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Evaluation of the Impact of an Educational Intervention Aimed at Improving Tuberculosis Infection Control Knowledge Among Health Care Workers in a Military Treatment Facility: A Quality Improvement Project

Allen C. Potter
allenpotter@gmail.com

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Evaluation of the Impact of an Educational Intervention Aimed at Improving Tuberculosis
Infection Control Knowledge Among Health Care Workers in a Military Treatment Facility:
A Quality Improvement Project

Allen C. Potter, MSN, APRN, FNP-BC

Doctor of Nursing Practice Project Report **submitted**
to the School of Nursing
at West Virginia University

in partial fulfillment of the requirements for the degree of
Doctor of Nursing Practice

Teresa Ritchie, DNP, APRN, FNP-BC, Chair
Sandra Cotton, D.N.P.
Kesheng Wang, Ph.D.
John Davis, Lt Col, USAFR

Department of Nursing

Morgantown, WV
2020

Keywords: Tuberculosis, infection prevention, infection prevention and tuberculosis.
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ABSTRACT

Evaluation of the Impact of an Educational Intervention Aimed at Improving Tuberculosis Infection Control Knowledge Among Health Care Workers in a Military Treatment Facility: A Quality Improvement Project

Allen C. Potter, MSN, APRN, FNP-BC

Background: Florida (FL) is one of the top five states in the nation for Tuberculosis (TB) infections. A majority of new infections can be found in the minority populations which represents 78% of all TB infections in the state. A combination of TB rates in FL, Orlando located 60 miles away and a transient population who frequently deploys worldwide to austere locations may result in an increased risk of acquiring TB. Literature suggests Health Care Providers (HCPs) obtain training regarding TB Infection Control (TB-IC). The Patrick AFB Military Treatment Facility (MTF) lacked a TB Infection Control (TB-IC) plan.

Objective: The overall objective was to increase TB-IC knowledge in HCPs within the Patrick AFB MTF..

Methods: A 4-hour educational intervention was executed with two aims for evaluation: 1) establish a TB-IC educational intervention to include a Pre/Post-test and have a minimum of 15 staff members complete 100% of the intervention. 2) 50% of the participants will increase scores from the pre to post-test by 50%.

Results: Staff knowledge was significantly increased; the educational intervention was successful as planned. 19 participants completed 100% of the training and 53% increased pre to post-test scores by 10%.

Discussion: This project demonstrated an educational intervention regarding TB-IC can be successfully implemented. The creation of a sustainable program to ensure the continued success of the intervention was recommended to the MTF leadership. However, this interventional program should be scalable in the future, the flexibility and agility of the program should be generalized to perhaps cover respiratory related issues rather than targeting a specific disease. Although TB is certainly relevant as the evidence has shown us, what we are currently experiencing is a reminder of just how fragile we are as humans and the speed at which respiratory disease can spread.

Acknowledgments

First and foremost I would like to thank God for positioning me in the field of Nursing and allowing me to achieve the highest level of education within such a great profession. My time at the West Virginia University School of Nursing has undoubtedly changed me, both as a person and as a professional. I want to thank everyone at the WVUSON. In particular, Dr. Teresa Ritchie and Dr. Sandra Cotton. To the both of you I offer my salute. Many times I doubted my success in this endeavor and you were both always there to ensure this would happen, I cannot thank you enough! I'd also like to thank Dr. Wang and Lt Col John Davis for their support as Capstone Committee Members. Finally, and most importantly, my wife Lisa and my children Alexis, Leah, and Luke – thank you for sacrificing time with me as I pursued my goal. We did it!

I have had the honor of traveling around the world more than once, courtesy of the United States Air Force. I have been as far from home as one can be. And I have been in situations where I wasn't sure I would come home. However, through all of these experiences I remained committed to the cause of why I was there. I can only attribute this to my upbringing in the great State of West Virginia. I am beyond proud of my home state and its people and will forever be a Mountaineer!

Let's Go!

Montani Semper Liberi

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Introduction

The 45th Medical Group (MDG) is a military treatment facility (MTF) located at Patrick Air Force Base, Cocoa Beach, Florida (FL). The MTF serves a population of 14,000 to include an active-duty and reserve component consisting of men, women and family members that frequently deploy around the world. Within this population and the surrounding communities, the likelihood of acquiring tuberculosis (TB) is higher. This can be attributed to the worldwide locations this population deploys to, along with the higher numbers of non-U.S.-born persons residing here in Brevard County, FL. According to the Centers for Disease Control (CDC, 2018), FL ranks in the top five states within the U.S. for TB. A tuberculosis infection control (TB-IC) protection plan did not exist in this facility. The purpose of this project was to evaluate the impact of an educational intervention aimed at improving (TB-IC) among healthcare providers in a MTF.

Background and Significance of the Problem

In 2017, TB was reported in all 50 states within the U.S., with TB counts highest in California, Texas, New York, and FL (CDC, 2018). These four states alone accounted for slightly under half of the total cases in the US (CDC, 2018). Patrick AFB is located south of Cocoa Beach in Brevard County and approximately 60 miles from Orlando, FL. Although the number of TB cases have decreased over the past twenty years, the number of persons who have died of TB is increasing annually and minority populations continue to disproportionately bear the burden of this disease (CDC, 2018). With over 9,000 TB cases reported in the US in 2017 and over 500 new cases in FL alone, this presented a challenge for this facility. According to the United States Census Bureau (2018), minority representation in FL is 23% and continues to increase. Brevard County identified 11 new TB cases in 2017, with a total of 59 new cases since

2013 (Florida Department of Health, 2018). Furthermore, Brevard County had a five-year new TB case average of 11.8 per year, while neighboring Orange County, which includes Orlando, averages 59.6 new cases annually. The surrounding populations impact the health of the deployable military members, along with other beneficiaries served, as well as the reverse.

Deployed members from the base are routinely sent to austere locations around the world to include Afghanistan, Iraq, Syria, and African locations. According to the World Health Organization (WHO, 2018), 58,000 new TB cases were estimated in 2014, and 13,000 Afghans die from the disease yearly. The WHO (2018) has estimated the region including Iraq and Syria is responsible for roughly 7% of the global burden of TB, while the African region accounted for a quarter of new TB cases worldwide, with over 25 % of TB deaths occurring in this region.

According to the CDC (2018), it is necessary to have a TB-IC plan in health-care centers. Persons who work or receive care in acute clinical settings are at a higher risk of becoming infected with TB (CDC, 2018), due to the increased risk of exposure. Within the CDC's recommendation, the use of respiratory protective equipment is paramount. The recommendation includes implementing a respiratory protection program, training health care workers on respiratory protection, and educating patients on respiratory hygiene and the importance of cough etiquette procedures (2018). Clearly this facility was lacking a TB-IC program to educate its personnel on TB-IC mitigation.

Problem Statement and Purpose of the Project

Lack of resources, insufficient communication of epidemiology data or surveillance, and deficits in the competencies referred to as knowledge, skills, and attitudes (KSA) of the health-care workers in this facility can lead to increase rates of TB exposure (Nathavitharana et al.,

2018). The purpose of this project was to develop a program to enhance the knowledge of clinic staff on the importance of recognizing and preventing the spread of TB among staff and patients. Development and implementation of an education and screening program will assist the clinic staff in recognizing the signs and symptoms of TB and the proper placement of a suspected TB patient in the clinic. This project will also facilitate readiness in the deployable population, by allowing the clinic staff to risk identify locations members are sent, with higher rates of TB, and decrease the likelihood of members contracting TB by implementing prevention measures and.

