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POTS: Educating School Nurses

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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
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Lynchburg, VA
October, 2017

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Abstract

The project used educational modules as a means for providing knowledge about postural orthostatic tachycardia (POTS) to school nurses. It evaluated knowledge of symptoms and the referral process. A pre and post-test were used immediately prior to and following an educational module to determine gained knowledge about POTS. Participants completed a survey evaluating their perceived knowledge and comfort level to evaluate POTS symptoms and refer patients for further evaluation. One hundred percent of participants demonstrated improvement in their post-test score confirming knowledge gained in all participants. All participants reported that the modules helped them about POTS, and they felt confident or very confident in identifying criteria to recognize symptoms as well as the referral process. Participants found the educational module and associated tools helpful in identifying symptoms and feeling confident in knowing when and where to refer students who may suffer from POTS symptoms.

Keywords: Postural Orthostatic Tachycardia Syndrome, POTS, school nurse, education

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POTS: EDUCATING SCHOOL NURSES

Introduction

Dysautonomia is an umbrella term often used to describe several different medical conditions found to cause a variety of malfunctions of the autonomic nervous system. These include postural orthostatic tachycardia syndrome (POTS), postural orthostatic hypotension, neurocardiogenic syncope (NCS), Ehlers-Danlos Syndrome (EDS), Mast Cell Activation Disorder (MCAD), and multisystem atrophy (MSA) to name a few (Dysautonomia International, 2016). Often when an individual is diagnosed with one form of dysautonomia, several other types tend to follow.

Background

POTS is one of the most prevalent, yet unheard of diseases affecting our nation. A form of dysautonomia, it is estimated to impact 1,000,000 to 3,000,000 Americans and millions more throughout the world (Dysautonomia International, 2016; POTS UK, 2016). It is a condition in which the affected individual's heart rate increases by 40 beats per minute or more when changing positions. This often causes syncopal episodes, and in rare occasions, seizures, which are thought to affect one in every one hundred individuals suffering from dysautonomia (Rowe, 2014). This disorder of the autonomic nervous system typically affects females, as early as age 10, and is diagnosed with the use of the tilt table test. Symptoms include an elevation in heart rate upon standing, syncope, hypovolemia, fatigue, headaches, lightheadedness, chest pain and palpitations, shortness of breath, exercise intolerance, nausea, diminished concentration or "brain fog," tremulousness, mottling to legs when standing, coldness and pain to extremities, and hypotension (Abed, Ball, & Wang, 2012; Dysautonomia International, 2016; Grubb, 2008).

Many people go undiagnosed for years, thus causing them to live with uncontrolled symptoms. Often, these patients receive incorrect diagnoses, medications, and treatment along their journeys due to lack of provider knowledge on the disease process. Currently, there is no cure for POTS, though with proper diagnosis and treatment, POTS patients are able to live highly functioning lives and are often able to manage symptoms without the use of medications through the use of lifestyle adaptations.

The scholarly project was an evidence-based practice initiative designed to raise awareness about POTS. Currently, the average length of time from initiation of symptoms until correct diagnosis is two to seven years, with 75% of patients receiving a correct diagnosis over a year after the onset of symptoms, and 27% of patients seeing more than 10 doctors before being diagnosed with POTS (Dysautonomia International, 2016; Pavlik, Agnew, Stiles, & Ditoro, 2016). This results in increased healthcare expenditures, inappropriate management of symptoms, and prolonged illness and disability. Incorrect diagnoses most often attributed to POTS symptoms include depression, anxiety, Munchhausen's syndrome, and panic disorder, as well as a variety of other misdiagnoses. This often leads to a variety of unnecessary and potentially harmful prescriptions (Dysautonomia International, 2016; Grigoriou, Boris, & Dormans, 2015).

Problem Statement

Individuals are experiencing symptoms for significant periods of time before correct diagnosis and, despite seeking medical care, misdiagnosis is occurring. The supporting evidence listed above describes why this is such a significant problem. This problem negatively impacts POTS patients due to extended time and suffering between the onset of symptoms to diagnosis and treatment plan. A possible cause of this problem is lack of education of school nurses, who

are often the first to triage these symptoms. It is anticipated that an evidence-based practice project which implements education modules for school nurses in an effort to appropriately refer patients, will assist in decreasing length of time from onset of symptoms to diagnosis and initiation of a treatment plan.

Project Purpose

The purpose of the evidence-based practice project was to shorten the timeframe from onset of symptoms to diagnosis of POTS by educating school nurses on symptoms and appropriate referral to practitioners. The primary purpose of this evidence-based practice project was to identify a gap in knowledge regarding the diagnosis and treatment of patients presenting with POTS and provide education to school nurses as a first line of defense in referring patients to appropriate care. The aim of the project was to educate school nurses on symptoms associated with POTS, appropriate initial treatment and management of symptoms, and the appropriate referral process for patients meeting clinical criteria. The project's overarching aim was to bring about a significant decline in the timeframe of initial onset of POTS symptoms by referring appropriate patients for follow-up assessment, leading to correct diagnosis, and a correct treatment plan.

Clinical Question

The PICO framework provided an optimal model for presenting the elements of the clinical question while developing an educational module about POTS. The use of the PICO framework provided structure and format when forming the clinical question and assisted in focusing on elements of the question of interest (Moran, Burson, & Conrad, 2014). The use of this format helped the process of planning, implementing, and evaluating the need for a practice change (Melnyk, 2011). The PICO statement is as follows: In school nurses (P), does providing

education about postural orthostatic tachycardia syndrome (POTS) through the use of educational presentations (I) enhance knowledge and likelihood to refer patients for further assessment (O)?

DNP Essentials

Goals and objectives are used to provide a shared purpose and buy-in, create reciprocal trust amongst team members, and provides recognition and value to the project (Moran et. al., 2014). The goals and objectives for the project (Appendix A) were based on the American Association of Colleges of Nursing's (AACN) *The Essentials of Doctoral Education for advanced Nursing Practice* (American Association of Colleges of Nurses [AACN], 2016), and include the following:

- Identification of the population of interest (school nurses) for the education about postural orthostatic tachycardia syndrome (POTS)-*Essential III*
- Appraisal of organizational culture to determine the approach for education, development of an increased understanding of school nurses' awareness of POTS in the defined environment of care-*Essentials V, VI, VII*
- Development of new approaches to incorporate evidence-based practice changes to improve healthcare delivery-*Essentials II, VIII*

Literature Review

The following literature review reflects current research about postural orthostatic tachycardia syndrome (POTS). A variety of search engines were utilized including Medline, EBSCO HOST, Cochrane, PubMed, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) to gather evidence-based research data in an effort to gain peer-reviewed articles about POTS. The following keywords were employed to search for empirical literature

on: POTS, Postural orthostatic tachycardia syndrome, training modules, medications, resources, illness, and support. The literature review revealed information about the following topics: symptoms, pathophysiology of POTS and other dysautonomia disorders, diagnostic criteria, management and treatment, and referrals. The full literature can be found in table format in appendix B.

Symptoms

POTS is defined as an autonomic disorder in which the autonomic system fails to compensate for position changes such as upright body posture, causing a variety of symptomatic changes within the body including tachycardia and orthostatic hypotension (Abed, Ball, & Wang, 2012). According to Ulrich & Hartung (2015), POTS is definitive when the presence of symptoms of orthostatic intolerance lasts longer than six months, which are aggravated when standing and diminish when lying down. Orthostatic hypotension is defined as the sustained fall of systolic blood pressure by at least 20 mmHg of diastolic pressure within three minutes of standing or head-up tilt (Metzler, Duerr, Granata, Krismer, Robertson, & Wenning, 2013).

Symptoms vary between patients and episodes but often manifest in orthostatic intolerance, palpitations, shortness of breath, crushing chest pain that is responsive to nitroglycerin, tremors, syncope, dysesthesia, allodynia, blurry vision, loss of vision, seizure-like activity, insomnia, confusion, altered thought process, migraines, fatigue, exercise intolerance, heat or cold intolerance, photophobia, altered taste, hearing, vision, touch, smell, and delayed cap refill (Busmer, 2013; Landero, 2014). Metzler et al. (2013) reports a variety of hallmark symptoms which include dizziness, visual disturbances, pre-syncope, and syncope. Patients with POTS often report problems with memory and attention impairment (Shanks, Jason, Evans, & Brown, 2013). These clinical symptoms may occur within one to three years of the adolescent

growth spurt and often correlate with injury or a long period of inactivity, possibly leading to deconditioning (Urlich & Hartung, 2015).

Many individuals with POTS also suffer from a variety of other overlapping disorders including chronic fatigue syndrome (CFS), Ehlers-Danlos syndrome (EDS), vasovagal syncope, and inappropriate sinus tachycardia (Garland, Celedonio, & Raj, 2015). A study by (Grigoriou et al. 2015), demonstrates a connection between POTS and EDS including patients presenting with joint hypermobility symptoms of dysautonomia with orthostatic hypotension or POTS. Patients who reported visceral pain and dysmotility, presented with nausea, bloating, diarrhea or constipation and early satiety, fatigue, insomnia, fibromyalgia, weakness, and neurologic comorbidities including brain fog.

Pathophysiology

The pathophysiology surrounding POTS includes the abnormal response by the sympathetic and parasympathetic nervous systems. Pooling of blood in the ankles and the feet occur as a result of an abnormal response to standing due to the body's inability to pump blood back to the core and upper extremities (Abed et al., 2012; Busmer, 2013; Pavlik et al., 2016). Pathogenesis shows a significant increase in peripheral artery resistance with compensatory hyperemic blood flow curtailed (Landro, 2014). POTS patients have shown physiological autonomic control of the baroreflex arc as shown by the Valsalva maneuver with diminished subjective sleep quality and increased daytime sleepiness noted in many patients (Mallen, Isenmann, Mrazek, & Haensch, 2014).

Diagnostic Criteria

Diagnostic criteria for POTS includes an increased in heart rate of 30 or more beats per minute when changing from supine to standing position with the use of a tilt table test, with

symptoms worsening when standing (Abed et al., 2012; Garland et al., 2015). Confirmation of diagnosis includes the use of a tilt table test (Busmer, 2013; Thanavaro & Thanavaro, 2011). Clinical presentation in children often requires an increase of 40 beats per minute within ten minutes of changing positions from supine to standing without the use of a tilt table test (Pavlik et al., 2016).

Other considerable criteria include a history of orthostatic intolerance for 6 months or longer, symptoms that are exacerbated by standing and improved by recumbence, and no other obvious explanation for tachycardia such as hyperthyroidism, acute dehydration, or anemia. In addition to tilt table testing, often diagnosis occurs through the elimination of other suspected disease processes including the QSART sweat test, skin biopsy, plasma volume, plasma norepinephrine testing, antibody testing, and ECG findings (Pavlik et al., 2016). Many individuals report triggers such as exhaustion, dehydration, and stress which exacerbate symptoms including fatigue, lack of sleep, prolonged standing, dehydration, and feeling faint (Ross, Medow, Rowe, & Stewart, 2013). A variety of causes have been attributed to POTS. Some of these include vaccinations, specifically influenza and the Gardasil vaccination (Perring & Jones, 2012), autoimmune damage such as Epstein-Barr, concussions, gastrointestinal illness, and a variety of other suspected causes (Tomljenovic, Colafrancesco, Perricone, & Shoenfeld, 2014).

