ACO executives were better able to respond to this research question than to the questions regarding feedback and nonlinearity. Theme 2 best represents responses to this research question. The healthcare executives queried for the research project did not have healthcare analytics backgrounds and were largely unfamiliar with system modeling techniques.
By asking executive interviewees to consider operational interactions between health systems and ACOs or parameters associated with those interactions, interviewees were able to identify 57 health system/ACO causal links, leading to the emergence of Theme 2. A summary of the data supporting this finding appears in Appendix C. The identified causal links included references to 36 unique functions or parameters needed in a system dynamics model of health system/ACO interactions. Table 16 summarizes the 36 functions and parameters derived from interview questions built around Research Question 3.

**Table 16**

*Parameters to Include in a Health System/ACO System Dynamics Model*

<table>
<thead>
<tr>
<th>Parameter description</th>
<th>ACO business parameters</th>
<th>Health system business parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributed patient volume</td>
<td>Cost of care delivery</td>
<td></td>
</tr>
<tr>
<td>Care cost savings</td>
<td>Emergency department volume</td>
<td></td>
</tr>
<tr>
<td>Network leakage rate</td>
<td>Fixed cost</td>
<td></td>
</tr>
<tr>
<td>New initiatives</td>
<td>Inpatient volume</td>
<td></td>
</tr>
<tr>
<td>Non-personnel operating cost</td>
<td>Market growth investment</td>
<td></td>
</tr>
<tr>
<td>Payer value-based budget</td>
<td>Market share</td>
<td></td>
</tr>
<tr>
<td>Personnel operating cost</td>
<td>Non-personnel operating cost</td>
<td></td>
</tr>
<tr>
<td>Quality metric performance</td>
<td>Patient acuity mix</td>
<td></td>
</tr>
<tr>
<td>Shared savings</td>
<td>Patient satisfaction</td>
<td></td>
</tr>
<tr>
<td>Total claims cost</td>
<td>Payer fee-for-service payment rate</td>
<td></td>
</tr>
<tr>
<td>Total operating cost</td>
<td>Personnel operating cost</td>
<td></td>
</tr>
<tr>
<td>Total revenue</td>
<td>Readmission rate</td>
<td></td>
</tr>
<tr>
<td>Utilization management effectiveness</td>
<td>Revenue</td>
<td></td>
</tr>
<tr>
<td>Utilization management personnel cost</td>
<td>Site of service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staffing ratio</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total patient volume</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total revenue</td>
<td></td>
</tr>
</tbody>
</table>

**Relationship to the Conceptual Framework.** The conceptual framework for this research study consists of three concepts and four theories. Each of the themes developed from the analysis of coded interview data directly relates to one or more concepts and theories in the conceptual framework. Alignment of the themes with the conceptual framework supports the
relevance of the components of the conceptual framework put forward by the researcher. A detailed assessment of the relationship of the themes to the conceptual framework appears below. A visual representation of the relationships of the themes to the conceptual framework appears in Appendix M.

**Concept: Competing ACO Models.** The ACA left open the question of ACO structure to incentivize innovation regarding ACO models. The researcher’s results uncovered three variations on ACO models. Seven interviewees cited ACOs owned by health systems. One interviewee described an ACO model in which a health system entered into a partnership with an ACO jointly owned by a network of physician practices. The final interviewee described a variation of this model in which a network of physician practices joined in ownership of the ACO with a health system.

**Concept: Competing Economic Models.** Figure 26 includes a balancing feedback loop consisting of 10 causal links, as described previously. Themes 2, 3, and 4 reflect the research findings that enabled the development of Figure 26 from an initial set of related causal links derived from the coding of interview data. A distinguishing characteristic of Figure 26 is the inclusion of economic parameters from both the health system and the ACO. Figure 26 includes the health system’s cost of care delivery, total operating cost, total revenue, operating income, and operating margin. The feedback loop represents the relationship of these health system parameters to ACO shared savings, a critical economic parameter for ACOs.

Because the feedback loop in Figure 26 is a balancing loop, the implication is that the health system financial parameters act in opposition to ACO shared savings. As health system finances improve, ACO finances suffer in this specific feedback loop. Similarly, ACO shared savings acts in opposition to health system financial performance so that, as ACO shared savings
increase, the net effect on health system finances is negative. Despite confirming that ACO shared savings often contribute to health system revenue, a net negative impact occurs in this feedback loop. Therefore, through the insights associated with Theme 4, the research confirmed that health systems and ACOs have competing economic models. Theme 4 derives from Themes 2 and 3; thus, three themes illustrate the relevance of competing economic models to the research project.

**Concept: ACOs and ACO Partnerships are Complex, Dynamic Systems.** The presence of feedback processes is a defining characteristic of complex, dynamic systems (Forrester, 1961; Homer, 2019; Kunc et al., 2018; Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015; Morecroft, 2015; Sterman, 2000). Therefore, discovering feedback processes within ACOs and in ACO partnerships with health systems was necessary to support the concept that ACOs and ACO partnerships are complex, dynamic systems. The research findings that led to Theme 4 demonstrated the presence of feedback loops consistent with this concept.

The researcher discovered three feedback loops comprised solely of ACO parameters, meaning that these loops operated within the ACO organization. Theme 4A relates that the presence of feedback loops mathematically necessitates the presence of nonlinear behaviors. Thus, one may conclude that ACOs satisfy the criteria of complex, dynamic systems. Given that Themes 4 and 4A necessitate that an ACO exhibit dynamic system behavior, Theme 5 renders the use of traditional, linear modeling methods inadequate for accurate modeling of ACO financial behavior. Instead, only dynamic modeling methods such as SDM can produce accurate financial projections when changes occur in parameters associated with internal feedback loops.
That ACOs are complex and dynamic systems is sufficient to assert that an ACO partnership is also a complex, dynamic system (Ariyaratne et al., 2019; Cenci et al., 2020; Madhu & Jayaraman, 2017; Waseem et al., 2016). However, the researcher uncovered additional evidence to support the concept that partnerships involving health systems are also complex, dynamic systems. The researcher observed 12 feedback loops involving parameters from both ACOs and partner health systems, further supporting the development of Theme 4. These hybrid feedback loops represent the processes that cause ACO parameters to affect the outcomes of health system parameters and vice versa. As in the case of internal ACO feedback loops, the presence of the identified hybrid feedback loops dictates that ACO interactions with a partner health system will result in nonlinear behaviors for the parameters associated with the feedback loops, as demonstrated in support of Theme 4A. Therefore, Themes 4 and 4A also support the concept that ACOs and ACO partnerships are complex, dynamic systems requiring dynamic system modeling methods consistent with theme 5.

**Theory: Organizational Theory.** As noted in the discussion of the conceptual framework in Section 1, organizational theory provides a basis by which to understand why some ACO models have seen financial success while others have not (Vogus & Singer, 2016). The ACA, through which the ACO concept entered the U.S. healthcare model, did not specify a required ACO organizational structure or ownership model (Comfort et al., 2018; Obama, 2016; Patient Protection and Affordable Care Act of 2010, 2010; Watnick et al., 2012). The absence of a defined ACO organizational model led to various ACO organizational models with varying degrees of financial success (Lewis, Fisher, et al., 2017).

Theme 2 reflected what proved to be the first efforts of the interviewed healthcare executives to consider the points of interaction between ACOs and health systems in a system
thinking context. A series of interview questions required the interviewees to reflect on potential impacts on their organization resulting from linking their organizational performance to the actions of a partner health system or ACO. The result was the identification of a robust set of causal links involving ACO organizational parameters. The consolidation of causal link information led to Themes 4 and 4A, demonstrating the complexity of organizational interactions between health systems and ACOs.

The current academic literature is devoid of studies involving health system / ACO interactions, so the knowledge represented by Themes 2, 4, and 4A is a unique addition to the literature (Cassidy et al., 2019; Chang et al., 2017; Yu et al., 2018). The insights captured in Themes 4 and 4A, and the framework for health system / ACO simulation models that they enable, create the opportunity for ACOs to evaluate which ACO organizational structure, including the nature of partnerships, presents the most significant opportunity for financial success. Thus, the insights associated with Themes 2, 4, and 4A provide an organizational interaction framework to serve as the basis for an organization theory-based analysis of an ACO. The ACO leaders can use the structural framework established through Themes 2, 4, and 4A to evaluate the effects of variations in ACO ownership and partnership structure on ACO performance (Vogus & Singer, 2016).

**Theory: Organizational Learning Theory.** Organizational learning theory holds that organizations can improve performance through learning over time (Nembhard & Tucker, 2016). Nembhard and Tucker asserted that learning may occur by intentionally changing organizational parameters and observing impacts on performance. The authors also cited businesses’ inability to learn in rapidly-changing, complex environments as a common reason for failure, expressing
particular concern regarding the lack of organizational learning research involving ACOs (Nembhard & Tucker, 2016).

The themes discovered through this research project related directly to organizational learning theory. Theme 1 confirmed the lack of awareness among healthcare executives of the concepts of organizational feedback and associated nonlinear effects on performance. Subthemes demonstrated the failure to consider inter-organizational interactions and the ongoing use of linear financial modeling methods as the predominant method for projecting outcomes within healthcare organizations. However, once exposed to the principles of feedback and nonlinearity, executives unanimously expressed the desire to implement such methods within their organizations, thus illustrating an organizational learning mindset.

Themes 2 through 4 illustrated the potential for organizational learning. When led through a series of questions designed to evoke system thinking, executives successfully identified more than fifty causal links within and across organizational boundaries, which led to Theme 2. Theme 3 demonstrated that the combination of causal links with shared parameters could lead to discovering causal loops that were previously unknown to the organization. Themes 4 and 4A explicitly captured the presence of feedback loops involving interactions between a health system and an ACO. As Theme 1 reflected that healthcare executives did not historically consider the possibility of organizational feedback, Theme 4 represented substantial new knowledge to impart to health systems and ACOs. The implication of Theme 4 appears in Theme 5. Theme 5 states that health systems and ACOs must use dynamic modeling methods to reflect nonlinearity’s impact on organizational parameters accurately. Of particular interest is the effect of nonlinearity on financial outcomes in the presence of feedback loops.
The insights regarding organizational dynamics uncovered through this research project align with the double-loop organizational learning model represented in Figure 3. Interviewees first defined a set of variables believed to be relevant to health system and ACO operations and their interactions, as discussed in Theme 2. Prior to the insights revealed in this research, executive leaders defined action steps and strategies without consideration of inter-organizational interactions, which led to attendant results arising from linear analyses. Themes 3 through 5 presented here can change this process to an accurate, nonlinear learning model. The interactions associated with Themes 3 and 4 represent a more robust view of potential organizational strategies that consider the effects of partner organizations’ actions on the firm. New strategies imply the possibility of new results and consequences that, through the application of the modeling methods espoused in Theme 5, alter the value and weight ascribed to governing variables, completing the organizational learning feedback loop.

**Theory: Resource-Based Theory.** Conner and Prahalad (1996) asserted that resource-based theory linked a firm’s productivity to cooperation among stakeholders. According to Conner and Prahalad, stakeholders included both parties and functions within a firm and those connected to a firm through contracted partnerships. A health system / ACO partnership is an example of stakeholders connected through a contract-based relationship when applying this definition. Therefore, the degree of cooperation between a health system and a partner ACO should impact the productivity of both organizations.

However, as demonstrated previously, health systems and ACOs operate competing business models (Blackstone & Fuhr, 2016). Therefore, one may question the motivation for health systems and ACOs to cooperate rather than compete. Additionally, antitrust law places limits on the extent to which firms may collaborate for fear of placing consumers or other
competitors at an economic disadvantage (Neprash & McWilliams, 2019). If one accepts the premise of resource-based theory but must operate within antitrust constraints, an alternative for health systems or ACOs to improve productivity while engaged in a partnership is to simulate the effects of a partner’s actions on the firm. By learning about potential outcomes associated with various simulated conditions, leaders can adapt strategies to maximize performance under those conditions. The insights gained through this simulation capability result in a pseudo-collaboration in which partners do not engage directly in collaborative efforts. As a result, firms can make strategic and tactical decisions as though they possess insights gained through direct collaboration.

Theme 2 began identifying the assumptions regarding health system / ACO points of interaction that one might obtain through direct collaboration. The information that led to Theme 2 also informed the insights reflected in Themes 3 and 4. Proving the existence of feedback loops between a health system and an ACO, and illustrating the forms of those feedback loops, provides the basis for healthcare leaders to develop a system dynamics model. Once developed, a system dynamics model based on the feedback loops identified in this body of research will provide the ability to understand the effects of ACO actions on the productivity of the health system and vice versa. Each organization can then adapt its strategic and tactical choices to ensure optimal performance as though the organizations were sharing information collaboratively. This approach does not guarantee that each organization will choose strategies and tactics correctly, as it relies on assumptions regarding the partner’s actions. Thus, the firm’s knowledge remains uncertain and contributes to a persistent knowledge gap (Figurska, 2011). However, simulation allows leaders to effectively close this knowledge gap by vetting multiple
potential partner actions and choosing the path forward that best mitigates the risks to organizational performance encompassed by many partnership scenarios.

**Theory: Transaction Cost Economics.** The theory of transaction cost economics encouraged a wave of health system consolidations and vertical integration in the healthcare industry since the introduction of the ACA in 2010 (Camilleri & Colville, 2016; Mick & Shay, 2016; Shortell, 2016). Examples of vertical integration include health system ownership of an ACO. Evidence presented by other authors calls into question the value of healthcare consolidations (Blackstone & Fuhr, 2016; Post et al., 2018). Whether the theory of transaction cost economics leads to improved efficiency or economic unsustainability in the case of health system / ACO partnership remains an unanswered question (Blackstone & Fuhr, 2016).

The feedback loops underlying the development of Theme 4, and the associated need to apply dynamic models to the health system / ACO partnership to capture the nonlinear impacts of interactions between the entities (Theme 5), offers a mechanism to test the implications of transaction cost economics on this two-entity system. Using the feedback loops referenced in Theme 4, one can build a system dynamics model that captures internal feedback loops and interactions between a health system and an ACO partner.

Once one selects initial values for the operating parameters of the health system and the ACO, one may deactivate the inter-organizational feedback loops to observe the independent performance of a health system and ACO when they do not interact. One can reactivate the inter-organizational feedback loops to observe the performance of the interacting system under identical starting conditions. In this way, future researchers can attempt to identify parameter value sets, if any, that lead to economic advantages when a health system and an ACO partner or consolidate. To build models that enable the investigation of transaction cost economics in health
system / ACO partnerships, researchers and business leaders must know feedback loop structures and understand dynamic modeling methods. Themes 2, 3, 4, and 5 demonstrated the emergence of insights regarding feedback loop structures needed to model inter-organizational interactions.

**Relationship to Anticipated Themes.** The researcher anticipated several themes based on prior work experience in the health system / ACO industry. The analysis of codes derived from interview transcripts confirmed three of the researcher’s anticipated themes. Additionally, an anticipated theme identifying health insurers and physician groups as critical contributors to causal links did not emerge. The amount of discussion of the interdependency of health system FFS reimbursement rates and ACO value-based payment budgets was an unexpected theme that emerged from the coding of interview data.

**Anticipated Themes.** The researcher previously disclosed intimate knowledge of health system / ACO dynamics obtained through his role as an executive at a health system that owns a high-performing ACO. The researcher also has extensive knowledge of complex systems and nonlinearity gained through mathematics, physics, and business education. As a result, the researcher entered into the research process with a hypothesis about which themes might emerge from collecting and analyzing interview data. The researcher anticipated the emergence of three themes of particular importance:

- a lack of awareness and understanding of feedback phenomena among business and clinical executives,
- that demonstrable feedback loops exist between health systems and ACO partners, and
- that a health system / ACO partnership must exhibit the properties of a complex, dynamic system with nonlinear outcomes, including financial outcomes.
The emergence of Theme 1 confirmed the anticipated lack of awareness, understanding, and consideration of inter-organizational feedback among both health system and ACO executives. While not surprising, confirmation of this challenge raised concerns on the researcher’s part regarding the efficacy of strategic and tactical decisions made by health systems and ACOs without consideration of the effects of inter-organizational interactions.