Literature Review

A review of the literature was performed from May – Sep 2019. The literature search utilized five robust electronic data bases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Joanna Briggs Institute EBP Database, Cochrane Library, and EBSCOhost. The initial search included key words “tuberculosis” and “infection prevention” with limits set for human subjects, English Language, published within the last ten years, and randomized controlled trials (RCTs). This Search yielded 9,104 hits. Additional search terms included “infection prevention” with 275 hits, “infection prevention and tuberculosis” with 52 hits and “infection prevention and barriers” resulting in 68 hits. Finally, combinations of “barriers to tuberculosis prevention” and “educational intervention and tuberculosis infection control” yielded 14 results. No references were obtained by snowballing.

Inclusion criteria included: 1) knowledge regarding infection prevention 2) beliefs surrounding tuberculosis 3) knowledge of tuberculosis. After reviewing 14 articles, 6 were excluded due to 1) lack of evidence in knowledge, 2) interventions not surrounding adherence to TB infection control measures and 3) lack of information pertaining to barriers regarding TB.

The eight studies/articles chosen for this project include one systemic review (SR), six qualitative studies, and one clinical review article.

Critical Appraisal Strategies

Three key themes emerged from the literature as essential to address for a successful TB-IC program – 1) Program Barriers and Motivators, 2) TB-IC Knowledge, and 3) Healthcare Worker Attitudes. To establish validity, the SR and qualitative studies were critically appraised using the appropriate Scottish Intercollegiate Guidelines Network Checklists (SIGN, 2019) and the AACODS (authority, accuracy, coverage, objectivity, date, significance; Tyndall, 2010) checklist, designed to enable evaluation and critical appraisal of grey literature for the clinical review article. The Larrabee (2009) Literature Review Worksheet was employed to validate findings from both quasi-experimental study.

TB-IC Barriers and Motivators

Woith, Voldhenkov, and Larson (2013) conducted a qualitative study of 96 health care workers of differing professions. Participants of 15 focus groups completed an open-ended questionnaire, identifying three-central barriers to TB infection control practices. These included: 1) knowledge deficits 2) negative attitudes related to the discomfort of respirators, and 3) practices with the respect to quality and care of respirators (Woith et al., 2013). Barriers identified were related to education and training, fear of spreading disease to a loved one, and fear of punishment (Woith et al., 2013). These barriers could lead to increases in TB deaths and infection rates in the US and other locations around the world jeopardizing progress being made in TB control over the last 20 years. Limitations of the study include a self-selected sample, and

a language barrier between the primary investigator and the participants. Strengths include focus groups representing both rural and urban areas in two different regions.

Barriers to adherence are still perceived to TB infection control measures among health care workers according to Chapman et al. (2017). Using a qualitative approach, the authors used a semi-structured interview guide of nine questions and conducted interviews with seven physicians and two nurses (Chapman et al., 2017). Three of the five perceived barriers from this study present some of the biggest challenges for TB control in this MTF: 1) Sense of invincibility of health care workers. 2) Personal beliefs of health care workers related to direct patient communication, and 3) Limited availability of protective masks for health care workers (Chapman et al., 2017). Recommendations made by the authors in addressing the barriers included “strengthening the infection control program infrastructure and implementing educational interventions” (Chapman et al., 2017, p. 20). Limitations of the study include a small sample size and all interviews were conducted by an external member which may have resulted in inhibited participation.

TB-IC Knowledge

Akande (2019) conducted a quasi-experimental study involving 200 participants. Participants were given a self-administered structured Likert based questionnaire to determine nurse’s knowledge and practices pertaining to TB-IC. The questionnaire was given to two groups initially and then again at six months after an educational program. The results showed a positive effect in improving knowledge through the educational intervention and validated the Likert based questionnaire. Limitations of this study include the nurses reporting their TB-IC practices using self-administered questionnaires rather than direct observation. Strengths included sample size (n = 200), open recruitment, and two groups versus one.

Buregyeya, Kasasa, & Mitchell (2016) conducted a cross-sectional study focusing on the knowledge of TB-IC among 512 health care workers in Uganda. Specifically, the study focused on the efforts initiated by the Ministry of Health's implementation of TB-IC training to health care workers (HCWs). Knowledge assessed included basic standards of TB diagnosis, treatment and TB-IC and attitudes towards TB-IC measures. Only 24% answered all of the basic TB knowledge questions correctly. However, overall, 69% had adequate TB-IC knowledge. Most importantly, non-clinical personnel were more likely to have poor TB-IC knowledge than their clinical counterparts. The authors concluded every effort should be made to include non-clinical staff in TB-IC training. Limitations of this study include not measuring the practice of TB-IC. The strengths included healthcare workers were both clinical and non-clinical.

Healthcare Worker Attitudes

Another cross-sectional study by Alotaibi et al. (2019) focused on the attitude and practice among HCWs during the 2016 Hajj. The Hajj is the annual pilgrimage made by approximately two million Muslims to the holy city of Mecca in Saudi Arabia, in the Middle East (BBC, 2019). The authors collected data from 540 HCWs from 13 hospitals in 17 countries to include physicians, nurses, and other non-administrative personnel. The study found the HCWs had average knowledge of TB patients, above average attitude and good practice regarding TB treatment. However, poor attitudes were found in willingness to work in a TB clinic or ward. The study's results found a statistically significant positive correlation between score for knowledge and attitude ($p = 0.009$) and attitude and practice ($p = 0.002$). The authors acknowledge that gaps consisting of poor attitudes and practices regarding TB were identified among HCWs during the 2016 Hajj. Limitations of the study included a cross-sectional nature of the study design providing only a snapshot in time, information obtained by questionnaire

(information bias), and no observation of practice included which may have produced an overestimation of good practice among the HCWs. Strengths include this being the first attempted study of its kind and will serve as a baseline to address future shortcomings.

The level of knowledge related to TB control was significantly associated with educational status, and TB training or orientation received in a qualitative study conducted by Shresth and colleagues (Shresth, Bhattarai, Thapa, Basel, & Wagle, 2017). One hundred and ninety HCWs in 28 health facilities located in Nepal were assessed for the “knowledge, attitudes and practices on TB-IC using a structured questionnaire” (Shresth et al., 2017). According to the authors, knowledge on TB-IC tended to be poor among HCWs and even worse among administration and lower level support staff (Shresth et al., 2017). Although a large majority of HCWs were concerned with being infected by TB, utilization of respirators among staff was limited and triaging of suspected TB patients was lacking (Shresth et al., 2017). The authors concluded effective TB-IC measures included skill-based training and/or orientation for health care workers of all categories could improve infection control practices regarding TB in health facilities (Shresth et al., 2017). Limitations of the study included a population of 190 people in over 28 practices. Which may result in diluted results and making standardization challenging. Also, TB-IC practices were self-reported. Strengths include being both the first study of its kind in Nepal and the inclusion of administrators. Highlighting the need for an inclusive approach.

Formal TB-IC Programs/Resources

One of the key components of the second pillar of the *WHO End TB Strategy* is TB-IC (Uplekar, 2015). Unfortunately, limited resources and little attention are applied to TB-IC from the clinic level to nationally. According to the clinical review article published by Nathavitharana et al., a position (staff-member) responsible for TB-IC and an appropriate budget

for activities to include training should be available in every health care facility (2018). The authors, who are consider experts on infectious disease as professors at Harvard Medical School, also recommend all staff receive TB-IC specific training at a minimum of every two years as recommended by the WHO (Nathavitharana et al., 2018). Finally, noting best practices include that it is “essential that HCWs, as well as ancillary staff working in patient-care areas, should have access to N95 respirators that fit correctly” (Nathavitharana et al., 2018, p. 60). The aim of this article is clearly stated by an authority in infectious disease who has an appointment as a clinical professor with the Harvard Medical School. This clinical review article was published in 2018 and is relevant and enriches the information repository for TB-IC as appraised by the Authority Accuracy Coverage Objectivity Data Significance (AACODS) checklist. (Tyndall, 2010).

