PEDIATRIC CONCUSSION MANAGEMENT IN THE SCHOOL SETTING: AN INTEGRATIVE LITERATURE REVIEW

A Scholarly Project

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Renee Wilson Mann

Liberty University

Lynchburg, VA

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Scholarly Project Chair Approval:

Dr. Rachel Joseph, Ph.D., CCRN, Associate Professor June 2021

ABSTRACT

Concussions in the pediatric population are a growing concern due to the impact concussions could have on the child's health and well-being. Appropriate management of concussions in the pediatric population promotes recovery and the return of the student who has sustained a concussion to school and to normal physical activities. The purpose of this integrative review project is to evaluate the current practices, evidence-based recommendations, and guidelines to ascertain the optimum recovery times in children who have sustained a concussion within the school setting, grades K-12. An integrative review was conducted utilizing the Whitmore and Knafl framework. The four main themes found through the utilization of the thematic analysis included: (a) Recommended guidelines and evidence-based practices facilitate recovery and reduce risk of long-term symptoms; (b) Knowledge base and practices of providers in the management of concussions in school-age children may vary; (c) Concussion management in school-age children requires a community-based approach; and (d) Concussion management training for all stakeholders is important to ensure that evidence-based guidelines and recommendations are adhered to in the school setting. The integrative review will be published in a journal that will reach the targeted audience in the school system.

Keywords: concussions, concussion management, pediatrics, children, concussion guidelines, school, K-12

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Dedication

I dedicate the manuscript to my husband, Shane, for his support and encouragement in the continuation of my nursing education and the completion of the DNP/FNP program. I would also like to dedicate the manuscript in memory of my mother-in-law, Peggy Mann, who encouraged and facilitated my enrollment in a nursing program which led to the beginning of my nursing career.

Acknowledgments

Dr. Rachel Joseph was the mentor/chair for this project for the Doctor of Nursing Program. Her guidance and knowledge throughout the process was a blessing that aided in the completion of the capstone project.

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List of Abbreviations

American Academy of Pediatrics (AAP)

Centers for Disease Control (CDC)

Collaborative Institutional Training Initiative (CITI)

Doctor of Nursing Practice (DNP)

Institutional Review Board (IRB)

Levels of Evidence (LOE)

Mild traumatic brain injury (mTBI)

Preferred Reporting Items for Systemic Review and Meta-analysis (PRISMA)

Return to Learn (RTL)

Return to Play (RTP)

Sport Concussion Assessment Tool (SCAT-5)

Virginia High School League (VHSL)

Virginia Department of Education (VDOE)

SECTION ONE: FORMULATING THE REVIEW QUESTION

Introduction

Concussion management in the pediatric population is a topic of concern for healthcare providers, schools, parents, and the community. Appropriate management of concussions in the pediatric population promotes recovery and the return of the student who has sustained a concussion to school and physical activities. The current practices for managing children who have sustained a concussion vary, and those caring for them may not adhere to evidence-based practices or recommended guidelines which could impede the recovery of the student. The impact of utilizing evidence-based practices and concussion guidelines per the Centers for Disease Control (CDC), Virginia concussion laws, and Virginia Department of Education (VDOE) recommendations in promoting recovery of the child with a concussion will be evaluated in this integrative literature review.

Defining Concepts and Variables

A concussion is defined as a head injury that occurred to the head or neck from a form of trauma or shaking that affects brain function. Concussions are also referred to as traumatic brain injuries (TBI). The possible effects of a concussion include nausea and headaches, along with impacts on concentration, memory, balance, and coordination. Symptoms experienced and the severity of concussions vary among individuals. Symptoms are usually short-term but can be prolonged in some individuals/cases, such as children who exhibit visual or vestibular symptoms (Kontos et al, 2017). In addition, prolonged symptoms may be seen in female children, those who present with severe initial symptoms, or those who have loss of consciousness (Fehr et al., 2017). For this project, the term concussion was utilized.

Literature on concussion management in children in grades K-12 was reviewed, and an anticipated recovery time of 24-48 hours prior to return to school and one week for return to sports/physical activities was used as the standard based on evidenced-based research and recommended guidelines. The review included concussions that occurred due to head trauma such as sports-related or accidents.

Rationale for Conducting the Review

Concussion in children is a growing concern for the community, as concussion management in the pediatric population requires a community-based approach, especially in the school-age populations (Reisner et al., 2017). According to Silverberg et al., (2019), three million Americans sustain a concussion, or TBI, every year. The cause of TBI may be the result of some form of head trauma related to accidents, abuse, or sports-related events. For appropriate concussion management to occur in the pediatric population it is imperative that providers are knowledgeable about the concussion definition, as well as the signs and symptoms in order to ensure correct diagnosis or to rule out a severe head injury (Halstead et al., 2018). Due to the increasing awareness of the incidence and impact of concussions in the pediatric population, the standards of care and guidelines for management have evolved significantly in the last five years (Silverberg et al., 2019).

The provider needs to understand diagnostic evaluation and initial management of concussions in the pediatric population to implement interventions (Halstead et al., 2018). An inter-disciplinary approach that consists of the parent, teacher, school administrator, school nurse, coach, athletic trainer, and the primary care provider is essential to ensure appropriate management in children who have sustained a concussion. Concussion management should be individualized based on the child's symptoms and the extent of the injury to promote positive

outcomes. The initiation of appropriate concussion management can promote recovery and reduce the risk of long-term sequala (Halstead et al., 2018).

Barriers to concussion management could include knowledge base and clinical practices of the provider or athletic trainer, as well as resources utilized for the diagnosis and treatment (Williamson et al., 2018). In the school setting, the assessment of a suspected concussion may be performed by the school nurse, athletic trainer, coach, or a volunteer; therefore, the assessment methods or tools utilized may vary and become a barrier to the identification of symptoms of a possible concussion. The sideline assessment tool Sport Concussion Assessment Tool (SCAT-5) is one tool that may be utilized by coaches or athletic trainers to identify a possible sports-related concussion in children age 13-18 years old. The Child SCAT-5 is designed for use in children 12 and younger to aid in identifying concussions. However, these tools should not be utilized by themselves in the diagnosis of a concussion in the pediatric population, as further evaluation is needed to determine the diagnosis. This evaluation includes a complete neurological exam that includes assessment of oculomotor, balance, and coordination and functions to aid in diagnosis of a concussion and the severity of the concussion in children (Silverberg et al., 2020).

