TUBERCULOSIS EDUCATION TO STOP TB

by

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As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Ann Ottesen titled *Tuberculosis Education to Stop TB* and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

Dr. Rita Wunderlich, PhD, RN, CNE Date: August 8, 2021

Committee Chair Name

Final approval and acceptance of this DNP project is contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

_____ Date: August 8, 2021

[Committee Chair signature]

DNP Project Committee Chair

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DEDICATION

I Dedicate this Project to my Family, Friends, Coworkers Past and Present, Cascade Peer and Self Help Center, and also myself.

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ABSTRACT

Tuberculosis Education to Stop TB at a Peer Center for those with Mental Health and Addiction Struggles

Purpose: The purpose of this project was to determine if the implementation of a Tuberculosis (TB) educational session would improve post- as compared to pre-education test scores. The overall aims of this project were to increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and screening.

Background: TB practice guidelines include annual TB education for all healthcare workers regardless of risk. At a peer center for those that have experienced mental health and addiction struggles in the Northwest region of the United States, it was found that no TB education was provided to the paid peers employed by the center or volunteers. To address this issue, the researcher of this project, in collaboration with the manager of the peer center, conducted a quality improvement project.

Methods: A quantitative, exploratory design was utilized for this project. Thirty-nine participants were engaged from a peer center located in the Northwest region of the United States in a TB educational intervention to determine if the implementation improved knowledge of the risk of TB and the importance of TB screening and readiness to talk to a provider about TB risk and screening. The intervention launched with a pre-test followed by a didactic session about TB knowledge and talking to a provider about care steps to be healthy. Some of the participants flipped through a binder with the materials on their own and others engaged with the researcher and/or other peers. Afterwards, participants completed the test again (post-test). The

changes in the pre-test and post-test scores were evaluated to determine the effectiveness of the education intervention.

Results: A paired *t* test was conducted to compare the pre-test to post-test scores after the educational program. There was a significant difference in the scores of pre-test (M = 5.6667, SD = 1.37199) and post-test (M=7.1111, SD = 1.40958). This gain is statistically significant *(t (*17) = 4.305, p < 0.001) by paired *t* test. The results demonstrated there was a significant increase in participants' knowledge after the completion of the TB education intervention. The sign test did not demonstrate a statistically significant difference in readiness to talk to a provider about care steps to be healthy, exact binomial p (1-tailed) = 0.125 or TB risk and TB screening, exact binomial p (1-tailed) = 0.067.

Conclusions: A standardized TB education intervention increased TB knowledge for participants at a peer center but did not increase readiness to talk to a provider about TB risk and TB screening. This capstone project demonstrates that more than a standardized education intervention is needed to prepare people in the community to talk to their providers about their risk for TB and TB screening.

Key words: TB education, Tuberculosis education, TB screening, Tuberculosis screening, TB risk, Tuberculosis risk, community, peer center, healthcare workers, standardized educational tool

Tuberculosis Education to Stop TB

Chapter One: Phenomenon of Interest

Education is an essential priority to stop Tuberculosis (TB). It is estimated that up to thirteen million people live with latent TB in the United States. Practice guidelines to screen and prevent the spread of TB are supported by the CDC and National Tuberculosis Controllers Association. The CDC recommends that healthcare workers be screened for TB upon hire and provided TB education annually regardless of risk.

Quality education provided to health workers or peers is a cost-effective sustainable measure that can maximize current resources to increase capacity by addressing capabilities, motivations, and improving opportunities for TB control. Quality education includes needs assessments, evaluation of effectiveness, varied modalities for delivery that include opportunities for interaction with an instructor or facilitator, and content that is relevant to the students to address capabilities, motivations, and opportunities related to TB control. Many factors contribute to effective tuberculosis education including needs assessment, evaluation, delivery, capabilities, motivation, and opportunities.

Interest and Expertise

Having been exposed to tuberculosis and subsequently developing latent TB infection requiring nine months of antibiotic treatment, this author has an interest in stopping TB. As a nurse who has worked with many clients to promote behavior change, it was important to hone the aims of the project while considering the desired target behavior of the intervention by thinking about facilitators and barriers to behavior change such as knowledge, culture, convenience, skills, processes, innate ability, memory, resources, motivation, environment, and so much more.

Purpose and Aims

Tuberculosis (TB) practice guidelines include annual TB education for all healthcare workers regardless of risk. At a peer center for those that have experienced mental health and addiction struggles in the Northwest region of the United States, it was found that no TB education was provided to the paid peers employed by the center or volunteers. To address this issue, the researcher of this project, in collaboration with the manager of the peer center, conducted a quality improvement project. The purpose of this project was to determine if the implementation of a TB educational session would improve post- as compared to pre-education test scores. The overall aims of this project were to increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and screening. In addition, as health equity is important to the author and marginalized people are often under-represented in research, the author wanted to promote inclusivity by implementing the project in such a manner where the goal was autonomous universal participation.

Background

Populations at risk for contracting Tuberculosis (TB) include health care workers, people who engage in illicit drug use, and people who have lived or worked in high TB risk congregate settings such as homeless shelters, jails, and prisons (American Lung Association, 2020; Centers for Disease Control and Prevention [CDC], 2018; Lewinsohn et al., 2017). The peer workers and volunteers at the peer center are at risk of TB infection because they are health care workers and volunteers and are in close contact with people who have experienced homelessness, incarceration, and illicit drug use.

Opportunities such as human resources and community resources are considered for prioritizing TB control activities, and TB control often happens in the community (Adane et al., 2019; Aldridge et al., 2015; Lukman et al., Ibrahim et al., 2019; Marks, 2019; Spruijt et al., 2019; Wieland et al., 2019). The peer center has human resource personnel who are available and engaged in promoting health through partnerships with healthcare agencies, making it a community resource for engaging in TB education and control.

Education is utilized to address TB control and is recommended on an annual basis for health workers regardless of risk (CDC, 2018; Sosa et al., 2019; World Health Organization [WHO], 2008). TB education has been shown to improve knowledge, attitudes, and practices related to decreasing the risk of contracting TB (Adane et al., 2019; Bisallah et al., 2018; Cabral et al., 2017; Scott et al., 2019; Spruijt et al., 2020; Wieland et al., 2019).

Theoretical Domains Framework (TDF) was utilized to guide the project. In partnership with the peer center, county health department, and local health center, the target TB preventive behavior of talking to a provider about TB risk and screening was identified along with potential barriers and facilitators (Atkins et al., 2017; Michie et al., 2005). A pre-education test with knowledge questions and an assessment of readiness to talk to a provider about TB risk and screening was administered, followed by an educational session, and then administration of a post-education test to see if there was improvement in the scores and determine the need for future interventions.

Significance

Tuberculosis is caused by an infection with the mycobacterium tuberculosis bacteria (CDC, 2021). Some people get sick when they are infected and others stay healthy. TB infection in humans can be traced back as far as 9,000 years ago (CDC, 2021), and today, about one

quarter of the world's population is infected with Tuberculosis (TB) and approximately ten million people become ill with TB per year (World Health Organization, 2020). It is the number one infectious disease killer in the world despite being curable and preventable (World Health Organization, 2021). Most people who become ill from TB are from low- and middle- income countries, but TB is present all over the world. TB is the leading cause of death from HIV and a major contributor to global antimicrobial resistance (World Health Organization, 2021). Testing for TB infection and treating those at risk for TB disease is important in ending TB (CDC, 2021).

Nursing General Practice

Nurses should be taking on more leadership roles that will influence the state of the health care system (Institute of Medicine [IOM], 2011). Nurses are uniquely positioned in the United States health system to provide conservative and preventative care and approach problems from a public health perspective. Due to the nature of nursing work and historical and current constraints faced when providing patient care, nurses are creative and have expertise at utilizing various resources. Historically, nurses approach healthcare from a unique and patient-based perspective. Nurses view patient care in the context of access, patient resources and barriers, and logistical hurdles (Joel, 2013). The practice of nursing utilizes five patterns of knowing: empirics, ethics, aesthetics, personal knowing, and emancipatory knowing (Chinn & Krammer, 2013).

Patterns of Knowing.

Chinn and Krammer describe personal knowing as the process of knowing oneself and the self in relation to others (2013). The empirical knowledge embodies the science and theory of nursing (Chinn & Krammer, 2013). Education has been demonstrated to improve health. Specific

delivery methods of the education are still being explored. Education can be utilized to increase TB screening and stop TB.

Ethical and emancipatory knowing are intertwined. Ethical knowing is about knowing what is right and ought to be done, and emancipatory knowing is applying ethical knowing in the context of changing values and beliefs with the goal of addressing inequality and injustice (Chinn & Krammer, 2013). Justice is the principle of fairness (Ingham-Broomfield, 2017). More specifically, justice can apply to health care workers, patients, communities, the health system, and society and can be classified as procedural justice or distributive justice (Morrison & Furlong, 2019). These authors refer to procedural justice as fairness in designing and implementing procedures and distributive justice as the fairness of the distribution of burdens and benefits.

Both procedural and distributive justice are important in health care and are important to nurses. According to the American Association of Colleges of Nursing, the American Nurses Association, and the International Council of Nurses, the concept of nursing was defined as the "full participation in society and the balancing of benefits and burdens by all citizens resulting in a just ordering of society" (Walter, 2017, p. 225). In other words, it is arguable that the discipline of nursing was founded based on the principle of justice.

According to distributive justice, each person should get an equal share of burden and benefit except when there is a material reason to discriminate such as the person needs it or the person deserves it (Morrison & Furlong, 2019). When it comes to disease management, lifestyle and culture are involved and must be addressed to get to the root of the issue. The community setting is an appropriate area that nursing can intervene to make lasting changes that involve lifestyle or culture. The value of these changes can be determined only when looking at the long-

lasting impacts of these small changes, but as this value is difficult to measure, it requires research and contemplation.

Aesthetics is the art of nursing including the interactions and relationships that are formed with others (Chinn & Krammer, 2013). In the community setting, nurses are able to practice the art not only with the patient, but with the patient's environment including the physical and social environment. As environment is so instrumental to health, this role of nursing is unique in its ability to work within and influence the environment.

Healthcare at Large

The Oregon Health Authority recently announced Coordinated Care Organization 2.0 (CCO 2.0). Priorities include addressing health disparities and prioritizing payments on value (Oregon Health Authority [OHA], 2019). This project is aligned with the changes in care delivery that Oregon Health Authority funds and supports. This project would serve to address health disparities for patients by looking at value innovatively and differently than is traditionally considered when it comes to project evaluation. Short term benefits are more readily captured currently but the long-term benefits are not considered as part of the value. Oregon is innovating health care delivery by considering value over a longer term. This could be translated into project evaluation by capturing long term value.