Theme 4 demonstrated the researcher’s second anticipated theme by confirming 12 health system / ACO feedback loops. Theme 4A spoke to the necessity of nonlinear outcomes associated with a health system / ACO partnership, given the presence of multiple feedback loops. The combination of Themes 4 and 4A confirmed that health system / ACO partnerships possess the characteristics of complex systems. The discovered inter-organizational feedback loops containing financial parameters from health systems and ACOs confirmed the researcher’s third anticipated theme: health system / ACO interactions must lead to nonlinear financial outcomes.

**Unanticipated Themes.** The researcher did not anticipate the prevalence of references to the importance of linkages between the terms of health system FFS contracts and the terms of ACO value-based contracts. In aggregate, the researcher documented 24 references among seven interviewees to the linkage between health system FFS contracts and ACO value-based contracts. All interviewees cited negotiation strategies in which health systems in partnership with ACOs attempted to leverage hospital market share to derive more favorable terms for the partner ACO’s value-based contract. Similarly, executives cited a strategy of using more stringent terms agreed to around ACO quality metrics and care cost savings to obtain more favorable FFS reimbursement rates for the partner health system. This linkage between health system and ACO contracts became a prevalent causal link informing Themes 2, 3, and 4.
causal link appeared directly in one inter-organizational feedback loop, with influences on parameters appearing in multiple other feedback loops.

While the researcher anticipated a lack of awareness of feedback phenomena among executive interviewees, it came as a surprise that interviewees were uniformly unaware of the mathematical concept of nonlinearity. As multiple interviewees reported completion of a MBA degree, the researcher anticipated prior exposure to the concept of nonlinearity through statistics or decision sciences coursework. Once the researcher detected this theme among interviewees, it became clear that the failure to consider, from a conceptual viewpoint, the possibility of nonlinear, inter-organizational effects would cause leaders not to explore methods to account for nonlinearity in simulation models.

**Missing Themes.** The researcher previously discussed the lack of prior understanding of complex systems, feedback, and nonlinearity among healthcare executive interviewees. Given this finding, that interviewees did not surface a theme that identified ongoing efforts to advance simulation modeling to account for complexity and nonlinearity was not unexpected. The absence of this theme suggests a significant gap in understanding factors that can impact operational and financial performance when engaged in contractual relationships with other organizations (Porter, 2008). Failure to account for nonlinear impacts resulting from interactions with other organizations suggests an incomplete assessment of environmental factors that impact the firm if one applies Porter’s classic Five Forces strategy assessment tool (Porter, 2008) to a health system’s or ACO’s market strategy.

While interviewees made a few references regarding health system and ACO relationships with health insurers and physician groups, the information provided fell short of developing into a prominent theme. Nonetheless, the information collected by the researcher
suggested that the presence of feedback loops involving health insurers and physician groups may be necessary components of a complete health system / ACO simulation model. The researcher will discuss this finding in greater detail when discussing future research opportunities.

**Relationship to the Literature.** Each of the five themes emerged from analyses of coded interviews, found support through triangulation of survey data, and related to multiple literature review topics. Theme 1 summarized the finding that health system and ACO executives demonstrated a general lack of awareness of the concepts of feedback loops and nonlinearity and did not, therefore, consider the possible effects of inter-organizational interactions when attempting to model organizational performance. This finding aligned with the lack of published research focused on health system / ACO interactions. Theme 2 recognized that healthcare executives described a substantial collection of causal links when subjected to interview questions rooted in system thinking principles despite a lack of prior knowledge of feedback loop concepts. Additionally, the approach used by the researcher to develop the list of causal links demonstrated the importance of using GMB to define parameters to include in the simulation of complex systems. Theme 2 formed the basis for exploring causal loops, feedback loops, and nonlinearity, as discussed in the literature review.

Theme 3 asserted that the causal links identified by healthcare executive interviewees, when integrated through shared parameters, led to complete causal loops. This theme had implications for the discussion of causal loops and feedback loops in the literature review and had implications relevant to identifying health systems and ACOs as complex, dynamic systems and the choice of modeling method required to simulate health system / ACO partnerships accurately. Theme 4, which asserted the existence of health system / ACO feedback loops, and
the related Theme 4A, which proved that health system / ACO partnerships must be subject to nonlinear behaviors, also had multiple links to the literature review. Each of Themes 4 and 4A related to issues of ACOs’ relationship to value-based care, joint health system / ACO strategy, and the implications for selecting appropriate simulation methods arising from the existence of feedback loops. Finally, Theme 5 relied on expert sources cited in the literature review when asserting that, of the available dynamic system modeling methods, SDM is the most appropriate choice for simulating the effects of health system / ACO interactions. A discussion of each of these relationships to the literature appears below.

**Major Business Objectives and Economics of ACOs.** Shami (2016) cited the ACA as creating a responsibility for ACOs to drive the healthcare industry from FFS reimbursement to a value-based care model. Executive interviewees frequently discussed the relationship between health system FFS reimbursement contracts and ACO value-based budget contracts. Analysis of coded interview transcripts led the researcher to develop causal and feedback loops (Themes 3 and 4) that reflected the relationship between FFS and value-based contracts. Additionally, causal and feedback loops associated with Themes 3 and 4 contained references to ACO quality incentives and the utilization management function, which owns the role of ensuring the reduced total cost of care while improving health outcomes (Shortell et al., 2015).

**ACOs Facilitate Value-Based Care.** Blackstone and Fuhr (2016) and Phelps and Parente (2018) further described the economics of ACOs. The authors noted that ACOs earn shared savings by reducing the total cost of care for health insurance members treated by ACO-affiliated physicians (Blackstone & Fuhr, 2016; Phelps & Parente, 2018). To earn shared savings, ACOs must manage the utilization of healthcare services and meet or exceed quality metric thresholds established by health insurers (Phelps & Parente, 2018). The researcher’s interviews with health
system and ACO executives surfaced numerous causal links associated with ACO utilization management effectiveness. Additionally, interviewees cited causal links affecting or affected by ACO quality metrics. These causal links were among those cited in Theme 2, leading to the formation of causal and feedback loops cited in Themes 3 and 4.

**Joint Health System / ACO Economics and Strategy.** Singer (2018) cited the ACA as the driving force behind a wave of healthcare consolidation that occurred since its passage in 2010. Health systems underwent consolidation to achieve economies of scale in operating costs believed necessary to sustain financial viability as the industry transitioned to value-based care (Lewis, Tierney, et al., 2017; Singer, 2018). Health system partnerships with ACOs formed another mechanism expected to reduce healthcare costs (Lewis et al., 2018), consistent with transaction cost economics theory (Camilleri & Colville, 2016; Mick & Shay, 2016; Shortell, 2016).

While economic theory supported the idea that the consolidation of healthcare organizations would result in cost efficiencies, actual results varied (Colla et al., 2016; Lewis et al., 2018; Murray et al., 2018). The research results in Theme 4A reflect a potential reason why expectations regarding financial performance did not always match actual results. The presence of inter-organizational feedback loops between health systems and ACOs confirmed in Theme 4 led to the conclusion put forward in Theme 5 that financial outcomes must be nonlinear when health systems and ACOs engage in a partnership. The results underlying Theme 1 demonstrated conclusively that neither health systems nor ACOs currently employs methods capable of simulating nonlinear behaviors.

**Lack of Studies of Health System /ACO Interactions.** Cassidy et al. (2019) reported a lack of research regarding the dynamic modeling of health system / ACO interactions. In the
present study, the researcher confirmed, as reported in Theme 1, that health system and ACO executives did not routinely consider interactions between health systems and ACOs when anticipating future organizational performance. None of the executive interviewees reported awareness of research, or the lack of research, on the topic of health system / ACO interactions.

Additionally, a lack of experience with the concepts of organizational feedback and nonlinearity led executive interviewees not to consider that partner organizations might have direct or indirect influence over outcomes within the firm. Therefore, neither the executives nor their organizations pushed for academic research into, or internal modeling of, the potential effects of health system / ACO feedback on organizational performance. Theme 2, however, provided substantial evidence that such interactions exist and that, when prompted to consider such interactions through questions rooted in systems thinking (Radzicki, 2020), the same executives were capable of identifying a multitude of interactions that the research documented as 158 causal links.

The Problem of Conflicting Business Models. Without the ability to simulate nonlinear behaviors, neither health systems nor ACOs can accurately model the financial impacts of conflicting business models. Blackstone and Fuhr (2016) questioned the sustainability of a health system that owned an ACO because the business models of each organization work at cross purposes concerning hospital inpatient utilization and total cost of care. Complicating the ability to determine the viability of a joint health system / ACO model was that both organizations and, therefore, the organizations’ combination represented complex, dynamic systems (Theme 4).

Causal Loops, Feedback Loops, and Nonlinearity. Causal loop diagrams are visual representations of the relationships between variables and illustrate potential cause-and-effect influences exerted by each variable on the others present in a system (Marshall, Burgos-Liz,
Ijzerman, Osgood, et al., 2015; Morecroft, 2015; Sterman, 2000). The visualization of causal loops provides a representation of the mental model of a system, displaying the cause-and-effect relationships that exist among system parameters (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015). In systems that lack causal loops, a change in one variable, A, causes a linear change in a second variable, B. The new value of variable B does not, in turn, affect the value of variable A (Sterman, 2000). In the presence of a causal loop, however, variable A has an effect on variable B, which, in turn, changes the value of variable A (Morecroft, 2015; Radzicki, 2020; Sterman, 2000; Šviráková & Bianchi, 2018; Torres et al., 2017). The latter is representative of real-world systems (Morecroft, 2015; Sterman, 2000; Sterman, 2002). This process is known as feedback and leads, mathematically, to the presence of a nonlinear relationship between variables A and B (Jolly, 2015; Radzicki, 2020; Sterman, 2000).

Theme 3 describes the discovery of causal loops by analyzing causal links identified in Theme 2. The researcher identified causal loops within health systems and ACOs. Additionally, the researcher identified hybrid causal loops that exhibited dependencies on health system and ACO variables. Further evaluation of these causal loops’ reinforcing or balancing behaviors led to identifying the 21 feedback loops discussed in Theme 4. After demonstrating the existence of inter-organizational feedback loops in Theme 4, the researcher presented in Theme 4A the mathematical basis for the required presence of nonlinearity in health system / ACO partnerships.

Health Systems and ACOs are Complex, Dynamic Systems. The application of inductive reasoning to demonstrate the presence of causal loops, feedback loops, and nonlinearity led to the conclusion that health system / ACO partnerships satisfy the requirements of a complex, dynamic system. Theme 3 confirmed the existence of causal loops within health systems, within
ACOs, and connecting the two organization types. The researcher identified three causal loops within ACOs based on the causal links associated with Theme 2. Additionally, the researcher identified six causal loops within health systems.

Further assessment of the causal loops demonstrated that all three ACO loops were reinforcing feedback loops. In the case of health systems, two loops presented as reinforcing loops and four presented as balancing loops. Feedback loops imply nonlinear behaviors within health systems and ACOs (Morecroft, 2015; Sterman, 2000). Feedback loops and nonlinearities mean that health systems and ACOs are complex, dynamic systems (Forrester, 1961; Morecroft, 2015; Sterman, 2000, 2018).

**Modeling Complex Dynamic Systems.** What was not addressed by Blackstone and Fuhr (2016) or Doulgeris and Bonvicino (2014) when asserting concerns regarding financial viability in the presence of conflicting business models was whether one could develop an operating model for a joint health system / ACO that relied on optimization modeling. In principle, an optimization modeling approach may enable the parent firm of a joint health system / ACO entity to derive operating parameters that sub-optimize the individual performances of the health system and ACO but yield a persistent, financially-viable net return for the parent. Themes 2, 3, 4, and 4A combined to demonstrate that health system / ACO partnerships are complex, dynamic systems. Therefore, to evaluate the possibility of deriving a set of operating parameters that optimizes parent firm performance requires the ability to simulate likely outcomes, including nonlinearities, as one varies the values of critical parameters (Monauni, 2017; Sterman, 2000, 2018).

Theme 5 demonstrated that accurate simulation of a health system / ACO partnership requires dynamic system modeling methods. This conclusion followed from Theme 4A, which
stated that the presence of feedback loops connecting health systems and ACOs necessitates the presence of nonlinear behaviors consistent with complex, dynamic systems. Theme 2 demonstrated that health system and ACO executives could identify, through the discussion of causal links, key parameters to inform a dynamic system model.

**System Dynamics Methods are Necessary for Simulating Health System / ACO Interactions.** Cosenz and Noto (2016) asserted the necessity of using dynamic simulation methods to quantify potentially nonlinear outcomes arising from complex, multi-business interactions in enterprises such as a health system / ACO partnership. This viewpoint aligns with the research of Marshall, Burgos-Liz, Ijzerman, Crown, et al. (2015), whose review of simulation modeling methods capable of reflecting nonlinear behaviors concluded that dynamic modeling methodologies offered the best approach to capture the effects of nonlinearities associated with feedback loops. Nevertheless, despite previous research asserting the need to apply dynamic system modeling methods to complex systems in healthcare, Cassidy et al. (2019) found an absence of published research into nonlinear behaviors resulting from health system / ACO interactions.

In Theme 4, the researcher demonstrated the existence of feedback loops involving both health system and ACO parameters. Given the established presence of hybrid feedback loops, Theme 4A provided the mathematical basis for asserting the unavoidable presence of nonlinear behaviors associated with parameters involved in feedback loops. The presence of feedback loops and nonlinear behaviors established that health system / ACO partnerships form complex, dynamic systems. Theme 5, therefore, arose from the work of complex system researchers that demonstrated the superiority of SDM as a method for simulation modeling involving macro

**Group Model Building to Ensure Validity.** Group model building offers a means to mitigate individual biases and increase the validity of research findings (Browne & Keeley, 2017; Carbone et al., 2019; Freebairn et al., 2016; Homer, 2019). Carbone et al. (2019) asserted that groups made better decisions than individuals for problems involving ambiguity. Cosenz and Noto (2016) attributed improvements associated with group decision-making to the ability of the group to mitigate individual biases. Despite these findings and the complexity associated with health systems and ACOs, Freebairn et al. (2016) cited a lack of application of GMB in the healthcare industry.

The researcher employed GMB to mitigate individual experts’ biases and improve the prospects of capturing a complete set of health system / ACO interactions. The GMB proved essential for determining a complete set of causal links, causal loops, and feedback loops, as reflected in Themes 2, 3, and 4, respectively. The researcher tracked progress toward code saturation to determine when to stop adding case studies without the risk of overlooking potential codes. The result of the researcher’s code saturation analysis appears in Figure 54.

The first interview resulted in 53 codes, or 33%, of the ultimate code set of 158 codes. Interview 7 was the last interview to result in new codes, with one newly-identified code bringing the total number of codes to 158. The mean number of codes identified in an interview was 52, with a median of 53, indicating a non-skewed distribution; the standard deviation was 11. Therefore, the average interviewee identified 33% of the entire codebook. The maximum
number of codes identified in a single interview was 69, or 43.4% of the total codes. Interviews 8 and 9 did not add new codes and confirmed that the researcher achieved code saturation with seven interviews. The results achieved in successive interviews appear in Table 17.