Management & Treatment

The primary goal in the treatment of POTS is increased functioning, particularly in activities of daily living (ADLs) (Bruce, Weiss, Harrison, Allman, Peterson, Luedkte, & Fischer, 2016). Many practitioners are deficient in this area due to lack of knowledge. Evaluation and management of symptoms begins with a detailed history of illness and continues with a detailed

physical examination and treatment plan (Grubb, 2008). In many cases treatment has shown to be individualized according to patient needs using a structured approach of identifying the underlying causes. Treatment options vary from non-pharmacological options to aggressive drug therapy with most patients requiring a combination of pharmacological and non-pharmacological intervention (Busmer, 2013; Metzler et al., 2013). As a whole, treatment is directed toward addressing and treating symptoms through the use of pharmacotherapy and intravascular volume expansion (Grigoriou et al., 2015). A variety of non-pharmacological factors have been shown to play a role in the improvement of POTS symptoms. Diet changes, including small frequent meals and increased fluids intake to two to three liters a day can help relieve symptoms while exercise, sleep hygiene, and increased sodium intake have also shown to be crucial in management (Abed et al., 2012; Busmer, 2013; Garland et al., 2015).

Pharmacological management according to Abed et al. (2012) includes the use of normal saline infusions, beta-blockers, fludrocortisone, Ivabradine, Erythropoietin, pyridostigmine bromide, vasoconstrictors, and NSAIDs which have shown to reduce or eliminate symptoms. Pavlik et al. (2016) report that symptoms are best managed with a combination of pharmacological and non-pharmacological interventions including oral fluid replacement, beta-blockers, alpha-1 antagonists, and SSRIs. The most frequently reported interventions included the use of IV saline, stimulant medications, salt tablets, intramuscular vitamin B12 injections, and midodrine, however, midodrine is only an effective treatment for neuropathic POTS but not for hyperadrenergic POTS (Ross et al., 2013; Ross et al., 2014). POTS patients with higher flow-mediated vasodilation values tend to have a better response to midodrine compared to other medications (Liao, Tsai, & Chou, 2014).

Referrals

The referral of patients to appropriate practitioners is crucial in the management and treatment of POTS. Early management can make an impact of overall success of living to the patient's fullest potential despite this devastating diagnosis. It is imperative that health care providers be cognizant of the symptoms and clinical manifestations of POTS in an effort to correctly diagnose patients expeditiously (Thanavaro & Thanavaro, 2011). Many patients will be referred to cardiologists and/or neurologists who specialize in POTS. Other specialists may be called in to care for specific aspect such as GI disturbances. These referrals come from a variety of sources including primary care providers, emergency department doctors, specialists such as neurologists, endocrinologists, and gastroenterologists, and especially care providers who see symptoms routinely such as school nurses (Urlich & Hartung, 2015).

Role of the School Nurse

The role of the school nurse includes the facilitation of care between students, parents, health care providers, and educators. The nurse is responsible for understanding medical diagnoses and communicating needs to the health care provider, while advocating for the student and supporting parents (Ensz, 2016). He or she should act as the first line of defense in recognizing symptoms, referring appropriate students, and utilizing non-pharmacological interventions to ease or eliminate symptoms.

Conceptual Frameworks**IOWA Model**

The conceptual framework and practice model used for the project was the IOWA Model. This model provides a step by step process of effective EBP implementation. The Iowa Model identifies with the triggering issue of a clinically identified issue. The model has re-evaluation

points which allow opportunities to consider revision, reassembly, additional research, redesign of a plan, or alternatives to complete the process. Using the IOWA model helps to have clearly defined stages to keep the project moving forward. A question was identified and considered to be a priority within the organization. A team was formed between DNP student and a large dysautonomia organization. Future steps include the appraisal and synthesis of the body of evidence, design and piloting of the practice changes, integration and sustaining the practice change, and dissemination of the results (University of Iowa Hospitals and Clinics, 2015).

The Iowa model uses a flow chart approach to guide decision making, utilizes problem solving steps, and feedback loops to guide the change process, while other models focus on critical thinking and use of evidence by the individual clinician, categorizing evidence as external and internal (Schaffer, Sandau, & Diedrick, 2012). The model considers input from the entire organizational system, including the patient, providers, and organizational infrastructure, and involves nurses in each step (Schaffer et al., 2012). The model incorporates the inclusion of a trial of the practice change before making a decision about implementation.

Based on the IOWA model, both problem-focused triggers and knowledge-focused triggers were identified. The identification of a clinical problem and philosophy of care were noted. The topic was identified as a priority for Dysautonomia International. A team was formed with the DNP student and the organization. A literature review was completed and feedback received from the medical advisory board. A pilot study will be utilized to obtain feedback. It is assumed that the change is appropriate for adoption in practice and would then be distributed into practice.

Project Details

The scholarly project was a quality improvement initiative to raise awareness about a particular disease process. The premise of the project is to shorten the timeframe from onset of symptoms to diagnosis of POTS by educating school nurses on symptoms and appropriate referral to practitioners. IRB approval was received prior to implementation.

Methodology

The proposal project was an evidence-based project utilizing a quasi-experimental approach to gather and analyze data. A convenience sample was used, utilizing the IOWA Model. Project success will be measured using pre and post-test (Appendix C) created by this writer, to determine knowledge gained. Pre and post-tests were administered to eighteen public school nurses immediately prior to and immediately following the educational in-service. Participants then had the opportunity to complete a short survey to provide qualitative feedback about their experience.

Outcomes

The desired outcome of the scholarly project was to decrease the timeframe from onset of symptoms to correct diagnosis in patients with POTS. The detailed outcomes of the project (Appendix A) were as follows:

- School nurses with limited knowledge on the subject were identified in an effort to tailor education about postural orthostatic tachycardia syndrome (POTS).
- An appraisal of culture was completed by identifying factors that contribute to the school nurses' ability to complete educational training modules in addition to determining the top five needs for education related to POTS.

- An increased understanding of nurses' awareness of POTS was developed using pre and post-testing to evaluate knowledge about POTS.
- An evaluation was complete through the use of a survey to show the school nurses' likelihood to refer patients. (AACN, 2006)

Subjects

The target population included public school nurses with no previous knowledge or training about POTS diagnosis, management, and/or treatment plans. The group included eighteen individuals who participated in a pilot study, completed the educational session, and the pre and post-tests. These individuals also provided feedback about the overall presentation, content, and information through the use of a post education survey. Future goals include partnering with dysautonomia organizations to distribute the educational modules to school nurses around the country to spread awareness and education in an effort to decrease the timeframe from onset of symptoms to correct diagnosis and treatment. "School nurse" is defined as current registered nurses and/or licensed practical nurses functioning in the role of nurse within a public school system in the Mid-Atlantic United States.

Setting

The project was completed in a public school system in the Mid-Atlantic United States as public school nurses who have agreed to participate. After completing a consent (appendix H), each completed the educational modules along with pre and post-tests and survey during their monthly in-service. The project is supported by the board of education staff and dysautonomia organizations as well as clinics caring for dysautonomia patients.

Tools

Pre and post-tests were used to measure knowledge gained by the school nurses who participated in the educational experience. Reflection of the team and process helps to provide the possibility of understanding and validation of research during program implementation (Muhammad, Wallerstein, Sussman, Avila, Belone, & Duran, 2015). The collection of positive feedback helps to validate not only the need, but also the success of the program to be implemented. Sampling procedures included a convenience sample of practitioners who agreed to participate in the practice study. Inclusion criteria for the project include practitioners without previous knowledge of POTS.

Testing and Education

Participants were asked to complete a pre-test (appendix C) consisting of ten questions about the diagnosis and treatment of POTS symptoms. Immediately following, the participants were provided with a video presentation about POTS. The educational video discussed the following information:

- Objectives of the training modules
- Review of the autonomic system
- Defining terms such as dysautonomia and POTS
- Providing vital statistics of the syndrome
- Diagnostic criteria
- Additional diseases associated with POTS
- Symptoms and management
- Pharmacological and non-pharmacological interventions in treatment
- Referral criteria and process

After completing the 20 minute video, participants had the opportunity to ask questions about any of the topics covered. Participants then completed the same test (post-test) as well as a survey (appendix D) about their experience, confidence level in recognizing symptoms, and likelihood to refer patients to appropriate practitioners.

The pre and post-test was validated prior to use. Validity is the extent to which a data collection tool measures its intended data. For tests of measurement to be valid, it should be understood by its subjects/participants to receive relevant answers (Jain, Dubey, & Jain, 2016). This is best validated through the use of a pilot sampling of the test. A pilot sample of the ten question test was completed by five Master's Degree prepared nurse educators trained in test writing and building. All five educators confirmed the validity of the test.

Intervention & Data Collection

The intervention of the scholarly project was to reduce the time from onset of symptoms to diagnosis for patients with POTS through enhancing knowledge and likelihood to refer patients for further assessment. This was accomplished by providing educational presentations to nurses who agreed to participate in the pilot study. Data collection was obtained through the use of pre and post-testing immediately following the educational teaching. Additionally, participants answered a short survey about their experience. Data analysis procedures included the use of Statistical Package for the Social Sciences (SPSS) analytical software to evaluate the significance of data and apply findings to further the project on a larger scale.

A total of eighteen participants completed the educational session and completed the post educational survey. All eighteen participants showed increased knowledge on post-test score in comparison to pre-test scores. Additionally, all participants reported increased comfort levels of

identifying POTS related symptoms and increased likelihood to refer patients with symptoms to appropriate health care providers.

Analysis

Data analysis was completed using the Statistical Package for Social Sciences (SPSS) software. A paired *t*-test was performed on the pre and post-test data collected. Other data analyzed includes frequency and percentage of educational characteristics of participants (see table 1), and mean and standard deviation of pre and post-score results. Additionally, the survey was evaluated to determine qualitative feedback.

A paired-samples *t*-test can be used to examine the mean of a continuous (scale) variable when subjects are matched to form pairs or each subject is measured under two conditions. For the analysis conducted, subjects were measured under two conditions (i.e. two time points). The paired-samples *t*-test was conducted to evaluate the impact of the intervention on participants' scores from pre-test ($M= 6.67, SD=.970$) to post-test ($M=9.56, SD=.511$), $t(17) = -13.615, p < .0005$ (two-tailed). The mean increase score in post-test was -2.889 with a 95% confidence interval ranging from -3.337 to -2.441 . Because the *p*-value is less than .005 level of significance, one can conclude the pre-test scores are significantly different than the post-test scores (see table 2).

Table 1

Frequency and Percentage of Educational Characteristics of Participants

Highest level of Nursing	<i>N</i>	%
Associate's Degree in Nursing	1	5%
Bachelor's Degree in Nursing	15	84%
Master's Degree in Nursing	2	11%
Doctorate Degree in Nursing	0	0%

The standard deviation is a measure of the average spread of each score around the mean. The higher the standard deviation, the greater the variability amongst the scores (e.g. the pre-test scores are more “spread out” than the post-test score). The standard error of the mean is the standard deviation divided by the square root of the sample size. In essence, it measures the variability of the mean between repeated samples (i.e. it measures the standard deviation of the distribution of the sample mean).

Table 2

Mean and Standard Deviation of Pre-Score and Post-Score of Study

	Mean	<i>N</i>	Std. Deviation	Std. Error Mean
Pair 1 Pre-Score	6.67	18	.970	.229
Post-Score	9.56	18	.511	.121

The values being evaluated in a paired t-test are the differences between the pre-test score and post-test score for each subject (see table 3). Considering, the results in the Paired Samples Test table all deal with the difference.