The following four AIMs of the Central Oregon Regional Health Improvement Plan are met by the project: "Individuals and families in Central Oregon experiencing poverty are provided equitable access and connected to appropriate resources that help them overcome obstacles to self-sufficiency and address health-related challenges" (COHC, 2019, p. 29); "Equitably and measurably support all Central Oregonians to prevent disease by improving health behaviors and reducing risk factors that contribute to premature death and diminished

quality of life" (COHC, 2019, p. 49); "Increase equitable access to skilled and coordinated care between specialty behavioral health and the larger health system, including primary care, while decreasing barriers to ensure an effective and timely response" (COHC, 2019, p. 39); and "All communities in Central Oregon have equitable access and opportunities to health, education, healthy relationships, community support, and experiences necessary to thrive at every stage of life from prenatal to adulthood" (COHC, 2019, p. 79). TB prevention education related to TB risk and importance of screening for a high-risk population and the skill of talking to a provider about care steps to be healthy meet these aims by helping the participants address health-related challenges directly with their providers. This skill serves to prevent disease in the future and improve health behaviors. The peers are evidence-based specialty behavioral health healthcare workers, and so by promoting their skills in talking with a provider about care steps to be healthy and encouraging them to directly address their TB risk with their primary care providers, there is improved coordination of care between specialty behavioral health and primary care. In addition, the education opportunity provided more equitable access to health and education by being delivered in a setting that is comfortable and convenient for the peers and volunteers.

Advanced Practice Nurses

The Advanced Practice Nurse (APN) is trained to promote evidence-based practice by consuming and implementing research into clinical situations and practice settings (Joel, 2013). They are trained to critique research, adapt their practice to apply the research, define quality indicators, evaluate interventions in terms of outcomes, and collaborate with multidisciplinary team members to design research and share knowledge (Joel, 2013). As such, APNs must be able to provide mentoring, persistency, and leadership to promote practice changes in the clinical environment (Joel, 2013). The APN is trained to not only continue to use research to promote

evidence-based practice for patient-specific situations but also to approach practice changes in context of the entire health system and society to promote quality and affordable healthcare for all. In addition, Advanced Practice Nurses can help RNs take on leadership roles through mentorship, by setting up protocols, by providing education, and by utilizing prescriptive authority to help get tasks accomplished.

Support for Project

The manager of the peer center wrote the letter of approval for this Doctor of Nursing (DNP) project and the board of the peer center voted to allow the researcher to conduct the project at the center. The student arranged the logistics of the project in such a manner that the peers would not feel burdened by it so that they would support future projects at the center. For future projects, grants could be utilized to increase capacity at the peer center and meet other aims to increase health equity.

Benefit of Project to Practice

Healthcare in Oregon is moving away from a fee for service model and towards value-based payment models. This project will examine innovative ways to consider value from a public health perspective that may extend beyond the direct benefit to the patient. The epidemiology of diseases is that there is a strong correlation with environment. The analysis will promote utilizing resources in healthcare towards interventions that consider progress from a macro perspective to allow practices that focus on capacity building, partnering with patients and their resources, and problem solving for immediate benefit with great downstream gains. This would in term serve to innovate practice as when designing interventions, the broader outcomes would be considered. Promoting patients to talk with their providers about their TB risk and TB screening is a skill that can be used to talk about any care steps to be healthy. Education that

involves TB knowledge as well as promoting this skill is an opportunity to stop TB and also improve communication between clients and their providers to promote health.

Conclusion

The plan is to look at innovative ways to promote health in the community. Lack of TB education and screening was identified as a problem at a peer center where people are at a higher risk for TB. Promoting patients to talk with their providers about their TB risk and TB screening is a skill that can be used to talk about any care steps to be healthy. Education that involves TB knowledge as well as promoting this skill is an opportunity to stop TB and improve communication between clients and their providers to promote health. In addition, this project could establish a relationship at the peer center so that in the future, other projects could be accomplished but with grant money to further build capacity at the peer center.

Chapter Two: Literature Synthesis

Populations considered at risk for contracting Tuberculosis (TB) include people who engage in illicit drug use and people who have experienced homelessness, and it is estimated that up to thirteen million people live with latent TB in the United States. Practice guidelines to screen and prevent the spread of TB are supported by the CDC and National Tuberculosis Controllers Association, and the CDC recommends that healthcare workers be screened for TB upon hire and provided TB education annually, regardless of risk. At a peer center for those who struggle with addiction and/or mental health issues in the Northwest region of the United States, it was found that no consistent education was provided to peer support specialist (PSS) healthcare workers (HCWs) to screen and prevent the spread of TB. For PPS HCWs at the peer support center that serves many people at risk for TB, would an education intervention increase knowledge about TB risk and screening and promote peers to get screened for TB infection?

Search History

An advanced search was done in PubMed for articles from January 2019 through March 2020, using the keywords "tuberculosis" AND "education" AND "health workers" OR "health professionals" OR "healthcare workers" OR "health extension workers". There were 75 resulting articles. The titles and abstracts of all these articles were reviewed to determine if they would be applicable to the project, and articles that were not in English or not primary research were eliminated. In addition, articles were excluded if they primarily related to TB risk, TB treatment, latent TB treatment, multidrug resistant TB, TB contact investigation, or something else that is associated with TB such as tobacco use, diabetes or HIV and did not have a significant component related to TB education. There was also one article excluded

because the full text of the article was not available through the Maryville University library due to technical problems on the host site. The resulting ten articles all related to tuberculosis knowledge and attitudes of health workers, and all of them addressed education related to TB. A search using the same keywords, Boolean phrases, and limiters was done in Cumulative Index to Nursing & Allied Health Literature (CINAHL), and there were 14 resulting articles. After reviewing titles and abstracts, no new articles were found that related to tuberculosis knowledge and attitudes of health workers and addressed education related to TB.

A search was done in the Cochrane database without any date restrictions of "tuberculosis" OR "TB" AND "education". The purpose of using Cochrane database was to discover additional resources in the systematic review references. There were eleven resulting articles. These were all reviewed and the two reviews that involved tuberculosis and education both only addressed adherence to tuberculosis management after diagnosis, and so the reference lists were not included in the review. Another search was done in PubMed to uncover articles. This time, the search was restricted to publications within the last five years and the keywords were searched within titles: "tuberculosis" OR "TB" AND "education" OR "educator*". There were thirteen results of which five additional relevant articles were applicable. A search was done in the CINAHL database using the limiter of subject for "tuberculosis" OR "TB" AND "education" OR "educator*", limiting to full-text articles published in English since 2019, and there were fifty-six results. After reviewing titles and abstracts, one additional article was found applicable.

The final search was performed in the PubMed database for articles from January 2019 through March 2020. The keywords searched within titles were "tuberculosis" OR "TB" AND "screening" AND "community". Of the eleven results, five were considered relevant.

Integrated Review of Literature

When it comes to TB control, most of the literature either addresses TB treatment and treatment compliance or TB screening, identification, and prevention. This review synthesizes literature that involves TB screening, identification, and prevention, however, it is understood that screening and identification are not helpful if treatment is not available or treatment compliance is not addressed. When provided skillfully, education is a sustainable and cost-effective way to address capabilities and motivations regarding TB control behavior, and human resources are available in all parts of the planet affected by TB. Capabilities and motivations are limited by opportunities, however, so opportunities or lack of opportunities related to environmental contexts, resources, and social influences should be considered when deciding where to prioritize quality TB control education. In addition, population risk is helpful to consider when deciding how to prioritize TB control. Themes that will be explored for this review related to TB control are population risk, opportunities, and quality education.

Population Risk

Related to globalization, infectious diseases that are spread from human to human have the capability of reaching all populations when provided transmission opportunities. The mycobacterium that causes TB becomes airborne when a person with active TB disease coughs, sneezes or breaths, and remains in the air for hours. Breathing the contaminated air facilitates infection, and all humans breath. Risk of TB infection is affected by immune system functioning and exposure to air contaminated by the mycobacterium. In low TB burden countries like the United States, Canada, New Zealand, Australia, and United Kingdom, most new infections can be sourced from abroad because the prevalence of active TB in low burden countries is so low. There still remains a significant portion of the population in the United States with latent TB

infection. Persons that have spent a significant time abroad in high TB-burden countries, have been exposed to people with active disease, or have compromised immune systems are at higher risk. When opportunities are identified for TB control, intervening in populations at higher risk can yield better return-on-investment, and so population risk should always be considered when selecting a population for intervention in low TB burden countries.

The studies regarding TB control were conducted mostly in countries with high TB burden including Brazil (Cabral et al., 2017; Felix & Soares, 2019), China (Chen et al., 2019), Ethiopia (Adane et al., 2019, Gebretnsae et al., 2020; Shiferaw et al., 2019; Sima et al., 2019), India (Joseph et al., 2019), Indonesia (Lukman et al., 2019), Lesotho (Ramathebane et al., 2019), Myanmar (Kyaw et al., 2020), Nigeria (Bisallah et al., 2018; Ekeke et al., 2020), South Africa (Engelbrecht et al., 2019; Scott et al., 2019), Peru (Penaloza et al., 2019), and Vietnam (Marks et al., 2019; Ngo et al., 2019). Despite the entire population in these countries being relatively at risk for TB, many of these studies attempted TB control in populations that were additionally at risk for tuberculosis including inmates (Adane et al., 2019), healthcare workers (Brakel et al., 2019; Engelbrecht et al., 2019; Ngo et al., 2019), diabetics (Ekeke et al., 2020), HIV patients (Bisallah et al., 2018), tribal people (Joseph et al., 2020), and household members of active TB contacts (Gebretnsae et al., 2020; Shiferaw et al., 2019). Poverty was associated with risk due to overcrowding, poor ventilation, malnutrition (Joseph et al., 2019), and poor health literacy (Penazola et al., 2019). Two of the studies justified TB control activities for the future by further stratifying TB risk (Ngo et al., 2019; Penazola et al., 2019). Ngo et al. (2019) identified healthcare workers in the emergency department as being particularly at risk for TB infection in a non-TB specialized hospital in Vietnam, and Penazola et al. (2019) identified that being a transport worker was inversely associated with TB knowledge. Opportunities for TB control in

these higher-risk stratified populations as effective TB control have the potential to yield greater impacts, but only if there are sufficient opportunities for control. Unfortunately, if there are too many basic environmental or resource constraints such as lack of availability of antibiotics, trained health workers, testing facilities or equipment, masks and other personal protective equipment, space to isolate, and means to ventilate, TB education activities will have little impact despite the high burden of TB.