**Figure 54**

*Progression Toward Code Saturation, by Interview*

The researcher required seven interviews to obtain a complete set of codes and causal links (Theme 2), demonstrating the value of the GMB process. An interview from any single case study proved inadequate for identifying the complete codebook presented in Appendix C. Only through the application of GMB was the researcher able to discover a representative set of feedback loops associated with health system / ACO partnerships.
Relationship to the Research Problem. The general problem to address was the inability of health system managers to model the effects that ACO subsidiary strategy has on combined health system / ACO margin, resulting in subjective assumptions about how ACO strategy impacts combined health system / ACO financial viability. The specific problem to address was the inability of managers in a health system in the southeastern United States to model the effects that ACO subsidiary strategy has on combined health system / ACO margin, resulting in subjective assumptions about how changes in ACO strategy will impact combined health system / ACO financial viability. The researcher asserts that all five themes that emerged from the research project directly related to the general and specific research problems.

Theme 1 confirmed the stated research problem. Statements from southeastern U.S. health system and ACO executive interviewees universally revealed the lack of existing models of interactions between health systems and ACOs. Additionally, the executives were unaware of the implications that inter-organizational interactions might have, particularly concerning the emergence of nonlinear behaviors among system parameters, including finances. Executives
reported the continued use of linear finance models, primarily executed in Excel® spreadsheets without dynamic modeling methods such as SDM. They were unaware of the need to include external interactions to obtain accurate estimates of organizational behaviors because of nonlinearities induced by feedback loops.

The coding analysis of interview transcripts further revealed that because executives did not consider the possible effects of inter-organizational interactions, they made few assumptions regarding the possible effects that a partner health system or ACO might have on the interviewee’s organization. Themes 2, 3, and 4 revealed the existence of feedback loops connecting health system and ACO operational and performance parameters. Thus, these three themes demonstrated the existence of inter-organizational interactions that health systems and ACOs do not currently account for when projecting organizational performance. Additionally, because Themes 2 and 3 led to confirmation of hybrid feedback loops, as discussed in Theme 4, the problem of not accounting for inter-organizational interactions led executives not to attempt to capture nonlinear effects in performance models. Theme 5 addressed the conclusion that health systems and ACOs must deploy dynamic system modeling methods to simulate nonlinear effects on organizational performance accurately. Dynamic system modeling methods enable health systems and ACOs to simulate performance interdependencies, as captured by inter-organizational feedback loops, including operating margin and other financial and operational parameters.

**Summary of the Findings**

The analysis of data collected through semi-structured interviews with health system and ACO executives demonstrated the need to use system dynamics modeling to obtain accurate estimates of effects resulting from health system / ACO interactions. When exposed to interview
questions that caused executive subject matter experts to reflect on influences caused by the actions of health system or ACO partners, executives were able to identify dozens of point-to-point interactions, or causal links, between health systems and ACOs. While executives could not directly identify complete causal loops, a compilation of causal links exhibiting shared health system or ACO parameters led to the discovery of 21 complete causal loops.

Of the 21 causal loops identified, 12, or 60%, involved parameters from health systems and ACOs. Assessment of the polarity of the causal loops involving both health systems and ACOs (hybrid loops) confirmed the presence of inter-organizational feedback loops. Five hybrid feedback loops exhibited reinforcing behavior, while seven displayed balancing behavior. Nine of the 12 hybrid feedback loops included financial parameters from health systems or ACOs, of which eight hybrid feedback loops included both health system and ACO financial parameters.

The presence of feedback loops associated with health system / ACO interactions confirmed that the effects of interactions must be nonlinear. Sixty-seven percent of hybrid feedback loops, and 89% of finance-oriented hybrid feedback loops, contained financial parameters from health systems and ACOs. Therefore, the interactions between health systems and ACOs must, mathematically, result in nonlinear effects on health system and ACO financial performance, including operating margin. Thus, health systems and ACOs must incorporate dynamic simulation modeling methods such as SDM to assess inter-organizational interactions' effects on financial performance accurately.

**Application to Professional Practice**

**Introduction**

The themes derived during the research study demonstrated the need conclusively for health systems and ACOs to revise financial and operational modeling approaches based on the
study results. Neither health systems nor ACOs accounts for nonlinear effects caused by feedback loops when projecting partnership performance expectations. However, the research study results demonstrated that nonlinear effects must exist (Morecroft, 2015; Sterman, 2000). Further, the mathematics of nonlinear systems dictates that outcomes are sensitive to initial conditions (Madhu & Jayaraman, 2017; Waseem et al., 2016). Therefore, failure to account for nonlinear effects may lead to radically different results than projected. Implementing simulation methods that account for the feedback loops identified in the research will improve business practice by producing realistic projections of partnership outcomes in the face of strategic and tactical decisions affecting feedback loop parameters.

The challenge for applying the research results to professional practice arises from Theme 1. Health systems and ACOs do not currently employ dynamic simulation methods and lack familiarity with the concepts of feedback loops and nonlinearity. Therefore, strategies to apply the research results to professional practice must address the development of executive support to adopt new, more complex simulation methods (Brown & Gottlieb, 2016; Monauni, 2017; Torres et al., 2017). Executive-level support must extend to acquiring the tools and expertise to conduct system dynamics modeling either in-house or through academic partnership. Furthermore, modeling efforts must proceed systematically to develop understanding and trust among healthcare leaders for results that may well differ substantially from results previously derived from linear methods.

**Improving General Business Practice**

The results of the researcher’s analysis demonstrated that health systems and ACOs do not currently account for inter-organizational interactions when anticipating performance results. Senior leaders of health systems and ACOs do not seek out sources of inter-organizational
feedback, nor do the organizations employ simulation techniques capable of producing the nonlinear behaviors proven to exist through the presence of feedback loops identified in the current research study. Therefore, health systems and ACOs cannot presently project financial and operational performance outcomes accurately (Morecroft, 2015; Sterman, 2000).

The results of the current research study point to opportunities to improve the business practices of health systems and ACOs. Theme 1 demonstrated the lack of awareness among health system and ACO leaders of the principles of inter-organizational feedback, nonlinearity, and complex, dynamic system modeling. Current approaches to performance analysis assume linear cause-and-effect models that do not consider the presence of feedback effects. This approach is analogous to introductory physics models that assume a frictionless surface.

A frictionless surface simplifies the mathematical analysis of mechanics problems but results in a poor representation of reality (Mays, 2019). A realistic representation requires one to introduce factors that account for air resistance, surface tension, and other real-world variables that affect an object’s motion but increase the mathematical complexity of calculations. In the current analysis, the results uncovered in the research study identified for the first time the real-world factors that alter the trajectories of health system and ACO performance when compared to the analysis of each organization in isolation.

Given exposure to the potential nonlinear implications of inter-organizational feedback loops for organizational performance, interviewees wanted to incorporate complex system modeling methods into business practices. To do so will require additional education on the part of health system executives to hire resources with the skills necessary to develop and implement complex system models. Organizations will also need to deploy new, inexpensive software tools
to model dynamic feedback processes. Examples of such tools include Vensim® and AnyLogic®.

Before health systems or ACOs can construct dynamic models of inter-organizational feedback, they must identify the sources of feedback (Cosenz & Noto, 2018; Crown et al., 2017; Groesser & Jovy, 2016; Kok et al., 2015). The results in the present study provide 21 examples of feedback loops, 12 of which represent inter-organizational interactions. Therefore, the research results provide a set of feedback processes that health systems and ACOs may use to develop system dynamics models.

Perhaps more importantly, the research study identified an approach to collecting and analyzing inter-organizational interaction data using the qualitative method of thematic coding. The methodology used by the researcher resulted in the ability to translate interview data into causal links, the intersection of which resulted in feedback loops. Health system and ACO personnel can follow the researcher’s approach to validate the feedback loops identified in the research study and add and customize feedback loops through additional thematic coding of local interviews.

The researcher also demonstrated the reliability and validity of a survey instrument used to triangulate the results of the thematic coding of interview data (Creswell & Creswell, 2018; Creswell & Poth, 2018; Yin, 2018). Health system and ACO personnel can use the survey to triangulate additional data collected within their organizations. As neither health systems nor ACOs currently pursues research into feedback interactions, they do not deploy a survey instrument designed to triangulate results. Health system and ACO analysts can use the researcher’s survey as a template to assess newly-developed results and ensure the validity of feedback processes proposed for inclusion in local system dynamics models. Analysts can also
pursue additional reliability studies by collecting responses from a more extensive set of respondents than surveyed in the present study, bolstering conclusions derived from thematic coding and survey triangulation. The researcher presented this recommendation for future research based on Fleiss’ kappa computation in the current study.

Each of the efforts described above to improve business practice ultimately serves the need for businesses to move beyond the oversimplification of business models and embrace the complexity of the healthcare industry (Burwell, 2018; Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015). The present research demonstrated that to continue with the historical approach of evaluating the effects of strategic or tactical decisions on business performance using linear financial models must produce demonstrably inaccurate results. Health systems and ACOs can improve business practices by supplementing current business analyses with analyses based on dynamic modeling techniques that account for internal and external organizational interactions. Only by identifying feedback loops and incorporating them into business simulation models can health systems and ACOs hope to understand and account for the effects of inter-organizational interactions on the firm’s performance. Therefore, health systems and ACOs must create the expectation that senior executives invest themselves in developing the skills required to apply system thinking and recognize points of interaction between health systems and ACOs, as illustrated by the study’s results.

**Potential Application Strategies**

The application of the results in the present research study requires the consideration of several application strategies. The first and most critical of the application strategies is a commitment among senior leaders within a health system or ACO to account for organizational interactions and nonlinearity in strategic decision-making processes using new methods. The
primary barrier to gaining the commitment of healthcare executives, as suggested by the results associated with Theme 1, is a lack of awareness of the potential effects of inter-organizational interactions and the fact that traditional modeling methods cannot capture nonlinear effects. Therefore, to gain widespread adoption of the findings of the research study will require a campaign to educate senior healthcare executives regarding the added business value of implementing nonlinear modeling techniques (Aguinis & Solarino, 2019; Natow, 2020). One may consider presenting material at industry conferences attended by senior executives or publishing informative articles in industry periodicals as options for providing the necessary exposure and education.

Gaining support among senior executives is only the first of several necessary strategies. Given that health systems and ACOs do not currently employ the tools and methods necessary to conduct system dynamics modeling in-house, the organizations may need to consider partnering with academic researchers to carry out initial SDM efforts. Contracting with existing resources in academia that already have expertise with dynamic modeling methods offers a faster time-to-value proposition than a strategy of standing up a new, in-house modeling function requiring the recruitment of qualified personnel.

Health systems or ACOs may choose to enter into research collaborations with similar organizations to leverage the skills and share the cost of academic system dynamics consultants. A hybrid model is also possible in which health system or ACO resources work in parallel with academic experts for knowledge transfer to the health system or ACO. Analytics resources within the health system or ACO that have prior business simulation experience may develop expertise with system dynamics modeling by working side-by-side with academic experts. A hybrid strategy offers the benefit of building system dynamics modeling expertise within the
firm while simultaneously deriving value through the work of academic experts. The research partnership strategy aims to create the means to begin exploring the effects of feedback and nonlinearity on organizational performance while minimizing financial investment and risk for the firms involved.

A third application strategy is to build the capability to conduct system dynamics modeling within the advanced analytics function of a health system or ACO where such a function currently exists. The SDM is a complex discipline but accessible to those with previous training and experience in computational model development or simulation methods (Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015; Marshall, Burgos-Liz, Ijzerman, Osgood, et al., 2015). Providing experienced staff with access to available online training or support for academic programs can enable firms to develop system dynamics modeling skills among staff that already know and understand the firm’s data and business challenges. The third strategy offers an option to firms with existing advanced analytics capability to forego a partnership strategy by making marginal investments in new, dynamic simulation tools.

Once a health system or ACO determines how to carry out SDM, it must determine a strategy for conducting and applying the modeling research. The researcher suggests three application strategies:

1. Build a system dynamics model using the results of the current research.
2. Determine the basic nonlinear behaviors of the model by assuming linear response functions in causal links.
3. Empirically determine response functions, conduct sensitivity analysis by varying initial conditions, and compare the results with real-world observations.
To apply the results obtained in the research study, one must first use the results to construct a system dynamics model of health system / ACO interactions (Chang et al., 2017; Morecroft, 2015; Sterman, 2000). The complete causal link diagram in Figure 16 provides the architectural foundation for a system dynamics model, and the feedback loops in Figures 44-47 provide causal link polarities. The details of system dynamics model development are beyond the scope of the current study, but multiple sources described the process in detail (see, for example, Chang et al., 2017; Cosenz & Noto, 2018; Jankuj & Voracek, 2015; Morecroft, 2015; Sterman, 2002).

In general, developing a system dynamics model requires translating causal link parameters into stocks, flows, and ancillary variables (Morecroft, 2015; Sterman, 2000). After creating the system dynamics model structure, one must associate response functions with each causal link. The empirical determination of causal link response functions is a complex process. Therefore, the research suggests the following strategies for applying the system dynamics model to identify the effects of health system / ACO interactions.

The presence of feedback loops in health system / ACO system dynamics models dictates nonlinear behaviors among feedback loop parameters. The response functions associated with individual causal links may be nonlinear, adding to the complexity of model outputs. Healthcare executives expressed unfamiliarity with nonlinearity. The researcher recommends an application strategy to increase executives’ understanding. Simplified first models will help demonstrate to executives that nonlinearity exists even when assuming linear relationships between causal links. Rather than conducting sensitivity analysis using the entire system dynamics model in the case of executives unfamiliar with nonlinearity, researchers may adopt a strategy that uses one isolated model component. For example, one may focus on the behavior of a system dynamics model constructed from one of the simple feedback loops found in Figure 46.
Figure 55

_Hypothetical Application of Linear Response Functions for Sensitivity Analysis_

The recommended strategy requires the assignment of hypothetical linear response functions to each causal link such that parameter B is a linear function of parameter A (see Figure 55). The application of response functions of this type is consistent with assumptions commonly employed by healthcare executives when modeling the effects of strategic decisions (Theme 1). By conducting sensitivity analysis under the assumption of linear response functions, executives can observe that health system / ACO interactions must create nonlinear behaviors through the presence of feedback loops even when all individual parameter interactions are linear (see Figure 56). This strategy aims to provide real-world examples of nonlinearity to healthcare leaders for evaluation, convince healthcare leaders that nonlinearity is inevitable in health system / ACO partnerships, and create executive support within the firm for ongoing research into health system / ACO system dynamics.
A final application strategy moves the firm from a basic understanding of nonlinearity toward a realistic health system / ACO partnership simulation. A realistic simulation requires substituting realistic causal link response functions for previously-assumed linear response functions (Morecroft, 2015; Sterman, 2000). To determine the form of actual response functions requires a methodical research and measurement process. The strategy to move the firm toward a realistic simulation model requires systematically adding real-world response functions to the system dynamics model to understand the direct effects of each new addition. As researchers add each empirical response function, employing sensitivity analysis by systematically varying the initial values of parameters in feedback loops will reveal the potential solution space defined by the model. After adding all measured or estimated response functions, researchers can identify potential future states of the partnership based on simulations using parameter values aligned with the current state of each firm.
Summary

Methods currently used to project financial and operational outcomes in health system / ACO partnerships cannot produce accurate results because they cannot simulate nonlinear effects. As identified in the research, the implementation of simulation methods that account for nonlinearity caused by feedback loops will improve business practice by producing realistic projections. Embracing the research study results requires embracing a substantially greater level of complexity in business analysis than historically undertaken by health systems or ACOs. The transition from current simulation methods to the methods required by the research results requires a multi-component strategy. Based on the research results, advocates of SDM must educate healthcare executives regarding the nature and effects of complex systems, feedback loops, and nonlinearity. Through education, advocates must gain support for acquiring tools and expertise through academic partnerships or in-house efforts. Finally, advocates must construct a working system dynamics model using the research study results and conduct sensitivity analysis to build trust among leadership that results, which may differ substantially from prior projections, are reliable and valid.