Due to the impact of concussions in the various aspects of the child's day to day activities such as school, athletics, and social/family life, there is a potential for a negative effect on the well-being of the child with a concussion (Halstead et al., 2018). Inadequate concussion management or lack of adherence to the evidence-based recommendations could impede the recovery in the child with a concussion. Inadequate concussion management may occur due to variation in knowledge about concussion among the various stakeholders within the school system which can cause longer recovery times in school-age children with concussions. As such, a review of literature was necessary and appropriate.

Purpose and/or Review Question

The purpose of this integrative review project was to evaluate the current practices and evidence-based recommendations and guidelines to ascertain if there is an optimum recovery time for children who have sustained a concussion within the school setting (grades K-12). The integrative review project evaluated the literature to identify evidence for optimum post-concussion recovery time in school-age children. Publications on children with mild traumatic brain injury (mTBI) were only included in this review because children with severe TBI will receive critical care and will be followed up appropriately, while children with mTBI may not receive the care needed or appropriate follow-up care to identify prolonged symptoms that would need further management evaluation/interventions.

Clinical Question

Does adherence to recommended guidelines and evidence-based practices in the school setting promote safe recovery time of children who have sustained a mild to moderate concussion?

Formulate Inclusion and Exclusion Criteria of Literature

Peer-reviewed, full text articles published from 2015-2021 on the topic of concussion in children in grades K-12, including concussions related to sports and/or trauma, were reviewed. The exclusion criteria for articles on concussion management included adults, children under the age of five, and children with disabilities. Articles published prior to 2015, those pertaining to severe TBI and in other languages were excluded.

Conceptual Framework (Whitmore and Knafl)

The conceptual framework described by Whitmore and Knafl (2005) was used as a framework for the integrative review. The integrative process consists of six steps that include

formulation of a broad purpose/review question, systematic search of the literature using predetermined criteria, critical appraisal of selected research, analysis and synthesis of literature, discussion of new knowledge, and dissemination of findings. The Whitmore and Knafl framework provided guidance to ensure that a systematic process was followed and that synthesized and appraised literature from various databases were included to address the relevance to the chosen topic of interest.

SECTION TWO: COMPREHENSIVE AND SYSTEMIC SEARCH

In this section of the integrative review, the literature as it pertains to concussion management in the school setting was reviewed. This included the following sections: search strategy, critical appraisal, synthesis, and conceptual framework.

Search Strategies

The literature search was conducted to include publications on the topic of pediatric concussion management. The Jerry Falwell Library online resource was utilized to research multiple databases such as ClinicalKey, CINAHL Plus with Full text, ProQuest, PubMed, and JAMA in the search for peer-reviewed journals regarding concussion management. The key words utilized in the search included: concussions, concussion management, pediatrics, children, concussion guidelines, and school setting. The results of the search included 20 articles after the initial inclusion criteria was applied; the inclusion criteria included peer-reviewed, journal, online full-text, and a date timeframe of 2015-2021 to ensure that articles were not older than five years. The exclusion criteria of children under age five, children with disabilities, adults, and severe concussions were applied to establish the relevance of the articles to current recommendations and practices in pediatric concussion management that resulted in 7 articles being excluded from use in the final integrative review. Out of the initial twenty articles

retrieved, 13 articles were utilized in the final integrative review due to overall relevance to the literature review topic and application of the exclusion criteria. The PRISMA diagram displays the selection process of the articles used in this review (Appendix A).

Summary of Preliminary Review

The preliminary review of literature indicated that there was sufficient evidence that established the need for further investigation of concussion management in the pediatric population. Several articles reinforced the need for evaluation of current concussion management practices in the primary care setting, emergency department, and in the school setting, as the research indicates that providers are not comfortable with concussion management or there are differing practices regarding pediatric concussion management. The review also provides evidence that evidence-based practices and guidelines are directed at providing the child with a concussion with adequate cognitive and physical rest, which aids to reduce recovery time and long-term symptoms.

SECTION THREE: MANAGING THE COLLECTED DATA

Data were collected and stored in a citation manager, RefWorks. Once all data had been collected in citation manager software, articles were screened, selected, and sorted. The first step was to screen the articles for relevance to the scholarly project through consideration of the article title and abstract to ascertain relevance to the project. The second step was to select articles that had full text availability and store those in a separate folder (Toronto & Remington, 2020) for a final review of relevance to the integrative review to determine which articles were included or excluded. The final step of the data collection was to sort the articles into studies for evaluation of types of research, quantitative or qualitative, and level of evidence as determined

by Melnyk's LOE. Once selection, screening and sorting the data occurred, then the results were reported narratively and visually.

SECTION FOUR: QUALITY APPRAISAL

A literature matrix (Appendix B) was created for clustering and analyzing the 13 included articles for the final review. Melnyk's Level of Evidence (LOE) was utilized in the integrative review to aid in evaluating the quality of the review literature and reduce bias. Melnyk's LOE is an appraisal tool that enables the project leader to analyze and score and/or rank the 13 articles according to the hierarchy of level 1-7, with level 7 being the lowest ranking. An illustration of Melnyk's LOE pyramid is provided in Appendix C, and the literature LOE matrix is included as Appendix B in the literature review.

Sources of Bias

Bias can occur at any point in the research process (Toronto & Remington, 2020). Bias refers to selection, measurement, attrition, and performance. In the integrative review, bias may be present related to the types of articles that were included in the review.

Internal Validity

Internal validity refers to the risk of bias and believability of the results of the integrative review (Toronto & Remington, 2020). As stated previously, there is a risk of bias in the integrative review due to the selection of articles that were included in the integrative review. The integrative review provides support that evidence-based practices and recommended guidelines promote optimum recovery in children who have sustained a concussion. In addition, the integrative review supports that providers are not comfortable or lack the knowledge to manage concussions in children. These data enforce the believability of the validity of the integrative review results.