Six of the studies were conducted in lower TB burden countries including Australia (Visser et al., 2019), Italy (Bella et al., 2019), the Netherlands (Spruijt et al., 2020), Saudi Arabia (Alotaibi et al., 2019), the U.S. (Wieland et al., 2019), and the United Kingdom (Aldridge et al., 2015), but they addressed at-risk populations including outpatient health workers (Bella et al., 2019), Australian indigenous communities (Visser et al., 2019), Eritrean migrants (Spruijt et al., 2020), Islamic pilgrims from high TB burden countries (Alotaibi et al., 2019), adults at an education center that serves a large foreign-born population at risk (Wieland et al., 2019), and homeless in hostels in London (Aldridge et al., 2015). For ongoing TB control in lower TB burden countries, active disease containment and treatment need to continue while opportunities should be identified for screening and latent TB treatment in higher risk populations.

Identifying Opportunities: Context and Resources

It is important to consider the context and resources before TB control can be improved and targeted. Context and resources can be considered related to active disease containment, and treatment or screening and latent TB treatment. If active disease cannot be effectively contained and treated, the cost effectiveness of screening and latent TB treatment will be greatly diminished, as those with active disease will continue to transmit the bacteria. In a study in Vietnam, globally, efforts to contain infection need to be addressed and then the same context

and resources can be utilized to screen for and treat latent TB simultaneously. In low burden TB countries, screening and latent TB treatment will continue to keep TB prevalence low, but will not eradicate TB until the TB burden globally is diminished.

Infection containment: context and resources.

Level of benefit for infection containment depends on availability of space to quarantine those with active disease, availability of ventilation to clear TB air particles including mechanical ventilation and natural ventilation or ultraviolet germicidal irradiation devices when ventilation is not available (WHO, 2009), availability of personal protective equipment (PPE), especially masks to reduce the release of bacteria in the air by infected individuals and respirator masks to protect those nearby from breathing in the bacteria, availability of labs and equipment needed to diagnose infection or a means to transport samples there, availability of antibiotics to treat infection, and availability of human resources to ensure treatment is completed and provide the control activities. If these basic resources are not available to contain infection, there is limited benefit to other implementations that seek to control TB.

For rural areas, a major challenge to TB control is convenience and availability of resources to perform the lab tests needed to diagnose infection (Adane et al., 2019; Joseph et al., 2019). In a qualitative study by Joseph et al. (2019) one lab technician identifies that the testing needs to be done at main hospitals due to lack of availability in rural areas and additionally, the lab is overburdened by work delaying test results. Unless a plan to address this barrier can be financially accomplished, TB control will not result in as much benefit in this region. Even basic public transportation to facilities that provide lab services for highly motivated individuals is not always available (Gebretnasae et al., 2020). This barrier needs to be addressed before providing TB control interventions and may be used to decide on where to perform the interventions.

For health workers in both the community and hospital setting, there is limited access to masks and other appropriate personal protective equipment (PPE) (Engelbrecht et al., 2019; Lukeman et al., 2019; Ngo et al., 2019). A means for protection is needed if stigma and fear are to be addressed for managing TB and health workers are to be retained (Engelbrecht et al., 2019; Lukeman et al., 2019). In many populations, grouping those with infection and increasing ventilation are all that is available for quarantining the disease (Adane et al., 2019) or are utilized because advanced resources are over-taxed (Ngo et al., 2019). Basic protections for the uninfected needs to be available before infection containment TB control activities can be considered.

Health extension workers and peers have been identified as human resources for TB control (Adane et al., 2019; Aldridge et al., 2015; Joseph et al., 2019; Gebretnsae et al., Lukeman et al., 2019; 2020; Ramathebane et al., 2019; Shiferaw et al., 2019; Sim et al., 2019; Spruijt et al., 2020). Many are volunteers and due to the challenges of the work, have high attrition rates (Lukeman et al., 2019). As mentioned above, other basic resources to contain the disease need to be available in addition to labs for providing testing before human resources can be fully utilized. These human resources will also be most effective if they have reasonable compensations available to them (Adane et al., 2019) as retention will be increased and effectiveness of TB containment activities will then also be increased.

Screening and latent TB treatment: context and resources.

If a population has the capability of infection containment, screening and latent TB treatment can be provided. Currently, this appears to not be provided in high-burden TB countries as even studies conducted to screen for latent TB did not result in treatment (Ngo et al., 2019). Screening tests, antibiotics, and human resources need to be readily available for benefits

to be realized related to increased screening and treatment of latent TB. Even in low burden TB countries where the resources to address TB control are relatively infinite, convenience and availability of lab services and antibiotics are crucial for TB control. For instance, many efforts were made to provide screening opportunities in a timely and convenient manner for participants in several of the studies (Adane et al., 2019; Aldridge et al., 2015; Spruijt et al., 2020; Ngo et al., 2019; Wieland et al., 2019).

Social support.

Whether considering infection containment or screening and latent TB treatment, social support is another important opportunity that should be considered when targeting TB control. Social support for TB control activities was garnered from peers (Adane et al., 2019; Aldridge et al., 2015; Spruijt et al., 2020), various community leaders, health workers, and other people in positions of authority (Adane et al., 2019; Aldridge et al., 2015; Spruijt et al., 2020; Wieland et al., 2019). When social support is diminished, efforts to improve screening and case detection result in diminished effects. While ongoing social support from those in leadership and authority positions can be provided after initiating TB control activities and education, an initial assessment of social support should be considered before investing in TB control.

Quality Education

When it comes to TB control, education should be provided where there are decent opportunities for TB control and the population is considered at increased risk. Quality education is a cost-effective sustainable measure that can maximize current resources to increase capacity by addressing capabilities, motivation, and slightly improving opportunities for TB control.

There were eight studies that involved TB education interventions (Adane et al., 2019; Aldridge et al., 2015; Bisallah et al., 2018; Cabral et al, 2017; Felix & Soares, 2019; Scott et al.,

2019; Spruijt et al., 2020; Wieland et al., 2019). The education was provided to peers that then went on to be TB health workers (Adane et al., 2019; Aldridge et al., 2015; Spruijt et al., 2020), health professionals including nurses and multidisciplinary staff (Bisallah et al., 2018; Cabral et al., 2017; Felix & Soares, 2019; Scott et al., 2019), and other high risk populations in the community (Spruijt et al., 2020; Wieland et al., 2019) and the clinic (Bisallah et al., 2018). Assessment of education needs and evaluation of education effectiveness are correlated with quality of education. In addition, using multiple training modalities, promoting interactivity by using trained educators, facilitators, or coordinators to deliver or supplement the education, and education that targets a variety of domains for behavior change in specific populations are suspected to affect quality.

Education needs are important to assess when providing quality education. Spruijt et al. (2020) and Wieland et al. (2019) involved the target community in designing the education programs. Specifically, Spruijt et al. (2020) invited Eritreans to discuss materials and pilot them and Wieland et al. (2013) utilized focus groups to determine education points, make a video, pilot the video, and evaluate the video. Details about the education provided to the homeless peers are unknown for the Aldridge et al. (2015) study, but the charity that organized them called Groundswell is dedicated to enabling homeless and vulnerable populations by maximally involving homeless peers in research, education, and other activities (Groundswell, 2012). Experts in behavior modification and preventive medicine were consulted to design the Bisallah et al. (2018) modules.

An important component of effective education is assessment of its effectiveness. Training effectiveness was formally assessed in at least six of the eight studies (Adane et al., 2019; Bisallah et al., 2018; Cabral et al., 2017; Scott et al., 2019; Spruijt et al., 2019; Wieland et

al., 2019). For the Spruijt et al. (2020) and Adane et al. (2019) studies, not only was the training effectiveness assessed for the peers, but knowledge was also assessed in the greater population after the peers had helped to provide them with education interventions. For the Aldridge et al. (2015) study, the peer training was done by a different organization and was not reported on by the researchers, but the education had included a 3-day session that was followed by shadowing an existing peer educator and ongoing support. Felix and Soares (2019) did not report on training effectiveness.

Multiple training modalities were utilized in the studies including lecture, interactive learning, demonstrations, group discussions, and teach back sessions (Adane et al., 2019), training along with shadowing (Aldridge et al., 2015), flipped classroom, simulation, conceptual maps, storytelling, and problem-based learning (Felix & Soares, 2019), videos along with presentations (Spruijt et al., 2019; Wieland et al., 2018), power point presentations with videos embedded and demonstration activities (Scott et al., 2019), information modules with facts about TB and motivational module that counters misconceptions about TB (Bisallah et al., 2018), and written text on slide show presentation (Cabral et al., 2017). Live educators, facilitators, or coordinators were available to promote interactive learning in some form for all of the studies (Adane et al., 2019; Aldridge et al., 2015; Bissallah et al., 2018; Cabral et al., 2017; Felix & Soares, 2019; Scott et al., 2019; Spruijt et al., 2019; Wieland et al., 2018), but degree of availability and skill level are variable.

The domains of behavior change include knowledge, skills, self-efficacy, role, beliefs about consequences, motivations, intentions, memory/attention/decision processes, environmental context and resources, social influences, emotions, and behavior regulation (Atkins et al., 2017; Michie et al., 2005). For TB control, knowledge includes knowing about

modes of transmission, symptoms of active TB disease and treatment, knowledge about latent TB and importance of treatment, measures to prevent the spread of TB, and more. Knowledge was always assessed and addressed in the education interventions and was fairly consistent across studies (Adane et al., 2019; Aldridge et al., 2015; Bissallah et al., 2018; Cabral et al., 2017; Felix & Soares, 2019; Scott et al., 2019; Spruijt et al., 2019; Wieland et al., 2018).

A variety of different methods of education were used to address the other domains. Skills were utilized by prioritizing the selection of educators that had crossover skills through previous experience with health care in some form (Adane et al., 2019; Bissallah et al., 2018; Spruijt et al., 2019), and by selecting peers that had language skills of the benefit group (Spruijt et al., 2019). Skills specific to TB were taught in the education intervention for some including properly wearing n95 masks (Scott et al., 2019) and TB case finding and teaching (adane et al., 2019). Self-efficacy was established when educators were given the opportunity to practice their skills through teach back demonstrations and simulated case-finding (Adane et al., 2019).

Role delineation was very clearly included in two of the education programs (Adane et al., 2019; Scott et al., 2019). Scott et al. (2019) provided separate trainings for clerks, security guards, porters, nurses, cleaning staff, and ambulance staff with specific roles and responsibilities included for each. Beliefs about consequences were addressed with regards to effectiveness of masking by demonstrating how difficult it was to blow a candle out when a mask was placed on the blower (Scott et al., 2019), performing actual screenings for people so they would know if they had latent TB infection (Spruijt et al., 2020; Wieland et al., 2019); and imparting knowledge about free treatment being available (Adane et al., 2019; Spruijt et al., 2020; Wieland et al., 2019). Motivations were address by promising certificates (Adane et al., 2019; Cabral et al., 2017), providing the education during work hours (Scott et al., 2019), and

monetary compensation (Adane et al., 2019; Spruijt et al., 2020). Intentions were addressed by initially recruiting volunteers to participate (Adane et al., 2019; Aldridge et al., 2015).