Joshi, Reingold, Menzies, and Pai (2006) reviewed 42 articles consisting of 51 studies producing data on incidence, prevalence, and risk factors for latent tuberculosis infection (LTBI) among HCWs. The authors determined the risk for TB disease in HCWs is almost three times greater than the general population. An increased risk for acquiring TB was associated with work locations, (laboratory, emergency departments, and inpatient wards), along with occupational categories (nurses, attendants, paramedics, and emergency medical technicians). The authors concluded the evidence reinforces the need to design and implement ample TB-IC programs in health-care facilities. The authors clearly defined the inclusion/exclusion criteria in this systematic review and completed a comprehensive search. All excluded studies were listed in the review. Using the SIGN criteria this SR was considered “high-quality” (SIGN, 2019).

Synthesis of the Literature

Evidence from the literature review reveals barriers to TB-IC exists in the form of knowledge deficits. Alotaibi et al. (2019) and Nathavitharana et al. (2018) have shown that with proper training, HCWs report less barriers to caring for suspected TB patients. Similarly, (Buregyeya, Kasasa, & Mitchell, 2016) determined that it is vital, non-clinical personnel within health care organizations assist in identifying TB and executing TB-IC practices for improved outcomes. This same deficit in the knowledge of administrators was also supported by Shresth and colleagues (2017). Administrators scored much lower than HCWs on knowledge of TB-IC (Shresth et al., 2017). Chapman et al. (2017) and Woith et al. (2013) note HCWs to have reported a lack of protective equipment (masks) along with complaints of discomfort when donning masks. Chapman et al. (2017) found a sense of invincibility in HCWs contributing to a knowledge gap shared across the globe.

Evidence from all studies reviewed demonstrated that training can enhance knowledge to TB-IC and decrease existing barriers. Additionally, locations/personnel from around the world included in the literature reveals empirical evidence TB-IC training is lacking globally. Furthermore, while many training avenues exist for TB-IC, one that presents both a pre and post-test offering has shown improved results. Therefore, the evidence supports the PICOT question: Does an educational program focused on TB-IC prevention, presented by a military nurse practitioner to HCWs in the 45th Medical Group improve TB-IC knowledge?

Theoretical Framework

To increase the likelihood of success for this system change intervention, Kotter's Leadership Change Theory (1996) was used to guide the project. Kotter's model (1996) consists

of eight steps to guide organizations in leading and sustaining successful change. Kotter (1996) noted multiple reasons why organizational change fails: too much complacency, absence of a guiding coalition, underestimating and under communicating the power of vision, allowing obstacles to block a new vision, lack of short-term wins, declaring victory too soon, and failure to create lasting change within the organization culture. Additionally, Kotter (1996) addresses strategies to overcome the noted barriers at various stages in order to facilitate lasting change.

The initial stage in Kotter's model is establishing a sense of urgency (Kotter, 1996). This first step is paramount as it helps to overpower the complacency that may plague an organization. Complacency within the organization must be recognized and removed promptly or transformational change would likely fail. No specific TB-IC procedures or education was provided to the staff at the facility. With this facility located in one of the top five states for TB and serving a population that continually deploys world-wide justification for this intervention existed.

Next, according to Kotter (1996) a group of individuals with shared characteristics such as key players in positions of power, expertise in the topic being changed, persons with credible reputations for completing tasks, and other leaders to help pilot the change result in a powerful change coalition and represent the second step. For this project, the coalition consisted of nursing professionals, the Infection Preventionist, the Chief of Medical Staff, personnel from education and training, and the executive committee of the facility. These members are most knowledgeable of the topic and provided strong leadership for the coalition's success.

Additionally, to facilitate the change effort, steps three and four pertain to developing and communicating a vision (Kotter, 1996). When change is questioned, and confusion is apparent the vision has not been clarified according to Kotter & Cohen (2002). Kotter & Cohen (2002)

have also noted the vision needs to be clear and concise, and able to be articulated quickly. If the organization is not clear on the vision, no coordination of efforts can exist. In order to appropriately articulate the vision of implementing an evidence-based education intervention the change included information on the location of the facility and the patient population. The vision was communicated to personnel and pre-chosen change agents in the organization using the *CDC's TB 101 for Health Care Workers* (CDC, 2019). A single session was offered on Friday 10 July from 0700 to 1200 to capture 19 HCWs from the facility.

Following steps five and six of Kotter's (1996) change theory involve empowering broad-based action and generating short-term wins. Empowering broad-based action includes removing any processes or other roadblocks that may prevent attaining the change or vision. Kotter (1996) recommends risk taking during this phase and encourages nontraditional ideas. Recruiting facility-wide champions steered the development and implementation of a TB-IC initiative in this organization. Recognizing these champions publicly drove the short-term wins by showing the staff the change was indeed real and being implemented in the organization.

Kotter's seventh step is to promote and develop individuals capable of implementing the change (1996). Once the phases of change begin Kotter (1996) argues new staff will step forward and show initiative in the project. This continually breeds new ownership and energy into the change and solidifies the initiative among organizations. However, Kotter (1996), warns of the constant celebration of short-term wins can decrease momentum and create complacency. Hence, new projects and change agents must be identified to continually move forward.

Kotter's (1996) eighth and final step speaks to creating lasting change in the organizations culture. Those involved in the front lines of the organization must be convinced the change is beneficial or regression may appear. If the change is incompatible within the

organizations culture, regression is likely. The organization the project was implemented in values compassionate, high quality care, and ensuring mission ready forces and healthy families with the goal of ensuring safe, quality care. The purpose of this project is to protect staff and patients along with family members, is evidenced based, and the change is congruent with the organizations' goals and will undoubtedly be adopted by the organizational stakeholders.

Evidence-Based Project/Intervention Plan

This is a quality improvement project using an evidenced based educational intervention from the *The Core Curriculum on Tuberculosis Infection Control* (CDC, 2013). This project was divided into three elements:

- Element 1 covered the theoretical aspect of TB, to include the definition, prevalence/incidence, and infection/transmission of TB and was presented with Microsoft PowerPoint (PPT) presentations in 24 slides.
- Element 2 covered the clinical characteristic of the disease, such as signs/symptoms, complications, prevention, treatment modalities, and diagnostic/screening exams. Element 2 was covered in 20 PPT presentation slides.
- Element 3 included the respiratory protection plan and consists of knowing where to place the patient, how to apply the N95 respirator, and what organizations to consult with. Element 3 was also presented in PPT and contains 21 slides.

The three elements were delivered in one session over four hours. Evaluation of the educational intervention occurred by comparing the pre and post intervention based questionnaire. The anonymous questionnaire was adopted from Akande's (2019) quasi-experimental study and an experiential study by Kanjee et al (2011). The questionnaire assessed the knowledge associated with TB-IC. It does not contain any identifying participant

information other than demographics. The knowledge scale contained 33 items, with each having response options of “true”, “false”, or “I don’t know”. Each correct answer had a score of “1” and an incorrect answer, “0” while “I don’t know” was also coded as an incorrect answer. The knowledge and practice scales had a maximum possible score of 33. The TB-IC practice scale had 6 items which measures self-reported frequency of adherence to various TB-IC practices. It was scored using a 5-point Likert-type scale: “never” (1 point), “rarely” (2), “sometimes” (3), “often” (4), and “always” (5), resulting in a maximum possible score of 30. A Descriptive analysis was utilized to report the demographic information obtained from participants.

The educational intervention was held in the 45th MDG Education and Training building (1381) on Patrick AFB located within Brevard County in central FL. The classroom contains seating for 20 individuals and has appropriate computer and overhead projector capabilities. The participants were all clinic staff, including: physicians, physician assistants, registered nurses, licensed practical nurses, and emergency medical technicians.