Appraisal Tool (Melnyk's LOE)

Use of different appraisal tools to evaluate studies could potentially provide different conclusions for the same study (Toronto & Remington, 2020). The use of Melnyk's LOE appraisal tool (Appendix C) for the integrative review aided in providing a rapid critical appraisal of the studies/articles that were evaluated for inclusion and exclusion in the integrative review. Melnyk's LOE enabled the project leader to analyze, score, and/or rank the 13 articles, for the final integrative review according to the hierarchy of levels 1-7, with level 7 being the lowest ranking.

Applicability of Results

The rank of the studies/articles included in the integrative review included seven articles ranked at level 4, one article ranked level 2, one article ranked at level 3, three articles ranked at level 1and one article ranked at level 6. These rankings per Melnyk's LOE provided a strong foundation for the literature review. The Melnyk LOE literature matrix is included as Appendix C.

Reporting Guidelines (Whitmore & Knafl)

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was utilized to provide transparency and limit bias in the integrative review (Toronto & Remington, 2020). In addition, the PRISMA aided in providing evaluation of the entire research conducted and was not limited to the evaluation of each article/study included in the integrative review. The PRISMA provided a description of the minimum set of characteristics needed to report in a systematic review (Toronto & Remington, 2020). The PRISMA for the integrative review is included as an Appendix A.

SECTION FIVE: DATA ANALYSIS AND SYNTHESIS

The data analysis and synthesis section include the review and analysis of the included articles/studies to provide a visual display of PRISMA and Melnyk's LOE literature matrix, which include the data and strength of the articles included in the integrative review. The data analysis, descriptive results, and synthesis of the results will be discussed.

Data Analysis Methods (Thematic Analysis)

Thematic analysis is a frequently used method utilized in research that aids in the identification, analysis and reporting of patterns that are obtained throughout the research process (Toronto & Remington, 2020). The thematic analysis was the data method that was utilized in the integrative review which aided in identifying patterns/themes in concussion management for children in the school setting. The thematic analysis enables the researcher to cycle through six phases to guide the thematic analysis. The six phases consist of the researcher becoming familiar with the data, generating general codes, searching for themes, defining, and naming themes, and producing a report (Toronto & Remington, 2020).

The first stage was to obtain 13 articles and order the articles into a spreadsheet with columns that consisted of article title/author, study purpose, sample, methods, study results, level of evidence, study results, and relevance of study to concussion management in school-age children utilizing Melnyk's LOE pyramid (Appendix C). In addition to the articles that were reviewed and analyzed, recommended guidelines per the Center for Disease Control (CDC) and the Virginia Department of Education (VDOE) for concussion management in school-age children were analyzed and synthesized for the integrative review. This process aided the project leader in becoming familiar with the data, as well as organizing and identifying common themes in the literature review.

The second stage was to analyze and synthesize data that supported the purpose of the integrative review. The data were displayed utilizing Melnyk's LOE matrix for visualization of data collection and evaluation the of strength of articles. Melnyk's LOE provided ease of comparison of data to aid in identification of patterns of concussion management in school-age children. This stage enabled a thorough review of the collected data and enabled the project leader to define themes related to the common themes in the literature review.

The final stage of thematic analysis was to provide a report of the common themes that were identified in the review related to concussion management in school-age children and adherence to evidence-based practices and recommended guidelines. The four main themes found through the utilization of the thematic analysis included: (a) Recommended guidelines and evidence-based practices facilitate recovery and reduce risk of long-term symptoms; (b) Knowledge base and practices of providers in the management of concussions in school-age children may vary; (c) Concussion management in school-age children requires a community-based approach; and (d) Concussion management training for all stakeholders is important to ensure that evidence-based guidelines and recommendations are adhered to in the school setting.

Descriptive Results

A total of 20 articles were evaluated for relevance to the topic of the integrative review that met the inclusion criteria of peer-reviewed, journal, online full text articles within the timeframe of 2015-2021 to ensure inclusion of current information relevant to the integrative review. Of the 20 articles, seven articles were omitted after the application of the exclusion criteria of children under age five, adults, disabled children, and severe concussion. A total of 13 articles was included in the integrative review, two were qualitative studies, and eleven were quantitative articles.

Three systematic review articles that evaluated clinical guidelines with an LOE of one. One case study article evaluated the use of SCAT3 and ChildSCAT-3 in controlled groups in the diagnosis of concussion for ages 5-16, with an LOE of four. Four articles utilized surveys to obtain data regarding concussions knowledge and management in school-age children, have an LOE of four. One cohort study article examined adherence to Return to Learn (RTL) and Return to Play (RTP) guidelines in children, with an LOE of four. One secondary data article which used chart reviews to obtain data on concussion symptoms in children, has an LOE of two. An additional quantitative article that reported a quasi-experimental design study in which previous studies and expert opinions are assessed with intervention implementation and evaluation, had an LOE of three. A list of the type of articles can be found in a Table of Descriptive Results (Appendix D).

In addition to the articles utilized in the integrative review, other sources such as recommended guidelines/recommendations for concussion management in the pediatric population were included in the integrative review. These guidelines/recommendations included the CDC concussion guidelines (Brain Injury Basics, n.d.) and the Virginia concussion laws (Virginia Concussion Law, n.d.). Additionally, the current VDOE concussion recommendations for school systems (Virginia Department of Education Guidelines for Policies on Concussion in Students, n.d) were reviewed. These guideline and recommendation review has an LOE of one.

Additionally, information was included in the review from the project leader's five years of experience as a school nurse in one rural school district serving third, fourth and fifth graders for that community in the state of Virginia. Per the project leader's experience in one rural school district as a school nurse, there were cases in which concussed students returned to school earlier than the current recommendations provided by the VDOE and CDC guidelines.