Memory/attention/decision processes were addressed by offering the trainings over several modules (Cabral et al, 2017; Adane et al., 2019) and days (Adane et al., 2019; Aldridge et al., 2015). Tools were also included with the education to help participants with TB control memory/attention/decision processes including a Tuberculosis Infection Control (TIC) sheet (Scott et al., 2019), symptom screening form (Adane et al., 2019), treatment follow-up reporting sheet (Adane et al., 2019), and flow diagram for screening in the emergency department (Scott et al., 2019). Behavioral regulation was promoted by assigning peer educators to blocks and scheduling the education every two weeks (Adane et al., 2019), agreeing on a plan of work (Aldridge et al., 2015), and using a sign-up sheet for screening that was given to the TB nurses (Wieland et al., 2019).

Environmental context and resources were addressed in the education by discussing the importance of masking (Scott et al., 2019), ventilation principles in crowded prisons (Adane et al., 2019), grouping active TB cases together (Adane et al., 2019; Scott et al., 2019), and discussing barriers to diagnosis such as hospital distance and resource availability (Adane et al., 2019). Another aspect of environmental context and resources that was addressed was the creation of multiple education resources to promote repeatability of the education including videos (Spruijt et al., 2020; Wieland et al., 2019), power point presentations (Scott et al., 2019), online modules (Cabral et al., 2017), and training manuals (Adane et al., 2019; Bisallah et al., 2019).

Social influence and emotions were also utilized. For instance, fear and stigma were addressed by Adane et al. (2019), Aldridge et al. (2015), and Spruijt et al. (2020). The social

influences were also identified and recruited. Spruijt et al. (2020) provided the education and developed it with Eritrean leaders and attempted to involve community members with authority including church leaders, soccer coaches, and teachers. The guards and health workers in the prison were involved to supervise the prisoners (Adane et al., 2019). Peers were chosen because of their social influence and cultural connectivity to the benefit populations (Adane et al., 2019; Aldridge et al., 2015; Spruijt et al., 2020).

Assessment Strategies

Assessment is an integral part of the nursing process. It begins with curiosity, which results in observation, and leads to interpretation. At an early age, children demonstrate the circular and infinite nature of this process by responding to every answer with a question: "why?". No matter how many times one answers the question "why?", it can continue to be asked, revealing a new and deeper understanding of one's realities.

Assessment involves input along with interpretation of that input. The input can be gained through the senses by using eyes, ears, nose, mouth, touch, and mind. It can be gained through study and through stories. It can also be gained using scientific avenues that involve measurement and data collection. In the mind, the interpretation part of assessment involves perception, and for data analysis, the interpretation part of assessment involves statistics. Perception and statistics are both molded by the observer and thus can result in infinite realities.

When it comes to tuberculosis research, there can be a variety of assessments performed and for different purposes. Three fundamental types of assessments are noted in the review of the literature depending on their role in the study: formulatory assessments, primacy assessments, and opportune assessments. It is helpful to view the literature through the lens of assessment to understand and critique it.

Formulatory Assessments

Formulatory assessments are used to shape the study design and primary objectives of the study. Some of these assessments are done so that the maximal amount of formal knowledge can be incorporated into the study design and objectives, and some of these assessments are done to promote informal knowledge, innovation, and community engagement in shaping the study. Depending on the literature available, data available, and study objectives, the formulatory assessments can vary greatly. The most effective studies use formulatory assessments to formulate study objectives, identify facilitators, identify barriers, and identify solutions.

For many studies, not much has been assessed about the phenomenon of interest or the study population before the study begins (Alotaibi et al., 2019; Bissallah et al., 2018; Cabral et al., 2017). Alotaibi et al. (2019) has identified that the Hajj pilgrimage is an event risk for tuberculosis, Bisallah et al. (2018) has identified that the rising incidence of TB among HIV patients in Nigeria is a great threat to TB control and very few are enrolled in TB treatment and care, and Cabra et al. (2017) has identified that TB burden is high in Porto Alegre Brazil and delayed timing until start of treatment is suspected. For all three of these studies, the formulatory assessment is very limited and can be summarized in a simple statement. The literature review only includes basic information about TB and basic descriptive epidemiological data, and detailed information about facilitators, barriers, and solutions for improved TB control is not included.

While less common, other studies include a lot of varied formulatory assessment information. The formulatory assessments for the Adane et al. (2019), Aldridge et al. (2015), and Spruijt et al. (2020) studies include extensive information about TB epidemiology in the study population, identify barriers to TB control, identify facilitators to address those barriers, and

include information about proposed solutions. Not only are the formulatory assessments extensive and multifaceted for these three studies, but they also include specific information about solutions that have worked to promote health in the target populations, even though they were outside the typical realms of where one might normally search with regards to TB control. For instance, the Adane et al. (2019) study done in the prison system of Ethiopia included information about solutions that have been utilized to solve health problems in prison populations, the Spruijt et al. (2019) study done on Eritrean migrants in the Netherlands included information about solutions that have been utilized to promote health among migrant populations, and the Aldridge et al. (2015) study done on people in homeless hostels included information about successful methods used to promote health for those experiencing homelessness.

Primacy Assessments

The primacy assessments should reflect the primary objectives of the study. These require data collection during the study and allow for repeatability, generalizability, collaboration, and rigorous evaluation among the political and scientific community. They are almost always done formally, and methods are disclosed. The primacy assessments can be used to assess intervention effectiveness (Aldridge et al., 2015; Adane et al., 2019; Bisalla et al., 2018; Cabral et al., 2017; Scott et al., 2019; Spruijt et al., 2020; Wieland et al., 2019), justify focusing TB control on a specific population (Bella et al., 2019; Ekeke et al., 2020; Penaloza et al., 2019), or plan for future interventions (Alotaibi et al., 2020; Engelbrecht et al., 2019; Gebretnaseae et al., 2020; Joseph et al., 2019; Lukman et al., 2019; Ngo et al., 2020; Ramathebane et al., 2019; Sima et al., 2019). The primacy assessments for the reviewed studies reflect the overall study objectives except for the one by Scott et al. (2019) which only collected primacy data related to

one of the four interventions done. There was also one article by Felix et al. (2019) which detailed interventions that were done, but the study authors did not perform formal primacy assessments to demonstrate effectiveness. Education interventions were done, but formal data was not collected in the form of knowledge tests or student satisfaction surveys.

Opportune Assessments

Opportune assessments are used to shape future objectives and identify new facilitators, barriers, and solutions. They include literature searches, interviews, surveys, and more, and are performed after the study design and objectives have already been determined and the study is underway. They do not need to be planned in advanced, and do not necessarily align with the primary objectives of the study. Like formulatory assessments, opportune assessments can be done stringently or spontaneously. They are often detailed in the discussions section and can serve many purposes including critiquing the study. They are immediately applicable when performed to identify new barriers to success (Adane et al., 2019; Aldridge et al., 2015, Rathembane et al., 2019) or new facilitators to success (Spruijt et al.., 2020). They can also be used to identify new objectives and solutions.

Opportune assessments can identify barriers to interventions. When the intervention does not work, Aldridge et al. (2015) reports on a discussion that was conducted between the peer educators and the staff after the trial and identifies lack of assertiveness in the peers that might relate to lack of technical knowledge and confidence. This information could immediately be used to improve the study design by performing interventions that improve their confidence and knowledge. The prison study by Adane et al. (2019) had assessed that the hospitals in Tigray investigated all referred inmates with presumptive tuberculosis, but one of the hospitals in Amhara limited the investigations to those with prominent symptoms and the case finding was

lower in Amhara. This is an identified barrier related to the referring hospitals that might need to be considered for future peer interventions in prisons and might need to be addressed if certain results are expected. During their study, Ramathebane et al. (2019) assessed that clinics operate differently as some had village health worker (VHW) coordinators and some did not. They did not identify VHW coordinators as facilitators or lack of VHW coordinators as barriers, but improving coordination between VHWs and the clinics would likely result in improved outcomes.

The most innovative use of opportune assessments of the reviewed studies is demonstrated in the study of Eritreans in the Netherlands. This study is unique in that the opportune assessments were planned ahead and were centered around facilitators, barriers, and solutions. The TB physicians of study participants that were identified as eligible for LTBI treatment completed questionnaires about language barriers, occurrence of side effects, challenges experienced, and when applicable, the reasons for discontinuing the LTBI treatment (Spruijt et al., 2020). Even though 97% of the participants started the treatment and only one did not finish, the researchers had data about it. Instead of being used to investigate outcome failures, the data was used to investigate outcome success. Individual interviews were conducted with clients on LTBI treatment and group interviews were conducted with Eritrean participants that came to the LTBI screening (Spruijt et al., 2020). This data was then used to learn lessons from the program, further explore facilitators and barriers for screening, and determine the future direction of research and intervention. For instance, participants requested tests for other diseases like HIV be offered and younger Eritreans identified wanting representation in program delivery as they sometimes felt mistrust from the older generation (Spruijt et al., 2020). The use of

opportune assessments in this way promotes ongoing problem solving and community engagement in the study and results in successful outcomes.

Intervention Targeting

Analyzing intervention targeting is difficult because it can only be understood by operationalizing the study population. Operationalizing the study population is best accomplished by examining study objectives and how close or removed they are from the overarching goal of direct TB control. For the sake of simplicity, intervention targeting will be considered in the context of an intervention population and a benefit population. Generally, the intervention population is the population that data is being collected from and is most directly involved in the intervention or assessment. The benefit population is the population that is hoped to benefit directly from the assessment and intervention through improved TB control. Some studies collect data from and involve both the intervention and the benefit populations, but most of the studies focus on one of the populations. Occasionally, the benefit and intervention population are the same. The newly generated data from the studies resulting from an assessment or intervention shall be used to define and operationalize the population of interest. For this discussion, an assessment is considered an intervention if the purpose of the assessment is to target future interventions. The studies below are organized based on the intervention and benefit populations. Strengths and weaknesses are demonstrated based on how well the populations are defined and how clearly the objectives and interventions are targeted.

For some studies, the intervention population are peers of the benefit population. Two of these studies of peers have very targeted interventions and objectives. Adane et al. (2019) utilizes peers in the prison setting to address TB among prisoners. The intervention population is given the responsibility of increased case finding of TB cases and trained and tasked with activities that

support case finding. Aldridge et al. (2015) utilizes peers to attempt to increase x-ray screening uptake for people experiencing homelessness in hostels.