Table 3
Paired Samples Test

	Paired Differences				<i>t</i>	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
				Lower				Upper
Pair 1	-	.900	.212	-3.337	-	17	.000	
Pre-score-Post-Score	2.889			2.441	13.615			

The mean provided, - 2.889, is the difference between the pre-test score and the post-test score (6.67 - 9.56), and the standard deviation (and standard error) given is that for the difference. The 95% confidence interval is the interval for the difference. While the actual difference is -2.889, the confidence interval indicates that with 95% confidence, you can conclude that the mean difference between the pre-test and post-test scores will be between - 3.337 and -2.441. Another way to consider the results is that the value -2.889 is a single point estimate. If one wishes to use this value to represent the change in score for all school nurses

(i.e. if you wish to generalize your results to a larger group – population – of school nurses), it could be said that scores would improve by 2.889 points after the training. With the confidence interval, one can give a degree of certainty (here, 95%) about the estimate, while also providing a range of possible values of the improvement as opposed to just a single value. Therefore, one can say that they are 95% confident that the scores of school nurses will improve by at least 2.441 points and at most 3.337 points after receiving the training (this interpretation is based on the assumption that the sample used for the study is representative of the population of interest).

The test statistic (t) and the degrees of freedom (df) are used to calculate the p-value (Sig.). The p-value is the probability of obtaining a mean difference of -2.889 or more extreme if there was truly no difference between the pre-test mean and the post-test mean. Therefore, a small p-value indicates that the means are significantly different. Please note that the confidence interval also “indicates” a significant difference because the interval does not contain zero – both the lower and upper limits are negative, so you can conclude that the pre-test scores are less than the post-test scores.

Table 4
Survey Results

Survey Question	Very Confident		Confident	
	N	%	N	%
Do you feel that the educational modules helped you to learn about POTS?	14	78%	4	22%
How confident do you feel in understanding the criteria used to diagnose POTS?	4	22%	14	78%
How likely are you to refer patients with symptoms of POTS?	7	41%	10	59%

All participants reported feeling confident or very confident that the educational module assisted in learning about POTS. Each communicated feeling confident or very confident in understanding the criteria used to diagnose POTS. Additionally, all nurses in the study disclosed that they were likely or very likely to refer patients presenting with or reporting symptoms of POTS. This is significant because, as reported by Hackett, the school nurse is identified as an individual who plays a key role in safeguarding the needs of school aged children (Hackett, 2013). Feeling confident in recognizing and managing symptoms of these patients is crucial. Adolescents experiencing POTS symptoms may feel frustrated, anxious, and misunderstood by those around them including parents, teachers, and even friends. The school nurse is often a person with whom these students feel comfortable health symptoms and concerns. For this reason, the school nurse holds a role requiring important leadership and assessment skills to

advocate for the student, educate colleagues, and to serve as a medical resource to all involve in the student's care (Urlich & Hartung, 2015).

Assignment of Tasks

Personnel for the project included the utilization of a statistician, editor, preceptor, and committee members. The DNP student worked to create the education modules and testing methods and analyze data while the editor will assist in preparing the work for final submission and publication. The role of the preceptor was to act as a mentor and expert on the topic of POTS and dysautonomia and to assist in distributing modules to school nurses. The role of the committee members were to act as mentors on the scholarly project process.

The investment by a DNP student will greatly assist dysautonomia organizations with implementing the project. The project benefits both parties and gives the organizations the ability to launch a program that is desperately needed and does not cut into current workforce and budget restraints to pay an individual to develop, implement, and track results. As with any process improvement or EBP project, individuals within the organization must have buy-in before the project can be successful. Steps that can be incorporated include the validation of need and financial support. It is believed that there are rarely tangible incentives for distributing or adopting evidence-based health services (Brownson, Colditz, & Proctor, 2012). Because the project is based at educating school nurses about the disease process and referral of POTS patients, one incentive may include the use of continuing education credits for any nurse who completes a pre and post quiz while completing the interactive modules. This provides a benefit to the school nurse for completing the education while the project is successfully educating patient caregivers.

Cost/Benefit Analysis

Economic evaluation assesses the efficiency and appointment of resources for interventions that have the potential to improve both health care and outcomes (Hoomans & Severens, 2014). Economic considerations within the project include the limited monetary needs which are outweighed by an overall decrease in physician charges, decreased unwarranted physician visits to incorrect practitioners, and a decrease in length of time for correct diagnosis.

Cost/budget analysis for expansion of the project should include the utilization of grants, sponsorships, and donations from supports of available foundations. Many dysautonomia organizations are run by individuals who have been effected by autonomic diseases such as POTS or are medical personnel fighting against these diseases through research and/or clinically who are seeking awareness of autonomic disease processes; therefore, the specific strategy would be widely supported within the organization. It is extremely likely that these organizations will not only be a strong supporters of the project, but will also be willing to help the project receive global recognition.

Often the use of organizational funding is determined through the organization's board of directors. Currently monies are allocated for research, marketing materials, outreach programs, and conferences to spread awareness and knowledge about diseases under the dysautonomia umbrella. By teaming with a large organization, the project is able to use resources available through the organization to create a successful implementation of education and awareness. The organization benefits by saving money on the DNP to implement the program.

Evaluation, Analysis, & Dissemination Settings and Populations

School nurses are often the first health care worker to encounter children experiencing symptoms of POTS. Because of the consistently interacting with the students, patterns can be

noted with relative ease. Symptoms are often worse in the morning due to position changing, and episodes are likely to occur during the school day. For this reason, nurses who are educated in identifying symptoms, managing acute symptoms, and appropriate practitioner referral are an asset to students suffering with POTS like symptoms. Continuing education is critical to the wellbeing of students and professional development of school nurses, ensuring that nurses have the application of advanced clinical knowledge and skills in the school setting (Vought-O'Sullivan, Meehan, Havice, & Pruitt, 2006). Nurses who feel confident in their skills and assessment of an illness are more likely to refer patients for further treatment. 100% of the nurses surveyed in study reported feeling confident or very confident in understanding criteria used to diagnose POTS and likely or very likely to refer patients with POTS like symptoms (see table 4).

Program/Policy Implementation

By providing validation of the project, this enhances the likelihood of public and private school would participate in and utilize the training modules to spread POTS awareness. Future training should be considered using an online platform for ease of user, due to time and location constraints. This could potentially require individuals to review and pass a post test on the information provided. The use of a posttest ensures quality measures are met, requiring participants to score 80% or higher.

Outcomes for Decision Making

As with any implementation, validity is important to determine the need for programs. By creating, accomplishing, and reviewing outcomes of the project, this helps organizations determine outcomes for decision making in the treatment plans used to manage POTS patients. After review of the project validates increased knowledge, organizations may show interest in participating in the training.

The desired outcome of the education project was to decrease the timeframe from onset of symptoms to correct diagnosis in patients with POTS, with an anticipation that public schools will create procedures that include the evaluation and appropriate referral of at risk patients. As with any implementation, validity is important to determine the need for programs. Pre and post-tests were validated by three nursing experts in the field. After review of the project validates increased knowledge, organizations may show interest in participating in the training in the future.

Significance & Implications

The implications are wide reaching and offer a trickle down affect. When school nurses are provided with proper education on the disease process, patients are much more likely to receive a more expeditious and correct diagnosis. Allison, Nativio, Mitchell, & Yuhasz (2014), discuss the crucial role that school nurses play in recognizing subtle symptoms and changes associated with health issues. In particular, school nurses have shown to improve outcomes as well as provide emergency intervention affecting chronic illness management in conditions such as asthma, severe allergies, sickle-cell anemia, diabetes, and seizure disorders (Keehner Engelke, Guttu, Warren, & Swanson, 2008).

Early intervention offers less suffering to patients and their families. It also eliminates the need for miscellaneous specialty physician visits in an attempt to find a diagnosis to their symptoms which will also eliminate monies spent by both the patient and insurance companies. Additionally, correct diagnosis will significantly decrease overcrowding in physician offices.

Plans for dissemination include distributing the educational modules to participating school nurses. Key stakeholders of the project include patients and families suffering from

POTS, school nurses, and practitioners caring for POTS patients. Future plans include publication of the findings of the pilot study in an effort to spread further awareness of POTS.

The successful completion of this project gives validation to the use of educational modules as a learning tool for a variety of disease processes. Once the modules have been adapted for online distribution, the cost to maintain the modules would be minimal, and therefore a practical option for providing education moving forward.

Limitations

Limitations of the project include limited sample size, n=18. All nurses were located in the same county and geographical location. Additional limitations include short time allotted for teaching and the need for additional follow up to determine if referrals have increased after educational modules.

Conclusion

While POTS is relatively unheard, it impacts an estimated 3,000,000 Americans. Many of these individuals go undiagnosed or misdiagnosed do to the lack of education that medical professionals have received about the syndrome. This project was used to raise awareness within the school nursing community, where POTS is prevalent. After completing an educational training session, data showed that 100% of nurses showed a higher knowledge base on the topic. In addition, 100% of participants reported higher levels of confidence in recognizing symptoms and referring students to appropriate practitioners. Additional follow up is needed to determine the accuracy of these results with a larger participant population and to evaluate the number of referrals received after education.

Goals moving forward include expansion of the project to reach additional school nurses at the state and national levels. This can be accomplished with the use of electronic modules

available to nurses online. The use of the modules helps to spread awareness, making POTS a commonly known diagnosis within the school nursing community. Additionally, this training can be used as a template to raise awareness about other forms of dysautonomia and childhood illnesses.

The project allowed opportunities for policy evaluation and change within the participating school system as well as other school systems in the future. Additionally, the project can be used within the dysautonomia community to raise further awareness for school nurses and other school personnel. The concept of the project can also be used to create additional educational modules within the school nurse setting.