Additionally, in the project leader's experience, providers were unclear or did not provide accommodations for return to learn/play in the school setting. The athletic trainer would assess and provide accommodations for return to learn/play for all students within the district. There was a written stepwise procedure for return to learn/play; however, cases of students returning to school prior to the 24–48-hour guidelines per the CDC (Brain Injury Basics, n.d) and children returning to school before the recommended sustainment of 30–45-minute cognitive stimulation per VDOE (Virginia Department of Education Guidelines for Policies on Concussion in Students, n.d) were noted by the project leader. Therefore, the assessment of this one school district's concussion management procedures does not adhere to the recommendations and guidelines provided by the VDOE and the CDC which are supported by evidence-based practices, and more education is required for stakeholders to promote the recovery and reduce the risk of long-term symptoms (e.g., post-concussive syndrome). The assessment of one school district's concussion management procedures is an LOE of seven as this is based on the project leader's knowledge and opinion.

Synthesis

The completion of the integrative review revealed four relevant themes related to concussion management in children within the school setting. The first theme was that recommended guidelines and evidence-based practices aid to facilitate recovery in children who have sustained a concussion and reduce long-term symptoms. The second theme was that the knowledge base and practices of providers vary in the management of concussions in school-age children. The third theme was that concussion management in school-age children requires a community-based approach which includes effective communication between the child's provider, parents, student, and school staff (teachers, administrators, school nurses, coaches, and

athletic trainers). The fourth and final theme was that providing concussion management training to providers, school administrators, teachers, coaches, school nurses, parents, and community members is important to ensure that evidence-based guidelines and recommendations are implemented for school-age children in the school setting to promote recovery and aid in the prevention of long-term symptoms.

The integrative review provided support that adherence to the evidence-based practices and recommended guidelines in the management of children who have sustained a concussion promoted recovery and reduce prolonged symptoms related to a concussion. The guidelines and recommendations reviewed and included in the integrative review included Virginia concussion laws (Virginia Concussion Laws, n.d.) CDC (Brain Injury Basics, n.d) and the VDOE (Virginia Department of Education Guidelines for Policies on Concussions in students, n.d).

Virginia concussion laws (Virginia Concussion Laws, n.d.) provide guidelines that state school systems must provide annual concussion education to student athletes, their families, and coaches. In addition, Virginia concussion laws state that schools are required to adhere to recommended accommodations from the student's health care provider in the management of concussions within the school setting (Virginia Concussion Laws, n.d.). Therefore, if the student's provider has a knowledge deficit in the management of pediatric concussions this could have the potential to impact the recovery of the concussed student as the RTL and RTP guidelines may not be implemented.

The current guidelines per the CDC and VDOE recommend that children who have sustained a concussion are to remain at home for the initial 24-48 hours following a concussion, with return to school being initiated when the child is able to sustain 30-45 minutes of cognitive stimulation (Brain Injury Basics, n.d; Virginia Department of Education Guidelines for Policies

on Concussions in students, n.d). The CDC and the VDOE also recommend a return to learn phase that is individualized based on the student's need which could include limiting homework, providing rest periods during the school day, and reducing school day to half days, etc. These accommodations may be initiated informally; however, if symptoms last longer than two to three weeks then a 504 or RTL plan, should be implemented. This is a formal written plan of care to include specific academic accommodations for the concussed child to include collaboration with the student's provider, parent, and school staff, to meet the specific needs of the child with a concussion to facilitate recovery. Return to Play recommendations include that any child who is suspected of sustaining a concussion should be removed from play. In addition, children who have sustained a concussion will not resume physical activity for one week from the date of the initial concussion; they will then be allowed a gradual return to play.

The results support that providers are uncomfortable or lack the knowledge to manage concussions in children. According to Arbogast et. al., (2017) and Provance et. al., (2015) providers reported a lack of adequate knowledge and skills to manage children with concussions. In addition, research supports that there are varying provider knowledge bases and practices which could be related to lack of experience or training related to concussion management in children. The literature review results support the provision of educational training to providers within the primary care, emergency department and urgent care settings. This education should include information regarding the identification, definition, pathophysiology, and management of concussions in children.

The results of the review also support that a community-based approach to concussion management in the school-age child is imperative to adherence and implementation of evidence-based practices and guidelines within the school setting to promote positive outcomes. This can

be accomplished through collaboration and effective communication between the student's provider (who should be completing an RTL and RTP recommendation per Virginia concussion law), parents and school staff, so that accommodations may be implemented for the concussed child's return to the school setting.

Additionally, the results of the literature review support the need for education on concussions in children that aids in promoting the adherence to evidence-based practices, recommended guidelines, identification, and management of concussions in the school-age child. Education should be aimed at primary care providers, emergency department providers and urgent care providers to enhance their knowledge and practices related to identification, diagnosis, and management guidelines for concussions in children. Educational training for school staff should be aimed at the identification of symptoms of concussions, anticipated accommodations for concussed children, and regular communication with the student/parent regarding schoolwork completion to determine whether accommodations are adequate.

Ethical Considerations

This integrative review did not have any ethical considerations as the data collected did not involve human subjects. The DNP student completed the CITI training as required by Liberty University for the scholarly project, as the understanding of ethical principles should be understood by the researcher (Ingham-Boofield, 2017). The DNP student submitted the project to the Liberty University Institutional Review Board (IRB) and received an email from the IRB that the project had been approved. The DNP student included the IRB email and the CITI training certificate as Appendix E and F.

TIMELINE

Summer 2020 (NURS 839/840)

- Complete/finalize scholarly project proposal by the completion of NURS 839/840
- Attain approval for proposal the chair

Fall 2020

- Defend Proposal and pursue IRB approval for the project
- Begin work on the scholarly project once approval is obtained from IRB
- Meet with the chair as needed to discuss progress on project periodically and as needed to achieve completion of the project

Spring 2021 (NURS841/842)

- Continue to work on the scholarly project
- Complete a draft of the scholarly project and submit to chair
- Make revisions to draft as needed per chair's feedback and guidance
- Meet with chair as needed to discuss progress on project periodically and as needed to achieve completion of project

Summer 2021 (NURS 843/844)

- Complete final draft of the scholarly project and submit to the committee for review
- Make a final defense appointment with the chair before the defense
- Present and defend the scholarly project
- Submit final written report and after approval submit to Liberty University Crossing

SECTION SIX: DISCUSSION

The literature review consisted of the evaluation of 13 articles related to concussion management in school-age children and the impact of concussion management in the school setting. In addition to the articles reviewed, the guidelines/recommendations of the CDC, VDOE and Virginia concussion law were reviewed and evaluated regarding the management of

concussed children within the school setting. The project leader's experience as a school nurse in one local rural school district provides support that there is a need for further education among stakeholders regarding recommended guidelines for concussion management in the school setting.