For some studies, the intervention population is composed of health extension workers and the benefit population is composed of the people they serve. Of the three studies below, two are targeting TB control while one is not. Lukman et al. (2019) interviews village community health volunteers from two regencies of Bandung City in West Java Indonesia to identify facilitators and barriers for TB control and health extension worker effectiveness. While knowledge is assessed, other important factors are considered as well. Spruijt et al. (2020) engages seven Eritrean community members that were already working to perform other health-related projects in the community to develop, implement, and test several LTBI screening programs. They are focused on utilizing their expertise in other areas besides TB to improve TB control. Ramathebane et al. (2019) interviews both the intervention population which are the village health workers and the benefit population which are the community members to determine knowledge of TB and utilization of TB control services. While the Lukman et al. (2019) and Spruijt et al. (2020) studies are targeting TB control, the Ramthebane et al. (2019) is focused on TB knowledge and utilization of TB control services. This study is not very helpful because simply increasing knowledge will not necessarily result in increased utilization of TB control services.

For some studies, the intervention population is healthcare workers and the benefit population their patients. Of the following four studies, two had targeted objectives that were utilized and two did not. Alotaibi et al. (2019) examines healthcare workers that have been deployed during the 2016 Hajj and the benefit population are those attending the Hajj. For the Alotaibi et al. (2019) assessment, the authors do not appear to have any objectives for the

healthcare workers to accomplish except to assess the health care workers' knowledge, attitude, and practices. It would have been helpful to determine how they wanted to utilize the healthcare workers' skills to improve TB control during the Hajj before deciding what data to collect. After all, they are only going to be involved with the benefit population for a brief period, and so the care they can provide would be limited. If they were to determine that these workers would screen everyone or provide education to everyone, that might be helpful. For Bella et al. (2019), the intervention population is outpatient healthcare workers and the benefit population are their patients, but they plan to screen these workers to prevent them from spreading TB instead of engaging their help to solve TB control issues. Their objective is to justify the screening from a monetary standpoint, and they accomplish that objective. For Cabral et al. (2017), the intervention population is nurses that provide inpatient or outpatient care in the city of Porto Alegre Brazil and the benefit population would be their patients. For the Cabral et al. (2017) intervention, healthcare workers were more confused about their role in TB control after the education than before the education. Furthermore, the education was not designed to improve TB control with any objective in mind and therefore had little use. For Sima et al. (2019), the intervention population includes all 46 health professionals and 65 health extension workers in a pastoralist community in Ethiopia and the benefit population is the pastoralist community. This study had identified more specific objectives, and that is reflected in the assessment activity that aimed to determine knowledge and attitude towards TB control systems and TB patients. They also aimed to assess if they would be willing to collaborate with traditional healers to control TB and recognized community involvement as necessary for controlling TB. None of these studies, however, engaged the healthcare workers in identifying facilitators, barriers, or solutions to TB control.

For some studies, the intervention population is the same as the benefit population. Bisallah et al. (2018) educates HIV patients in a general hospital in Nigeria because TB amongst people living with HIV has been associated with high transmission. Penaloza et al. (2019) evaluates health literacy and TB knowledge among outpatients at a hospital in Lima, Peru. Ekeke et al. (2020) assesses TB prevalence in diabetes patients at large diabetes clinics that have readily accessible DOTS centers in Nigeria. The Penaloza et al. (2019) study and the Bisallah et al. (2018) study are not very targeted because there is no intervention in mind. For the Penaloza et al. (2019) study, the patients do not even have increased risk of TB. The Bisallah et al. (2018) study like the Cabral et al. (2017) study delivers education to the study population without an objective in mind to promote TB control. This makes the intervention not very helpful. The Ekeke et al. (2020) has clear objectives of the study as it would like to assess cost-effectiveness of screening all diabetes patients for TB.

Engelbrecht et al. (2019) assesses knowledge, attitudes, and practices of healthcare workers in public hospitals in Free State Province in South Africa with the intent of addressing TB in this population of healthcare workers. Ngo et al. (2019) assesses healthcare workers in a general hospital of Vietnam for knowledge, attitude, and practices and performs TB screening on them. The Engelbrecht et al. (2019) study is focused on stigma and fear regarding TB in healthcare workers but not on interventions to promote TB control. For example, they identified perception of adequate disposable respirators available as especially pertinent but neglected to ask if healthcare workers know what is recommended or about procedures regarding use of them. Ngo et al. (2019) screened all the healthcare workers for TB and so were able to not only assess knowledge, attitude, and practices but also decide where to target next interventions as they discovered that the E.D. nurses tested positive most frequently. Unlike the Engelbrecht et al.

(2019) study, they asked questions about the use of PPE and how to prevent transmission by patients with confirmed or suspected TB as well. The study design targets interventions.

There are also a few studies where the intervention population is not well defined and so the intervention cannot be targeted. Scott et al. (2019) implemented several interventions to improve TB infection control at a hospital in South Africa. A TB screening procedure in the E.D. was formally evaluated, and the E.D. nurses were the intervention population and the E.D. patients the benefit population. This part of the intervention was successful because it was targeted with well-defined intervention and benefit populations. The other interventions did not have data and were not well defined or targeted. Gebretnsae et al. (2020) interviews patients treated for TB to determine if household contacts were screened for TB by health extension workers. In this case, the intervention population is patients treated for TB and the benefit population is their household contacts. Implied is that the Health Extension Workers will become the intervention population, but patients that have been treated for TB would have been seen by medical professionals. The process for referral and intervention is not made clear in the study and so objectives cannot be targeted. Wieland et al. (2019) reports on a partnership between Hawthorne staff, Olmsted County TB Clinic, and nursing students from Winona State University to provide education and a sign-up sheet for screening at an adult education center that serves a large foreign-born population in Minnesota. The benefit population are the adults at the education center, but the intervention population is not well defined and the roles change. The study was not very sustainable in that the screening was not performed consistently from year to year, likely because the intervention population and tasks were not well defined.

Community Engagement and Dissemination

One aspect worth noting is that the intervention population may benefit in ways that are not direct objectives of the study as noted by Aldridge et al. (2019) stating that the peer educators may benefit from being involved in the study because they were involved in a structured and meaningful activity. In the Lukeman et al. (2019) study of community health volunteers, the subjects also identified that being involved in TB care and prevention initiatives increased their self-esteem and self-actualization as members of society. These benefits are significant and should not be discounted. They imply that the intervention population is also the benefit population. It can also be proposed that the more the intervention population is involved in directing the study, the more they will benefit. As a result of this benefit, they will be more engaged in the study objectives and thus more effective. Similarly, soliciting involvement from the benefit population can also translate into increased engagement in study objectives.

Comparing the two peer studies with targeted interventions, the one that provided the most engagement and support from the community to the peers was more successful. They did not solicit the peers to identify facilitators and barriers or come up with solutions, but they did provide a lot of support. In the prison, the peers were provided with extensive training, testing, incentives, recognition, and support from the study investigators and healthcare workers in the prison (Adane et al., 2019). For the homeless hostel peers (Aldridge et al., 2015), they did not receive incentives and were not involved in the design or the intervention. Furthermore, many of them were not actually peers of the homeless hostel people, as peer was defined as someone who had experienced either TB infection or homelessness. The study authors acknowledged that lack of confidence and authority was likely an issue.

For the three studies that deemed community health workers as the intervention population, there were varying levels of engagement and support. The community health workers

also had varied experience with TB and community engagement. The community health workers in the Lukman et al. (2019) study had expertise in TB but appeared to lack knowledge, capabilities, and support with regard to community engagement. The Spruijt et al. (2020) study engaged workers that had experience in other health control activities but not necessarily knowledge about TB to identify facilitators, barriers, and solutions to engaging the community in TB control. They were supported by a team that included a TB specialist nurse and ultimately also pillars of the community such as church leaders. The Ramathebane et al. (2019) study neither engaged the community health workers in identifying facilitators, barriers, or solutions to engaging the community in TB control nor did they provide any support. They identified that the health workers did not have much knowledge about TB, but they did not assess their ability to engage the community in activities or their need for support to do so. Community health workers were able to be utilized at a much higher level when they were supported by both community authorities and medical expertise.

Joseph et al. (2019) focuses in-depth interviews on tribal members in Tamil Nadu India by strategically selecting interviewees that have a variety of different perspectives by soliciting ASHAs, VHNs, Anganwadi workers, medical officers, lab technicians, and male and female community members. Like the Lukeman et al. (2019) study of community health volunteers, the Joseph et al. (2019) study solicits the participants to identify facilitators and barriers for the problem of TB control. They were able to gain knowledge from individuals that did not necessarily have much knowledge about TB by asking about other subjects such as health seeking behavior, acculturation, and treatment adherence.

Literature Critique

The most successful studies regarding tuberculosis screening and education intervention involved multifaceted strategies for a variety of purposes including comprehensive assessments, selecting the target population, developing study outcomes, evaluating of effectiveness of the interventions, and learning lessons from the project that could be used to direct future research. The best studies involved interventions that as a results of extensive assessments, were designed to target a specific population and achieve specific outcomes related to TB control. Level of community engagement and dissemination throughout the research process also helped to determine effectiveness of the studies.

Strengths

Much has been identified about benefit and target populations for TB control activities. Though recommendations vary between low and high prevalence TB countries, benefit populations that have been identified include healthcare workers, people experiencing homelessness, prisoners, people with HIV infections, people with diabetes, and people that experience poverty along with low health literacy. Intervention populations include healthcare workers and extension health workers. Extension health workers can be further categorized as community volunteers, prison peers, homeless peers, and migrant leaders. Some of the studies identify methods that have worked to promote health in similar populations and apply them to the study population.

Many of the studies identify an intervention population that would be closely involved with the TB control activities for the benefit population on a regular basis. For instance, in the general hospital setting, the E.D. healthcare workers are the most exposed to tuberculosis (Ngo et al., 2019) and may be the best population of healthcare workers in the general hospital setting for

identifying active cases of TB in the general population as demonstrated by the intervention by Scott et al. (2019).

Weaknesses

Other studies also identified that lack of support and collaboration may be a factor in effectiveness of health extension workers at providing household screening for active TB cases (Lukeman et al., 2019; Shiferaw et al., 2019). Studies that attempt to promote collaboration and communication between extension health workers and community health centers that treat active TB as well as promote the authority of the extension health workers would likely result in improved TB control.

Two benefit populations have been identified to target TB interventions: HIV patients (Bisallah et al., 2018) and diabetes patients (Ekeke et al., 2020). Like in the prison setting (Adane 2019), peers from these populations could be solicited to improve TB screening and case finding in the clinic setting. Peers would be most beneficial if they were engaged in the research process, empowered by the expertise of healthcare workers, and involved in identifying facilitators, barriers, and solutions to problems.