Recommendations for Further Study

The research put forward in this project represents substantial progress toward the documentation of operational feedback between health systems and ACOs. The researcher identified examples of feedback loops that future researchers can exploit to build the first system dynamics model capturing health system / ACO interactions and the resulting nonlinear effects. However, the structural framework of feedback loops is not the only consideration for constructing a realistic system dynamics model. Advancement of health systems’ and ACOs’ abilities to leverage system dynamics models of interaction effects requires several avenues of
further study. Given the absence of research into the interactions between health systems and ACOs (Cassidy et al., 2019), the current study opens the door to multiple, future research efforts.

In the discussion of identified feedback loops, the researcher noted that only reinforcing loops emerged within the ACO structure. Real-world systems must contain both reinforcing and balancing loops to prevent the emergence of unconstrained exponential behaviors (Morecroft, 2015; Sterman, 2000). Therefore, it is logical to expect that at least one internal ACO balancing loop exists but did not emerge from the interviews in this research. The probable cause for the absence of internal ACO balancing loops was the researcher’s focus on documenting the potential existence of inter-organizational feedback loops.

One avenue of future research is to conduct interviews with ACO leaders to document internal business function interactions and analyze the data to search for feedback loops. While internal health system balancing and reinforcing loops emerged from the present research, the researcher recommends a similar project to focus on health systems’ operations and identifying a more robust set of internal operational feedback loops. These proposed studies create the potential to lead to additional inter-organizational feedback loops and a more robust system dynamics model.

Additional insight regarding internal ACO and health system feedback loops may result in a more robust system dynamics model. However, the current research provided substantial evidence of feedback loops that form the basis for model construction. The researcher recommends constructing a health system / ACO system dynamics model based on the research results. As noted, healthcare executives did not display familiarity with nonlinearity and its consequences. Therefore, the researcher proposes a means to demonstrate the nonlinearity concept.
Each causal link in a system dynamics model represents an interaction, and a mathematical response function describes the behavior resulting from each interaction. For a system dynamics model to produce results consistent with observations, one must know the form of each response function (see the discussion below). As a starting point, however, one can adopt simple, linear response functions to illustrate the effects of nonlinearity caused by feedback. Executives implicitly assume linear response functions, as demonstrated in Theme 1. The underlying expectation is that changes in variable A will create a linear response in variable B. By associating linear response functions with each causal link, one should expect to observe nonlinear changes in the values of feedback variables, including joint operating margin. One can conduct sensitivity analyses by varying the values of linear response functions and observing changes in model output. Such a demonstration has the potential to illustrate to healthcare executives the importance of adopting dynamic modeling methods to achieve reliable performance projections.

To make the output of a health system / ACO system dynamics model more realistic, one must replace the assumptions of linear causal link response functions with empirically-derived functions. The researcher proposes a future study to measure actual response functions. The ACO concept emerged in 2010. Health systems and ACOs can use historical data to examine the stimulus-response history of causal links. The researcher proposes applying statistical analysis and curve-fitting methods to derive response functions empirically. One can repeat a structured series of simulations to map out model sensitivity with each new empirical response function.

Healthcare executives made a small but valuable set of references to health systems’ and ACOs’ interactions with health insurers and physician groups. The latter may be ACO or health system partners or stakeholders. The information obtained in the present analysis was
insufficient to determine feedback loops involving health insurers or physician groups. The researcher proposes a multiple case study similar to the one undertaken in the current research to understand the nature of causal link relationships involving all four entities: health systems, ACOs, health insurers, and physician groups. Future researchers may add resulting feedback loops to those derived in the current research and proposed ACO and health system-focused investigations to arrive at a more comprehensive model of interactions among the principal entities that interact in the current U.S. healthcare industry.

Finally, the researcher demonstrated reliability and validity for the survey instrument used to triangulate the results of the thematic coding of interview data. Cronbach’s alpha and the intraclass correlation coefficient reflected acceptable values. However, the researcher noted that enhancing the reliability of agreement between survey respondents, as reflected in Fleiss’ kappa, may require a more extensive set of survey respondents than queried by the researcher. Therefore, the researcher recommends extending the survey to a more extensive set of respondents. Researchers’ recomputation of the interrater agreement may determine whether the survey requires revision to boost interrater agreement.

**Reflections**

**Introduction**

The research subjects participated in semi-structured interviews and a 31-question survey investigating interactions between health systems and ACOs. The participants were senior executives with leadership roles in health systems or ACOs engaged in partnerships with ACOs or health systems, respectively. Given their senior-level experience with health system / ACO partnerships, the researcher expected the interviewees to hold strong opinions regarding the nature of health system / ACO interactions affecting their organizations (Lewis, Tierney, et al.,
Instead, the researcher discovered that the interviewees professed little reflection on the partner organization’s effect on their organizations. At the heart of this finding was

- limited experience with system thinking principles,
- no prior exposure to the science of complex systems and feedback loops,
- unfamiliarity with the mathematical underpinnings of nonlinearity, and
- no awareness of the existence of dynamic modeling techniques and the necessity to use such methods in the presence of nonlinearity.

All research participants were highly trained and experienced healthcare industry experts. Nonetheless, the current research project results demonstrated a shared set of gaps in knowledge that prevented health systems and ACOs from implementing techniques capable of simulating the industry’s complexity.

Interviewees also struggled to articulate complete feedback loops even after being presented with an explanation of how feedback loops might arise in a health system / ACO partnership. The researcher found that interviewees were adept at identifying operational functions within their home domain (either a health system or an ACO) but had difficulty relating those functions to a partner’s operational functions. Similarly, when asked to identify interactions that might be more susceptible to nonlinear outcomes, participants were not familiar enough with the mathematical concept of nonlinearity to do so. The researcher recognized, in retrospect, an incorrect assumption that the educational backgrounds and experience of interviews in senior executive positions did not guarantee awareness of mathematically-oriented concepts such as complex systems, feedback loops, or nonlinearity. The researcher offered verbal explanations beginning with the third interviewee based on observations from the first two
interviews. The researcher’s experience suggests future researchers would do well to offer a brief pre-reading assignment prior to the interview to introduce all participants to these critical concepts using examples from the industries in which they work.

After re-analyzing the first several interviews, the researcher noted the need to conduct multiple coding revisions (Creswell & Plano Clark, 2010; Saldaña, 2021). The code revision process followed the methodology described by Saldaña (2021). Codes assigned during the analysis of the first interview later proved to be too broad, encompassing what later became several unique codes. Moreover, the emergence of code categories changed with each successive revision of primary codes (Saldaña, 2021). It was not until the fourth revision of primary codes that the codebook began to stabilize and what would become the final set of code categories emerged to create a workable analytical structure aligned with the research problem and research questions.

The process of evolving the interview and survey data analysis led the researcher to new personal and professional insights. The research project had a stated goal of informing health system and ACO strategic decisions regarding optimizing financial outcomes when engaged in a partnership. However, interview data connected financial outcomes and the quality of patient care in a way that led to reflections related to the effect of health system / ACO partnerships on patients from a Christian worldview (Hardy, 2004; Keller & Alsdorf, 2012).

**Personal and Professional Growth**

The researcher entered the dissertation research process with a thirty-year history of conducting quantitative research in the healthcare industry. The decision to take on a qualitative research project for the dissertation was intentional, with the goal of developing a deeper understanding of qualitative research methods. The process of developing a qualitative interview
guide, learning to conduct thematic coding and theme development from qualitative data through NVivo®, creating a new survey instrument, and applying techniques to ensure the reliability and validity of the survey (Creswell & Creswell, 2018; Creswell & Plano Clark, 2010; Robson & McCartan, 2016; Yin, 2018) were new to the researcher. The robust results obtained through the qualitative research process highlighted, for the researcher, the value of qualitative research and its potential as a complement to quantitative research in mixed-methods studies (Creswell & Creswell, 2018; Creswell & Plano Clark, 2010; R. B. Johnson & Onwuegbuzie, 2004). The researcher will adopt a more extensive use of qualitative research tools in the work environment, passing the learning realized through the dissertation process to employees.

Interactions with senior executive subject matter experts led the researcher to personal insight. While each of the interviewees was a highly successful healthcare executive with extensive business or medical credentials, none had an awareness of the concepts or methods to enable their organization to conduct analysis that accounts for real-world complexity (Aguinis & Solarino, 2019; Natow, 2020). It became clear that the knowledge of how to examine and document industry complexity and how to translate that knowledge into breakthrough insights regarding the effects of organizational interactions is a unique value proposition owned by the researcher. The insight gained from the dissertation research process creates an opportunity for continued career growth by articulating the value of the researcher’s unique skill set and its application to problems of healthcare strategy (Cosenz et al., 2020; Cosenz & Noto, 2018; Groesser & Jovy, 2016; Torres et al., 2017).

The researcher also learned a lot about personal resiliency. The threshold for the researcher’s ability to manage multiple, highly-complex workstreams simultaneously was higher than previously believed. Resiliency became a substantial factor for avoiding doctoral attrition
(Devos et al., 2017; Rockinson-Szapkiw, 2019). The researcher began the Doctor of Business Administration degree process shortly before the onset of the global SARS-CoV-2 pandemic. As a healthcare executive responsible for systemwide analytics and data science, the researcher was at the epicenter of the development of simulation modeling needed to understand the progression of this novel disease. The demands on the researcher’s time as a result of Covid-19 issues were immense, yet progress continued toward completing this dissertation while also maintaining balance with family commitments. Managing both efforts while managing family commitments tested self-discipline, time management, and strategic thinking skills in ways not experienced previously (Devos et al., 2017; Rockinson-Szapkiw, 2019). The researcher gained substantial insights into his capacity to manage multiple, complex tasks simultaneously. These insights produced a renewed confidence in the researcher regarding the ability and inner strength to take on next-level responsibilities.

**Biblical Perspective**

The researcher’s study investigated the interactions between two critical entities in the U.S. healthcare delivery system: health systems and accountable care organizations. While the two entities have competing economics models, they share the goal of providing cost-effective, high-quality care for the benefit of ill patients. Thus, from a humanitarian perspective, health systems and ACOs share a commitment to healing God’s children.

The Bible provides abundant evidence of Jesus’ commitment to healing. Matthew documented multiple instances of Jesus’ healing ministry:

- [Jesus] went throughout all Galilee, teaching in their synagogues and proclaiming the gospel of the kingdom and healing every disease and every affliction among the people (*ESV Bible*, 2001, Matthew 4:23).
• When He went ashore He saw a great crowd, and He had compassion on them and healed their sick (Matthew 14:14).

• And He called to Him His twelve disciples and gave them authority over unclean spirits, to cast them out, and to heal every disease and every affliction (Matthew 10:1).

Luke also referenced Jesus’ healing, stating, “When the crowds learned it, they followed Him, and He welcomed them and spoke to them of the kingdom of God and cured those who had need of healing” (ESV Bible, 2001, Luke 9:11). Indeed, healing humanity in the face of sin was Jesus’ ultimate mission on earth, as Peter noted, “He himself bore our sins in His body on the tree, that we might die to sin and live to righteousness. By His wounds you have been healed” (1 Peter 2:24).

Reflecting on the current research study through a worldview that recognizes healing as the Godly mission of Jesus on earth aligned the researcher with Keller’s and Alsdorf’s (2012) view that continuing God’s work on earth, His garden, renders humankind’s work divine. To undertake a research project with the potential to improve the healthcare rendered to one’s fellow children of God attaches to the work a higher purpose. Seeking a higher purpose, the researcher dedicated substantial time and effort toward collecting and analyzing data, interpreting results, and producing the dissertation. The research process, and associated results, viewed through a biblical worldview in which man’s work glorifies God, thus became an expression of Colossians 3:23 (ESV Bible, 2001), “Whatever you do, work heartily, as for the Lord and not for men.”

God created men and women in His image (ESV Bible, 2001, Genesis 1:27). Therefore, by devoting the research effort to serving and improving the lives of fellow human beings, the researcher rendered a service to God. Matthew articulated Jesus’ perspective on the value of
serving others, quoting, “And the King will answer them, ‘Truly, I say to you, as you did it to one of the least of these my brothers, you did it to me’” (Matthew 25:40). Rather than solely attributing financial benefit to the results obtained from the research study, a Christian worldview enabled the researcher to seek knowledge that improves the effectiveness of the U.S. healthcare system. As Keller and Alsdorf (2012) noted, profit is only one of many bottom lines. Scripture shares a reminder that “The second is this: ‘You shall love your neighbor as yourself.’ There is no other commandment greater than these” (Mark 12:31). A Christian worldview helped the researcher develop a sense of fulfilling the greatest commandment. The researcher recognized that more accurate simulation of health system and ACO operations would enable improved healthcare outcomes. Therefore, the researcher’s work served more than improving financial outcomes.

The results obtained through the research study surfaced new knowledge for the academic and healthcare practitioner audiences. The pursuit of new knowledge in a Christian worldview gives life meaning and enables one to advance God’s work on earth (Keller & Alsdorf, 2012). Further, seeking new knowledge that improves the existence of the people around us is an investment in the divine economy (Hardy, 1990, 2004). The researcher sought to gain new qualitative research skills in this project. The researcher also took great care to ensure that research results exhibited reliability and validity. Through this effort, the researcher demonstrated competency in the conduct of research and the trustworthiness of the results. Keller and Alsdorf (2012) asserted that devotion to greater competency in one’s work is an outcome of a Christian worldview in which the quality of one’s work reflects service to God. Timothy reinforced this idea when setting the expectation, “That the man of God may be competent, equipped for every good work” (ESV Bible, 2001, 2 Timothy 3:17).
The research project’s nature and results were to determine the information needed for future researchers to build a representative model of health system / ACO interactions. The results demonstrated that interactions exist through causal links and dictate nonlinear outcomes. The ability to simulate the effects of health system / ACO interactions will provide healthcare leaders the guidance they need to make better-informed strategic decisions. Strategic decisions by healthcare leaders affect the quality of healthcare delivered to patients. Moral and ethical rules apply to the provision of care to patients. However, there is no established set of moral or ethical rules to guide healthcare administrators’ decisions and guarantee improvement of the healthcare system from the patient’s perspective. A simulation model constructed from the knowledge surfaced through the current study will allow healthcare leaders to test how decisions may affect financial outcomes and associated impacts on the quality of outcomes. The result will be an increase in the wisdom associated with decisions made by healthcare leaders. As Keller and Alsdorf (2012) asserted, “Wisdom is more than just obeying God’s ethical norms; it is knowing the right thing to do in the 80 percent of life’s situations in which the moral rules don’t provide the clear answer” (p. 215).

**Summary**

The research carried out in this study led to personal, professional, and spiritual growth for the researcher. From a professional perspective, completing the research study required the researcher to develop new skills, including greater familiarity with qualitative research methods (Creswell & Creswell, 2018; Creswell & Poth, 2018; Yin, 2018). Data collection required the researcher to develop a standard interview guide and to conduct semi-structured interviews without introducing personal bias with the potential to influence outcomes (Creswell & Creswell, 2018; Creswell & Poth, 2018; Yin, 2018). The researcher gained experience with the thematic
coding of interview data, including the evolution of primary codes through several rounds of iterative processing leading to a final set of code categories and emergent themes (Saldaña, 2021). The researcher also learned how to create a survey instrument and evaluate its reliability and validity as a tool to triangulate results from primary research (Creswell & Creswell, 2018; Creswell & Poth, 2018; Fink, 2009; Yin, 2018).