The results of the literature review provided supportive data that suggest there are variations in knowledge base and practices regarding concussion management in children among providers that may impact the implementation of appropriate concussion management in children that could impede recovery time (Williamson et al., 2018). Due to these inconsistencies in concussion management in school-age children as evidenced by the results of the integrative review, there is a potential for non-adherence to evidence-based practices and recommended guidelines in Virginia school systems. The Virginia concussion laws, Virginia Department of Education (VDOE), and the Centers for Disease Control (CDC) concussion guidelines are supported by evidence-based practices.

In general, most children with mild to moderate concussions recover in one to three weeks with an initial 24-48 hour with cognitive and physical rest phase at home implemented after sustaining a concussion. Accommodations for return to school/learn are completed by the student's provider (Virginia Department of Education, n.d; Virginia Concussion Laws, n.d). Children with vision and vestibular symptoms (e.g., dizziness, balance, and coordination concerns) may require longer recovery time; greater than 21 days and rehabilitation for these symptoms (Kontos et al., 2017). The literature review provided support that children who have sustained a concussion that exhibits symptoms longer than the expected recovery time may need further evaluation to determine appropriate interventions such as rehabilitation by individuals

that are trained specifically for therapies that aid to improve visual and vestibular symptoms of the concussed child (Corwin et al., 2017; Kontos et al., 2017; Silverberg et al., 2020).

The integrative review supported the need for improvement in the management of concussions in school-age children due to variations in providers' management of concussions in children related to knowledge, practices and adherence to recommended guidelines (Arbogast et al, 2017; Provance et al., 2015). Concussion management in school-age children is a community-based approach that includes the need to educate and provide training to school administrators, teachers, coaches, athletic trainers, school nurses and primary care providers to promote optimum recovery and reduce the risk for long-term complications. The CDC guidelines are supported by evidence-based research. In addition, the CDC offers the "Heads Up" tool kit to aid in providing education concerning, identifying, and managing concussions in the school setting (Brain Injury Basics, n.d). Adherence to the post-concussion recommendations and evidence-based practices for children may promote recovery, and thus a return to school and normal physical activities.

Comparison

The results of the integrative review are consistent with the American Academy of Pediatrics (AAP) recommendations for concussion management in the school setting as they utilize the established CDC concussion guidelines for implementation of RTL and RTP accommodations (Jenco, 2018). The Virginia High School League (VHSL) provides guidance and recommended resources for concussion management in athletes in Virginia schools. These recommendations are supportive of Virginia concussion laws, cognitive rest and a stepwise return to play protocol that are supportive of the CDC recommended guidelines (Concussions, n.d.) Some resources listed on the VHSL website regarding concussions range from 2012-2015,

which may not include recent updates to concussion guidelines in schools. Additional research on this topic (from September of 2020 through March of 2021 after the initiation of the scholarly project in August of 2020) identified articles that are supportive or reiterated findings from the integrative review when the same inclusion and exclusion criteria were applied to a new search utilizing the same databases in the Jerry Falwell Library (Gailbraith et al., 2020; Rice & Curtis, 2018; Taubman et al., 2021).

Potential Barriers

Barriers in concussion management in school-age children could relate to the experience and knowledge of providers in the implementation of evidence-based practices and recommended guidelines. In addition, the acceptability of concussion training to providers, school staff, students and parents could be a potential barrier to the implementation of recommended guidelines and evidence-based practices in concussion management in the school setting. Other barriers to the implementation of appropriate concussion management in children could be related to access to healthcare providers due to socioeconomic (i.e., transportation, financial, etc.) status and the availability of team physicians, school nurses, and athletic trainers within the school system.

Potential Enhancers

The potential facilitator for improving concussion management in the school setting is the desire for individuals involved in the care of school-age children to promote recovery, reduce the risk of long-term complications, and facilitate return to learn and resumption of normal activities. School systems, parents, and providers value the safety, health, and academic success of their students; this could aid to promote the implementation of evidence-based practices and recommended guidelines in concussion management in the school setting. The adherence to

appropriate concussion management guidelines can aid to promote positive outcomes, reduce negative impact on social and academic aspects of the child, and potentially aid to reduce the financial burden to the concussed child's family.

For appropriate concussion management to occur in the school setting the four areas that have been identified in the literature review should be considered. These include: (a) following recommended guidelines and evidence-based practices, (b) improving the knowledge base and practices of providers in the management of concussions in school-age children, (c) facilitating a community-based approach to concussion management in the school setting that includes effective communication between all stakeholders, and (d) implementing strategies to incorporate concussion management training to all stakeholders. These are important to ensure evidence-based guidelines and recommendations are implemented for school-age children in the school setting to promote recovery and aid in the prevention of long-term symptoms or complications. The literature review supports the notion that recommended guidelines and evidence-based practices help promote optimum recovery of concussed children in the school setting. In addition, resources are available to school districts that could aid in the development or adoption of appropriate concussion management policies such as the CDC "Heads up toolkit, the VDOE recommended guidelines and Virginia Concussion Laws.

Implications for Practice/ Future Work

The findings of this integrative review have the potential to impact concussion management in the school setting and provide guidance to pediatric providers, family practice providers, school systems, school nurses, coaches, and athletic trainers. Additionally, the integrative review could be utilized in providing guidance on concussion management to other providers such as those in the Emergency Department or urgent care settings. Adherence to

evidence-based practices and recommended guidelines may facilitate optimum recovery and reduce long-term complications in children.