Recruitment occurred two weeks prior to the implementation for the intervention. Participation was voluntary, and the participants were notified of the policy via email. Fridays are training days at this facility and the pre-intervention questionnaire was completed on a Friday morning, with the intervention presented next, followed by the post-intervention questionnaire. The project began at 8:00 am and lasted for 4 hours. As participants entered the training session, they received a randomly numbered packet in a large manila envelope with the following items: an instruction sheet, a consent form, a demographic data sheet, a pre-test (on yellow paper) and a post-intervention test (on blue paper). After a brief introduction, the participants had 20 minutes to read and sign the consent and complete the demographic and pre-intervention questionnaires.

To assure anonymity, the project leader collected the consent and demographic questionnaire and placed them in a large folder. The participants put the completed pre-intervention questionnaire in the folder and placed it in the basket under his/her seat during the intervention. At the conclusion of the intervention, the participants were given 20 minutes to complete the post-intervention questionnaire and place it back in the manila envelope. As the participants exited the room, he/she placed the envelope in a specified basket. The data was measured through a paired sample t-test using SPSS software; measurement was for the mean score both pre and post-intervention and statistical significance. Demographic data was collected as well. The collected data was stored in a locked file cabinet within the Education and Training building which was only accessible by the investigator.

Pre/Post Intervention Questionnaire: See Appendix B

Feasibility Analysis

Currently, no program existed within this facility. The marketing of the program was executed through email and advertised appropriately in the facility with the use of posters and flyers located and placed throughout the facility. The WHO (2018) recommends all health care professionals receive up to date knowledge and skills to provide the best patient care. The complexity of this disease and the nature of the population served in this location – create difficulties in information dissemination among the staff. Therefore, an opportunity to improve the current training clearly linked the project to the organizations strategic plan by providing trusted care and ensuring mission ready forces and healthy families.

Project Resources: Personnel & Technology

This project was implemented utilizing existing technology located in the education and training facility on the clinic campus. This technology includes two classrooms with computer and smart board installed and provides seating for up to 20 people at a time. The intervention educational session was 4 hours of training. An additional 16 hours was utilized by the author for preparations, administrative burden, and executing the project.

Budget

The author was the primary interventionist and the intervention was implemented as a DNP final project at no cost to the organization. No staff time was required outside of usual business hours. The costs associated with the staff (including physicians, nurses, and emergency medical technicians) and physical location was negligible as the education occurred on an existing weekly training day. Training materials used from the CDC were with no additional charge, and printed copies of the pre/posttest cost was \$20.

Staff	Physical Location	Training Materials	Travel Expenses	Total
\$0	\$0	\$20.00	\$0.00	\$20.00

Congruence of the Organization's Strategic Plan to the Project

This project is congruent with the organizations strategic plan as evidenced by its mission statement, values, and goal. The mission of this facility where the project was implemented is to provide compassionate, high quality care, ensuring mission ready forces and healthy families. The intent of this project is to facilitate an enhancement of knowledge and attitude in the staff regarding TB infection control through an educational intervention which ensures mission ready

forces and healthy families. The goal of this organization is to ensure safe, quality care. The overall goal of this project is to ensure the health and safety of both the staff and the population treated in this facility through the intervention and enhancement of knowledge and attitudes. Finally, the organization's vision is to be the trusted choice for innovative patient-centered care for the world's premier gateway to space. The project is congruent to this vision as it is ultimately providing a safer environment of care by investing in the organization's staff in order to provide best care practices for the population being served.

Evidence of Key Site Support

This project is supported and approved by the Chief of Medical Staff (SGH) of the MTF. See Appendix A. The administration activities of this project, to include emails, facility reservations and other activities, were completed by the author.

Timeline

1	9/30/2019	12/15/2019	Submit DNP proposal for revision(s)
2	1/15/2020	2/01/2020	Paper revisions/Sent to team members
3	04/2020	05/2020	Proposal Presentation and faculty approval obtained
4	05/2020	06/2020	IRB Submission/approval
5	07/2020	07/2020	Project Implementation/Collect & Evaluate Data
6	07/2020	07/2020	Complete Paper
7	07/27/2020	07/27/2020	Oral Defense
8	07/31/2020	07/31/2020	ETD Submission

Measurable Project Objective

The objective of this project was to enhance knowledge regarding tuberculosis infection control in an outpatient clinic. The author, DNP student investigator, hypothesized that a four hour presentation utilizing the *CDC's Core Curriculum on Tuberculosis* and Microsoft PowerPoint will enhance knowledge and practices pertaining to TB-IC. Two measurable project objectives were associated with the intervention.

Goal:

S - Staff TB-IC training will occur on a Friday, the facilities training day.

M - At least 15 staff members will attend the training (CDC's Core Curriculum on TB.)

A - The DNP student/author will administer the intervention (pre-test).

R – 100% of participants will complete the pre-test.

T - Staff's ability to recognize TB signs/symptoms will improve with the training immediately.

1. Goal:

S – Staff will complete the training/intervention

M – Knowledge of TB-IC will increase in 50% of the participants by 10% from the pre-test to the post-test.

A – The DNP student will administer the complete intervention.

R – 100% of the staff will complete the entire intervention.

T – Results from the intervention will show an improvement in TB-IC knowledge immediately.

Inclusion and Exclusion Criteria

Inclusion criteria included current employment status at the military treatment facility where the educational intervention was implemented, direct patient access/care, and adults over the age of 18. A letter of consent explaining the intervention was given to all participants before the start of the intervention, and was read and signed by each person. Anyone not currently employed at this facility, under the age of 18, and not involved in direct patient care/access was excluded from the intervention.

Evaluation Plan

The purpose of this project implementation was to provide a TB-IC education intervention to increase the TB-IC knowledge of health-care workers at the 45th MDG. The program utilized the *CDC's Core Curriculum on TB* utilizing the tools within the curriculum and an evidence-based questionnaire from a previous study. Results were shared with the senior leadership within the organization and a recommendation for ongoing training was made.

The first step of the implementation was to meet with the clinic leadership and explain the use of the anonymous system used to measure the intervention's success. The second step of the implementation was to have each participant sign the consent form and complete the demographics sheet. The demographics sheet included gender, profession, and age. The third step included distribution of a pre intervention questionnaire. The fourth step included the educational intervention followed by the fifth step, a post intervention questionnaire. Both the pre and post questionnaires contained the exact same questions regarding TB-IC (see Appendix

B). The method of statistical analysis used for the pre- and post-tests was the paired sample t-test for continuous outcome/variable, which is the comparison of two means from the same group. For binary outcome/variable (True/False), the McNemar chi-square test was used to determine if there were differences on a dichotomous dependent variable between two related groups. For ordinal outcome/variable (Never, Rarely, Sometimes, Often and Always), the Wilcoxon Matched Pairs test was used to compare medians of two pretest and posttest groups. A descriptive analysis was utilized to describe the demographic information obtained from participants. All analyses were conducted using JASP (Version 0.13, 2020) software.

Results

Goal 1 was accomplished as a total of 19 de-identified ($n = 19$) participants completed the pre-test, intervention session, and posttest questionnaires. As previously mentioned, the first goal was a minimum of 15 participants. Demographical information (see Table 1) included a mean age of 42 and 74% were female while 26% reported as male. Most participants involved in this educational intervention were LPNs or EMTs (47%). Registered nurses accounted for 21% with the remainder a mix of physician assistants and physicians (32% combined). Results were considered statistically significant if p-value was $< .05$.

The pre-post questionnaire revealed a positive knowledge difference with all participants increasing his/her score. A paired t-test for the comparison of the pre and posttest scores was used for the statistical analysis (see Table 2). Demographical data was analyzed by parametric descriptive statistics. Scores for the pre-test averaged 49% (48.7) compared to the average score on the posttest of 60% indicating an 11% change in mean scores in a positive direction from pre to posttest. Table 1 illustrates both the pre and posttest data statistics. McNemar's chi-square analysis performed on each question (1-33) and Wilcoxon Matched Pairs Test on questions 34-

39 revealed 66% of the pre vs posttest answers to be statistically significant. (see Tables 8 & 9 for analysis).