The researcher learned the ability to recognize complex systems and the mathematical implications of their characteristics is not a commodity among successful, senior industry leaders. This knowledge demonstrated a unique and differentiable skill set held by the researcher within the ranks of healthcare executives accountable for health system or ACO strategy. Recognition of this advantage offers the researcher opportunities for further career growth and advancement.

The researcher faced substantial personal challenges in completing doctoral research during a global pandemic and working in the healthcare industry. Time constraints became severe due to work commitments associated with managing a health system analytics team that played a pivotal role in guiding a health system and an ACO through the Covid-19 pandemic. The result, however, was a renewed appreciation for the researcher’s resiliency and ability to manage multiple, complex tasks through effective time management. The researcher’s resiliency contributed to the successful completion of the research and dissertation processes (Devos et al., 2017; Rockinson-Szapkiw, 2019). Suppose the timing of the pandemic was known prior to the start of the doctoral research process. In that case, serious doubts about the ability to conduct doctoral research concurrent with expanded work commitments may have led the researcher to abandon the doctoral research. Instead, the researcher gained new insight regarding the human capacity to succeed in the face of a substantial workload.
A significant factor in sustaining the researcher through adversity was the adoption of a Christian worldview (Hardy, 1990, 2004; Keller & Alsdorf, 2012). The researcher’s worldview associated a higher purpose with the researcher’s work beyond the achievement of the doctoral degree. The research work enabled the researcher to explore rigorously the gifts provided by God and to apply those gifts to a project with the potential to benefit his employer and the community. In this way, although the research project focused on optimizing operating margin in the presence of a health system / ACO partnership, the potential to improve healthcare outcomes through more effective and efficient health system / ACO interactions remained a focus (Keller & Alsdorf, 2012).

**Summary and Study Conclusions**

The researcher undertook the current study to investigate the general research problem: the inability of health system managers to model the effects that accountable care organization (ACO) subsidiary strategy has on joint health system / ACO margin, resulting in subjective assumptions about how ACO strategy impacts combined health system / ACO financial viability. The specific problem to address was the inability of managers in a health system in the southeastern United States to model the effects that ACO subsidiary strategy has on joint health system / ACO margin, resulting in subjective assumptions about how changes in ACO strategy will impact combined health system / ACO financial viability. No research addressing the nature or impacts of health system and ACO inter-organizational interactions currently exists in the academic literature (Cassidy et al., 2019; Chang et al., 2017; Yu et al., 2018). The general and specific research problems gave rise to three research questions:

- What do health system and ACO managers believe are the feedback loops that exist in a health system / ACO partnership model and that affect joint margin?
• Which ACO strategic, operational variable changes do health system and ACO leaders believe create nonlinear changes in health system or ACO margin?

• What factors would health system and ACO managers quantitatively model to reduce uncertainty about health system or ACO financial viability in a health system / ACO partnership model?

To address the general and specific research problems and related research questions, the researcher conducted a qualitative multiple case study requiring the analysis of semi-structured interviews of nine health system and ACO senior executives. The interviewees each had accountability for aspects of a health system / ACO partnership. The researcher’s objective for the interview process was to gather and analyze the opinions of subject matter experts regarding the sources of interactions in a health system / ACO partnership. Thematic coding was the qualitative analysis method of choice in this study. The researcher also collected quantitative data using an online survey as a second research instrument. The survey included 31 questions informed by the research questions and preliminary results of thematic coding. The quantitative data collected through the survey enabled the researcher to triangulate the findings of the interview analyses using statistical analyses (Creswell & Poth, 2018; Fusch et al., 2018; Robson & McCartan, 2016). NVivo® served as the CAQDAS tool for storing and organizing all research data and analyses (Woods, Macklin, et al., 2016; Woods, Paulus, et al., 2016; Yakut Çayir & Saritas, 2017).

The iterative application of thematic coding (Saldaña, 2021) resulted in 158 primary codes derived from the semi-structured interviews. The 158 primary codes, documented in the codebook provided in Appendix C, supported 13 unique code categories and 29 code subcategories. One of the code categories defined by the researcher, category 3, held 57 causal
link codes established from the analysis of interview data. Among the 29 ACO-driven links and 28 health system-driven links, the researcher documented for the first-time definitive evidence of direct links between health systems and ACOs. The results derived from the statistical analysis of survey data showed general agreement with the causal links developed through coding. However, survey respondents showed uncertainty about the polarity of causal links, perhaps due to a lack of familiarity with feedback loop analysis. The presence of causal links formed the basis for Theme 2 arising from the current research.

By exploring the intersections of parameters found in causal links, the researcher added to new knowledge by documenting the presence of 21 causal loops. Among the causal loops, 12 contained parameters from both the health system and partner ACO. The results proving the existence of health system / ACO causal loops was the basis for theme 3.

Analysis of the polarities of the causal loops resulted in the documentation of 21 feedback loops. Thus, the researcher documented for the first time the existence of 12 inter-organizational feedback loops having combinations of ACO and health system parameters. The documentation of feedback behavior in health system / ACO partnerships led to the emergence of Theme 4, which provided an answer to Research Question 1.

The confirmed presence of inter-organizational feedback loops meant that health system / ACO partnerships must evoke nonlinear impacts on each partner. The mathematical formulation of feedback loops dictates that a feedback loop results in nonlinear relationships among the parameters involved in the loop, as demonstrated by Forrester (1961) and Sterman (2002). The confirmed presence of inter-organizational feedback loops thus proved that health systems and ACOs create nonlinear effects on the other through operational interactions, as captured in Theme 4A. Theme 4A answered Research Question 2 by defining the parameters in feedback
loops, which must exhibit nonlinear behaviors. Additionally, multiple feedback loops contained financial parameters from health systems and ACOs. All parameters included in feedback loops containing financial parameters contribute to financial behaviors and must, therefore, form the basis for modeling financial outcomes, answering Research Question 3.

Theme 5 followed the above findings, asserting that health systems and ACOs must employ dynamic system modeling techniques to account for the nonlinear effects arising from partnerships. The linear modeling techniques in current use by health systems and ACOs (Theme 1) are incapable of replicating nonlinear effects, necessarily making the simulation of future outcomes incomplete. Of the dynamic system modeling techniques, system dynamics models are the most appropriate for simulating complex systems at the macro-level (Cassidy et al., 2019; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015).

The researcher developed concerns regarding the ability to extract information concerning the potential presence of feedback behavior due to interviewees’ universal lack of awareness of the concepts of organizational feedback and nonlinearity. However, the analysis of interview data revealed that interviewees had substantial knowledge of inter-organizational interactions. The current study proved that the coding of operations-based discussions of health system / ACO partnerships could identify information that researchers familiar with dynamic system modeling methods can translate into casual links and feedback loops. Thus, qualitative research involving the analysis of semi-structured interviews with subject matter experts proved a practical approach to defining parameters that can serve as the basis for a future system dynamics model.

The researcher named additional avenues for future research beyond constructing a system dynamics model of health system / ACO interactions and financial outcomes. Given the
lack of understanding of the effects of feedback and nonlinearity, research that assumes
simplistic, linear cause-and-effect response functions between causal link parameters yet shows
nonlinear outcomes will serve as evidence for such behaviors for healthcare leaders. Researchers
must investigate and document the nature of real-world cause-and-effect response functions
associated with causal loops to move system dynamics models toward realistic simulations.

Finally, the researcher argued that adopting a Christian worldview brought a higher
purpose to the research project. The research project results ultimately create the possibility for
healthcare leaders to improve the cost of care and quality of outcomes for patients by optimizing
decisions about how health systems and ACOs interact. The potential human benefits of the
research through a biblical worldview align with Jesus’ healing ministry on earth, including his
ultimate sacrifice for humanity. It remains for health system and ACO leaders to apply the
researcher’s results to improve healthcare delivery without focusing solely on operating margin.
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Appendix A: ACO / Health System Interactions Interview Guide

I. Introduction and Context (Target = 5 min.)

Welcome and thank you for agreeing to participate in this sixty-minute interview in support of my Doctor of Business Administration research. The goal of my research project is to identify those functions of health systems and ACOs that interact with each other when the entities enter a partnership. By interact, the research refers to the ability of strategic decisions, policy changes, operational changes, volume changes, reimbursement changes, or other changes made by one entity to impact the operations and, consequently, the operating margin, of the other entity.

I will ask you a series of questions related to interactions between health systems and ACOs. All responses will be strictly confidential. As the researcher, I will de-identify all respondents and respondent organization information prior to engaging fellow researchers in the thematic coding of interview responses. The researcher will keep all data, including recordings of interviews, interview transcripts, and results of interview thematic coding in a secure location. I will not disclose the identity of a research respondent or his/her organization without the express, written consent of the research respondent.

Before I proceed, let me inform you of my intent to record your responses for the purpose of confirming data collection accuracy during data analysis. Do I have your permission to record this interview?

II. Respondent Background Information (Target = 5 min.)

- Please provide your name, the name of your organization, and your title.
- Is your organization a health system or an ACO?
• Please describe the way in which your role provides you with insight into the nature of health system interactions with ACOs.

• How would you characterize the business relationship between your (health system / ACO) and the largest (ACO / health system) with which it works? E.g., ownership, contractual partnership, joint venture, etc.

III. Interviewer Context: (Target = 20 min.)

RQ1. What do health system and ACO managers believe are the feedback loops that exist in a health system / ACO partnership model and affect joint margin?

1. Please explain why you agree or disagree with the statement that strategic and operational decisions made by a (health system / ACO) have the potential to impact the operating margin of its partner (ACO / health system).

2. Think about the top three-to-five functions or activities under the control of a partner (health system / ACO) that have an impact on your (ACO’s / health system’s) bottom line [operating margin].

3. What are those functions and describe the mechanism through which they impact your bottom line?

4. Think about the top three-to-five functions or activities under the control of your (health system / ACO) that have an impact on your partner (ACO’s / health system’s) bottom line [operating margin].

5. What are those functions and describe the mechanism through which you believe they impact your partner’s bottom line?

6. How does your (health system / ACO) directly subsidize or invest in your (ACO / health system) partner?
7. If your partner (ACO / health system) receives shared savings incentive payments from its customers, does your (health system / ACO) receive a portion of those shared savings incentives?

IV. Interviewer Context: (Target = 12 min.)

RQ2. Which ACO strategic operational variable changes do health system and ACO leaders believe create nonlinear changes in HS or ACO margin?

8. Please explain whether you agree with the statement that strategic and operational decisions made by a (health system / ACO) may result in nonlinear (unpredictable or difficult to model) impacts on the operating margin of its partner (ACO / health system).

9. Please explain which clinical, operational, or policy changes made by your (health system / ACO) partner you believe are most likely to result in nonlinear financial effects for your (ACO / health system) and why.

10. Please explain how your (health system / ACO) simulates or predicts today the possible nonlinear financial effects of operating decisions made by your partner (ACO / health system).

V. Interviewer Context: (Target = 16 min.)

RQ3. What are the factors that health system and ACO managers would quantitatively model to reduce uncertainty about HS or ACO financial viability in a HS / ACO partnership model?

11. If you were building a model to simulate the way your (health system / ACO)’s finances are influenced by the operations of a (ACO / health system) partner,
which functions, or operating parameters, of each organization would you include?

12. For each partner (ACO / health system) function you listed:
   a. With which of your (health system / ACO) functions does it interact (i.e., influence) and how strong is the interaction?
   b. Does it impact your revenue, operating cost, or both?

13. Which of your partner (ACO / health system)’s activities create the greatest challenges for your (health system / ACO) to achieve its quality incentive targets?

14. Which of your partner (ACO / health system)’s activities create the greatest challenges for your (health system / ACO) to achieve its financial targets?

VI. Closing Statement (Target = 2 min.)

   The purpose for identifying the nature of health system interactions with ACOs is to enable the future construction of a system dynamics model capable of simulating health system / ACO interactions. Such a model will give healthcare executives the ability to identify the potential nonlinearity of financial impacts caused by interactions, or feedback loops, between the two entities. A model that accounts for nonlinear outcomes will be a powerful strategic planning tool. You will have access to the research findings upon publication of the dissertation.
Appendix B: ACO / Health System Interactions Survey

1. The actions of a health system impact the financial performance of an ACO, and vice-versa.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

2. ACO Utilization Management Effectiveness at least partially determines Health System Patient Volumes.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

3. Changes in Health System Patient Volume at least partially reflect ACO Utilization Management Effectiveness.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
4. ACO Utilization Management Effectiveness at least partially determines ACO Shared Savings.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

5. Health System Staffing Ratios affect ACO Network Leakage.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

6. If Health System Total Patient Revenue increases, then ACO Cost of Care Savings decreases.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
7. An increase in Health System Market Share will increase ACO Total Claims Costs.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

8. A Health System's ACO subsidy payments, if any, reflect a Cost to the health system and either Revenue or Cost Savings to the ACO.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

9. A Health System may use proceeds from Operating Margin to fund Market Growth Investment to grow market share.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
10. A Health System's cost structure includes the Cost of Care Delivery, Personnel Costs, and Non-Personnel Operating Costs.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

11. Contract negotiations with health insurers will result in Health System Reimbursement Agreements affecting ACO Value-Based Agreements, and vice-versa.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

12. More favorable terms in Health System Reimbursement Agreements with health insurers will result in more stringent performance criteria in associated ACO Value-Based Agreements.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
13. **More favorable terms** in ACO Value-Based Agreements with health insurers will result in **reduced reimbursement rates** in associated Health System Reimbursement Agreements.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

14. As Health System Staffing Ratios **increase** (more staff per patient), Health System Personnel Costs **increase**.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

15. As Health System Staffing Ratios **decrease** (fewer staff per patient), Health System Patient Satisfaction Scores **decrease**.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
16. As Health System Patient Satisfaction Scores **decrease**, ACO Quality Metric Performance **increase**.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

17. As Health System Emergency Department Patient Volumes **increase**, Health System Patient Satisfaction Scores **decrease**.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

18. ACO Shared Savings contributes to at least some extent to the Total Revenue of an associated Health System.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
19. **Increased** Health System Inpatient Volumes contribute to **increased** Emergency Department Volumes as a result of readmissions.

   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

20. In general, **increasing** ACO Utilization Management Personnel **decreases** ACO Utilization Management Effectiveness.

   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

21. **Increases** in Health System Inpatient Care Volumes (market share) **increase** Population Health Management Costs for an affiliated ACO.

   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
22. ACO efforts to shift care from the inpatient setting to the outpatient or ambulatory setting **increase** the revenue of an affiliated health system.
   
   a. Strongly disagree.
   
   b. Moderately disagree.
   
   c. Neither agree nor disagree.
   
   d. Moderately agree.
   
   e. Strongly agree.

23. ACO efforts to shift care from the inpatient setting to the outpatient or ambulatory setting **decrease** the operating costs of an affiliated health system.
   
   a. Strongly disagree.
   
   b. Moderately disagree.
   
   c. Neither agree nor disagree.
   
   d. Moderately agree.
   
   e. Strongly agree.

24. Each percentage point improvement in ACO Utilization Management Efficiency has a proportional percentage impact on Health System Patient Volumes and associated Claims Revenue.
   
   a. Strongly disagree.
   
   b. Moderately disagree.
   
   c. Neither agree nor disagree.
   
   d. Moderately agree.
   
   e. Strongly agree.
25. Changes to ACO population health management policies impact the operating costs of an affiliated health system.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

26. Changes to ACO population health management policies impact the revenue of an affiliated health system.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.

27. An increase in ACO affiliated lives (increased ACO market share) must decrease the revenue of an affiliated health system.
   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
28. Changes in health system operating margin are always **directly proportional** to the percentage of inpatient volume subject to ACO population health management (i.e., health system margin is a **linear function** of ACO population health management volume).

   a. Strongly disagree.
   
   b. Moderately disagree.
   
   c. Neither agree nor disagree.
   
   d. Moderately agree.
   
   e. Strongly agree.