Future work in the management of concussions in school-age children could include concussion training and periodic refresher training for providers, parents, and the community, which may help provide optimum care to children who sustain concussions. The implementation of annual concussion training of school staff including administrators, teachers, coaches, athletic trainers, and school nurses has the potential to improve concussion management. Concussion training would facilitate adherence to evidence-based practices and recommendations in the school setting, as well as in the development of appropriate protocols or adherence to existing evidence-based recommendations. The role of the athletic trainer in secondary schools is not clearly defined by the VDOE or Virginia concussion law: therefore, future research regarding the athletic trainer's role in the absence of a team physician should be investigated in relation to concussion diagnosis and management within the secondary school setting. Additionally, further research regarding concussion management in multiple school districts would aid to strengthen the results of this integrative review.

Dissemination

The results of the integrative review were presented at Liberty University Research Week in the form of a poster presentation, with a discussion of the content provided to judges and other visitors at Research Week. The poster presentation received the second-place award for the category of Textual/Investigative presentations. In addition, permission has been granted to the Jerry Falwell Library to archive the poster presentation. In addition, the poster presentation will be available in Scholar's Crossing at Liberty University, which will enable it to become Google searchable. Participation in Liberty University's Research Week and subsequent archiving of the

poster presentation aids in the dissemination of the literature review results to other research and aids to promote scholarship. The dissemination of the results of the integrative review will be sought through publication in a journal that will reach the targeted audience of pediatric providers and school systems. The DNP student will endeavor to disseminate the results of the integrative review through in-person training opportunities for seminars and school districts.

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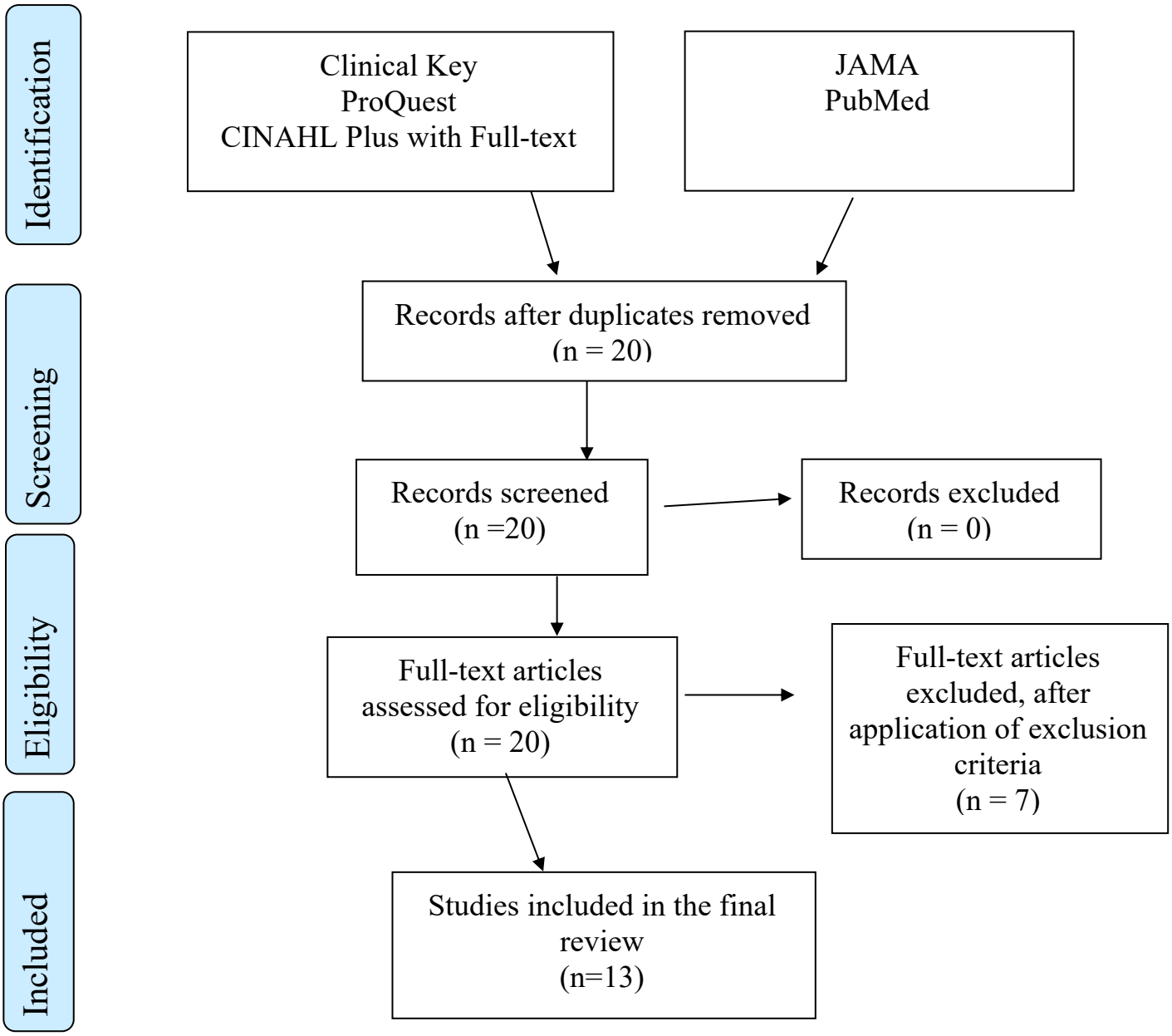
Appendix A: PRISMA Flowsheet