Table 1

Descriptive Statistics for Pre and Posttest Scores (n = 19)

Descriptive Statistics

	Pre Intervention	Post Intervention	Difference
Valid	19	19	19
Missing	0	0	0
Mean	48.789	60.211	11.421
Std. Error of Mean	2.143	1.403	1.480
Std. Deviation	9.343	6.115	6.449

Statistical significance was determined by utilizing a paired sample t-test with $p = < .001$. This represents a statistically significant increase in HCWs knowledge after the intervention. Further, utilizing Cohen's d, the author can conclude with 95% confidence that evidence exists to suggest a statistically significant increase in test scores after the educational intervention. Therefore, the null hypothesis could be rejected. These results are shown in Table 2 below.

Table 2

Paired Samples T-Test for Educational Intervention

Paired Samples T-Test

Measure 1	Measure 2	t	df	p	Mean Difference	SE Difference	95% CI for Mean Difference		Cohen's d	95% CI for Cohen's d	
							Lower	Upper		Lower	Upper
Post Intervention	- Pre Intervention	7.719	18	< .001	11.421	1.480	8.313	14.529	1.771	1.032	2.491

Note. Student's t-test.

An unintended positive consequence was found with the female participants achieving a higher statistical significance than their male counterparts $p < .001$ vs. $.012$. However, male participants had a greater pre to post mean difference, which could be attributed to the lower number of male participants. See Table 3 Paired Samples T-Test for females within this project.

Table 3

Paired Samples T-Test Female

Paired Samples T-Test

Measure 1		Measure 2		t	df	p	Cohen's d	95% CI for Cohen's d	
								Lower	Upper
Pre Intervention Females	-	Post Intervention Females		-7.012	12	< .001	-1.945	-2.873	-0.990
Difference	-								

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Pre Intervention Females	13	49.462	7.688	2.132
Post Intervention Females	13	59.923	6.563	1.820
Difference	13	10.462	5.379	1.492

See Table 4, Paired Samples T-Test for males within this project. The statistical significance between the pre and post intervention was slightly lower but could, as stated before, be attributed to the overall lower number of males participating ($n=5$). One may also conclude in Tables 5-7, the greatest statistical significance was found in the EMP/LPN T-Test, $p < .001$.

Table 4*Paired Samples T-Test Male*

Paired Samples T-Test

Measure 1		Measure 2		t	df	p	Cohen's d	95% CI for Cohen's d	
								Lower	Upper
Pre Intervention Males	-	Post Intervention Males		-3.878	5	0.012	-1.583	-2.799	-0.312

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Pre Intervention Males	6	47.333	12.987	5.302
Post Intervention Males	6	60.833	5.529	2.257

Another unintended finding was the EMT/LPN participants having the greatest statistical significance of the professional groups included, $p = .001$ vs. RNs at .043 & Physicians/Assistants at $p = .018$. Additionally, this group had the largest pre-post mean difference between each of the groups at 12.8 vs. RNs at 8.5, and physicians/assistants at 11.5. However, this could be attributed to the larger sample size of the EMT/LPN group. See Table 5 Paired Samples T-Test for EMT/LPN within the project.

Table 5*Paired Samples T-Test EMT/LPN*

Paired Samples T-Test

Measure 1		Measure 2		t	df	p	Cohen's d	95% CI for Cohen's d	
								Lower	Upper
Pre Intervention EMT/LPN	-	Post Intervention EMP/LPN		-6.328	8	< .001	-2.109	-3.298	-0.886

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Pre Intervention EMT/LPN	9	48.556	6.207	2.069
Post Intervention EMP/LPN	9	61.333	2.500	0.833

Table 6*Paired Samples T-Test RN*

Paired Samples T-Test

Measure 1		Measure 2		t	df	p	Cohen's d	95% CI for Cohen's d	
								Lower	Upper
Pre Intervention RN	-	Post Intervention RN		-3.398	3	0.043	-1.699	-3.283	-0.047

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Pre Intervention RN	4	54.250	3.594	1.797
Post Intervention RN	4	62.500	3.416	1.708

Table 7*Paired Samples T-Test Physicians/Assistants*

Paired Samples T-Test

Measure 1	Measure 2	t	df	p	Cohen's d	95% CI for Cohen's d	
						Lower	Upper
Pre Intervention Physician/Assistants	- Post Intervention Physician/Assistants	-3.481	5	0.018	-1.421	-2.563	-0.221

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Pre Intervention Physician/Assistants	6	45.500	14.419	5.886
Post Intervention Physician/Assistants	6	57.000	9.940	4.058

Table 8

Variable Symptom of TB	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
	McNemar’s Chi-Square Test					
Q1 Blurry Vision	True	5	26.3	0		.031
	False	12	63.1	19	100	
	I don’t know	2	10	0		

Q2 Coughing for longer than 2-3 weeks	True	14	73.6	18	94.7	.125
	False	1	0.05	1	5.2	
	I don't know	4	21.0	0		
Q3 Coughing up blood	True	15	78.9	18	94.7	.067
	False	1	5.2	1	5.2	
	I don't know	3	15.7	0		
Q4 Ear pain	True	9	47.3	0		.001
	False	8	42.1	19	100	
	Don't Know	2	10.5	0		
Variable Symptom of TB	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q5 Fever	True	15	78.9	18	94.700	.250
	False	2	10.5	0		
	I don't know	2	10.5	1	5.2	

Q6 Memory loss	True	12	63.1	1	68.5	.000
	False	6	31.5	18	31.5	
	I don't know	1	5.2	0		
Q7 Night sweats	True	14	73.6	19	100	.125
	False	5	26.3	0		
	I don't know	0		0		
Q8 Pain with urination	True	9	47.3	2	10.5	.000
	False	5	26.3	17	89.4	
	Don't Know	5	26.3	0		
Variable Symptom of TB	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q9 Watery eyes	True	12	63.1	2	10.6	.000
	False	5	26.3	17	89.4	
	I don't know	2	10.5	0		

Q10 Weight loss	True	11	57.8	18	94.7	.016
	False	8	42.1	1	5.2	
	I don't know	0		0		
Mode of Spread and Risk of TB						
Q11 TB can be spread to others through semen or vaginal fluid	True	9	47.3	4	21.0	.031
	False	9	47.3	15	78.9	
	I don't know	1	5.2	0		
Q12 TB can be spread to others through the air	True	17	89.4	19	100	.000
	False	1	5.2	0		
	Don't Know	1	5.2	0		
Variable Mode of Spread and Risk of TB	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q13 TB can be spread to others	True	12	63.1	15	78.9	.250

through contact with blood	False	8	42.1	3	15.7	
	I don't know	0		0		
Q14 Patients with TB disease can infect other people by coughing	True	17	89.4	19	100	.001
	False	0		0		
	I don't know	2	10.5	0		
Q15 Patients with TB disease can infect other people by sharing food	True	12	63.1	2	10.5	.000
	False	3	15.7	17	89.4	
	I don't know	4	21	0		
Q16 Patients with TB disease can infect other people by talking or singing	True	13	72.2	18	94.7	.063
	False	3	15.7	0		
	Don't Know	3	15.7	1	5.2	
Variable Mode of Spread and	Response	Pre-Test		Post-Test		p-value