References

- Abed, H., Ball, P. A., & Wang, L. (2012). Diagnosis and management of postural orthostatic tachycardia syndrome: A brief overview. *Journal of Geriatric Cardiology*, 9(1), 61-67. <http://dx.doi.org/10.3724/SP.J.1263.2012.00061>
- Allison, V., Nativo, D., Mitchell, A., & Yuhasz, J. (2014). Identifying symptoms of depression and anxiety in students in the school setting. *The Journal of School Nursing*, 30(3), 165-172. <http://dx.doi.org/10.1177/1059840513500076>
- American Association of Colleges of Nursing. (2006). *The Essentials of Doctoral Education for Advanced Nursing Practice*. Retrieved from <http://www.aacn.nche.edu/publications/position/DNPEssentials.pdf>
- Brownson, R. C., Colditz, G. A., & Proctor, E. K. (2012). *Dissemination and implementation research in health: Translating science into practice*. Oxford, NY: Oxford University Press.
- Bruce, B. K., Weiss, K. E., Harrison, T. E., Allman, D. A., Peterson, M. A., Luedkte, C. A., & Fischer, P. R. (2016). Interdisciplinary treatment of maladaptive behaviors associated with postural orthostatic tachycardia syndrome (POTS): A case report. *Journal of Clinical Psychology*, 23(1), 147-159. <http://dx.doi.org/10.1007/s10880-015-9438-3>
- Busmer, L. (2013). Diagnosis and management of postural tachycardia syndrome. *Nursing Standard*, 27(20), 44-48. <http://dx.doi.org/10.7748/ns2013.01.27.20.44.c9502>
- Dysautonomia International. (2016). Postural Orthostatic Tachycardia Syndrome. Retrieved from <http://www.dysautonomiainternational.org/page.php?ID=30>
- Dysautonomia International. (2016). What is Dysautonomia? Retrieved from <http://www.dysautonomiainternational.org/page.php?ID=34>

- Ensz, C. E. (2016). Order up! Understanding the school nurse's role. *Nursing Made Incredibly Easy*, 14(5), 20-30. <http://dx.doi.org/10.1097/01.NME0000489905.93337.24>
- Garland, E. M., Celedonio, J. E., & Raj, S. R. (2015). Postural tachycardia syndrome: Beyond orthostatic intolerance. *Current Neurology and Neuroscience Reports*, 15(60). <http://dx.doi.org/10.1007/s11910-015-0583-8>.
- Grigoriou, E., Boris, J., & Dormans, J. P. (2015). Postural orthostatic tachycardia syndrome (POTS): Association with Ehlers-Danlos syndrome and orthopaedic considerations. *Clinical Orthopaedics in Related Research*, 473(1), 722-728. <http://dx.doi.org/10.1007/s11999-014-3898-x>
- Grubb, B. P. (2008). Postural Tachycardia Syndrome. *Circulation*, 117(1), 2814-2817. <http://dx.doi.org>/Retrieved from
- Grubb, B. P., KanjWal, Y., & Kosinski, D. J. (2006). The postural tachycardia syndrome: A concise guide to diagnosis and management. *Journal of Cardiovascular Electrophysiology*, 17(1), 108-112. <http://dx.doi.org/10.1111/j.1540-8167.2005.0318.x>
- Hackett, A. (2013). The role of the school nurse in child protection. *Community Practitioner*, 86(12), 26-29.
- Hoomans, T., & Severens, J. L. (2014). Economic evaluation of implementation strategies in health care. *Implementation Science*, 9(1), 168-173.
- Jain, S., Dubey, S., & Jain, S. (2016). Designing and validation of questionnaire. *International Dental & Medical Journal of Advanced Research*, 2(1), 1-3. <https://doi.org/10.15713/ins.idmjar.39>
- Keehner Engelke, M., Guttu, M., Warren, M., & Swanson, M. (2008). School nurse case management for children with chronic illness: Health, academic, and quality of life

- outcomes. *The Journal of School Nursing*, 24(4), 205-214.
<http://dx.doi.org/10.1177/10598405083119929>
- Landero, J. (2014). Postural orthostatic tachycardia syndrome: A dermatologic perspective and successful treatment with Losartan. *The Journal of Clinical and Aesthetic Dermatology*, 7(8), 41-47. <http://dx.doi.org/Retrieved from>
- Liao, Y., Tsai, J., & Chou, F. (2014). The effectiveness of an oral health care program for preventing ventilator-associated pneumonia. *Nursing in Critical Care*, 20(2), 89-97.
<http://dx.doi.org/10.1111/nicc.12037>
- Lin, J., Han, Z., Oches, T., Zhao, J., Zhang, X., Yang, J., ... Jin, H. (2014). Risk factors for postural tachycardia syndrome in children and adolescents. *PLoS ONE*, 9(12).
<http://dx.doi.org/10.1371/journal.pone.0113625>
- Mallen, J., Isenmann, S., Mrazek, A., & Haensch, C. (2014). Sleep disturbances and autonomic dysfunction in patients with postural orthostatic tachycardia syndrome. *Frontiers in Neurology*, 5(118). <http://dx.doi.org/10.3389/fneur.2014.00118>
- Melnyk, B. M. (2011). *Evidence-Based Practice in Nursing & Healthcare: A Guide to Best Practice* (2nd ed.). [Kindle]. Retrieved from <http://lww.com>
- Metzler, M., Duerr, S., Granata, R., Krismer, F., Robertson, D., & Wenning, G. K. (2013). Neurogenic orthostatic hypotension: Pathophysiology, evaluation, and management. *Journal of Neurology*, 260(1), 2212-2219. <http://dx.doi.org/10.1007/s00415-012-6736-7>
- Moore, L., Lavoie, A., Bourgeois, G., & Lapointe, J. (2015). Donabedian's structure-process-outcome quality of care model: Validation in an integrated trauma system. *The Journal of Trauma and Acute Care Surgery*, 78(6), 1168-1175.
<http://dx.doi.org/10.1097/TA.0000000000000663>

- Moran, K., Burson, R., & Conrad, D. (2014). *The Doctor of Nursing Practice Scholarly Project: A Framework for Success*. Burlington, MA: Jones & Bartlett Learning.
- Muhammad, M., Wallerstein, N., Sussman, A. L., Avila, M., Belone, L., & Duran, B. (2015). Reflections on research identity and power: The impact of positionality on community based participatory research (CBPR) process and outcomes. *Critical Sociology*, *41*(7-8), 1045-1063. <http://dx.doi.org/10.1177/0896920513516025>
- Pavlik, D., Agnew, D., Stiles, L., & Ditoro, R. (2016). Recognizing postural orthostatic tachycardia syndrome. *Journal of the American Academy of Physician Assistants*, *29*(4), 17-23. <http://dx.doi.org/10.1097/01.JAA.0000481398.76099.09>
- Perring, S., & Jones, E. (2012). Assessment of changes in cardiac autonomic tone resulting from inflammatory response to the influenza vaccine. *Clinical Physiology and Functional Imaging*, *32*(1), 437-444. <http://dx.doi.org/10.1111/j.1475-097x.2012.01147.x>
- POTS UK. (2016). Postural Tachycardia Syndrome - Raising Awareness of POTS. Retrieved from <http://www.potsuk.org/>
- Ross, A. J., Medow, M. S., Rowe, P. C., & Stewart, J. M. (2013). What is brain fog? An evaluation of the symptom in postural tachycardia syndrome. *Clinical Autonomic Research*, *23*(1), 305-311. <http://dx.doi.org/10.1007/s10286-013-0212-z>
- Ross, D. B., & Exposito, J. A. (2014). A dual perspective in leadership and decision making through a distance learning simulated city. *International Journal of Education and Social Science*, *1*(3), 1-13. <http://dx.doi.org/10.1177/1046878103253719>.
- Rowe, P. C. (2014). *General information brochure on orthostatic intolerance and its treatment*. Retrieved from <http://www.dysautonomiainternational.org/pdf/RoweOIsummary.pdf>

- Schaffer, M. A., Sandau, K. E., & Diedrick, L. (2012). Evidence-based practice models for organizational change: overview and practical applications. *Journal of Advanced Nursing*, 69(5), 1197-1209. <http://dx.doi.org/10.1111/j.1365-2648.2012.06122.x>
- Shanks, L., Jason, L. A., Evans, M., & Brown, A. (2013). Cognitive impairments associated with CFS and POTS. *Frontiers in Physiology*, 4(113). <http://dx.doi.org/10.3389/fphys.2013.00113>
- Smith, M. J., & Liehr, P. R. (2014). *Middle Range Theory for Nursing* (3rd ed.). New York, NY: Springer Publishing.
- Taylor, M., McNicholas, C., Nicolay, C., Darzi, A., Bell, D., & Reed, J. E. (2013). Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ Quality & Safety*, 23(4), 290-298. <http://dx.doi.org/10.1136/bmjqs-2013-001862>
- Thanavaro, J. L., & Thanavaro, K. L. (2011). Care of the patient with electrophysiology abnormalities postural orthostatic tachycardia syndrome: Diagnosis and treatment. *Heart & Lung*, 40(6), 554-560. <http://dx.doi.org/10.1016/j.hrtlng.2009.12.014>.
- Tomljenovic, L., Colafrancesco, S., Perricone, C., & Shoenfeld, Y. (2014). Postural orthostatic tachycardia with chronic fatigue after HPV vaccination as part of the “Autoimmune/autoinflammatory syndrome induced by adjuvants”: Case report and literature review. *Journal of Investigative Medicine High Impact Case Reports*, 2(1), 1-8. <http://dx.doi.org/10.1177/2324709614527812>
- University of Iowa Hospitals and Clinics. (2015). The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care. Retrieved from <https://www.uihealthcare.org/otherservices.aspx?id=1617>

- Ulrich, A. E., & Hartung, S. Q. (2015). "Doesn't Anyone Believe How I Feel?": Postural Orthostatic Tachycardia Syndrome (POTS). *NASN School Nurse*, 30(2), 106-115.
<http://dx.doi.org/10.1177/1942602X14563801>
- Vought-O'Sullivan, V., Meehan, N., Havice, P., & Pruitt, R. (2006). Continuing education: A national imperative for school nursing practice. *The Journal of School Nursing*, 22(1), 2-8. <https://doi.org/10.1177/10598405060220010201>
- Wandersman, A., Imm, P., Chinman, M., & Kaftarian, S. (2000). Getting to outcomes: a results-based approach to accountability. *Evaluation and Program Planning*, 23(1), 389-395.
[http://dx.doi.org/10.1016/S0149-7189\(00\)00028-8](http://dx.doi.org/10.1016/S0149-7189(00)00028-8)
- Weiner, B. J. (2009). A theory of organizational readiness for change. *Implementation Science*, 4(67). <http://dx.doi.org/10.1186/1748-5908-4-67>
- Wiseman, S., Chinman, M., Ebener, P. A., Hunter, S., Imm, P., & Wandersman, A. (2007). *Getting to outcomes: 10 steps for achieving results-based accountability*. Retrieved from http://www.rand.org/pubs/technical_reports/TR101z2.html

Appendix A

Scholarly Project Proposal Goals and Objectives

Goals	Objectives	Essentials of Doctoral Education (American Association of Colleges of Nurses [AACN], 2006).
<p>1. Identify the population of interest (school nurses) for the education about postural orthostatic tachycardia (POTS).</p>	<p>1.1 Create a survey to determine current knowledge about POTS.</p> <p>1.2 Evaluate findings to determine population lacking knowledge.</p> <p>1.3 Tailor education process to meet the needs of the population.</p>	<p>Essential III (AACN, 2006).</p>
<p>2. Appraise organizational culture to determine the approach for education.</p>	<p>2.1 Identify three factors that contribute to the nurses' ability to complete skills modules.</p> <p>2.2 Determine the top five needs for education (ex: pathophysiology,</p>	<p>Essential V, VI, VII (AACN, 2006).</p>

	<p>symptoms, management and treatment).</p>	
<p>3. Develop an increased understanding of school nurses' awareness of POTS in the defined environment of care.</p>	<p>3.1 Interview five school nurses.</p> <p>3.2 Create a pre-test to evaluate knowledge and deficits prior to completing the educational modules.</p> <p>3.3 Evaluate pre-test results determine knowledge and deficits prior to completing the educational modules.</p>	<p>Essential II, VIII (AACN, 2006).</p>
<p>4. Develop approaches to incorporate evidence-based practice changes to improve healthcare delivery.</p>	<p>4.1 Determine the type of professional knowledge and skills needed to support the integration of POTS education.</p> <p>4.2 Devise an approach to promote a formalized education process for</p>	<p>Essential I, II, VIII (AACN, 2006).</p>

	<p>school nurses utilizing teaching modules.</p> <p>4.3 Use post-test to evaluate effectiveness of teaching modules.</p>	
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Appendix B