Appendix B: Literature LOE Matrix

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Arbogast, K. B., Curry, A. E., Metzger, K. B., Kessler, R. S., Bell, J. M., Haarbauer-Krupa, J., . . . Master, C. L. (2017). Improving primary care provider practices in youth concussion management. *Clinical Pediatrics, 56*(9), 854-865. doi:10.1177/0009922817709555	To evaluate the use of an electronic tool and in person training for concussion management in pediatrics	Pediatrics	Review of patient office visit prior to and after implementation of concussion management strategies	The use of an electronic tool and in-person training may be instrumental in changing PCP behavior in pediatric concussion management	Level Three: Quasi-experimental Review of previous studies and expert opinions with evaluation of interventions	Limited to the accuracy of the data collected	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Babl, F. E., Dionisio, D., Davenport, L., Baylis, A., Hearps, S. J. C., Bressan, S., . . . Davis, G. A. (2017). Accuracy of components of SCAT to identify children with concussion. *Pediatrics (Evanston), 140*(2), e20163258. doi:10.1542/peds.2016-3258	To evaluate the ability of SCAT3 and ChildSCAT3 to differentiate children aged 5 to 16 years with concussion from controls.	Pediatrics	Observational study/case control	SCAT3 and ChildSCAT3 can differentiate concussed from nonconcussed patients, particularly in symptom number and severity.	Level 4 Case control	Limited to children that presented to ED with possible concussion	Yes, this data provides a supportive foundation for change in concussion management
Corwin, D. J., Grady, M. F., Joffe, M. D., & Zonfrillo, M. R. (2017). Pediatric mild traumatic brain injury in the acute setting. *Pediatric Emergency*	Reviews the definition, pathophysiology, signs and symptoms, physical examination findings, and acute management of	Pediatrics	Review of literature was conducted to review current knowledge	Provided information on definition, pathophysiology, signs and symptoms, physical examination findings, and	Level Three: Descriptive Design A review of current evidence from descriptive data and	Limited to the level of evidence of research utilized for article	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Care, 33(9), 643-649. doi:10.1097/PEC.0000000000001252	pediatric concussion.			acute management of pediatric concussion.	expert opinion		
DeMatteo, C. A., Lin, C. A., Foster, G., Giglia, L., Thabane, L., Claridge, E., . . . Connolly, J. F. (2019). Evaluating adherence to return to school and activity protocols in children after concussion. *Clinical Journal of Sport Medicine, Publish Ahead of Print* doi:10.1097/JSM.0000000000000800	to explore the prevalence and predictors of adherence to RTS and RTA concussion management protocols for children/youth.	Pediatrics	Prospective cohort	Children's knowledge of protocols and total PCSS scores significantly predicted adherence to RTS/RTA and may be the most important factors in predicting adherence during recovery from concussion.	Level 4 Cohort study	Limited to children within one hospital setting.	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Ellis, M. J., & Russell, K. (2019). The potential of telemedicine to improve pediatric concussion care in rural and remote communities in Canada. *Frontiers in Neurology, 10*, 840. doi:10.3389/fneur.2019.00840	provide an overview of telemedicine, tele-neurology, the principles of concussion assessment and management	Pediatrics	Review of use of telehealth studies in providing care to patients in rural settings	Telehealth could be used in the management of the pediatric population	Level Four: Correlational design Evaluates preliminary studies for potential use in pediatric concussion management	Limited to the level of evidence of studies evaluated	Yes, this data provides a supportive foundation for change in concussion management
Fehr, S. D., Nelson, L. D., Scharer, K. R., Traudt, E. A., Veenstra, J. M., Tarima, S. S., . . . Walter, K. D. (2017). Risk factors for prolonged symptoms of mild traumatic brain injury: A	To assess predictors of prolonged concussion symptoms in the pediatric population	Pediatrics	Retrospective chart review	Prolonged duration of TBI symptoms are related to severity of initial symptoms, female gender and LOC	Level two Retrospective study	Limited to the charts reviewed in one setting	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
pediatric sports concussion clinic cohort. *Clinical Journal of Sport Medicine, 29*(1), 11-17. doi:10.1097/JSM.0000000000000494							
Halstead, M. E., Walter, K. D., Moffatt, K., & Council on Sports Medicine and Fitness. (2018). Sport-related concussion in children and adolescents. *Pediatrics (Evanston), 142*(6), e20183074. doi:10.1542/peds.2018-3074	provides education on the current state of sport-related concussion knowledge, diagnosis, and management in children and adolescents.	Pediatrics	Review of evidence-based practices/guidelines for concussion management	Provided education on the current state of sport-related concussion knowledge, diagnosis, and management in children and adolescents.	Level One: Review of clinical guidelines	Limited to the level of evidence of the articles utilized in the review	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Provance, A. J., Engelman, G. H., Terhune, E. B., & Coel, R. A. (2015). Management of sport-related concussion in the pediatric and adolescent population. *Orthopedics, 39*(1), 24-30. doi:10.3928/01477447-20151218-13	to review current evidence regarding concussion treatment and return-to-school and return-to-play recommendations that can aid in the PCP and sports physician in managing concussions	Pediatrics	Review of current recommendations for concussion management	Provides guidance to Primary and sports physicians in managing concussions in pediatrics	Level One: Review of clinical guidelines	Limited to the level of evidence utilized in the review	Yes, this data provides a supportive foundation for change in concussion management
Reisner, A., Burns, T. G., Hall, L. B., Jain, S., Weselman, B. C., De Grauw, T. J., . . . Chern, Joshua J. (2017).	To evaluate the potential impact of a concussion management education program on community-	Pediatricians	Survey	A concussion educational program can serve as a model for improving the quality of	Level 4 Case control	Limited to one intervention	Yes, this data provides a supportive foundation for change in concussion management