Risk of TB		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q17 Patients with TB disease can infect other people by sneezing	True	16	84.2	18	94.7	.500
	False	2	10.5	1	5.2	
	I don't know	1	5.2	0		
Q18 Patients with TB disease are more likely to infect others if they cough up a lot of sputum	True	15	78.9	18	94.7	.250
	False	0		1	5.2	
	I don't know	4	21	0		
Q19 Treating TB patient with the right drugs does not affect how infectious they are	True	7	36.8	0		.002
	False	8	42.10	18	94.7	
	I don't know	4	21.0	1	5.2	
Q20 Healthcare workers in the outpatient	True	5	26.3	0		.033

clinic have the same risk of getting TB as any other person						
	False	14	73.6	19	100	
	Don't Know	0		0		
Variable Mode of Spread and Risk of TB	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q21 An HIV-positive person has the same risk of getting TB as an HIV-negative person	True	3	15.7	2	10.5	.031
	False	12	63.1	18	94.7	
	I don't know	4	21.0	0		
Q22 An HIV-positive staff member cannot get sick with TB if they practice TB infection control measures	True	5	26.3	1	5.2	.031
	False	12	63.1	18	94.7	
	I don't know	2	10.5	0		
Q23 It is alright for HIV-positive staff who are healthy to work	True	7	36.8	1	5.2	.001

in TB High-risk areas of the hospital						
	False	7	36.8	18	94.7	
	I don't know	5	26.3	0		
TB Infection Control Measures						
Q24 When entering the outpatient clinic, every patient should be asked if they are coughing	True	15	78.9	19	100	.021
	False	3	15.7	0		
	Don't Know	1	5.2	0		
Variable TB Infection Control Measures	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q25 Patients who are identified as presumptive TB cases should not be separated from other patients in the waiting area as this	True	14	73.6	2		.000
	False	4	21.0	17		
	I don't know	0		0		

will be seen to be discriminating against them						
Q26 A coughing/sneezing patient should be instructed to cover their mouth with a handkerchief, tissue or their arm while coughing/ sneezing	True	19	100	19	100	.871
	False	0				
	I don't know	0				
Q27 If coughing/sneezing TB patients or presumptive cases use handkerchief or tissue to cover their mouth while coughing or sneezing, that is usually enough to protect the health care worker	True	4	21.0	0		.021
	False	15	78.9	19	100	
	I don't know	0		0		
Q28 If a coughing patient has not been diagnosed as a case of TB, it is not necessary to instruct	True	3	15.7	2	10.5	.250

them to cover their mouth while coughing						
	False	14	73.6	17	89.4	
	Don't Know	3	15.7	0		
Variable	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
TB Infection Control Measures						
Q29 A coughing patient should be instructed to collect a sputum sample in the clinic	True	8	42.1	0		.001
	False	2	10.5	19		
	I don't know	9	47.3	0		
Q30 Opening windows in a room with a coughing patient has no effect on the spread of TB	True	6	31.5	2	10.5	.016
	False	8	42.1	15	78.9	
	I don't know	5	26.3	1	5.2	
Q31 If a fan is used in a room, opening windows will not provide additional	True	6	31.5	1	5.2	.008

benefit for TB infection control						
	False	9	47.3	17	89.4	
	I don't know	4	21.0	1	5.2	
Q32 The windows in a room where there is a TB patient should not be opened because they must be hidden from other people	True	0		0		.066
	False	14	73.6	19	100	
	Don't Know	5	26.3	0		
Variable TB Infection Control Measures	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
Q33 Possible TB cases in the waiting area should wait just as long as everyone else, and should not be rushed through the queue	True	2	10.5	1	5.2	.125
	False	14	73.6	18	94.7	
	I don't know	3	15.7	0		

TB Infection Control Measures	Wilcoxon Rank Test Results					
Q34 How frequently do you ask each patient when they enter the clinic if they are coughing?	Never					.000
	Rarely	1	5.2			
	Sometimes	1	5.2			
	Often	13	68.4	1	5.2	
	Always	4	21.0	18	94.7	
Q35 How frequently do you move coughing patients to wait at a nearby but separate waiting area?	Never					.004
	Rarely	2	10.5			
	Sometimes	6	31.5			
	Often	7	36.8	7	36.8	
	Always	3	15.7	12	63.1	

Variable	Response	Pre-Test		Post-Test		p-value
		<i>n</i>	Valid Percent	<i>n</i>	Valid Percent	
TB Infection Control Measures						
Q36 How frequently do/will you instruct coughing patients to cover their mouth with tissues, handkerchiefs or their arm when coughing?	Never					.000
	Rarely					
	Sometimes					
	Often	15	78.9	1	5.2	
	Always	4	21.0	18	94.7	
Q37 How frequently do/will you ensure collection of sputum samples from a patient is done outdoors or in separate, well-ventilated areas?	Never	3	15.7			.000
	Rarely	8	42.1			
	Sometimes	7	36.8			
	Often	1	5.2	6	31.5	
	Always			13	68.4	

Q38 How frequently do you rapidly move coughing patient to the front of the queue, so he/she is/will (be) seen quickly to minimize the amount of time they spend in the clinic?	Never					.004
	Rarely	8	42.1			
	Sometimes	6	31.5			
	Often	2	10.5	7	36.8	
	Always	3	15.7	12	63.1	
Q39 How frequently do you open windows in patient waiting area or a room where coughing patients are attended to (or check to see if they are open already)?	Never					1.00
	Rarely	9	47.3			
	Sometimes	4	21.0			
	Often	6	31.5	14	73.6	
	Always			5	26.3	

Discussion

Both goals for the study were met; there were 19 participants and a greater than 10% increase from pre to posttest was identified in 10 individuals which represented 53% of the sample size. This project reflects current literature and is an inexpensive, simple and effective education intervention that can lead to an increase in TB-IC knowledge among HCWs. However, limitations to the project existed. The size of the participant pool was small, the facility is located on a U.S. Military Installation resulting in limited access, and the intervention was conducted at a single site, which limits generalizing to other populations. Also, one needs to be aware the questionnaire may contain questions that may not be appropriate for every facility. However, the sample size is comparable to most outpatient clinic populations, serving a ~ 10k population. In addition, as an MTF the facility is still required to operate under the same policies and guidance as civilian organizations regarding the joint commission and add knowledge to TB-IC education.

Implications for Future Practice

This project demonstrated that an educational intervention regarding TB-IC can be successfully implemented. The creation of a sustainable program to ensure the continued success of the intervention was recommended to the MTF leadership. The recommendation included an annual training day devoted to TB-IC lead by the Infection Prevention Team within the facility. The Infection Prevention Team was given the materials from the CDC and the literature used for the intervention in a binder. The Chief of Medical Staff, along with other clinic leadership have all agreed to reinforce the training annually for HCWs assigned to the clinical areas. These future stakeholders included the MTF Commander, the Chief of Medical Staff and the Chief Nurse. Given the high rates of TB within the surrounding population and the

high risk potential for the development of TB with the transient world-wide military population, ongoing education to provide the best evidence to healthcare providers is essential to mitigate the development of TB infections. A comprehensive TB-IC program that addresses knowledge, skills and attitudes of healthcare workers is essential to mitigate TB infection.

Attainment of DNP Essentials

Essential I. Scientific Underpinnings for Practice

The first essential, scientific underpinnings of practice provides the advanced practice nurse with the foundation on which to build his or her professional practice (AACN, 2006). It is vital for a doctorally prepared advanced practice nurse to have a strong understanding of theoretical frameworks to guide project implementation and related decisions made throughout his or her career. For this project, the CDC's (2013) "*Core Curriculum on Tuberculosis Infection Control*" was chosen. This model along with Kotter's (1996) Leadership Change Theory was utilized to create this evidence-based scientific intervention. This intervention was designed to adequately assess and meet the needs of the clinicians by utilizing observation, surveys, and questionnaires. Completing this project has given this author the tools needed, as an advanced practice nurse, to identify a need and determine possible solutions using the scientific underpinnings of practice, incorporating relevant theory to solve population health problems at the systems level. Throughout my career as an advanced practice nurse I will use scientific underpinnings of practice to adequately perform early assessments, implement interventions, and utilize resources to meet the needs of clinicians and organizations through continuous process improvement.