Literature Review

Attachment 5-2: Summary and Synthesis Tables Tool			
Guidelines, Reviews, and Other Literature			
Citation	Critique: Type & Level of Evidence/ Limitations	Scope	Relevant Findings
<p>Abed, H., Ball, P. A., & Wang, L. (2012). Diagnosis and management of postural orthostatic tachycardia syndrome: A brief overview. <i>Journal of Geriatric Cardiology</i>, 9(1), 61-67. http://dx.doi.org/10.3724/SP.J.1263.2012.00061</p>	<p>Level of Evidence: Level IV</p>	<p>The study discussed the pathophysiology of POTS as well as management through pharmacological interventions, diet, and exercise.</p>	<ul style="list-style-type: none"> • Diagnostic criteria for POTS includes an increase in heart rate of 30 or more beats per minute when changing from supine to standing position, with symptoms worsening with standing. • Pathophysiology surrounding POTS

			<p>involves the pooling of blood in the ankles and feet.</p> <ul style="list-style-type: none">• Diet changes, including small frequent meals and increased fluid intake to 2-3 liters a day help relieve symptoms.• Exercise has shown to be beneficial in alleviating symptoms.• The use of medications, including Normal saline infusions, beta-blockers, fludrocortisone, Ivabradine, Erythropoietin,
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			<p>pyridostigmine bromide, vasoconstrictors, and NSAIDs have shown to reduce or eliminate symptoms of POTS.</p>
<p>Bruce, B. K., Weiss, K. E., Harrison, T. E., Allman, D. A., Peterson, M. A., Luedkte, C. A., & Fischer, P. R. (2016). Interdisciplinary treatment of maladaptive behaviors associated with postural orthostatic tachycardia syndrome (POTS): A case report. <i>Journal of Clinical Psychology, 23</i>(1), 147-159. http://dx.doi.org/10.1007/s10880-015-9438-3</p>	<p>Level of Evidence: Level IV</p>	<p>The study discussed a case in which an interdisciplinary team is utilized to manage a 19 year old male with a two year history of POTS symptoms.</p>	<ul style="list-style-type: none"> • The primary goal of the patient’s treatment was increased functioning. • Depression symptoms were measured using the CES-DC scale which measures symptoms on a 4-point scale. • Pain symptoms were measured using the pain catastrophizing scale for

			<p>children; a 13-item self-reporting questionnaire.</p> <ul style="list-style-type: none">• Anxiety was assessed using the multidimensional anxiety scale for children which is also a self-reporting questionnaire assessing physical symptoms, harm avoidance, social anxiety, and separation/panic.• A treatment plan was developed utilizing an interdisciplinary team including PT, OT, RT, RN case managers, APRNs,
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			<p>psychologists, and a pediatric anesthesiologist.</p>
<p>Busmer, L. (2013). Diagnosis and management of postural tachycardia syndrome. <i>Nursing Standard</i>, 27(20), 44-48. http://dx.doi.org/10.7748/ns2013.01.27.20.44.c9502</p>	<p>Level of Evidence: Level V</p>	<p>The study discussed symptoms and pathophysiology associate with POTS as well as the diagnosis and management of the disease.</p>	<ul style="list-style-type: none"> • Symptoms include dysfunction of the autonomic system characterized by orthostatic intolerance. • Pathophysiology of POTS in not known, however, it is believed that the mechanisms involved include the pooling of blood in an abnormal response to standing. • Diagnosis includes the use of a tilt table test to show a

			<p>heart rate increase of 30 BPM.</p> <ul style="list-style-type: none"> • Management is individualized and includes the use of medications, diet, exercise, fluid intake, and sleep hygiene.
<p>Ellaway, R. H., Pusic, M., & Kalet, A. I. (2014). Context matters: emergent variability in an effectiveness trial on online teaching modules. <i>Medical Education</i>, 48(1), 386-396. http://dx.doi.org/10.1111/medu.12389</p>	<p>Level of Evidence: Level III</p>	<p>The study discussed the use of the WISE-MD teaching modules to</p>	<ul style="list-style-type: none"> • Four main themes were identified: (1) contextual factors: how implementation of the intervention varied between educational contexts, (2) behavioral

		<p>educate surgical clerks.</p>	<p>factors: how students and teachers interacted with and behaved around the intervention, (3) attitudinal factors: how the modules were perceived by students and teachers, and (4) media factors: how students and teachers responded to the medium and design of the modules.</p>
<p>Garland, E. M., Celedonio, J. E., & Raj, S. R. (2015). Postural tachycardia syndrome: Beyond orthostatic intolerance. <i>Current Neurology and Neuroscience Reports</i>, 15(60). http://dx.doi.org/10.1007/s11910-015-0583-8.</p>	<p>Level of Evidence: Level VII</p>	<p>The study discussed the causes for orthostatic intolerance and</p>	<ul style="list-style-type: none"> • Diagnostic criteria include the increase of heart rate of 30 BPM or more while upright.

		<p>the comparison and potential connection to POTS.</p>	<ul style="list-style-type: none"> • The orthostatic tachycardia of POTS is worsened in the morning compared to the evening. • Common clinical features include orthostatic symptoms, non-orthostatic symptoms, and symptom triggers. • There are a variety of disorders that overlap with POTS including chronic fatigue syndrome (CFS), Ehlers-Danlos syndrome (EDS), vasovagal syncope,
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			<p>and inappropriate sinus tachycardia.</p> <ul style="list-style-type: none">• There are a number of pathophysiologies associated with POTS including neuropathic POTS, hypovolemia and the Renin-Angiotensin-Aldosterone system in POTS, Central Hyperadrenergic POTS, Norepinephrine transporter deficiency, mast cell activation, physical deconditioning, and
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			<p>autoimmune/autoantibodies.</p> <ul style="list-style-type: none"> • Treatment of POTS includes the use of non-pharmacological treatment such as exercise, and pharmacological treatment using a variety of medications.
<p>Green, E. A., Black, B. K., Biaggioni, I., Paranjape, S. Y., Bagai, K., Shibao, C., ... Raj, S. R. (2014). Melatonin reduces tachycardia in postural tachycardia syndrome: A randomized crossover trial. <i>Cardiovascular Therapeutics</i>, 32(1), 105-112. http://dx.doi.org/10.1111/1755-5922.12067</p>	<p>Level of Evidence: Level II</p>	<p>The original research study evaluated the hypothesis that melatonin will attenuate tachycardia and</p>	<ul style="list-style-type: none"> • Sample size included 78 female subjects 32 +/- 9 years with a supine heart rate 74 +/- 13 BPM, and BP 107 +/- 11/68 +/- 9 mmHg.

		<p>improve overall symptoms associated with POTS.</p>	<ul style="list-style-type: none"> • The findings showed no change in seated HR between melatonin and placebo, nor were there significant differences to blood pressure effects. • Findings confirmed a significant difference between standing HR (P=0.014) and ΔHR (P=0.044) before melatonin compared to after melatonin (1 h P=0.014, 2 h P=0.005, 3 h P=0.017, 4 h P<0.001).
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<p>Grigoriou, E., Boris, J., & Dormans, J. P. (2015). Postural orthostatic tachycardia syndrome (POTS): Association with Ehlers-Danlos syndrome and orthopaedic considerations. <i>Clinical Orthopaedics in Related Research</i>, 473(1), 722-728. http://dx.doi.org/10.1007/s11999-014-3898-x</p>	<p>Level of Evidence: Level IV</p>	<p>The study discussed postural orthostatic tachycardia (POTS) and its association with Ehlers-Danlos syndrome (EDS).</p>	<ul style="list-style-type: none"> • Case studies were used to demonstrate symptoms of patients with POTS and EDS. • Connections between the two syndromes include the following: patients with joint hypermobility syndrome also displayed symptoms of dysautonomia with orthostatic hypotension or POTS, patients reported visceral pain and dysmotility, presented with nausea, bloating, diarrhea
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			<p>or constipation, and early satiety, fatigue, insomnia, fibromyalgia, weakness, and neurologic comorbidities including brain fog.</p> <ul style="list-style-type: none"> • Treatment is directed toward addressing and treating symptoms through the use of pharmacotherapy and intravascular volume expansion.
<p>Grubb, B. P. (2008). Postural Tachycardia Syndrome. <i>Circulation, 117</i>(1), 2814-2817.</p>	<p>Level of Evidence: Level IV</p>	<p>This study discussed the use of a case</p>	<ul style="list-style-type: none"> • The study provided a functional definition of POTS, defining the

		<p>presentation to provide the classification and clinical findings of postural orthostatic hypotension (POTS).</p>	<p>syndrome as orthostatic intolerance with the provocation of symptoms upon standing, and are relieved upon recumbence.</p> <ul style="list-style-type: none"> • Classifications and clinical features include two forms of POTS: primary or secondary. • Primary POTS is either “partial dysautonomic” or “hyperadrenergic.” • Secondary POTS describes symptoms stemming from a state of peripheral autonomic deinnervation
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			<p>of vascular unresponsiveness.</p> <ul style="list-style-type: none"> • Evaluation and management begins with a detailed history of illness and continues with a detailed physical examination and treatment plan.
<p>Grubb, B. P., KanjWal, Y., & Kosinski, D. J. (2006). The postural tachycardia syndrome: A concise guide to diagnosis and management. <i>Journal of Cardiovascular Electrophysiology</i>, 17(1), 108-112. http://dx.doi.org/10.1111/j.1540-8167.2005.0318.x</p>	<p>Level of Evidence: Level VII</p>	<p>This study discussed the classification and clinical findings of postural orthostatic</p>	<ul style="list-style-type: none"> • The study mimics the above study by the same author and provided a functional definition of POTS, defining the syndrome as orthostatic intolerance with the

		<p>hypotension (POTS).</p>	<p>provocation of symptoms upon standing, and are relieved upon recumbence.</p> <ul style="list-style-type: none"> • Classifications and clinical features include two forms of POTS: primary or secondary. • Primary POTS is either partial dysautonomic or hyperadrenergic. • Secondary POTS describes symptoms stemming from a state of peripheral autonomic deinnervation of vascular unresponsiveness.
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			<ul style="list-style-type: none">○ Evaluation and management begins with a detailed history of illness and continues with a detailed physical examination and treatment plan.● Data on the prognosis of POTS is limited but shows that approximately one half of patients will make a good practical recovery within 2-5 years.
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<p>Kimpinski, K., Figueroa, J. J., Singer, W., Sletten, D. M., Iodice, V., Sandroni, P., ... Low, P. A. (2012). A prospective, 1-year follow up study of postural tachycardia syndrome. <i>Mayo Clinic Proceedings</i>, 87(8), 746-752.</p> <p>http://dx.doi.org/10.1016/j.mayocp.2012.02.020</p>	<p>Level of Evidence: Level III</p>	<p>The study discussed the follow up one year after evaluation of postural orthostatic tachycardia syndrome (POTS).</p>	<ul style="list-style-type: none"> • Retrospective testing showed that 80% of patients showed improvement and 60% of patients had minimal residual symptoms during a five year timeframe. • Patients meeting the following criteria were enrolled into the study: males or females age 13-50 years old, orthostatic heart rate increment of 30 beats/min within 5 minutes of HUT, and symptoms of orthostatic intolerance,
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			<p>including weakness, light-headedness, blurred vision, nausea, palpitations, and difficulty with concentration and thinking for a period of greater than 3 months.</p> <ul style="list-style-type: none">• Autonomic testing was used to determine dysfunction.• Results revealed three main findings: overall symptoms and functional status improved and no longer met the orthostatic heart rate criteria for
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			<p>POTS, heart rate increment on HUT for the cohort didn't differ significantly on the one-year follow up, the autonomic dysfunction of the patients at baseline and at the one-year follow up was mild.</p>
<p>Landero, J. (2014). Postural orthostatic tachycardia syndrome: A dermatologic perspective and successful treatment with Losartan. <i>The Journal of Clinical and Aesthetic Dermatology</i>, 7(8), 41-47.</p>	<p>Level of Evidence: Level IV</p>	<p>This study discussed the use of a case presentation to provide a dermatological perspective and successful</p>	<ul style="list-style-type: none"> • The prevalence of POTS is estimated to be at least 500,000 patients in the United States with a 5:1 female to male ratio. • Flares in a patient's condition typically manifest with palpitations,