29. If an insurance payer (Commercial, Medicare FFS, Medicare Advantage, Medicaid, etc.) pays a quality performance incentive to an ACO, the ACO’s affiliated Health System must lose money on patients covered by that payer.

   a. Strongly disagree.
   
   b. Moderately disagree.
   
   c. Neither agree nor disagree.
   
   d. Moderately agree.
   
   e. Strongly agree.

30. A marginal **increase** in Health System inpatient volumes always causes **predictable, linear (proportional) changes** in affiliated ACO operating margin.

   a. Strongly disagree.
   
   b. Moderately disagree.
   
   c. Neither agree nor disagree.
   
   d. Moderately agree.
   
   e. Strongly agree.
31. A marginal increase in ACO efforts to avert health system inpatient stays always causes predictable, linear (proportional) changes in affiliated Health System operating margin.

   a. Strongly disagree.
   b. Moderately disagree.
   c. Neither agree nor disagree.
   d. Moderately agree.
   e. Strongly agree.
### Appendix C: Codebook with Primary Codes and Code Categories

<table>
<thead>
<tr>
<th>Code Hierarchy</th>
<th>Code #</th>
<th>Category Description</th>
<th>Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td></td>
<td>ACO Levers affecting health system</td>
<td></td>
</tr>
<tr>
<td>Subcategory - Level 2</td>
<td>ACO volume levers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>1.</td>
<td>ACO - Alignment with Other Health Systems</td>
<td>The ACO may direct care to non-partner health systems.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>ACO - Utilization Management</td>
<td>The ACO manages the location and length of stay of care.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>ACO - Referral Management</td>
<td>The ACO manages referrals to reduce total cost of care.</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>ACO - Network Leakage</td>
<td>Care managed by the ACO that occurs outside the ACO-participating network.</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>ACO - Health System Patient Share</td>
<td>The ACO can affect the share of the ill population that uses the partner health system.</td>
</tr>
<tr>
<td></td>
<td>6.</td>
<td>ACO - Emergency Department Utilization Management</td>
<td>The ACO attempts to reduce emergency department visits by increasing primary care utilization.</td>
</tr>
<tr>
<td></td>
<td>7.</td>
<td>ACO - Demand Destruction</td>
<td>ACO activities that reduce the demand for partner health system services.</td>
</tr>
<tr>
<td>Subcategory - Level 2</td>
<td>ACO cost levers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>8.</td>
<td>ACO - Health System Inpatient LOS</td>
<td>ACO utilization management may affect health system inpatient length of stay.</td>
</tr>
<tr>
<td></td>
<td>9.</td>
<td>ACO - New Initiatives</td>
<td>New care or quality management initiatives may impact health system revenue, cost, or quality.</td>
</tr>
<tr>
<td></td>
<td>10.</td>
<td>ACO - Site of Service</td>
<td>ACO influence on the site of care delivery impacts health system revenue and cost.</td>
</tr>
<tr>
<td></td>
<td>11.</td>
<td>ACO - Staff Composition</td>
<td>Adding utilization management staff impacts health system utilization.</td>
</tr>
<tr>
<td>Subcategory - Level 2</td>
<td>ACO revenue levers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>12.</td>
<td>ACO - Cost of Care Reduction</td>
<td>ACO efforts to reduce total cost of care may impact health system revenue.</td>
</tr>
<tr>
<td></td>
<td>13.</td>
<td>ACO - Health System Reimbursement</td>
<td>ACO utilization management, by affecting health system</td>
</tr>
<tr>
<td>Code Hierarchy</td>
<td>Code #</td>
<td>Category Description</td>
<td>Code Description</td>
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</tr>
<tr>
<td>14.</td>
<td>ACO - Shared Savings</td>
<td>A health system may receive a portion of ACO shared savings.</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>ACO - Risk Adjustment</td>
<td>Risk adjustment of ACO attributed patients affects ACO shared savings and health system revenue.</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>ACO - Medication Management</td>
<td>ACO medication management impacts a substantial portion of the total cost of care.</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>ACO - Growth Plan</td>
<td>ACO efforts to grow the number of attributed patients puts more of the health system's patients under ACO management.</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>ACO - Medical Record Coding</td>
<td>ACO medical record coding determines attributed patient risk scores.</td>
<td></td>
</tr>
<tr>
<td><strong>Subcategory - Level 2</strong></td>
<td><strong>ACO quality levers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>19. ACO - Care Coordination</td>
<td>Improved ACO care coordination improves ACO quality scores, potentially at the expense of health system utilization.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20. ACO - Quality Metrics</td>
<td>ACO achievement of value-based quality metrics may affect health system utilization and quality metrics.</td>
<td></td>
</tr>
<tr>
<td><strong>Subcategory - Level 2</strong></td>
<td><strong>ACO contract negotiation levers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>21. ACO - Contracting - Payers</td>
<td>ACO value-based contracts may result in impacts to health system fee-for-service contracts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22. ACO - Contracting - Physician Groups</td>
<td>The ACO maintains the network of contracted physicians that provide in-network services to health system patients.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23. ACO - Payer Mix</td>
<td>By contracting with payers to manage total cost of care, the ACO can affect the reimbursement rates of the health system.</td>
<td></td>
</tr>
<tr>
<td><strong>Subcategory - Level 2</strong></td>
<td><strong>ACO business strategy levers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>24. ACO - Strategy</td>
<td>ACO strategies to achieve quality and reimbursement goals</td>
<td></td>
</tr>
<tr>
<td>Code Hierarchy</td>
<td>Code #</td>
<td>Category Description</td>
<td>Code Description</td>
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<tr>
<td>Category 2</td>
<td></td>
<td>ACO operating structure</td>
<td>may conflict with health system strategies.</td>
</tr>
<tr>
<td>Subcategory - Level 2</td>
<td></td>
<td>ACO finance operations</td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>25.</td>
<td>ACO - Finance</td>
<td>Oversees the ACO's financial performance, including the ACO, health system, and physician portions of shared savings.</td>
</tr>
<tr>
<td></td>
<td>26.</td>
<td>ACO - Payer Contracting</td>
<td>Negotiates value-based contracts, including total cost of care budget and shared savings terms.</td>
</tr>
<tr>
<td></td>
<td>27.</td>
<td>ACO - Funding</td>
<td>Sources of ACO financial support.</td>
</tr>
<tr>
<td></td>
<td>28.</td>
<td>ACO - Startup Subsidy</td>
<td>The ACO may receive startup funding from the partner health system.</td>
</tr>
<tr>
<td></td>
<td>29.</td>
<td>ACO - Other Subsidies</td>
<td>The ACO may receive funding from the partner health system to support operations.</td>
</tr>
<tr>
<td></td>
<td>30.</td>
<td>ACO - Startup Subsidy Repayment</td>
<td>The ACO may be required to repay all or a portion of startup subsidies to the partner health system.</td>
</tr>
<tr>
<td>Subcategory - Level 2</td>
<td></td>
<td>ACO finance operations</td>
<td></td>
</tr>
<tr>
<td>Subcategory - Level 3</td>
<td></td>
<td>ACO shared savings</td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>31.</td>
<td>ACO - ACO Shared Savings</td>
<td>The ACO's portion of ACO shared savings.</td>
</tr>
<tr>
<td></td>
<td>32.</td>
<td>ACO - Hospital Shared Savings</td>
<td>The partner health system's portion of ACO shared savings.</td>
</tr>
<tr>
<td></td>
<td>33.</td>
<td>ACO - Physician Group Shared Savings</td>
<td>The ACO participating physicians' portion of ACO shared savings.</td>
</tr>
<tr>
<td>Subcategory - Level 2</td>
<td></td>
<td>ACO risk management operations</td>
<td></td>
</tr>
<tr>
<td>Primary Code</td>
<td>34.</td>
<td>ACO - Cost Savings</td>
<td>Activities to reduce the total cost of care as measured under ACO payer contracts.</td>
</tr>
<tr>
<td></td>
<td>35.</td>
<td>ACO - Medical Record Coding</td>
<td>Activities to determine complete and accurate medical record diagnosis and procedure coding for risk adjustment.</td>
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<td>ACO - Risk Scoring (RAF)</td>
<td>Activities to ensure that ACO attributed patients are accurately</td>
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<td>scored for health risk and maximum reimbursement.</td>
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<td>37</td>
<td>ACO - Quality Management</td>
<td>Activities to achieve quality metric targets put forth under value-based care contracts.</td>
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<td>38</td>
<td>ACO - Data Analytics</td>
<td>Activities to support the analysis of ACO performance to enable the achievement of cost and quality incentive targets.</td>
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<td>ACO risk management operations</td>
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<td>ACO - Care Coordination</td>
<td>Activities to ensure patients receive the right care in the right clinical setting at the right time to improve outcomes and reduce cost.</td>
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<td>ACO - Utilization Management</td>
<td>Activities to ensure that only medically necessary services are delivered and in the most appropriate setting.</td>
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<td>ACO Network Leakage Rate to Health System Total Patient Volume</td>
<td>Indicates that ACO Network Leakage Rate causes changes in Health System Total Patient Volume</td>
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<td>ACO Network Leakage Rate to ACO Care Cost Savings</td>
<td>Indicates that ACO Network Leakage Rate causes changes in ACO Care Cost Savings</td>
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<td>ACO Network Leakage Rate to Health System Total Revenue</td>
<td>Indicates that ACO Network Leakage Rate causes changes in Health System Total Revenue</td>
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<td>ACO Network Leakage Rate to ACO Utilization Management Effectiveness</td>
<td>Indicates that ACO Network Leakage Rate causes changes in ACO Utilization Management Effectiveness</td>
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<td>ACO Payer Value-Based Budget to ACO Total Revenue</td>
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<td>ACO Payer Value-Based Budget to Health System Payer FFS Payment Rate</td>
<td>Indicates that ACO Payer Value-Based Budget causes changes in Health System Payer FFS Payment Rate</td>
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<td>ACO Utilization Management Effectiveness to ACO Quality Metric Performance</td>
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<td>ACO Utilization Management Effectiveness to Health System Ancillary Svc Volume</td>
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<td>ACO Utilization Management Effectiveness to Health System Claim Denials</td>
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<td>ACO Utilization Management Effectiveness to Health System Emergency Department Volume</td>
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<td>System Personnel Operating Costs</td>
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<td>ACO Utilization Management Effectiveness to Health System Patient Acuity Mix</td>
<td>Indicates that ACO Utilization Management Effectiveness causes changes in Health System Patient Acuity Mix</td>
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<td>ACO Utilization Management Effectiveness to Health System Cost of Care Delivery</td>
<td>Indicates that ACO Utilization Management Effectiveness causes changes in Health System Cost of Care Delivery</td>
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<td>ACO Utilization Management Effectiveness to ACO Care Cost Savings</td>
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<td>ACO Utilization Management Effectiveness to Primary Care Patient Volume</td>
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<td>ACO Utilization Management Effectiveness to ACO Utilization Management Personnel Cost</td>
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<td>ACO Utilization Management Effectiveness to Health System Non-Personnel Operating Costs</td>
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<td>ACO New Initiatives to ACO Shared Savings</td>
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<td>ACO Utilization Management Personnel Cost to ACO Utilization Management Effectiveness</td>
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<td>Health System Inpatient Volume to ACO Care Cost Savings</td>
<td>Indicates that Health System Inpatient Volume causes changes in ACO Care Cost Savings</td>
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<td>Health System Emergency Room Volume to Health System Inpatient Volume</td>
<td>Indicates that Health System Emergency Room Volume causes changes in Health System Inpatient Volume</td>
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<td>Health System Emergency Room Volume to Health System Patient Satisfaction</td>
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<td>Health System Inpatient Volume to Health System Cost of Care Delivery</td>
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<td>Health System Inpatient Volume to Health System Payer FFS Payment Rate</td>
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<td>Health System Ancillary Service Volume to Health System Market Growth Investment</td>
<td>Indicates that Health System Ancillary Service Volume causes changes in Health System Market Growth Investment</td>
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<td>Health System Inpatient Volume to Health System Ancillary Service Volume</td>
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<td>Health System Emergency Room Volume to ACO Utilization Management Effectiveness</td>
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<td>Indicates that Health System Payer FFS Payment Rate causes changes in ACO Payer Value-Based Budget</td>
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<td>Health System Payer FFS Payment Rate to Health System Claims Revenue</td>
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<td>Health System Readmission Rate to Health System Emergency Department Volume</td>
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<td>Health System Total Revenue to ACO Care Cost Savings</td>
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<td>Health System Total Revenue to ACO Utilization Management Effectiveness</td>
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<td>Health System Staffing Ratio to ACO Network Leakage</td>
<td>Indicates that Health System Staffing Ratio causes changes in ACO Network Leakage</td>
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<td>Health System Staffing Ratio to Health System Cost of Care Delivery</td>
<td>Indicates that Health System Staffing Ratio causes changes in Health System Cost of Care Delivery</td>
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<td>Health System Staffing Ratio to Health System Patient Satisfaction</td>
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<td>Payer Cost Savings to ACO Shared Savings</td>
<td>Indicates that Payer Cost Savings causes changes in ACO Shared Savings</td>
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<td>Payer Cost Savings to Health System Market Share</td>
<td>Indicates that Payer Cost Savings causes changes in Health System Market Share</td>
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<td>Indicator of whether the subject has roles in both a health system and an ACO.</td>
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<td>The health system determines the cost of care for patients attributed to the ACO.</td>
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<td>The growth of health system market share affects the total cost of care managed by the ACO.</td>
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<td>The addition or deletion of health system patients affects the</td>
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<td>The addition or deletion of health system patients affects the total cost of care managed by the ACO.</td>
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<td>The addition or deletion of health system services affects the total cost of care managed by the ACO.</td>
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<td>The cost of pharmacy services provided to health system patients affects the total cost of care managed by the ACO.</td>
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<td>Health System revenue received from health insurers affects the total cost of care managed by the ACO.</td>
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<td>Health System - Financial Performance - Margin</td>
<td>Health system margin affects the health system's ability to subsidize the ACO.</td>
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<td>Health System - Financial Decisions</td>
<td>The health system makes decisions that impact its financial performance, potentially affecting ACO funding or total cost of care.</td>
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<td>Health System - Patient Throughput</td>
<td>Health system patient volumes at least partially determine the total cost of care managed by the ACO.</td>
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<td>Health System - Post-Acute Care Partners</td>
<td>The health system's choice of post-acute partners, e.g., SNFs, affects the total cost of care managed by the ACO.</td>
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<td>Differences in the health system's reimbursement based on the site of service affects the total cost of care managed by the ACO.</td>
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<td>Health System - Staff Composition</td>
<td>The health system's decisions regarding staff skill set mix determines its ability to provide care and the total cost of care managed by the ACO.</td>
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<td>The health system controls patient length of stay, with implications for ACO total cost of care and quality incentives.</td>
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<td>The health system's strategy to create, maintain, and provide access to robust EHR data affects the ACOs ability to provide population health management.</td>
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<td>The health system's strategic decisions regarding internal operations, service offerings, access, and growth all affect the total cost of care managed by the ACO.</td>
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<td>Health system operating structure</td>
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<td>The health system's allocation of a portion of health system operating margin to provide financial support to its partner ACO.</td>
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<td>Health System - ACO Shared Savings</td>
<td>The terms by which the partner ACO returns a portion of shared savings to the health system as revenue.</td>
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<td>Health System - ACO Subsidies</td>
<td>The health system's activities to provide shared services to its partner ACO to reduce ACO operating costs.</td>
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<td>Health System - ACO Startup Subsidy</td>
<td>The health system's activities to fund the start-up of a partner ACO, and repayment terms.</td>
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<td>Health System - ACO Startup Subsidy Repayment</td>
<td>The contractual terms by which a partner ACO repays startup subsidies to the health system.</td>
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<td><strong>135. Health System - Cost Structure</strong></td>
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<td>All factors that contribute to the operating costs of the health system, which affect the total cost of care managed by the ACO.</td>
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<td>Patient volumes seen in the health system emergency department, which contributes to the total cost of care managed by the ACO.</td>
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<td>Patient volumes seen in the health system inpatient setting, which contributes to the total cost of care managed by the ACO.</td>
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<td><strong>Health System - Telehealth Visits</strong></td>
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<td>Patient volumes seen in via health system telehealth services, which averts inpatient or ED care and contributes to the total cost of care managed by the ACO.</td>
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<td>Market competition affects health system patient volumes and ACO attributed membership volume.</td>
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<td>Examples of nonlinear health system behaviors believed to be caused by ACO actions.</td>
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<td>The interviewee identifies as an ACO employee.</td>
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<td>The interviewee identifies as a health system employee.</td>
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<td>The interviewee identifies as participating in an ACO that is a</td>
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<td>Venture with Physician</td>
<td>joint venture between a health system and a physician group.</td>
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<td>Partnership Models -</td>
<td>The interviewee identifies as participating in an ACO that is wholly owned by a</td>
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<td>Functions controlled by a health insurer that impact the performance of a health</td>
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<td>system or an ACO.</td>
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<td>Physician Group - Patient</td>
<td>The quality of care delivered by physician groups determines patient satisfaction,</td>
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<td>which affects ACO quality incentive performance.</td>
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<td>Physician Group - Medical</td>
<td>The accuracy of physician group medical record coding determines the risk</td>
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<td>Record Coding</td>
<td>adjustment, and revenue, for ACO attributed members.</td>
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<td>Physician Group - Patient</td>
<td>Barriers to timely access of ambulatory services leads to network leakage and</td>
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<td>higher total cost of care for the ACO.</td>
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<td>Physician Group - Quality</td>
<td>Physician group efforts to improve the quality of care impact the ACO's ability</td>
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<td>Physician Group -</td>
<td>Physician group revenue received from health insurers affects the total cost of</td>
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<td>The terms by which the partner ACO returns a portion of shared savings to</td>
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<td>Use of Dynamics Models</td>
<td>Explores whether health systems or ACOs use dynamic modeling methods.</td>
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<td>Explores the limitations associated with using traditional, linear modeling tools and methods to project health system or ACO performance.</td>
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<td>Documentation of interviewees' support for the future use of dynamic modeling methods.</td>
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### Appendix D: Feedback Loop Component Detail