Essential II. Organizational and Systems Leadership for Quality Improvement and Systems Thinking

The second essential calls for the DNP graduate to demonstrate the ability to build and leverage connections to solve problems within health systems (AACN, 2006). Systems Thinking encourages the view that errors or incidents are not usually the result of one single action, but rather a symptom of a greater systemic process that should be improved. This facility had clearly lacked a TB-IC education program, which could have had potential negative effects on the staff and the patients. Systems Thinking encourages one to understand the second and third order effects of one single change. Accomplishing this successful intervention will undoubtedly impact decision making on many different levels within this MTF and have a profound impact on Quality Improvement. Systems Thinking has had an impact on how I have addressed issues as an advanced practice nurse. It has allowed me to understand how one decision or change in a particular area may impact others within the organization.

Essential III. Clinical Scholarship and Analytical Methods for Evidence-Based Practice

Being able to discover new knowledge, apply it appropriately in the clinical setting, and adequately evaluate implementation is paramount for the doctorally prepared advanced practice nurse (AACN, 2006). In order to demonstrate mastery of Essential III, Clinical Scholarship and Analytical Methods for Evidence-Based Practice, the Doctor of Nursing Practice (DNP) graduate is prepared to use evidence based research to design and implement process improvements and evaluate the outcomes. Through the completion of this educational intervention focusing on TB-IC, statistically significant results have indicated HCWs benefit from an evidence-based program, such as the CDCs (2013). Analytical methods performed included a critical appraisal

of literature reviewed to support the need for such an intervention. The intervention measured data pre and posttest and undoubtedly contributes to the evidence-based practice repository.

Essential IV. Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

The doctorally prepared advanced practice nurse is trained to analyze and communicate critical elements necessary to the selection, use, and evaluation of health care information systems and patient care technology (AACN, 2006). The group PowerPoint presentation used in the educational intervention is a type of technology perhaps most commonly used to present information. Once data was received from the participants, the analysis was conducted using a statistical software known as JASP (2020). Which is an open-source program designed to be familiar to SPSS users and can be downloaded or accessed with an internet connection.

Essential V. Health Care Policy for Advocacy in Health Care

With the uncertainty of the future of healthcare policy in the United States, advanced practice nurses will be pivotal in future decisions made regarding policy changes (AACN, 2006). Essential V calls for the advanced practice nurse to engage in political activism and maintain a commitment to policy development. Findings from this intervention are suited to help change policy and guidance in some of our nation's hardest hit areas for TB. Results have shown this type of intervention to be successful and easily implemented with a significant return on investment. Implementing policy within the top five states for TB infection to include an educational intervention for HCWs would influence Health Care Policy and advocate for both patients and staff.

Essential VI. Interprofessional Collaboration for Improving Patient and Population Health**Outcomes**

Advanced practice nurses are important members as leaders of the interdisciplinary team. The doctorally prepared advanced practice nurse will be in the position to develop and participate in as well as lead an interprofessional team (AACN, 2006). Throughout this project was an opportunity to work with many professions to include administrators, RNs, LPNs, PAs, Physicians, Dentists, and many more was key to the success of the project. The APN has a unique position to cross over and influence all professions within health care. It is within an interdisciplinary framework that change may be created to improve patient and population health outcomes.

Essential VII. Clinical Prevention and Population Health for Improving the Nation's**Health**

This project focused on the prevention of spreading disease, particularly one that has had a huge impact throughout history and event today, tuberculosis. As we enter a new era with another novel respiratory disease we are reminded of the vulnerabilities of our populations health. With this particular population caring for those who deploy and deploying to locations around the world, it was imperative to create and implement an intervention to prevent acquiring such diseases. Interestingly, the intent of this project may also be applied to be effective against new and emerging disease.

Essential VIII. Advanced Nursing Practice

Every advanced practice nurse must have the basic foundational competencies of advanced nursing practice (AACN, 2006). The Doctor of Nursing Practice Program has provided me with practical experiences that have built upon the education I received in both the baccalaureate and masters nursing programs and has allowed me to develop skills necessary to be successful as a DNP. The educational intervention consisted of identifying the problem, creating a PICO question, researching, completing a critical appraisal of the literature reviewed, and gathering data from pre/posttest activities. These activities all require advanced levels of clinical knowledge and judgement. Throughout the doctoral program, numerous assignments and clinical rotations have helped me to build a strong foundation that I will continue to build upon throughout my career as a DNP.

Conclusion

Literature documents TB-IC is lacking worldwide. Although the U.S. has seen a decline in TB rates, FL is one of four states whose combined total of TB cases nearly accounts for half of the cases nationwide. Furthermore, the military population rapidly deploys across the globe to austere locations increasing the odds of acquiring TB. As the nation enters a new era concerning respiratory diseases the timing is right to incorporate advanced training within our HCWs. This educational intervention focusing on implementing and evaluating a TB-IC program demonstrated a statistically significant increase in pre vs posttest knowledge levels, thereby addressing an essential component regarding a successful TB-IC program: the need for an educational intervention to improve TB-IC knowledge in a military treatment facility. Results of this study could be disseminated and utilized by other organizations, not only limited to MTFs.

The ease of sustainability associated with this intervention encourages confidence that TB mitigation may successfully be addressed through the use of a comprehensive TB-IC program.

References

- Akande, P. (2019). The effect of an educational intervention to improve tuberculosis infection control among nurses in Ibadan, south-west Nigeria: a quasi-experimental study. *BMC Nursing*. <https://dx.doi.org/10.21203/rs.2.16151/v1>
- Alotaibi, B., Yassin, Y., Mushi, A., Maashi, F., Thomas, F., Mohamed, G., Hassan, A., & Yezli, S. (2019). Tuberculosis knowledge, attitude and practice among healthcare workers during the 2016 Hajj. PLOS ONE. <https://doi.org/10.1371/journal.pone.0210913>
- American Association of Colleges of Nursing. (2006). *The essentials of doctoral education for advanced nursing practice* [PDF file].
<https://www.aacnnursing.org/Portals/42/Publications/DNPEssentials.pdf>
- British Broadcasting Company. (2019). <https://www.bbc.co.uk/newsround/24566691>
- Buregyeya, E., Kasasa, S., & Mitchell, E.M. (2016). Tuberculosis infection control knowledge and attitudes among health care workers in Uganda: a cross-sectional study. *BMC Infectious Diseases*, 16, 416.
<https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-016-1740-7>
- Centers for Disease Control and Prevention. (2018). Trends in tuberculosis, 2017 [Data file].
<https://www.cdc.gov/tb/publications/factsheets/statistics/tbtrends.htm>
- Chapman, H. J., Veras-Estevez, B. A., Pomeranz, J. L., Perez-Then, E. N., Marcelino, B., & Lauzardo, M. (2017). Perceived barriers to adherence to tuberculosis infection control measures among health care workers in the Dominican Republic. *MEDICC review*, 19(1), 16-22. . <https://pubmed.ncbi.nlm.nih.gov/28225541/>

- Florida Department of Health. (2018). Tuberculosis cases 2013-2017, distribution by county, 5 year average [Data file]. http://www.floridahealth.gov/diseases-and-conditions/tuberculosis/tb-statistics/documents/cases_by_county_2013-2017.pdf
- JASP Team. (2020). JASP (Version 0.13). [Computer software].
- Joshi, R., Reingold, A. L., Menzies, D., & Pai, M. (2006). Tuberculosis among health-care workers in low- and middle-income countries: A systematic review. *PLOS medicine*, 3(12), e494. doi:10.1371/journal.pmed.0030494
- Kanjee, Z., Catterick, K., Moll, A.P., Amico, K.R., & Friedland, G.H. (2011). Tuberculosis infection control in rural South Africa: A survey of knowledge, attitude and practice in hospital staff. *Journal of Hospital Infection*, 79 (4), 333-338.
- Kettner, P. M., Moroney, R. M., & Martin, L. L. (2013). Designing and managing programs: An effectiveness-based approach. Thousand Oaks, CA. SAGE Publications, Inc.
- Kotter, John P. (1996). Leading change. Boston, MA: Harvard Business School Press.
- Kotter, J. & Cohen, D. (2002). The heart of change: Real-life stories of how people change their organizations. Boston, MA: Harvard Business School Press.
- Mann-Woith, W., Volchenkov, G., & Larson, J. (2013). Barriers and facilitators affecting tuberculosis infection control practices of Russian health care workers. *Int Journal of Tuberculosis Lung Dis*, 16(8), 1092-1096.
- Nathavitharana, R. R., Bond, P., Dramowski, A., Koot, K., Lederer, P., Oxley, I.,...Zumla, A. (2018). Agents of change: the role of healthcare workers in the prevention of nosocomial and occupational tuberculosis. *Presse Med.* 46, 53-62.