		<p>treatment with the use of losartan.</p>	<p>shortness of breath, crushing chest pain that is responsive to NTG, tremors, syncope, dysesthesia, allodynia, blurry vision, loss of vision, seizure-like activity, insomnia, confusion, altered thought process, migraines, fatigue, exercise intolerance, heat intolerance, photophobia, altered taste, hearing, vision, touch, and smell, and delayed cap-refill.</p>
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			<ul style="list-style-type: none">• Pathogenesis shows a significant increase in peripheral arterial resistance with compensatory hyperemic blood flow curtailed.• Dermatologic manifestations of POTS include acrocyanosis, dysesthesia/allodynia, evanescent hyperemia, koilonychias, livedo reticularis, madarosis, raynaud’s phenomenon, and telogen effluvium.
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<p>Liao, Y., Yang, J., Zhang, F., Chen, S., Liu, X., Zhang, Q., ... Jin, H. (2013). Flow-mediated vasodilation as a predictor of therapeutic response to midodrine hydrochloride in children with postural orthostatic tachycardia syndrome. <i>American Journal of Cardiology</i>, 112(1), 816-820. http://dx.doi.org/10.1016.j.amjcard.2013.05.008</p>	<p>Level of Evidence: Level III</p>	<p>The original research study evaluated the use of flow-mediated vasodilation (FMD) as a predictor of therapeutic response of midodrine for children with POTS.</p>	<ul style="list-style-type: none"> • The study included 108 children in the POTS groups and 20 children in the control group. • Children in the POTS groups had an extensively higher HR during HUT testing in comparison to the control group. • POTS cases with higher FMD values had a better response to midodrine.
<p>Lin, J., Han, Z., Oches, T., Zhao, J., Zhang, X., Yang, J., ... Jin, H. (2014). Risk factors for postural tachycardia syndrome in children and adolescents. <i>PLoS ONE</i>,</p>	<p>Level of Evidence: Level III</p>	<p>The original research study evaluated risk</p>	<ul style="list-style-type: none"> • The study included 600 children and adolescents aged 7-18 in the test

<p>9(12). http://dx.doi.org/10.1371/journal.pone.0113625</p>		<p>factors for postural tachycardia syndrome in children and adolescents.</p>	<p>groups with another 197 subjects in the same age range enrolled in the validation group.</p> <ul style="list-style-type: none"> • Results showed a significant difference in daily water intake, the daily sleeping hours, supine HR, HR increment, and maximum HR during upright test between POTS and the unaffected children. • The study revealed that children who drank more water and received at least
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			<p>eight hours of sleep a night</p> <p>were less likely to have</p> <p>POTS.</p>
<p>Mallen, J., Isenmann, S., Mrazek, A., & Haensch, C. (2014). Sleep disturbances and autonomic dysfunction in patients with postural orthostatic tachycardia syndrome. <i>Frontiers in Neurology</i>, 5(118). http://dx.doi.org/10.3389/fneur.2014.00118</p>	<p>Level of Evidence:</p> <p>Level IV</p>	<p>The original study evaluated sleep disturbances and autonomic dysfunction in patients with POTS.</p>	<ul style="list-style-type: none"> • The study consisted of 38 POTS patients all meeting the standard diagnostic criteria for POTS and 31 healthy control group patients. • The results confirmed the findings of current literature: POTS patients showed physiological autonomic control of the baroreflex arc as shown by the Valsalva maneuver

			<p>with diminished subjective sleep quality and increased daytime sleepiness.</p> <ul style="list-style-type: none"> • The results confirmed previous findings that over 30% of POTS patients suffer from sleep disturbances and 48% complain of fatigue.
<p>Metzler, M., Duerr, S., Granata, R., Krismer, F., Robertson, D., & Wenning, G. K. (2013). Neurogenic orthostatic hypotension: Pathophysiology, evaluation, and management. <i>Journal of Neurology</i>, 260(1), 2212-2219. http://dx.doi.org/10.1007/s00415-012-6736-7</p>	<p>Level of Evidence: Level IV</p>	<p>The review evaluated the pathophysiology, evaluation, and management of neurogenic</p>	<ul style="list-style-type: none"> • Orthostatic hypotension is defined as the sustained fall of systolic blood pressure by at least 20 mmHg or diastolic blood pressure by 10 mmHg

		<p>orthostatic hypotension.</p>	<p>within 3 min of standing or head-up tilt.</p> <ul style="list-style-type: none"> • Hallmark symptoms include dizziness, visual disturbances, pre-syncope, and syncope. • Patients with NOH is split into two groups: disturbed central autonomic pathways and intact peripheral nonadrenergic innervations, or the loss of peripheral noradrenergic fibers. • Management includes a structured approach of
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			<p>identifying underlying causes with treatment options varying from non-pharmacological options to aggressive drug therapy.</p>
<p>Oztunc, F., Ugan Atik, S., Dedeoglu, R., Erbek Alp, F., & Gokalp, S. (2016). Cooccurrence of postural orthostatic tachycardia syndrome with two different clinical entities. <i>Case Reports in Pediatrics</i>, 2016(1). http://dx.doi.org/10.1155/2016/8542158</p>	<p>Level of Evidence: Level IV</p>	<p>This study discussed the use of a case presentation to compare two patients with POTS.</p>	<ul style="list-style-type: none"> • In patients with a clinical diagnosis of POTS, pheochromocytoma, neutrally mediated syncope, Addison's disease, scleroderma, mast cell disease, and connective tissue disease would be considered in differential diagnosis.

			<ul style="list-style-type: none"> • A connection between homocystinuria and POTS association is believed to be coincidental. • There is no single treatment modality for POTS. Patients should be educated about the symptoms of POTS as well as aggravating factors, and common treatment approaches.
<p>Pavlik, D., Agnew, D., Stiles, L., & Ditoro, R. (2016). Recognizing postural orthostatic tachycardia syndrome. <i>Journal of the American Academy of Physician Assistants</i>, 29(4), 17-23.</p>	<p>Level of Evidence: Level VII</p>	<p>This study described the symptoms of postural</p>	<ul style="list-style-type: none"> • The articles discusses the pathophysiology of POTS including the abnormal response by the

<p>http://dx.doi.org/10.1097/01.JAA.0000481398.7609</p> <p>9.09</p>		<p>orthostatic tachycardia syndrome (POTS) and how to recognize and treat them.</p>	<p>sympathetic and parasympathetic nervous system.</p> <ul style="list-style-type: none"> • Sub categories of POTS include hypovolemic POTS, neuropathic POTS, Hyperadrenergic POTS, autoimmune POTS, and mast cell activation with POTS. • Clinical presentation of the syndrome includes an increase of heart rate of 30 BPM (40 BPM in children) within 10 minutes of changing positions from
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			<p>supine to standing, orthostatic intolerance for 6 months or longer, symptoms that are exacerbated by standing and improved with recumbence, and no other obvious explanation for tachycardia such as hyperthyroidism, acute dehydration, or anemia.</p> <ul style="list-style-type: none">• Diagnosis occurs through the elimination of other suspected disease processes, the use of tilt table testing, the QSART
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			<p>sweat test, skin biopsy, plasma volume, plasma norepinephrine testing, antibody testing, and ECG findings.</p> <ul style="list-style-type: none"> • Management of symptoms include a combination of pharmacological and non-pharmacological interventions including oral fluid replacement, beta-blockers, alpha-1 agonists, and SSRIs.
<p>Perring, S., & Jones, E. (2012). Assessment of changes in cardiac autonomic tone resulting from inflammatory response to the influenza vaccine. <i>Clinical</i></p>	<p>Level of Evidence: Level III</p>	<p>The original study evaluated the assessment</p>	<ul style="list-style-type: none"> • The study included 71 healthy volunteers who were agreeable to have a

<p><i>Physiology and Functional Imaging</i>, 32(1), 437-444. http://dx.doi.org/10.1111/j.1475-097x.2012.01147.x</p>		<p>of changes in cardiac autonomic tone due to an inflammatory response to the influenza vaccination.</p>	<p>routine influenza vaccination. Those individuals were evaluated for potential changes in cardiovascular autonomic tone resulting from the temporary inflammatory effects of the flu vaccination.</p> <ul style="list-style-type: none"> • A host of variables including heart rate and breathing which were assessed 2-5 days prior to vaccination and 1-4 days post vaccination.
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			<ul style="list-style-type: none"> • Findings suggest that it is possible to measure changes to autonomic tone resulting from a low level of inflammation associated with the influenza vaccination.
<p>Ross, A. J., Medow, M. S., Rowe, P. C., & Stewart, J. M. (2013). What is brain fog? An evaluation of the symptom in postural tachycardia syndrome. <i>Clinical Autonomic Research</i>, 23(1), 305-311. http://dx.doi.org/10.1007/s10286-013-0212-z</p>	<p>Level of Evidence: Level III</p>	<p>The original study discussed the evaluation of symptoms of cognitive impairment known as “brain fog” in POTS.</p>	<ul style="list-style-type: none"> • Subjects with the diagnosis of POTS were asked to complete a 38 item questionnaire using the Wood mental fatigue inventory (WMFI). • Responses were received from 138 subjects aged 14-

			<p>29, with 88% being female.</p> <ul style="list-style-type: none"> • The top descriptors of brain fog were forgetful, cloudy, and difficulty focusing, thinking, and communicating. • The most frequently reported triggers included fatigue (91%), lack of sleep (90%), prolonged standing (87%), dehydration (86%), and feeling faint (85%). • The most frequently reported interventions
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			<p>include the use of IV saline (77%), stimulant medications (67%), salt tablets (54%), intra-muscular vitamin B12 injections (48%), and midodrine (45%).</p>
<p>Ross, A. J., Ocon, A. J., Medow, M. S., & Stewart, J. M. (2014). A double-blind placebo-controlled cross-over study to the vascular effects of midodrine in neuropathic compared with hyperadrenergic postural tachycardia syndrome. <i>Clinical Science</i>, 126(4), 289-296. http://dx.doi.org/10.1042/CS20130222</p>	<p>Level of Evidence: Level II</p>	<p>The original study described a double-blind placebo-controlled crossover study to determine the effects of midodrine in</p>	<ul style="list-style-type: none"> • A total of 20 POTS patients (12 neuropathic and 8 hyperadrenergic) aged 12-20 participated in the study. • POTS subjects received 2 weeks of treatment receiving either midodrine or a placebo with increased

		<p>neuropathic versus hyperadrenergic POTS.</p>	<p>dosing from 2.5mg to 10 mg TID.</p> <ul style="list-style-type: none"> • HR, MAP, Qcalf, and CVR were measured supine. • In neuropathic POTS, midodrine decreased supine HR, Qcalf, and Cv, while increasing MAP and CVR compared with the placebo while these effects were not seen in patients with hyperadrenergic POTS • Finding suggest that midodrine is an effective
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			<p>treatment for neuropathic POTS, but not for hyperadrenergic POTS.</p>
<p>Shanks, L., Jason, L. A., Evans, M., & Brown, A. (2013). Cognitive impairments associated with CFS and POTS. <i>Frontiers in Physiology</i>, 4(113). http://dx.doi.org/10.3389/fphys.2013.00113</p>	<p>Level of Evidence: Level II</p>	<p>The study discussed the cognitive impairments associated with chronic fatigue syndrome (CFS) and postural orthostatic tachycardia syndrome (POTS).</p>	<ul style="list-style-type: none"> • Patients with CFS and POTS often report problems with memory as well as attention impairment. • 85-95% of CFS patients report complaints of cognitive problems. • Cognitive impairments in both CFS and POTS have the potential to create problems with daily functioning and ADLs.