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**Parameter 1**
- Health System Payer FFS Payment Rate
- ACO Care Cost Savings
- ACO Utilization Management Effectiveness
- ACO Utilization Management Effectiveness
- ACO Utilization Management Effectiveness
- Health System Utilization Management Effectiveness

**Parameter 2**
- ACO Payer Value-Based Budget
- ACO Shared Savings
- ACO Quality Metric Performance
- Health System Claim Denial Rate
- Health System Emergency Department Volume

**Parameter 3**
- Health System Payer FFS Payment Rate
- Health System Total Revenue
- ACO Shared Savings
- Health System Claims Revenue
- Health System Patient Satisfaction

**Parameter 4**
- ACO Care Cost Savings
- Health System Total Revenue
- Health System Total Revenue
- ACO Quality Metric Performance

**Parameter 5**
- ACO Utilization Management Effectiveness
- ACO Utilization Management Effectiveness
- ACO Shared Savings

**Parameter 6**
- Health System Total Revenue

**Parameter 7**
- ACO Utilization Management Effectiveness
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## Appendix E: Descriptive Statistics for Triangulation Survey Responses

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<td>The actions of a health system impact the financial performance of an ACO, and vice-versa.</td>
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<td>ACO Utilization Management Effectiveness at least partially determines Health System Patient Volumes.</td>
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<td>Health System Staffing Ratios affect ACO Network Leakage.</td>
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<td>If Health System Total Patient Revenue increases, then ACO Cost of Care Savings decreases.</td>
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<td>A Health System's ACO subsidy payments, if any, reflect a Cost to the health system and either Revenue or Cost Savings to the ACO.</td>
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<td>A Health System may use proceeds from Operating Margin to fund Market Growth Investment to grow market share.</td>
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<td>Contract negotiations with health insurers will result in Health System Reimbursement Agreements affecting ACO Value-Based Agreements, and vice-versa.</td>
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<td>ACO Shared Savings contributes to at least some extent to the Total Revenue of an associated Health System.</td>
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<td>In general, increasing ACO Utilization Management Personnel decreases ACO Utilization Management Effectiveness.</td>
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<td>Increases in Health System Inpatient Care Volumes (market share) increase Population Health Management Costs for an affiliated ACO.</td>
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<td>If an insurance payer (Commercial, Medicare FFS, Medicare Advantage, Medicaid, etc.) pays a quality performance incentive to an ACO, the ACO’s affiliated Health System must lose money on patients covered by that payer.</td>
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Appendix F: Computation of Cronbach’s alpha

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**Cronbach’s alpha =** \[1-(\text{MS Error/MS Rows})\] = 0.73
Appendix G: Computation of Intraclass Correlation Coefficient (ICC)

Anova:
Two-Factor Without Replication

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### ANOVA

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**Intraclass Correlation Coefficient = 0.50**

### ICC Calculation Detail:

Numeratort = MS Rows – MS Error

\[ A = \text{MS Rows} \]

\[ B = \text{df Columns} \times \text{MS Error} \]

\[ C = (\text{df Columns} + 1) \]

\[ D = (\text{MS Columns} - \text{MS Error}) \]

\[ E = (\text{df Rows} + 1) \]

Denominator = \( (A + B + C \times D/E) \)

\[ \text{ICC} = \frac{\text{Numerator}}{\text{Denominator}} \]
## Appendix H: Computation of Fleiss’ Kappa

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<td>5</td>
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<tr>
<td>Q3</td>
<td>2</td>
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<td>1</td>
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<tr>
<td>Q31</td>
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Fleiss’ Kappa Calculation Detail:

Numerator = (Vertical Sum/31 – Horizontal Sum)

Denominator = (1 – Horizontal Sum)

Where,

Horizontal Sum = \sum_{i=1}^{5} (\text{Sum} / (10 \ast 31))^2

Sum = Total Responses Per Question

Sum/(10*31) = Sum / (N Respondents * N Questions)

Vertical Sum/31 = Vertical Sum / N Questions

Vertical Sum = \sum_{i=1}^{31} \text{Sum Sq C} / (10 \ast 9)

Sum Sq C = \sum_{i=1}^{5} (Number of Responses Column² – Number of Responses Column)

Sum Sq C/(10*9) = Sum Sq C / (N Respondents * N-1 Respondents)

Fleiss’ Kappa = Numerator / Denominator
### Appendix I: Summary of Stratified Survey Responses

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Question</th>
<th>Health System Question Mean</th>
<th>ACO Question Mean</th>
<th>Statistical Significance p(T&lt;=t) two-tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>The actions of a health system impact the financial performance of an ACO, and vice-versa.</td>
<td>1.5</td>
<td>1.2</td>
<td>0.35</td>
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<tr>
<td>Q2</td>
<td>ACO Utilization Management Effectiveness at least partially determines Health System Patient Volumes.</td>
<td>2.0</td>
<td>2.2</td>
<td>0.75</td>
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<td>Q3</td>
<td>Changes in Health System Patient Volume at least partially reflect ACO Utilization Management Effectiveness.</td>
<td>2.8</td>
<td>1.6</td>
<td>0.01</td>
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<td>Q4</td>
<td>ACO Utilization Management Effectiveness at least partially determines ACO Shared Savings.</td>
<td>2.2</td>
<td>1.4</td>
<td>0.03</td>
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<td>Q5</td>
<td>Health System Staffing Ratios affect ACO Network Leakage.</td>
<td>2.5</td>
<td>2.8</td>
<td>0.68</td>
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<td>Q6</td>
<td>If Health System Total Patient Revenue increases, then ACO Cost of Care Savings decreases.</td>
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<td>3.0</td>
<td>0.49</td>
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<td>Q7</td>
<td>An increase in Health System Market Share will increase ACO Total Claims Costs.</td>
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<td>3.4</td>
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<tr>
<td>Q8</td>
<td>A Health System's ACO subsidy payments, if any, reflect a Cost to the health system and either Revenue or Cost Savings to the ACO.</td>
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<td>3.0</td>
<td>0.45</td>
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<td>Q9</td>
<td>A Health System may use proceeds from Operating Margin to fund Market Growth Investment to grow market share.</td>
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<td>2.0</td>
<td>1.00</td>
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<td>Q10</td>
<td>A Health System's cost structure includes the Cost of Care Delivery, Personnel Costs, and Non-Personnel Operating Costs.</td>
<td>1.7</td>
<td>1.6</td>
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<td>Contract negotiations with health insurers will result in Health System Reimbursement Agreements affecting ACO Value-Based Agreements, and vice-versa.</td>
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<tr>
<td>Q12</td>
<td>More favorable terms in Health System Reimbursement Agreements with health insurers will result in more stringent performance criteria in associated ACO Value-Based Agreements.</td>
<td>2.8</td>
<td>3.0</td>
<td>0.76</td>
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<tr>
<td>Q12</td>
<td>More favorable terms in Health System Reimbursement Agreements with health insurers will result in more stringent performance criteria in associated ACO Value-Based Agreements.</td>
<td>2.8</td>
<td>3.0</td>
<td>0.76</td>
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<td>Q13</td>
<td>More favorable terms in ACO Value-Based Agreements with health insurers will result in reduced reimbursement rates in associated Health System Reimbursement Agreements.</td>
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<td>3.4</td>
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<td>Q14</td>
<td>As Health System Staffing Ratios increase (more staff per patient), Health System Personnel Costs increase.</td>
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<td>Q15</td>
<td>As Health System Staffing Ratios decrease (fewer staff per patient), Health System Patient Satisfaction Scores decrease.</td>
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<td>Q16</td>
<td>As Health System Patient Satisfaction Scores decrease, ACO Quality Metric Performance increase.</td>
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<td>4.2</td>
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<td>Q17</td>
<td>As Health System Emergency Department Patient Volumes increase, Health System Patient Satisfaction Scores decrease.</td>
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<td>Q18</td>
<td>ACO Shared Savings contributes to at least some extent to the Total Revenue of an associated Health System.</td>
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<td>1.8</td>
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<td>Q19</td>
<td>Increased Health System Inpatient Volumes contribute to increased Emergency Department Volumes as a result of readmissions.</td>
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<td>In general, increasing ACO Utilization Management Personnel decreases ACO Utilization Management Effectiveness.</td>
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<td>------------------</td>
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<td>Increases in Health System Inpatient Care Volumes (market share) increase Population Health Management Costs for an affiliated ACO.</td>
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<td>3.0</td>
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<td>ACO efforts to shift care from the inpatient setting to the outpatient or ambulatory setting increase the revenue of an affiliated health system.</td>
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<td>3.4</td>
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<td>ACO efforts to shift care from the inpatient setting to the outpatient or ambulatory setting decrease the operating costs of an affiliated health system.</td>
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<td>Q24</td>
<td>Each percentage point improvement in ACO Utilization Management Efficiency has a proportional percentage impact on Health System Patient Volumes and associated Claims Revenue.</td>
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<td>2.6</td>
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<td>Changes to ACO population health management policies impact the operating costs of an affiliated health system.</td>
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<td>Changes to ACO population health management policies impact the revenue of an affiliated health system.</td>
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<td>3.2</td>
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<td>An increase in ACO affiliated lives (increased ACO market share) must decrease the revenue of an affiliated health system.</td>
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<td>Q28</td>
<td>Changes in health system operating margin are always directly proportional to the percentage of inpatient volume subject to ACO population health management (i.e., health system margin is a linear function of ACO population health management volume).</td>
<td>3.8</td>
<td>3.8</td>
<td>0.95</td>
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<td>If an insurance payer (Commercial, Medicare FFS, Medicare Advantage, Medicaid, etc.) pays a quality performance incentive to an ACO, the ACO’s affiliated Health System must lose money on patients covered by that payer.</td>
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<td>ACO Question Mean</td>
<td>Statistical Significance p(T&lt;=t) two-tail</td>
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<td>---------------------------------------------------------------------------</td>
<td>----------------------------</td>
<td>------------------</td>
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<td>Q30</td>
<td>A marginal increase in Health System inpatient volumes always causes predictable, linear (proportional) changes in affiliated ACO operating margin.</td>
<td>4.5</td>
<td>3.4</td>
<td>0.03</td>
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<td>A marginal increase in ACO efforts to avert health system inpatient stays always causes predictable, linear (proportional) changes in affiliated Health System operating margin.</td>
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Appendix J: Tree Diagrams Illustrating Theme Development

Theme 1 Tree Diagram

- **Subtheme 1A**
  - Health Systems and ACOs Do Not Use Dynamic Models
  - **Category 4**
    - Executive Characteristics
  - **Category 8**
    - Evidence of Nonlinearity
  - **Category 13**
    - Historical Approaches to Simulation Modeling
  - **Code 98**
    - Executive Accountability
  - **Code 100**
    - Executive Role
  - **Code 141**
    - ACO Nonlinear Impact on Health System
  - **Code 142**
    - Health System Nonlinear Impact on ACO
  - **Code 155**
    - Use of Dynamic Models

- **Subtheme 1B**
  - Excel Spreadsheets and Linear Models are the Norms
  - **Category 4**
    - Executive Characteristics
  - **Category 13**
    - Historical Approaches to Simulation Modeling
  - **Code 98**
    - Executive Accountability
  - **Code 100**
    - Executive Role
  - **Code 159**
    - Use of Traditional Finance Models

- **Subtheme 1C**
  - Executives Support the Introduction of Dynamic Models
  - **Category 4**
    - Executive Characteristics
  - **Category 8**
    - Evidence of Nonlinearity
  - **Category 13**
    - Historical Approaches to Simulation Modeling
  - **Code 98**
    - Executive Accountability
  - **Code 100**
    - Executive Role
  - **Code 141**
    - ACO Nonlinear Impact on Health System
  - **Code 142**
    - Health System Nonlinear Impact on ACO
  - **Code 157**
    - Dynamic Models Support
Theme 3 Tree Diagram

Theme 3
Connecting Causal Links
Confirms Causal Loops in Health System / ACO Partnerships

Category 3
Causal Links

Subcategory
ACO-Driven Linkages
Coded 41-60

Subcategory
Health System-Driven Linkages
Coded 70-95

Analysis:
Identify causal links containing shared parameters

Result:
Formation of 21 closed causal loops

Analysis:
Connect causal links containing shared parameters
Theme 4 Tree Diagram

Intermediate Result: Identification of 57 causal links

Theme 2
Healthcare Executives Can Identify Health System / ACO Interactions

Intermediate Result: Formation of 21 closed causal loops

Theme 3
Connecting Causal Links Confirms Causal Loops In Health System / ACO Partnerships

Result:
Label resulting feedback loops as reinforcing or balancing

Analysis:
Determine the polarities of closed causal loops

Theme 4A
Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes

Analysis:
Apply theory of feedback loops to results
(Morecroft, 2015; J. Sterman, 2000)
Theme 5 Tree Diagram

Theme 5
Accurate Simulation of Interactions Between Health Systems and ACOs Requires Dynamic System Models

Result:
Dynamic system models are necessary to simulate the nonlinear behaviors resulting from health system / ACO interactions