Gaps

A study by Brakel et al. (2019) calls on researchers to find commonalities across different health-conditions to approach stigma and discrimination. This cry for action was born out of a frustration that so many stigma scales and interventions have been developed in silos for particular health conditions when cross-cutting approaches can save resources and be easier to use for personnel working with multiple conditions (Brakel et al., 2019). Tuberculosis is an infectious disease, but the tools used to assess it, interventions used to address it, and lessons learned from studying it could be applied to other health conditions. For example, not only is

HIV an infectious disease like tuberculosis, but it also carries a similar burden and stigma to tuberculosis. In future studies of tuberculosis, formulatory assessments should include more reviews of methods, facilitators, and barriers related to HIV control and the control of other similar conditions and vice versa. Another example of crossover that has been identified is peer support. Peer support is utilized to promote health for patients with similar medical conditions. In Nigeria, diabetes mellitus has been identified as a risk factor for progressing from latent to active tuberculosis, and tuberculosis has been found in a higher proportion of diabetes patients than the general population (Ekeke et al., 2020). Perhaps diabetes peers could be solicited to promote prevention, screening, and case finding of tuberculosis in Nigeria.

Another major gap that has been identified repeatedly throughout all the studies is the lack of tools to be used to repeat the studies. Copies of questionnaires, links to education materials, and interview topic guides are rarely included, and when included, are most often embedded in a table alongside the results. Mimicry is the ultimate flattery, so study authors should make their study materials as available as possible to other researchers. In addition, these tools would help to further repeat and standardize the research so that results could be better collated and generalized. Eventually, if this were to become widespread practice, researchers would be accustomed to formulating materials in such a way as to promote generalizability, even when customizing to a study population. Perhaps there could be a process whereby as the study materials become edited to be applicable in more and more situations, an imprint by study authors could be left behind to track how they evolve and provide a means for recognition of contributions.

Community engagement is also lacking. Studies will be more effective if study investigators can engage stakeholders in all phases of the study. Even when they are not experts

in the direct subject matter, community members can offer various levels of expertise that would be helpful in identifying facilitators, barriers, and solutions to the study problems. With increased input comes increased engagement and effectiveness.

Lack of personal protective equipment (PPE) is another major hurdle that needs to be addressed by research. With the COVID-19 virus, much development is happening regarding durable PPE, which could be used in countries that struggle with limited resources and high TB burden. Research that identifies solutions for getting PPE to health workers and promotes their proper use of it is needed.

Limitations

Most of the studies lack community engagement and dissemination in the research process. Those that include the community either neglect to include the community in the formulatory and opportune areas of assessment or do include the community, but the research is not presented or developed in a way that promotes easy replication for other researchers. For instance, in London, Aldridge et al. (2015) includes peers in the primacy assessment and the intervention, but they were not included in the formulatory assessment to inform study design. The intervention may have been more effective if the peers could have had input regarding the procedures. In addition, the study authors identified that the peers lacked assertiveness and confidence, so including them in the formulatory assessment would have probably boosted their confidence and increased their assertiveness and thus effectiveness as well.

For Adane et al. (2019), input from the guards was utilized to select the prisoners to provide the peer support for TB screening. The peers were also provided with incentives including money, a certificate of recognition, and increased opportunities for parole (Adane et al., 2019) which suggests there was collaboration with the authorities for deciding on this aspect

of the study. Any other time that the peers or guards were mentioned, it was to say they were informed but not engaged in the process. It would be interesting to do a study that included more community input in the formulatory assessment and opportune assessment. In addition, soliciting input from the general inmate population would have added to the community engagement. If the input were included, it would be helpful to have a guideline as to how they did it to promote future dissemination.

For Spruijt et al. (2019), the research methods utilized formulatory and opportune assessments to engage the community in the research process. Descriptions of what was conducted were also very helpful. This allows for insight into the community engagement and dissemination. While very thorough, it would be advantageous if the study authors included guides to be modified for future studies. All efforts to formalize the community engagement and assessment would serve to promote ease of replicability in future studies.

Concepts and Definitions

The most important concepts related to understanding tuberculosis management include tuberculosis screening, tuberculosis risk assessment, tuberculosis symptom assessment, tuberculosis testing, interferon-gamma release assay (IGRA), tuberculin skin test (TST), mycobacterium tuberculosis infection, latent tuberculosis infection (LTBI), and tuberculosis disease (TB disease). Concepts that were mentioned and defined in the synthesis of the literature include formulatory assessment, primacy assessment, opportune assessment, intervention population, and benefit population. They will not be redefined in this section.

Tuberculosis Screening

According to the CDC, Tuberculosis screening includes risk assessment, symptom assessment, and tuberculosis testing of individuals with no prior tuberculosis infection using

either the interferon-gamma release assay (IGRA) or tuberculin skin test (TST) (CDC, 2019). Included in the screening is follow-up related to positive test results. The IGRA and TST tests are used to detect presence of the mycobacterium tuberculosis in the body (Menzies, n.d.). The IGRA test involves taking a blood sample and exposing the blood to the TB antigen and measuring the reaction whereas the TST involves injecting tuberculin under the skin and determining if there is an antigen reaction under the skin (Menzies, n.d.). According to the manufacturer of the blood test, advantages of utilizing the blood draw are that the patient does not need to return for the reading and interpretation and that those that have had the TB vaccine will not have false positives (Qiagan, 2016). UpToDate summarizes that there is no clear recommendation of one test over the other test for high-risk patients, and recommends doing both tests if unsure (Menzies, n.d.). For low-risk patients, the blood test is more convenient (Menzies, n.d.).

Tuberculosis Risk Assessment

According to the CDC, people should be considered at increased risk for TB if they answer "yes" to any of the following:

> Temporary or permanent residence (for ≥ 1 month) in a country with a high TB rate (i.e., any country other than Australia, Canada, New Zealand, the United States, and those in western or northern Europe); or current or planned immunosuppression, including human immunodeficiency virus infection, receipt of an organ transplant, treatment with a TNF-alpha antagonist (e.g., infliximab, etanercept, or other), chronic steroids (equivalent of prednisone ≥ 15mg/day for ≥ 1 month), or other immunosuppressive medication; or close contact with someone who has had infectious TB disease since the last TB test. (CDC, 2019, p. 441).

Tuberculosis Symptom Assessment

General symptoms of tuberculosis disease include unexplained fatigue, unexplained weight loss, and fever, chills, or night sweats for unknown reasons (Centers for Disease Control and Prevention [CDC], n.d.). Symptoms of tuberculosis disease in the lungs also include a productive cough lasting more than 3 weeks, chest pain, persistent shortness of breath, and hemoptysis (CDC, n.d.). TB in other parts of the body can have other manifestations. Important to note is that it is possible for someone with tuberculosis disease that is immunosuppressed not to exhibit symptoms (Menzies, n.d.). (Bernardo, n.d.)

Mycobacterium Tuberculosis Infection

Mycobacterium tuberculosis is a bacterium that causes tuberculosis infection. Latent tuberculosis infection is defined as infection without the progression to TB disease (Menzies, n.d.). When someone has latent infection, they do not have signs and symptoms of the disease and cannot transmit the disease to others (Menzies, n.d.). People with latent infection carry the bacteria in their body but contain it with their immune systems (Menzies, n.d.). It is important to identify individuals with latent tuberculosis because they are at risk of developing TB disease and can be treated to reduce the risk (Menzies, n.d.). Tuberculosis disease results when the bacteria overcome the immune system and is definitively diagnosed when the mycobacterium tuberculosis is established from the culture of a body secretion or body tissue including sputum, pleural fluid, lung tissue, or blood (Bernardo, n.d.). Most commonly, the disease manifests in the lungs (Bernardo, n.d.). Sometimes imaging of the lungs is used to establish a diagnosis, because the bacteria cannot always be detected (Bernardo, n.d.). It is important to note that individuals with latent tuberculosis that have a history of TB disease can have chronic abnormalities that

appear on images of the lungs (Menzies, n.d.). People with tuberculosis disease can spread the disease to others through droplets in the air when they breath, talk, cough, or sneeze.

Theoretical Framework

The science of behavior change outlined by the Theoretical Domains Framework (TDF) developed in the United Kingdom by a consensus approach shall be used for the project. In 2004, recognizing that the implementation aspect of evidence-based practices presented challenges, behavioral scientists and implementation researchers developed a consensus of theoretical models that relate to behavior change to identify opportunities and methods for interventions (Michie et al., 2005). The domains identified were knowledge, skills, social/professional role and identify (self-standards), beliefs about capabilities (self-efficacy), beliefs about consequences (anticipated outcomes/attitude), motivation and goals (intention), memory/attention/decision processes, environmental context and resources (environmental constraints), social influences (norms), emotions, behavioral regulation, and nature of behaviors (Michie et al., 2005).

By 2017, a publication about how to use TDF to investigate implementation problems had emerged. The TDF was slightly modified to a version two that added optimism and reinforcement, removed nature of the behaviors, and separated intentions from goals (Atkins et al., 2017). Both constructs also emphasize the importance of precisely identifying the behavior that needs to change before implementation (Atkins et al., 2017; Michie et al., 2005). The second publication outlines seven steps for TDF implementation: select and specify target behavior, select study design, develop study materials, decide on the sampling strategy, collect data, analyze the data, and report findings (Atkins et al., 2017). Included are considerations for each of the steps, along with detailed explanations about the reasoning that goes into each of the steps.

There is a focus on facilitators and barriers when considering the behavior change and these need to be taken into consideration when deciding on a project approach (Atkins et al., 2017).

This framework was very helpful when selecting the Doctorate of Nursing (DNP) project by examining facilitators and barriers after deciding on a place and intervention population. After examining several project ideas from the peers at the center as well as the county health department, it was decided that a TB intervention would be the best DNP project. The CDC recommends all healthcare workers be screened for tuberculosis upon hire, and education and symptom screening be done annually (CDC, 2019). These peer support specialists are only newly becoming accepted as healthcare workers in the state of Oregon. By implementing the screening for them, it would further legitimize their status as HCWs.