<p>Thanavaro, J. L., & Thanavaro, K. L. (2011). Care of the patient with electrophysiology abnormalities postural orthostatic tachycardia syndrome: Diagnosis and treatment. <i>Heart & Lung, 40</i>(6), 554-560. http://dx.doi.org/10.1016/j.hrtlng.2009.12.014.</p>	<p>Level of Evidence: Level IV</p>	<p>The study discussed the care of patients with ECG abnormalities and POTS to find a diagnosis and treatment.</p>	<ul style="list-style-type: none"> • The study reviewed three separate cases of patients who presented with POTS like symptoms. • A tilt table test was used to diagnosis each case. • Findings showed that health care providers must be cognizant of the symptoms and clinical manifestations of POTS in an effort to correctly diagnose patients expeditiously. •
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<p>Tomljenovic, L., Colafrancesco, S., Perricone, C., & Shoenfeld, Y. (2014). Postural orthostatic tachycardia with chronic fatigue after HPV vaccination as part of the “Autoimmune/autoinflammatory syndrome induced by adjuvants”: Case report and literature review. <i>Journal of Investigative Medicine High Impact Case Reports</i>, 2(1), 1-8. http://dx.doi.org/10.1177/2324709614527812</p>	<p>Level of Evidence: Level IV</p>	<p>The study discussed the case of a 14 year old girls with developed POTS symptoms after receiving the Gardasil vaccination.</p>	<ul style="list-style-type: none"> • It is estimated that 40% of patients with chronic fatigue syndrome (CFS) also suffer from POTS. • An autoimmune mechanism has been suggested as a causal mechanism in both POTS and CFS due to frequent findings of autoantibodies including ANA, with up to 60% of CFS patients suffering from autoimmune responses. • A total of seven cases aged 12-22 years developed
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			<p>symptoms of POTS within 6 days to 2 months of the Gardasil vaccination, with two reporting a positive ANA and all seven cases being debilitating.</p>
<p>Umeda, S., Harrison, N. A., Gray, M. A., Mathias, C. J., & Crutchley, H. D. (2015). Structural brain abnormalities in postural tachycardia syndrome: A VBM-DARTEL study. <i>Frontiers in Neuroscience</i>, 9(34), 1-8. http://dx.doi.org/10.3389/fnins.201500034</p>	<p>Level of Evidence: Level III</p>	<p>The original research study used MRI with voxel-based morphometry (VBM) applying the diffeomorphic anatomical registration</p>	<ul style="list-style-type: none"> • The study included the use of 11 POTS patients with 23 age-matched normal control subjects. • Group comparison of gray matter revealed diminished gray matter volume within the left anterior insula, right middle frontal gyrus,

		<p>through exponentiated lie algebra (DARTEL) procedure to examine variation in regional brain structure associated with POTS.</p>	<p>and right cingulate gyrus within the POTS group.</p> <ul style="list-style-type: none"> • The findings of the structural differences suggest a link between dysregulated physiological reactions arising from compromised central autonomic control and increased vulnerability to psychiatric symptoms in POTS patients.
<p>Urlich, A. E., & Hartung, S. Q. (2015). "Doesn't Anyone Believe How I Feel?": Postural Orthostatic Tachycardia Syndrome (POTS). <i>NASN School</i></p>	<p>Level of Evidence: Level VII</p>	<p>The study discussed the role of a school nurse in the</p>	<ul style="list-style-type: none"> • POTS is defined as the presence of symptoms of orthostatic intolerance lasting longer than 6

<p><i>Nurse</i>, 30(2), 106-115.</p> <p>http://dx.doi.org/10.1177/1942602X14563801</p>		<p>diagnosis of postural orthostatic tachycardia syndrome (POTS).</p>	<p>months, which are aggravated when standing and diminished with lying down.</p> <ul style="list-style-type: none"> • Many clinical symptoms of POTS may occur with 1-3 years of the adolescent growth spurt. • Symptoms often correlate with an injury of long period of inactivity, possibly leading to deconditioning. • The school nurse plays an important role in the
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			<p>assessment and diagnosis of adolescents with POTS.</p> <ul style="list-style-type: none">• Becoming familiar with symptoms and diagnostic criteria of POTS will enable the school nurse to play a critical role in aiding the family and physicians in finding a diagnosis.
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Appendix C

POTS: Educating School Nurses Pre-Test/Post-Test

1. True or false, males are three times more likely to develop postural orthostatic tachycardia syndrome (POTS): True False

2. Which of the following are symptoms that are commonly seen in patients with POTS (select all that apply)
 Chest Pain Liver Failure Brain Fog
 Increased Cavities GI Disturbances Hyperactivity

3. Pharmacological treatment of POTS includes the use of (Check all that apply):
 Ritalin/Adderall HCTZ Midodrine Augmentin

4. Non-pharmacological treatment of POTS includes (select only one response):
 Including additional sugar in diet to ensure adequate glycemic coverage
 Withholding fluids in an effort to prevent exacerbation of Congestive Heart Failure (CHF)
 Limitation of exercise to prevent strain on the heart
 Include additional salt in diet to ensure fluid retention

5. Referrals for patients suspected to have POTS should go to (select all that apply):
 A pediatric cardiologist with experience in POTS
 A pediatric neurologist with experience in POTS
 Urologist with experience in POTS
 Nephrologist with experience in POTS

6. A 16 year old girl comes to the school nurse reporting that she was playing basketball in gym class and she passed out in the bathroom. The syncopal episode was not witnessed. She was sent to the ER with a diagnosis of dehydration. Since that time she has been in to see the nurse several times complaining of chest pain and tachycardia, but has completed a 48 hour halter monitor with no EKG changes or concerns. Would this patient be appropriate for a referral to her primary care provider to rule out POTS?

Yes No

7. A 14 year old male freshman football player receives a concussion during a game. After completing the concussion protocol with the school trainer and follow up with his primary care provider, he passes the concussion test to return to practice, he reports to the school nurse that he is still having headaches, severe stomach pain, light-headedness, and occasional burning to his chest. Would this patient be appropriate for a referral to his primary care provider to rule out POTS?

Yes No

8. A 12 year old female patient reports to the school nurse that she feels like someone is stabbing her in the stomach. You note that this complaint happens every few weeks, and reports a headache during the same periods of the abdominal pain, lasting several hours longer. Would this patient be appropriate for a referral to her primary care provider to rule out POTS?

Yes No

9. A 12 year old female reports to the school nurse that she has short periods of tachycardia and chest pain every day for a week. A co-worker reports that the student is completing volleyball tryouts during the same week and is able to participate without any complaints of symptoms. Would this patient be appropriate for a referral to her primary care provider to rule out POTS?

Yes

No

10. A 17 year old female student reports to the school nurse that she is experiencing “all over joint pain” with occasional tingling to her extremities. She is able to participate in varsity cheer and track without any worsening or improvement of symptoms. Her teachers report that she is forgetful though she is a good student, and often has periods of light and/or sound intolerance in class. Would this patient be appropriate for a referral to her primary care provider to rule out POTS?

Yes

No

Appendix D

POTS School Nurse Educational Module Survey

1. Please list your credentials

☆ RN

☆ LPN

☆ NP

☆ Other _____

2. Do you feel that the educational modules helped you to learn about POTS

☆ Strongly Agree ☆ Agree ☆ Neutral ☆ Disagree ☆ Strongly Disagree

3. How confident do you feel in understanding the criteria used to diagnose POTS?

☆ Very Confident ☆ Confident ☆ Neutral ☆ Unconfident ☆ Very Unconfident

4. How likely are you to refer patients with symptoms of POTS?

☆ Very Likely ☆ Likely ☆ Neutral ☆ Unlikely ☆ Very Unlikely

5. Do you have any suggestions to improve these educational modules?

6. Would you like to receive additional information and resources about POTS for you or your patient population?

☆ Yes: Email_____

☆ No

7. Would you be interested in having a representative provide information to your and/or your staff on how to identify patients who may be suffering from POTS?

☆ Yes: Email_____

☆ No

8. Would you be interested in having a representative provide information to your and/or your staff on suggestions for 504 plans or IEP plans for patients who may be suffering from POTS?

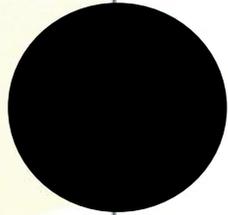
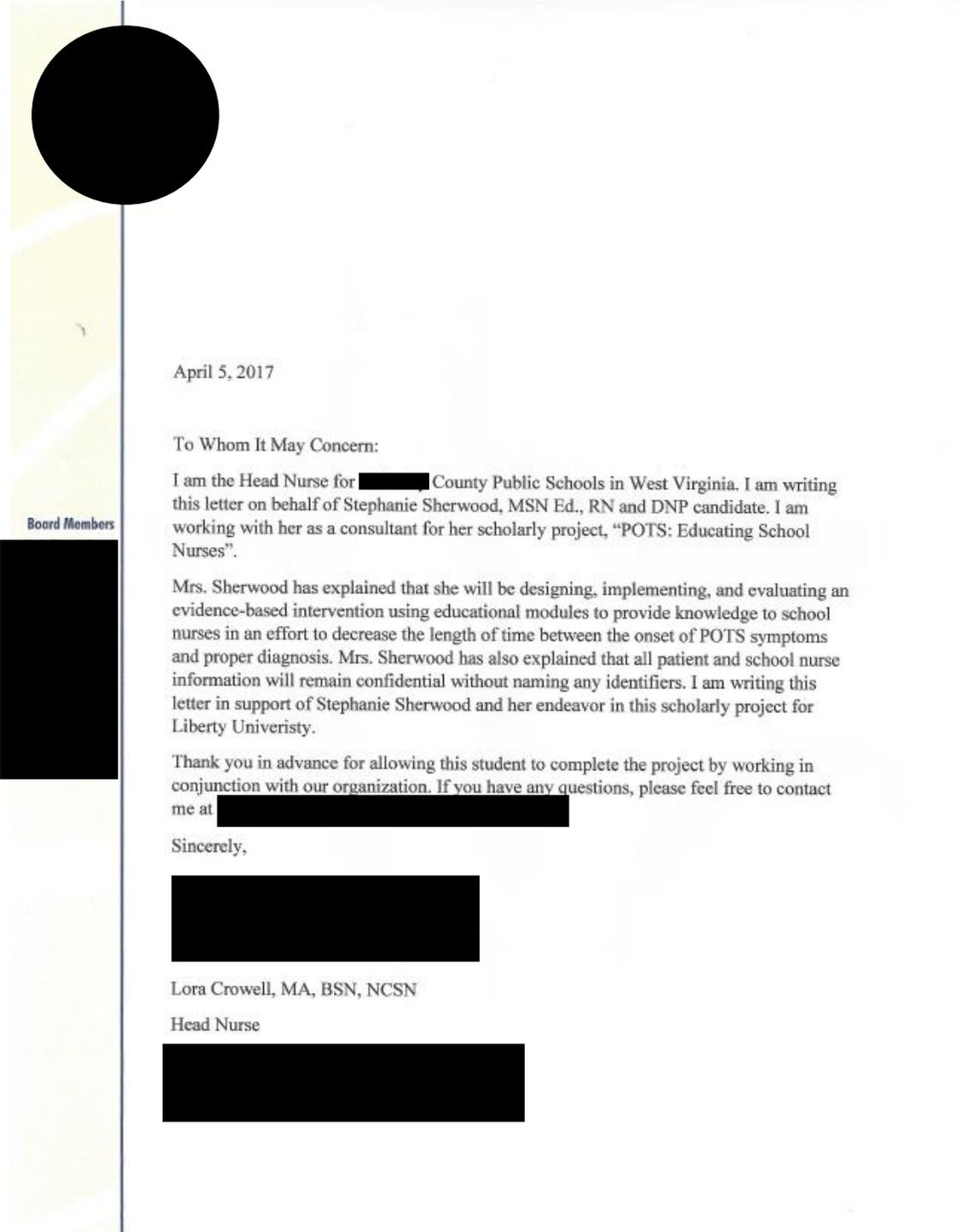
☆ Yes: Email_____