Theme 4
Feedback Loops Linking Health System and ACO Functions Exist

Theme 4A
Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes

Literature Review:
Complex systems exhibit feedback loops and nonlinear behaviors (Morecroft, 2015; J. Sterman, 2000)

Literature Review:

Literature Review:

Literature Review:
System dynamics modeling is the most appropriate technique for modeling macro behaviors in complex systems (Cassidy et al., 2019; Marshall, Burgos-Liz, Ijzerman, Crown, et al., 2015)
## Appendix K: Representative Comments Supporting Theme Development

<table>
<thead>
<tr>
<th>Theme #</th>
<th>Theme</th>
<th>Representative Supporting Comments</th>
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</table>
| 1       | Dynamic Simulation Models Are Not Common in Health Systems or ACOs. | "What I mean, we don't [use dynamic simulation models], so…"
|         |       | "Well, no, I feel like we don’t have [dynamic simulation] models in place."
|         |       | "So, we really don't, we really don't today. We do some modeling around our performance and our benchmark and how we're doing related to that benchmark. But we don't we really don't bring it down to how any specific ACO initiatives are then translating into loss of services on the hospital side." |
| 1A      | Health Systems and ACOs Do Not Use Dynamic Models Capable of Modeling Nonlinearity. | "Yeah, you know, I'm, I mean, I'm having a hard time with that linearity, nonlinearity thing. But I mean, I think the variables, there's so many sort of independent and dependent variables. And I wouldn't even, I wouldn't even know how to begin to map those out."
|         |       | "[A]nd that part of the [modeling] complexity is that some of these factors are much heavier, much more influential than others. So, there's a weighting." |
|         |       | "We don't [attempt to model interactions or nonlinearity]. Okay, yeah, we really don't. Our financial decisions are made….I know that the hospital when they make financial decisions or strategic decisions, they do consider the ACO [but not through interactions]. But I don't think anything we [the ACO] do does." |
| 1B      | Excel Spreadsheets and Traditional Linear Finance Approaches are the Norms. | "I did build a pretty detailed financial model [in Excel®] that could toggle in lots of different areas, depending on the variables like, you know, what amount were we able to negotiate in a particular contract? How is attribution under those plans actually going to flesh out? You know, we, we had a staffing model that was built based on what we believe the needs were going to be there, there are certain clinical staff members that you must have in that model."
<p>|         |       | &quot;Yeah, it absolutely is [done in Excel®]. You have our traditional contracting people who are trying to say the value of that on a fee for service basis, straight math, but the actuarial components come in where you're trying to predict what the trend is likely to be. They are more done on an Excel spreadsheet of…codes and what the reimbursement is.&quot; |
|         |       | &quot;If you look at most hospital budget models, you know, they're revenue driven. What's our admits gonna be? And then somebody in Finance is sitting there saying, 'Well, you know what's going on with our ACO, the admits seem to be falling.' So, then somebody's got to take into account that they are. Often they don't, but sometimes they do.&quot; |</p>
<table>
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<th>Theme #</th>
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<th>Representative Supporting Comments</th>
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<tbody>
<tr>
<td>1C</td>
<td>Executives Support the Introduction of Dynamic Models Once Aware of Nonlinearity.</td>
<td>&quot;I do, I think that where there's some real value from a model, like what you've described, would be in the…going back to sort of my vision, which is the ACO is not a standalone thing, but it's really who we are and what we do and how we deliver care. And so, I think that where a model like you're describing could be really valuable is in driving, helping to drive those discussions. So that as you line up on stuff, you can model the impact on both entities, right? And what, what, what both entities can expect to be the pluses and where they can expect there to be some minuses? And then how do we work through those minuses? So that's where I see it as extremely helpful, is that it could be really utilized to further drive and create that alignment.&quot; &quot;And I think this model to me is really more thorough…and it's to support the transition, right? Because if you really believe that your goal is to not provide care that patients don't need, and to make sure that you do provide the care that they do need, and the ACO is working to do that, and you find that that negatively impacts your facility side or some other port of your system, then that suggests that that need is not there for that. Right? And that [in] trying to protect that, you're really not serving the best interests of the patient.&quot; &quot;Yeah, there's so, many interactions. And the sort of connectivity between them. Right? You know, I would say, most of them, you know, there's some sort of feedback loop. Because it's, it's a partnership.&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Healthcare Executives Can Identify Health System / ACO Interactions.</td>
<td>&quot;If a health system’s making business decisions or strategic decisions that are not consistent with value-based initiatives that would be favorable to the ACO, then there's a negative impact on the ACO side.&quot; &quot;I think the decisions of the health plan impact the…they direct in the clinical domain, the utilization domain. The terms that are outlined [in reimbursement contracts] really impact you know, what the financial performance of the ACO.&quot; &quot;One component is understanding the impact on volumes. So while we overall know that we're decreasing, we want to overall decrease the total cost of care within the population that we're [ACO] managing, how you can find the win, win is by actually increasing volume to your own [health system] network, and capturing more of that total cost of care, while overall decreasing the total cost of care.&quot;</td>
</tr>
<tr>
<td>2A</td>
<td>System Thinking</td>
<td>&quot;I agree. Because the strategic decisions that we [the ACO] make do impact the finances of the hospital.&quot;</td>
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<td>Theme #</td>
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<tr>
<td>Promotes Discovery of Causal Links Among Executives Unfamiliar with System Dynamics Modeling Concepts.</td>
<td>&quot;The things that they [the health system] do to drive their volumes, and the probably the, the best example there is the ED utilization and what they do to drive ED utilization [increases total cost of care for the ACO].&quot;</td>
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<td>&quot;The things that the ACO can do to hurt the hospital are to destroy ER visits. Because, you know, 70 or 80% of the hospitals admits come through the ER and about 15% of the ER visits resulted in an admission.&quot;</td>
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<td>2B</td>
<td>ACO Operational Functions Affect Health Systems.</td>
<td>&quot;The ACO can do two or three things to help [health system financial performance]. The ACO can redirect leakage.&quot;</td>
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<td>&quot;I think the [ACO value-based] contract you know, the aggressiveness of the contract probably has is the biggest risk [for health system financial performance].&quot;</td>
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<td>&quot;So we're trying to improve quality and lower the cost of health care for our patients and in doing that we want to better coordinate care for our patients. [W]e want to make sure that we're getting their care in a timely manner that is not caught up with duplication of service, and so we want to reduce waste. So, we have the ability to impact utilization in the health system.&quot;</td>
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<tr>
<td>2C</td>
<td>Health System Operational Functions Affect ACOs.</td>
<td>&quot;I absolutely agree that it does. There are smaller examples, there are things that we do [health system services provided] on the fee-for-service side that raise the cost of claims and impact the margin of ACO and there's no question about it.&quot;</td>
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<td>&quot;And I think we're trying to do that at “Health System” when we look at the contract. We keep our fee for service contracts and value contracts together. So when we're doing actuarial analysis of how that contract is going to perform, we look at it from both a fee-for-service-perspective, as well as the value perspective.&quot;</td>
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<td>&quot;So in my mind, you know, access becomes the question of, do you do you even have enough providers, or when is your next first available appointment? Those types of things. Because that all ties into our ACO’s performance in multiple ways...because if you can't get in, you can't get seen in a timely fashion you're going to go down the street to “Health System A” or “Health System B”.”</td>
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<td>3</td>
<td>Connecting Causal Links Confirms Complete Causal Loops in Health System / ACO Partnerships.</td>
<td>Each these themes emerged from the analysis of the causal links identified in Theme 2. As reported in Theme 1, healthcare executive interviewees were unable to directly articulate causal loops, feedback loops, or possible sources of nonlinearity.</td>
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<td>4</td>
<td>Feedback Loops Linking Health System and ACO Functions Exist.</td>
<td>Without recognizing these concepts or the associated dynamic systems modeling techniques required for accurate simulation, interviewees were unable to directly comment on an appropriate choice of simulation tool or technique.</td>
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<tr>
<td>4A</td>
<td>Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes.</td>
<td>Therefore, themes 3, 4, 4A, and 5 emerged from inductive reasoning based on the analysis of findings associated with theme 2.</td>
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<td>5</td>
<td>Accurate Simulation of Interactions Between Health Systems and ACOs Requires Dynamic System Models.</td>
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Appendix L: Relationships of the Themes to the Research Questions

Research Question 1:
What do health system and ACO managers believe are the feedback loops that exist in a health system / ACO partnership model and that affect joint margin?

Theme 1
Dynamic Simulation Models Are Not Common in Health Systems or ACOs

Result:
A general lack of familiarity among healthcare executives of system feedback and its implications regarding nonlinear behavior.

Theme 1B
Excel Spreadsheets and Traditional Linear Finance Approaches are the Norms

Result:
Executives uniformly acknowledged that the effects that a partner health system or ACO might have on the executive’s organization were not a common consideration.

Theme 2
Healthcare Executives Can Identify Health System / ACO Interactions

Result:
While not able to identify feedback loops, healthcare executives were able to articulate points of interaction between health system and ACO functions (causal links).

Theme 4
Feedback Loops Linking Health System and ACO Functions Exist

Result:
By connecting causal links discussed by healthcare executives, the research demonstrated the feedback loops in health system / ACO partnerships, including those that impact financial performance.
Research Question 2: Which ACO strategic operational variable changes do health system and ACO leaders believe create nonlinear changes in health system or ACO margin?

Theme 1
Dynamic Simulation Models Are Not Common in Health Systems or ACOs

Result: Health system and ACO executives were unaware of feedback and nonlinearity and did not directly address sources on nonlinearity.

Theme 2
Healthcare Executives Can Identify Health System / ACO Interactions

Result: Healthcare executives were able to identify causal links in health system and ACO operations.

Theme 3
Connecting Causal Links Confirms Complete Causal Loops In Health System / ACO Partnerships

Result: The integration of causal links led to the identification of causal loops connecting health systems.

Theme 4
Feedback Loops Linking Health System and ACO Functions Exist

Result: The discovery of feedback loops connecting health systems and ACOs was new knowledge.

Theme 4A
Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes

Result: The discovery of feedback loops defined health system and ACO parameters associated with nonlinear effects.
Research Question 3:
What are the factors that health system and ACO managers would quantitatively model to reduce uncertainty about health system or ACO financial viability in a health system / ACO partnership model?

Theme 2
Healthcare Executives Can Identify Health System / ACO Interactions

Result:
Although healthcare executives did not consider the effects of interactions between health systems and ACOs, they identified operational links when discussing independently health system and ACO operations.

Theme 4
Feedback Loops Linking Health System and ACO Functions Exist

Result:
The discovery of feedback loops confirmed the presence of interactions affecting health systems' and ACOs' financial performances.

Theme 4A
Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes

Result:
The discovery of feedback loops confirmed that health system ACO partnerships must be impacted by nonlinear effects.

Result:
The presence of nonlinear effects adds complexity to the assessment of the effects of strategic decisions on financial viability.
Appendix M: Relationships of the Themes to the Conceptual Framework

Concepts:

Result:
Articulation of points of interactions between health system and ACO functions, including financial connections.

Result:
Provided the basis for establishing the presence of inter-organizational feedback.

Result:
Demonstrated feedback loops that included financial parameters in competition between health systems and ACOs.

Result:
Health system / ACO feedback loops exist and are a necessary feature of complex, dynamic systems.

Result:
The mathematics of feedback loops requires nonlinear behaviors among feedback loop parameters.

Result:
Complex, dynamic systems are governed by nonlinear behaviors.

Result:
Complex, dynamic systems require dynamic simulation methods for accurate modeling.

Theme 2
Healthcare Executives Can Identify Health System / ACO Interactions

Theme 3
Connecting Causal Links Confirms Complete Causal Loops in Health System / ACO Partnerships

Theme 4
Feedback Loops Linking Health System and ACO Functions Exist

Theme 4A
Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes

Theme 5
Accurate Simulation of Interactions Between Health Systems and ACOs Requires Dynamic System Models

Competing ACO Models

Competing Economic Models

ACOs and ACO Partnerships are Complex, Dynamic Systems

Conceptual Framework
Theories:

- **Theme 1**: Dynamic Simulation Models Are Not Common in Health Systems or ACOs
  - Result: Health system and ACO executives were unaware of feedback and nonlinearity and did not employ models appropriate for those issues.

- **Theme 2**: Healthcare Executives Can Identify Health System / ACO Interactions
  - Result: Healthcare executives were able to identify links between health system and ACO operations when guided by system thinking methods.

- **Theme 3**: Connecting Causal Links Confirms Complete Causal Loops in Health System / ACO Partnerships
  - Result: The documentation of causal loops connecting health systems and ACOs was a new knowledge.

- **Theme 4**: Feedback Loops Linking Health System and ACO Functions Exist
  - Result: The discovery of feedback loops connecting health systems and ACOs was a new knowledge.

- **Theme 4A**: Feedback Loops Between Health System and ACO Functions Must Produce Nonlinear Financial Outcomes
  - Result: Learning that health system / ACO partnerships must entail nonlinear behaviors proved that accurate projections of performance are possible only by using dynamic modeling methods.

- **Theme 4B**: Feedback Loops Linking Health System and ACO Functions Exist
  - Result: The presence of feedback loops means that health systems' and ACOs' performance affect each other.
### Structures for Health System/ACO Simulation

<table>
<thead>
<tr>
<th>Resource-Based Theory</th>
<th>Conceptual Framework</th>
<th>Transaction Cost Economics</th>
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<tbody>
<tr>
<td><strong>Theme 2</strong> Healthcare Executives Can Identify Health System / ACO Interactions</td>
<td><strong>Result:</strong> Healthcare executives were able to identify points of interactions between health systems and ACOs.</td>
<td><strong>Result:</strong> Understanding that points of interactions exist between health systems and ACOs means that the economics effects of interactions must be accounted for when engaged in partnerships.</td>
</tr>
<tr>
<td><strong>Theme 3</strong> Connecting Causal Links Confirms Complete Causal Loops in Health System / ACO Partnerships</td>
<td><strong>Result:</strong> The presence of causal links dictates that organizations engaged in partnerships function as though operations are intertwined as if the partners were part of a single organization.</td>
<td><strong>Result:</strong> The demonstrated existence of feedback loops connecting a health system and an ACO engaged in a partnership proves that the organizations' economic performances are interdependent.</td>
</tr>
<tr>
<td><strong>Theme 4</strong> Feedback Loops Linking Health System and ACO Functions Exist</td>
<td><strong>Result:</strong> The presence of feedback loops demonstrated the possibility of interactions, enabling executives to identify how collaboration might be adopted to improve organizational performance.</td>
<td><strong>Result:</strong> To reap the potential benefits of partnership or vertical integration, health system and ACO leaders must employ dynamic modeling methods to accurately determine whether proposed strategies result in a net benefit to the partnership.</td>
</tr>
</tbody>
</table>
| **Theme 5** Accurate Simulation of Interactions Between Health Systems and ACOs Requires Dynamic System Models | **Result:** To reap the potential benefits of partnership or vertical integration, health system and ACO leaders must employ dynamic modeling methods to accurately determine whether proposed strategies result in a net benefit to the partnership.
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Institution name
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5. The licensing transaction described in the Order Confirmation document shall be governed by and construed under the law of the State of New York, USA, without regard to the principles thereof of conflicts of law. Any case, controversy, suit, action, or proceeding arising out of, in connection with, or related to such licensing transaction shall be brought, at CCC's sole discretion, in any federal or state court located in the County of New York, State of New York, USA, or in any federal or state court whose geographical jurisdiction covers the location of the Rightsholder set forth in the Order Confirmation. The parties expressly submit to the personal jurisdiction and venue of each such federal or state court. If you have any comments or questions about the Service or Copyright Clearance Center, please contact us at 978-750-8400 or send an e-mail to support@copyright.com.