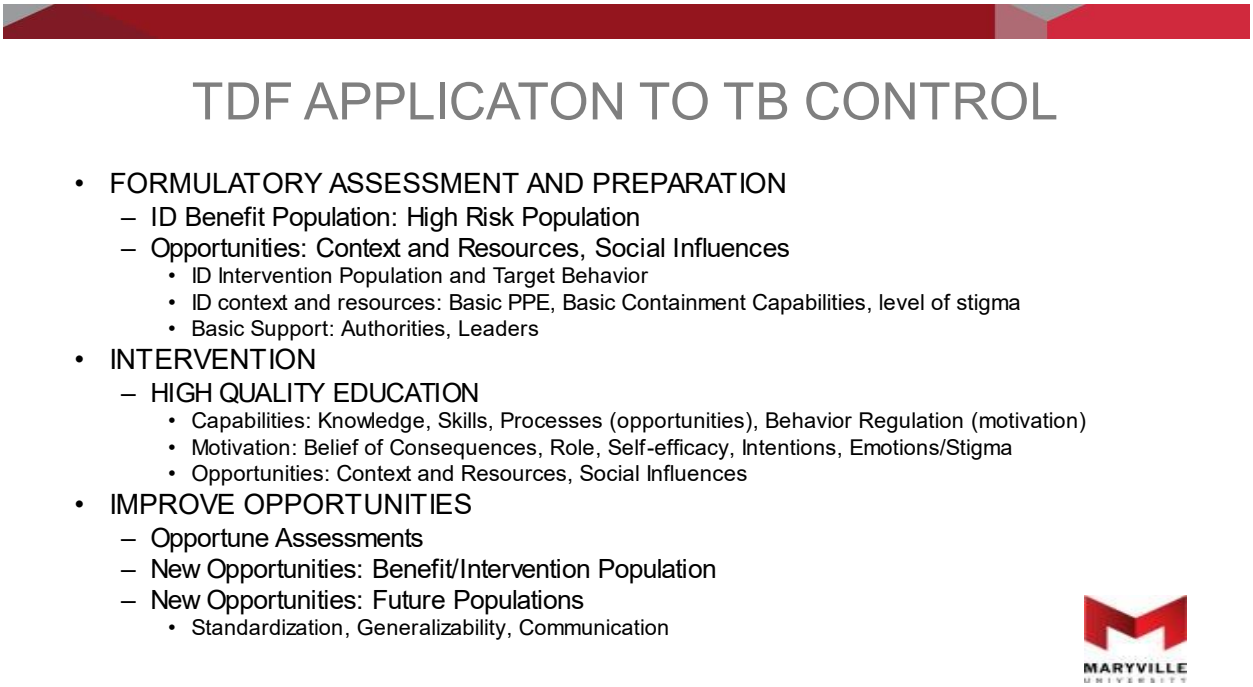
The World Health Organization has published a guideline regarding assessment surveys that can be used to promote advocacy, communication, and social mobilization for TB control (World Health Organization [WHO], 2008). These surveys are knowledge, attitude, and practice surveys which correlate nicely with TDF. Like TDF execution, the guideline recommends first doing research to learn what is known of the phenomenon of interest to define the objectives and determining the purpose of the survey including the intervention framework and the population (WHO, 2008). Then create a plan including ethical review and protocol (WHO, 2008).

At the peer center, it was determined that some peers were aware that HCWs get checked for TB but did not know much about TB, how it is transmitted, risk factors for developing TB, importance of getting proper treatment, signs and symptoms of active infection, or where to go to get screened and tested. The researcher worked with the manager of the peer center, public health department, and Mosaic Medical to identify opportunities, barriers, and facilitators to TB

control and select aim target behaviors. Then an education intervention was designed along with a pre- and post- education test to determine intervention effectiveness (see Figure 1).

Figure 1

Theoretical Domain Framework Application to TB Control



Conclusion

There is a plethora of literature that addresses TB education and screening. It has been identified that peers can facilitate screening and case finding of TB in high-risk populations when they partner with health care providers with expertise in TB control and are involved in the research process at all levels including identifying barriers and facilitators to screening as well as coming up with solutions. When they are provided with support and empowered by community leaders, peers can not only improve health for the population they serve, but also gain skills and confidence for themselves by being empowered and engaged in the work that they do.

Chapter Three: Methods

The Centers for Disease Control and Prevention (CDC) Tuberculosis (TB) practice guidelines include annual TB education for all healthcare workers (HCWs) regardless of risk. At a peer center for those that struggle with mental health issues and addiction in the Northwest region of the United States, it was found that no TB education was provided to the paid peers employed by the center or volunteers. The purpose of this project was to determine if the implementation of a TB educational session would improve post- as compared to pre-education test scores. The primary aims of this project were to increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and TB screening. The secondary aims included aligning the project with the agendas and values of the peer center, validifying the vocation of the peers as healthcare workers, promoting readiness to talk to a provider about any care steps to stay healthy, and providing a positive educational environment to promote an excitement and regard for research and educational opportunities at the peer center. The methodology, design, data collection instruments and tools, analysis plan, budget, and protection of human subjects were interwoven with the timeline, needs assessment, budget, and resources to craft a project that provided benefit to the peer center and allowed the student to earn her doctorate in nursing degree.

Methodology

A quantitative, exploratory pre-test post-test design was utilized for this project. Participants were engaged from a peer center located in the Northwest region of the United States in an educational intervention to determine if the implementation of a TB educational program improved knowledge of the risk of TB and the importance of TB screening, and readiness to talk to a provider about TB risk and TB screening. Participants were administered a

pre- education test (see Appendix A), then an education intervention was delivered and participants were given handouts (see Appendix B). Then participants were administered the test again post- education. The researcher recorded whether answers were correct or incorrect for the eight pre- and post- education knowledge question and answers to the two pre- and post-education readiness questions on a data collection sheet (see Appendix C). No participant identifiers were recorded on the pre- or post-education tests, but the pre- and post- education tests were matched by labeling them with a matching number and A for pre-test and B for post-test.

Needs Assessment

Populations at risk for contracting TB include health workers, people who engage in illicit drug use, and people who have lived or worked in high TB risk congregate settings such as homeless shelters, jails, and prisons (American Lung Association, 2020; Centers for Disease Control and Prevention [CDC], 2018; Lewinsohn et al., 2017). The peer workers and volunteers at the peer center are at risk of TB infection because they are health care workers and volunteers and are in close contact with people who have experienced homelessness, incarceration, and illicit drug use.

According to the county health officer, the county health departments in Oregon have been transitioning to providing limited screening for latent TB and are focused mostly on immigrants and uninsured populations (R. Fawcett, personal communication, May 19, 2020). The clinic setting is preferred for screening because the Quantiferon Gold test is more reliable and convenient than the subcutaneous skin PPD test (R. Fawcett, personal communication, May 19, 2020). Mosaic medical is the primary provider of health care to the peers at the center, but they were unable to partner with the peer center to provide latent TB screening on site or develop

formal protocols and procedures around latent TB screening due to other priorities (E. Knobbs-Seasholtz, personal communication, June 24, 2020).

Education was utilized to address TB control and is recommended on an annual basis for health workers regardless of risk (CDC, 2018; Sosa et al., 2019; World Health Organization [WHO], 2008). TB education has been shown to improve knowledge, attitudes, and practices related to TB (Adane et al., 2019; Bisallah et al., 2018; Cabral et al., 2017; Scott et al., 2019; Spruijt et al., 2020; Wieland et al., 2019).

Theoretical Domains Framework (TDF) was utilized to guide the project. In partnership with the peer center, county health department, and local health center, the target TB preventive behavior of talking to a provider about TB risk and screening was identified along with potential barriers and facilitators (Atkins et al., 2017; Michie et al., 2005). A pre-education test with knowledge questions and an assessment of readiness to talk to a provider about TB risk and screening was administered, followed by an education session, and then administration of a post-education test to see if there was improvement in the scores and to determine the need for future interventions.

Originally, implementation of the project was going to take place in September. With the COVID pandemic and related limitations, the capacity at the peer center had decreased and so the project date was moved to December.

Design

Approximately thirty-nine participants participated in this project. The data gathered was from participants' answers on a pre- and post- education test. This test included knowledge questions about the risk of TB and importance of TB screening and questions about readiness to talk to a provider about TB risk and screening (see Appendix A). The TB education took place

daily before lunch at a peer center in the Pacific Northwest for those with mental health and addiction struggles. The participants were paid peers and volunteers at the peer center. All genders were included. The participant's pre- and post-education tests were included in data collection if they were eighteen years of age or older, self-identified as employees or volunteers at the center, and the surveys were fully completed without missing answers. The participants completed the inclusion information that was written on the pre- and post-education tests (see Appendix A). Any participant that answered "no" to any of the questions was not included in the data collection. If either of the matched tests were not fully completed, both tests were not included in the data collection.

After IRB approval was obtained from Maryville University, flyers were posted to recruit participants for the study. The participants arrived at the education session and were provided a packet with an implied consent and handouts. Each participant was given a pre- and post-education test labeled with a 1A (pre-education test) and 1B (post-education test), a 2A (pre-education test) and 2B (post-education test), and so on for each packet (see Appendix A). No identifiers were included on the pre- or post-education tests.

The participants completed the pre-education tests and place them in a locked, sealed box at the front of the classroom labeled "Test A". They were informed to drop the uncompleted pre-education tests into the box if they chose not to participate. After the completion of the pre-education tests, an education session commenced with a PowerPoint® lecture that included optional experiential learning activities. As there was limited technology available at the peer center, the PowerPoint lecture was printed and placed in flip-book easels. There were several flip book easels available for participants to use for each education session.

After completion of the education session, the participants completed the corresponding post-education tests and placed them in a locked, sealed box at the front of the classroom labeled "Test B". They were able to utilize the handouts that were given to them as part of the education session. They were informed to drop the uncompleted post-education tests into the box if they chose not to participate. The completion of the pre-education tests, education session, and post-education tests took around sixty minutes each day that the education was offered.

Data Collection Instruments

Several instruments were utilized to carry out this project including a data collection sheet, pre- and post- education test, education PowerPoint, and handouts. The instrument that was designed to assess the effectiveness of TB education was the pre- and post- education test, but it was also utilized as a tool for learning. The rest of the instruments were utilized as tools for learning and to organize the data. The researcher took great care to incorporate images and plain language into the tests, educational PowerPoint, and handouts.

Data Collection Sheet

The researcher recorded the minimum necessary data to accomplish the goals of the project on the data collection sheet (see Appendix C). The pre and post tests were destroyed after the data had been transferred to the data collection sheet.

Pre- and Post- Education Test

This tool was designed by the researcher to hone the TB behavior goals and TB knowledge goals, and then was used to structure the TB education intervention and to measure education effectiveness (see Appendix A). This tool was designed before the education and was based on the goals of the education intervention and aims of the project.

The behavior goals of the project were determined before the knowledge goals so that the knowledge goals would relate to the behavior goals. Each of the knowledge aspects relate specifically to the desired target behavior of the participants feeling ready to discuss their risk for TB and TB screening with their provider. The second behavior goal of participants feeling confident about talking to their providers about care steps to be healthy relates to the primary behavior goal. Likert-scale questions were designed to measure readiness for these TB control behaviors. The researcher suspects that both of these behaviors are related in that participants would not be ready to talk about TB or TB screening with their providers if they are not confident about talking to their providers about care steps to be healthy. Similarly, if they acquire the new TB knowledge and still do not feel ready to discuss their risk for TB and TB screening with their providers, they will not be confident about talking to their providers about other care steps to be healthy. This would assume that the participants score low for both behaviors before the education and then both scores improve after the education. Meanwhile, feeling confident about talking to a provider about care steps to be healthy and being ready to discuss TB risk and TB screening with a provider may not be strongly correlated if there were to be a logistical or environmental hurdle involved, the participants did not believe they are at risk for TB, or the participants did not think it would be covered by insurance without a copay. If the scores to these questions did not correlate before or after the education intervention, then the reason for the discrepancy could be explored and there could be another intervention performed, or the TB education could be revised to address the barrier.