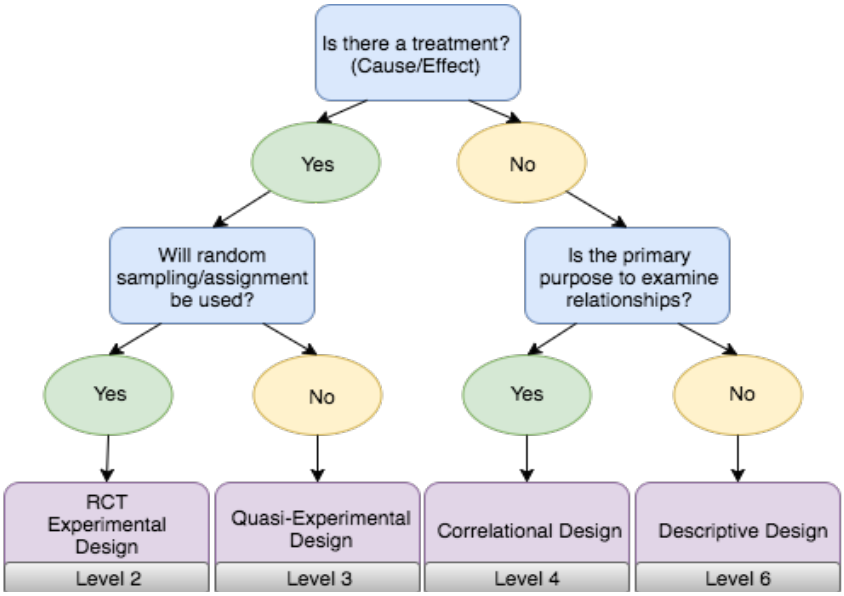
Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Quality improvement in concussion care: Influence of guideline-based education. *Journal of Pediatrics, The, 184*, 26-31. doi:10.1016/j.jpeds.2017.01.045	practicing pediatricians.			pediatric concussion management.			
Silverberg, N. D., Iaccarino, M. A., Panenka, W. J., Iverson, G. L., McCulloch, K. L., Dams-O'Connor, K., . . . American Congress of Rehabilitation Medicine Brain Injury Interdisciplinary Special Interest Group Mild TBI Task Force. (2020).	to review current evidence regarding concussion management	Clinicians	Review of current recommendations for concussion management	Provides guidance to Primary care physicians in managing concussions in primary care (school-age children, adults, athletes, and military)	Level One: Review of clinical guidelines	Limited to the level of evidence utilized in the review and not specifically directed at pediatrics	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Management of concussion and mild traumatic brain injury: A synthesis of practice guidelines. *Archives of Physical Medicine and Rehabilitation, 101*(2), 382-393. doi:10.1016/j.apmr.2019.10.179							
Weerdenburg, K., Schneeweiss, S., Koo, E., & Boutis, K. (2016). Concussion and its management: What do parents know? *Paediatrics & Child Health, 21*(3), e22-e26. doi:10.1093/pch/21.3.e22	To determine the sensitivity of parental suspicion of concussion relative to pediatric emergency physicians in children who presented to an emergency	Pediatrics	Survey	Results support the need for increased parental education on this injury.	Level 4 Case control	Limited to one setting	Yes, this data provides a supportive foundation for change in concussion management

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
	department (ED) with a head injury.						
Williamson, C. L., Norte, G. E., Broshek, D. K., Hart, J. M., & Resch, J. E. (2018). Return to learn after sport-related concussion: A survey of secondary school and collegiate athletic trainers. *Journal of Athletic Training, 53*(10), 990-1003. doi:10.4085/1062-605	To evaluate the use of Return to Learn recommendations in sports-related concussion by athletic trainer	Certified athletic trainers	Cross sectional study-online survey	Most athletic trainer utilize some form of Return to Learn in their sport-concussion management policy	Level 4 Case control	Limited to the number of athletic trainers that responded to the survey	Yes, this data provides a supportive foundation for change in concussion management
Zamarripa, A., Clark, S. J., Rogers, A. J., Wang-Flores, H., & Stanley,	To examine parental expectations and beliefs about	Parents of children, age 10-17 years old	cross-sectional web-based survey	Parents expects a comprehensive and	Level 4 Case control	Limited to the number of parents	Yes, this data provides a supportive foundation for

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Rachel M. (2017). Pediatric concussion management in the emergency department: A national survey of parents. *Journal of Pediatrics, The, 181*, 229-234. doi:10.1016/j.jpeds.2016.10.071	diagnosis and management of pediatric concussion.			definitive care, including imaging, a definitive diagnosis, a timeline for return to activity, and a signed return to play form.		that responded to the survey	change in concussion management

Appendix C: Melnyk's Level of Evidence Pyramid



Melnyk's Level of Evidence

Level 1 - Systematic review & meta-analysis of randomized controlled trials; clinical guidelines based on systematic reviews or meta-analyses

Level 2 - One or more randomized controlled trials

Level 3 - Controlled trial (no randomization)

Level 4 - Case-control or cohort study

Level 5 - Systematic review of descriptive & qualitative studies

Level 6 - Single descriptive or qualitative study

Level 7 - Expert opinion

Completed Attribution: "Melnyk's Level of Evidence/Which Level of Evidence Pyramid?" by University of Michigan Library is licensed under CC BY 4.0. No changes made.

Appendix D: Table of Descriptive Results

Type of publication	#	LOE
Quantitative articles (case study, survey, cohort, secondary data, systematic reviews, quasi-experimental)	6 1 3 1	4 2 1 3
Qualitative articles (descriptive and correlational)	1 1	6 4
Review of one school district's concussion management procedure	1	7
VDOE: Current recommendations	1	1
CDC: return to learn/play guidelines for school-age children	1	1
Virginia Concussion Law: review of required education and management regarding concussions in schools	1	1

Appendix E: CITI Training

CITI PROGRAM

Completion Date 12-Jul-2020
Expiration Date 12-Jul-2023
Record ID 37353091

This is to certify that:

Renee Mann

Has completed the following CITI Program course:

Not valid for renewal of certification through CME. Do not use for TransCelerate mutual recognition (see Completion Report).

Biomedical Research - Basic/Refresher (Curriculum Group)
Biomedical & Health Science Researchers (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Liberty University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w6ba768ce-49e5-4e40-8fdd-e1033dcf607d-37353091

Appendix F: IRB Approval

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

February 23, 2021

Renee Mann
Rachel Joseph

Re: IRB Application - IRB-FY20-21-669 Pediatric Concussion Management in the School Setting

Dear Renee Mann and Rachel Joseph,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study is not considered human subjects research for the following reason: It will not involve the collection of identifiable, private information.

Please note that this decision only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

Also, although you are welcome to use our recruitment and consent templates, you are not required to do so. If you choose to use our documents, please replace the word *research* with the word *project* throughout both documents.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office