☆ No

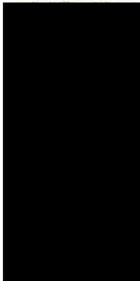
9. Please provide any additional comments or feedback below:

Appendix E

██████████ County Public Schools Letter of Support for Project



Board Members



April 5, 2017

To Whom It May Concern:

I am the Head Nurse for ██████████ County Public Schools in West Virginia. I am writing this letter on behalf of Stephanie Sherwood, MSN Ed., RN and DNP candidate. I am working with her as a consultant for her scholarly project, "POTS: Educating School Nurses".

Mrs. Sherwood has explained that she will be designing, implementing, and evaluating an evidence-based intervention using educational modules to provide knowledge to school nurses in an effort to decrease the length of time between the onset of POTS symptoms and proper diagnosis. Mrs. Sherwood has also explained that all patient and school nurse information will remain confidential without naming any identifiers. I am writing this letter in support of Stephanie Sherwood and her endeavor in this scholarly project for Liberty Univeristy.

Thank you in advance for allowing this student to complete the project by working in conjunction with our organization. If you have any questions, please feel free to contact me at ██████████

Sincerely,



Lora Crowell, MA, BSN, NCSN

Head Nurse



Appendix F

IRB Approval

LIBERTY UNIVERSITY.

INSTITUTIONAL REVIEW BOARD

June 2, 2017

Stephanie Sherwood
IRB Application 2892: POTS: Educating School Nurses

Dear Stephanie Sherwood,

The Liberty University Institutional Review Board 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.

Your study does not classify as human subjects research because evidence-based practice projects are considered quality improvement activities, which are not considered "research" according to 45 CFR 46.102(d).

Please note that this decision only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued non-human subjects research status. You may report these changes by submitting a new application to the IRB and referencing the above IRB Application number.

If you have any questions about this determination or need assistance in identifying whether possible changes 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
The Graduate School

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Appendix G

CITI Certificate

**COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS***

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Stephanie Sherwood (ID: 5136482)
- **Email:** sisherwood2@liberty.edu
- **Institution Affiliation:** Liberty University (ID: 2446)
- **Institution Unit:** DNP Program

- **Curriculum Group:** Human subject - Basic
- **Course Learner Group:** Nursing
- **Stage:** Stage 1 - Basic Course
- **Description:** This course is appropriate for students doing class projects that qualify as "No More Than Minimal Risk" human subjects research.

- **Report ID:** 17522798
- **Completion Date:** 04-Oct-2015
- **Expiration Date:** 03-Oct-2018
- **Minimum Passing:** 80
- **Reported Score*:** 99

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Belmont Report and CITI Course Introduction (ID: 1127)	04-Oct-2015	3/3 (100%)
Students In Research (ID: 1321)	04-Oct-2015	10/10 (100%)
History and Ethical Principles - SBE (ID: 490)	04-Oct-2015	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	04-Oct-2015	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	04-Oct-2015	5/5 (100%)
Assessing Risk - SBE (ID: 503)	04-Oct-2015	5/5 (100%)
Informed Consent - SBE (ID: 504)	04-Oct-2015	4/5 (80%)
Privacy and Confidentiality - SBE (ID: 505)	04-Oct-2015	5/5 (100%)
Records-Based Research (ID: 5)	04-Oct-2015	3/3 (100%)
Populations In Research Requiring Additional Considerations and/or Protections (ID: 16680)	04-Oct-2015	5/5 (100%)
Vulnerable Subjects - Research Involving Prisoners (ID: 8)	04-Oct-2015	4/4 (100%)
Vulnerable Subjects - Research Involving Children (ID: 9)	04-Oct-2015	3/3 (100%)
Vulnerable Subjects - Research Involving Pregnant Women, Human Fetuses, and Neonates (ID: 10)	04-Oct-2015	3/3 (100%)
Research and HIPAA Privacy Protections (ID: 14)	04-Oct-2015	5/5 (100%)
Vulnerable Subjects - Research Involving Workers/Employees (ID: 483)	04-Oct-2015	4/4 (100%)
Conflicts of Interest In Research Involving Human Subjects (ID: 488)	04-Oct-2015	5/5 (100%)
Unanticipated Problems and Reporting Requirements In Social and Behavioral Research (ID: 14928)	04-Oct-2015	5/5 (100%)
Cultural Competence In Research (ID: 15166)	04-Oct-2015	5/5 (100%)
Liberty University (ID: 15111)	04-Oct-2015	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing Institution identified above or have been a paid Independent Learner.

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**COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COMPLETION REPORT - PART 2 OF 2
COURSEWORK TRANSCRIPT****

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Stephanie Sherwood (ID: 5136482)
- **Email:** sisherwood2@liberty.edu
- **Institution Affiliation:** Liberty University (ID: 2446)
- **Institution Unit:** DNP Program

- **Curriculum Group:** Human subject - Basic
- **Course Learner Group:** Nursing
- **Stage:** Stage 1 - Basic Course
- **Description:** This course is appropriate for students doing class projects that qualify as "No More Than Minimal Risk" human subjects research.

- **Report ID:** 17522798
- **Report Date:** 18-Jan-2017
- **Current Score**:** 99

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
Students in Research (ID: 1321)	04-Oct-2015	10/10 (100%)
Liberty University (ID: 15111)	04-Oct-2015	No Quiz
History and Ethical Principles - SBE (ID: 490)	04-Oct-2015	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	04-Oct-2015	5/5 (100%)
Belmont Report and CITI Course Introduction (ID: 1127)	04-Oct-2015	3/3 (100%)
Records-Based Research (ID: 5)	04-Oct-2015	3/3 (100%)
The Federal Regulations - SBE (ID: 502)	04-Oct-2015	5/5 (100%)
Assessing Risk - SBE (ID: 503)	04-Oct-2015	5/5 (100%)
Vulnerable Subjects - Research Involving Prisoners (ID: 8)	04-Oct-2015	4/4 (100%)
Informed Consent - SBE (ID: 504)	04-Oct-2015	4/5 (80%)
Vulnerable Subjects - Research Involving Children (ID: 9)	04-Oct-2015	3/3 (100%)
Privacy and Confidentiality - SBE (ID: 505)	04-Oct-2015	5/5 (100%)
Vulnerable Subjects - Research Involving Pregnant Women, Human Fetuses, and Neonates (ID: 10)	04-Oct-2015	3/3 (100%)
Research and HIPAA Privacy Protections (ID: 14)	04-Oct-2015	5/5 (100%)
Vulnerable Subjects - Research Involving Workers/Employees (ID: 483)	04-Oct-2015	4/4 (100%)
Unanticipated Problems and Reporting Requirements in Social and Behavioral Research (ID: 14928)	04-Oct-2015	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	04-Oct-2015	5/5 (100%)
Cultural Competence in Research (ID: 15166)	04-Oct-2015	5/5 (100%)
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	04-Oct-2015	5/5 (100%)

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Appendix H

Consent Form for School Nurses

CONSENT FORM

POTS: Educating School Nurses
Stephanie Sherwood
Liberty University
School of Nursing

You are invited to be in a research study providing education about Postural Orthostatic Tachycardia Syndrome (POTS) to school nurses. You were selected as a possible participant because you are a current employee of Berkeley County Schools as a school nurse. Please read this form and ask any questions you may have before agreeing to be in the study.

Stephanie Sherwood, a doctoral candidate in the School of Nursing at Liberty University, is conducting this study.

Background Information: The purpose of this study is to determine if providing education about postural orthostatic tachycardia syndrome (POTS) to school nurses through the use of educational presentations enhance knowledge and likelihood to refer patients for further assessment.

Procedures: If you agree to be in this study, I would ask you to do the following things:

1. Complete a pre-test about your knowledge of POTS. This will take approximately 10 minutes.
2. Participate in an audiovisual presentation about POTS with the ability to ask questions throughout. This will take approximately 35 minutes.
3. Complete a post-test about your knowledge of POTS after the presentation. This will take approximately 10 minutes.
4. Complete a brief survey about your comfort level on the topic of POTS and your likelihood to refer patients for further evaluation.

Risks and Benefits of Participation: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

The direct benefits participants should expect to receive from taking part in this study are an increased knowledge in identifying, managing and referring students with POTS symptoms.

Benefits to society include a decrease in time from onset of symptoms to correct diagnosis, in addition to an improved knowledge base in school nurses for managing students with POTS.

Compensation: Participants will not be compensated for participating in this study.

Confidentiality: The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

- Participants will be assigned a username of their choosing when completing the pre and post-tests. This does NOT have to be the individual's name if they wish to remain anonymous. All

surveys will be completed in written form and remain anonymous unless the participant opts to provide additional information such as email address for additional information on POTS.

- Data will be stored on a password locked computer and may be used in future presentations. After three years, all electronic records will be deleted.
- I cannot assure participants that other members of the focus group will not share what was discussed with persons outside of the group.

Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

How to Withdraw from the Study:

If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, will be destroyed immediately and will not be included in this study.

Contacts and Questions: The researcher conducting this study is Stephanie Sherwood, MSN, RN. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at slsherwood2@liberty.edu You may also contact the researcher’s faculty advisor, Dr. Lynne Sanders, at lsanders@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 1887, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please notify the researcher if you would like a copy of this information for your records.

Statement of Consent: I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS IRB APPROVAL INFORMATION WITH CURRENT DATES HAS BEEN ADDED TO THIS DOCUMENT.)

Signature of Participant

Date

Signature of Investigator

Date