Pratt, C. C., MdcGuigan, W.M., & Katzev, A. R. (2000). Measuring program outcomes: Using retrospective pretest methodology. *American Journal of Evaluation*, 21 (3), 341-349.

Scottish Intercollegiate Guidelines Network. (2019). Critical appraisal: Notes and Checklists. <https://www.sign.ac.uk/what-we-do/methodology/checklists/>

Shrestha, A., Bhattarai, D., Thapa, B., Basel, P., & Wagle, R.R. (2017). Health care workers' knowledge, attitudes and practices on tuberculosis infection control, Nepal. *BioMed Central Infectious Disease* 17;17(1):724. DOI [10.1186/s12879-017-2828-4](https://doi.org/10.1186/s12879-017-2828-4)

Tyndall J. AACODS checklist for appraising grey literature. Adelaide: Flinders University; 2010. https://dspace.flinders.edu.au/jspui/bitstream/2328/3326/4/AACODS_Checklist.pdf, accessed 24 July 2020

United States Census Bureau. (2018). Quick facts Florida [Data file]. <https://www.census.gov/quickfacts/fl>

Uplekar, M., Weil, D. Lonnroth, K., Jaramillo, E., Lienhardt, C., Monica-Dias, H.,...Falzon, D. (2015). WHO's new end tb strategy. *The Lancet*, 385, 1799-1801.

World Health Organization. (2015, March 24). Afghanistan, tuberculosis kills 13,000 Afghans every year. <http://www.emro.who.int/afg/afghanistan-news/tuberculosis-kills-13-000-afghans-every-year.html>

WHO. (2018). Continuing education for health professionals. <http://www.who.int/genomics/professionals/education/en/>

Appendix A

DEPARTMENT OF THE AIR FORCE
45TH SPACE WING (AFSPC)

20 Nov 2018

MEMORANDUM FOR Maj Allen Potter

FROM: 45 MDG/SGH

SUBJECT: Capstone Proposal

Reference: West Virginia University, Doctor of Nursing Practice Degree Requirements

1. The 45th MDG has authorized support for the completion of the Capstone Proposal titled Enhancing attitudes and beliefs regarding a TB exposure protection plan in a high risk military population.

//Signed//
DAVID A. DY, DO, Maj, USAF, MC, FAAFP
Chief of Medical Staff

Appendix B

Questionnaire

The effect of an educational intervention to improve tuberculosis infection control among health care workers in the 45 Medical Group, Patrick AFB, Central Florida: A Process Improvement Initiative

Section A

Please circle the features that apply to you and fill in the required information where indicated.

1. Sex: You are:
 - a) Male
 - b) Female
2. What is your age? _____ (years)
3. What is your professional affiliation? (Circle only one.)
 - a) Physician
 - b) Registered Nurse
 - c) Licensed Practical Nurse
 - d) Emergency Medical Technician
 - e) Administrative Support

Section B

For each of the following symptoms, please check (v) "true" if you consider it a symptom of TB, "false" if it is not, or "I don't know" if you are not sure. Please choose only one option for each symptom.

SN	Symptom	True	False	I don't know
1	Blurry vision (False)			
2	Coughing for longer than 2-3 weeks (True)			
3	Coughing up blood (True)			
4	Ear pain (False)			
5	Fever (True)			
6	Memory loss (False)			
7	Night sweats (True)			
8	Pain with urination (False)			
9	Watery eyes (False)			
10	Weight loss (True)			

The following are statements about the mode of spread and risk of TB. For each statement, please check (✓) “true” if the statement is true, “false” if it is not, or “I don’t know” if you are not sure. Please choose only one option for each statement.

SN	Statement	True	False	I don't know
11	TB can be spread to others through semen or vaginal fluid (False)			
12	TB can be spread to others through the air (True)			
13	TB can be spread to others through contact with blood (False)			
14	Patients with TB disease can infect other people by coughing (True)			
15	Patients with TB disease can infect other people by sharing food (False)			
16	Patients with TB disease can infect other people by talking or singing (True)			
17	Patients with TB disease can infect other people by sneezing (True)			
18	Patients with TB disease are more likely to infect others if they cough up a lot of sputum (True)			
19	Treating TB patient with the right drugs does not affect how infectious they are (False)			
20	Healthcare workers in the outpatient clinic have the same risk of getting TB as any other person (False)			
21	An HIV-positive person has the same risk of getting TB as an HIV-negative person (False)			
22	An HIV-positive staff member cannot get sick with TB if they practice TB infection control measures (False)			
23	It is alright for HIV-positive staff who are healthy to work in TB High-risk areas of the hospital (False)			

The following are statements about practicing TB infection control measures. For each statement, please check (✓) “true” if the statement is true, “false” if it is not, or “I don’t know”) if you are not sure. Please choose only one option for each statement.

SN	Statement	True	False	I don't know
24	When entering the outpatient clinic, every patient should be asked if they are coughing (True)			
25	Patients who are identified as presumptive TB cases should not be separated from other patients in the waiting area as this will be seen to be discriminating against them (False)			
26	A coughing/sneezing patient should be instructed to cover their mouth with a handkerchief, tissue or their arm while coughing/ sneezing (True)			
27	If coughing/sneezing TB patients or presumptive cases use handkerchief or tissue to cover their mouth while coughing or sneezing, that is usually enough to protect the health care worker (False)			
28	If a coughing patient has not been diagnosed as a case of TB, it is not necessary to instruct them to cover their mouth while coughing (False)			

29	A coughing patient should be instructed to collect a sputum sample in the clinic toilet (False)			
30	Opening windows in a room with a coughing patient has no effect on the spread of TB (False)			
31	If a fan is used in a room, opening windows will not provide additional benefit for TB infection control (False)			
32	The windows in a room where there is a TB patient should not be opened because they must be hidden from other people (False)			
33	Presumptive TB cases in the waiting area should wait just as long as everyone else, and should not be rushed through the queue (False)			

Section C

The following are statements about practicing TB infection control measures. For each statement, please check (✓) the frequency with which you practice each of the measures. Please choose only one option for each statement.

SN	Task	Never	Rarely	Sometimes	Often	Always
1	How frequently do you ask each patient when they enter the clinic if they are coughing?					
2	How frequently do you move coughing patients to wait at a nearby but separate waiting area?					
3	How frequently do you instruct coughing patients to cover their mouth with tissues, handkerchiefs or their arm when coughing?					
4	How frequently do you ensure collection of sputum samples from a patient is done outdoors or in separate, well-ventilated areas?					
5	How frequently do you rapidly move coughing patient to the front of the queue, so he/she is seen quickly to minimize the amount of time they spend in the clinic?					
6	How frequently do you open windows in patient waiting area or a room where coughing patients are attended to (or check to see if they are open already)?					