The researcher designed the knowledge questions to relate to the behavior questions. These are simpler because the participants would either know them or not know them. All of the knowledge measures relate to the primary target behavior of feeling ready to discuss TB risk and

TB screening with a provider. As the participants had health insurance and were established with their primary care providers, logistical knowledge and skills such as knowing how to access the providers were not explored. After the education intervention, it was hoped that participants would know the following: TB is an infection as opposed to a germ or disorder of the lungs; TB is transmitted by a germ in the air as opposed to contaminated surfaces or contaminated food or water; it is common to have a long term cough when you are sick from TB; some people with TB get sick and some people stay healthy; everyone at the peer center is at increased risk for TB because they work or volunteer with people at higher risk for TB; you can take medicine to get rid of TB germs if you have TB; the best way to protect yourself and others from TB is to get checked for TB; and the best way to get checked for TB is to talk to your primary care provider. There are eight multiple choice questions with images that directly measure this knowledge. As learning can be done visually, auditorily, and kinesthetically, it was important to the researcher to include images on the tests when feasible. The researcher also read the tests to the participants whenever they desired it to be done.

Education PowerPoint

After the test and target behavior were finished, the education PowerPoint was constructed to guide the education. It is recommended that TB education be provided yearly to healthcare workers, so the PowerPoint was made with enough detail that it could be delivered by someone other than the researcher when used in the future. Information was presented that related to each of the knowledge questions, followed by a repeat of the knowledge questions giving the participants a chance to reflect on the information and guess the correct answer. Then, the correct answer was given with additional supporting information and detail. When possible, an explanation was given for why the other answers were incorrect. For the slides with the

correct answer, plain language was used as much as possible, but sometimes higher-level language and information was incorporated. This was only done to provide clarity as to why the answer was correct or incorrect.

The second half of the PowerPoint guided teaching and practicing the skill of talking to a provider about care steps to be healthy as well as being assertive with a provider if not understanding. This half of the presentation gave participants the opportunity to move, observe demonstrations, participate, and practice if they desired. The researcher had any participation in this interactive half of the education be voluntary and told the participants that it was okay if they chose not to participate.

First, the subject matter was presented. Participants were instructed that discussing care steps with a provider entails asking about the care step and what it entails, asking about the benefits of the care step, asking about the risks of the care step, asking about alternative choices, asking about cost and coverage, and asking about follow-up. When discussing care steps with a provider, it is common that they will not understand the responses completely as providers are often under time constraints and are expected to communicate quickly and use formal language when communicating with colleagues and for charting. Thus, providers often will unknowingly continue at the same speed and formality of language when they are with patients. The peers were advised that they can influence the communication process by requesting the provider to slow down, use plain language, show them, or schedule another appointment.

Next, a sample dialogue was given. Participants were given cards with requests to slow down, use plain language, show them, or schedule another appointment on them. If they were interested in participating, they were instructed to hold these card requests up when the

researcher role-played the provider to influence the researcher's response and see the results of their influence.

By the end of the presentation, they were given the option of practicing with one another a simplified version of the dialogue that was presented and relates directly to TB risk and TB screening. If they decided not to practice, they could still watch or read the dialogue and think about it.

The PowerPoint was in the form of individual easels or flipbooks. This was convenient because there was limited technology available at the center and it provided flexibility as to which space the researcher used. In addition, participants had the option of going through the education program individually at their own pace if they did not feel comfortable with education in a group format. Every individual was given their own flipbook to work through the education session.

Handouts

The researcher wanted the participants to leave the education session with handouts that summarized the TB knowledge information and skill about discussing care steps with a provider (see Appendix B). A two-sided handout incorporated most of the TB knowledge information along with the same images that were used for the test and the PowerPoint education. A smaller two-sided laminated handout was also given to them which included the skill information about talking to a provider about care steps to be healthy and requesting the provider to slow down, use plain language, show them, or schedule another appointment. They were encouraged to refer to these materials when they discuss their risk for TB and TB screening with their providers. The smaller handout could also be used for discussing other care steps with their providers, which is

why it was laminated. The smaller handout could be incorporated into future trainings when the desired target behavior involves discussing a care step with a provider.

Data Analysis Plan

The purpose of this project was to determine if the implementation of a Tuberculosis (TB) educational session improved post- as compared to pre-education test scores. For the test, there were eight multiple choice knowledge questions that were administered before and after the education intervention which were marked as either correct or incorrect, giving the researcher paired dichotomous nominal data (see Appendix A). Additionally, each test was given a score between one and eight, giving the researcher scaled data. There were also two Likert-scale readiness questions with answers that were assigned a ranking between zero and four, giving the researcher paired ordinal data. Statistical Package for Social Sciences (SPSS) software was used to analyze the data.

Descriptive

Frequency distribution tables were made to describe the data for the knowledge questions and for the Likert-scale questions. In addition, the knowledge data was presented as percentage correct by question and overall mean scores out of eight by test along with standard deviations. For the readiness questions, the mean and median scores out of four were calculated by question. To determine if the knowledge test scores had a normal distribution, they were graphed, and the Shapiro-Wilk test was performed (Laerd statistics, 2018 c).

Assess Effectiveness

In order to assess effectiveness of TB education, it was determined whether or not there was a difference in overall knowledge test scores between pre- and post- education tests. As the knowledge test scores were shown to have a normal distribution, the paired t-test was used to

determine if the education intervention made an overall difference in TB knowledge (Kellar & Kelvin, 2013). If the data had not been normally distributed, the Wilcoxon signed rank test would have been performed (Kellar & Kelvin, 2013). For the Likert-scale readiness questions, the sign test was performed by question to determine if there was a difference between pre- and post-education test scores because the differences in distribution were not normal (Kellar & Kelvin, 2013). If the differences in distribution had been normal, the Wilcoxon signed rank test would have been performed (Laerd statistics, 2018 b).

Opportune Analysis

In addition to assessing effectiveness of the education, the researcher also planned to propose hypotheses and make plans for future educational interventions and studies. The researcher planned to look at the paired individual knowledge questions by utilizing the McNemar's test if it seemed appropriate (Kellar & Kelvin, 2013). The results would have been used to hypothesize if specific TB knowledge facts were not effectively learned through the education session or were confounded by the TB education session. This information could have been examined in context of the educational experience and common sense to modify the program. As the sample size ended up being smaller than originally expected due to many of the tests needing to be thrown out, this analysis was not conducted.

The two readiness questions were intended to assess all aspects that contribute to behavior regulation including knowledge, skills, role, self-efficacy, beliefs about consequences, intentions, processes, context, resources, social influences, emotions, and behavioral regulation (Michie et al., 2005). They were considered more complicated than the knowledge questions in that there were more factors that could have contributed to the answers. As all of the participants had health insurance and providers, TB screening and treatment was required to be covered by

insurance per the affordable care act, and the county as well as primary care were unable to provide screening on site at the time of the study, the researcher had determined that the skill of talking with a provider about TB risk and screening through practice and the accompanying confidence gained from this practice were the two areas that the researcher could make the biggest impact with a single intervention. The researcher planned to assess the correlation between the two Likert-scale readiness questions in the tests using the Kendall's Tau test (Laerd statistics, 2018 a) as an exercise to propose hypotheses about the education, needs, and next steps. This would have been done out of interest and to propose theories, not to decide on effectiveness of TB education. It turned out that the researcher observed that most participants barely glanced over these two questions and did not seem interested in them when compared with the knowledge questions, so the researcher decided not to do the additional analysis.

Resources

Opportunities such as human resources and community resources are considered for prioritizing TB control activities, and TB control often happens in the community (Adane et al., 2019; Aldridge et al., 2015; Lukman et al., 2019; Marks, 2019; Spruijt et al., 2019; Wieland et al., 2019). The peer center had many human resource personnel, thus, it was a community resource for engaging in TB education and control.

The participants at the peer center all had health insurance through the Oregon Health Plan and had established primary care providers. Health insurance is mandated to fully cover TB preventive services including screening for latent TB in adult populations at increased risk (CDC, 2020). Anyone that spends a significant amount of time at the center was considered at increased risk for TB, so the costs of latent TB screening should have been fully covered by health insurance for all of the peer workers and volunteers at the center.

Budget

The project took approximately two weeks to implement, and it was anticipated there would be up to 100 participants with a maximum of ten participants per day. The budget for this project was based on anticipated costs needed to complete the study which included $1,000 for incentives for participants and $336.94 for refreshments for participants (Table 1). Calculated costs did not include paying the researcher as this was a volunteer project and did not include the peer and volunteer salaries as this was conducted during normal business hours at the center.

Table 1

Budget Plan

Budget Item	Number of Items	Cost per each	Total Cost	Reference for Cost
SPSS Software	IBM SPSS 6 month download	$34.95	$34.95	(StudentDiscounts.com, n.d.)
Color Printing Recruitment Flyers	5 Flyers	$0.49 per page	$2.45	(Office Depot Office Max, n.d.)
Color Printing Tests (2 pages per test, 2 tests per person)	200 tests	$0.98 per test	$196	(Office Depot Office Max, n.d.)
Black and White printing Tests (2 pages per test, 2 tests per person)	200 tests	$0.26 per test	$52	(Office Depot Office Max, n.d.)

Envelopes for tests	200 envelopes	$9.99/100	$19.98	(Amazon.com, n.d. a)
Color Printing Handouts 2.5 pages per handout	100 handouts	$1.225 per handout	$122.50	(Office Depot Office Max, n.d.)
Packet (Sleeve Protectors)	24	$7.94 per 12	$15.88	(Amazon.com, n.d. d)
Durable education signs printing costs	11	$0.49	$5.39	(Office Depot Office Max, n.d.)
Power Points printing costs (36 pages per power Point)	11 sets	$17.64 per set	$194.04	(Office Depot Office Max, n.d.)
Flip book easel	11	$9.99	$109.89	(Amazon.com, n.d. e)
Laminator	1	$21.99	$21.99	(Amazon.com, n.d. g)
Laminator Sheets	200	$21.99/200	$21.99	(Amazon.com, n.d. c)
Pens	$7.50 per 24 pack	5 packs	$37.50	(Amazon.com, n.d. k)
Mileage (7.2 miles per trip x 10 trips)	72 miles	57.5 cents per mile	$41.40	(Internal Revenue Service [IRS], 2019)
Participation incentives (Starbucks gift cards)	100	$10 each	$1,000	n/a
Refreshments Snacks (nut packs)	120	$10.99/24	$54.95	(Costco, n.d.)
Refreshments Snacks (fruit leathers)	144	$12.99/48	$38.97	(Instacart, n.d. b)

Refreshments Snacks (Vermont Pork/Beef sticks)	192	$111.63/192	$111.63	(Amazon.com, n.d. j)
Water Flavor Enhancers (Lemonade and Limeade varieties)	120	$9.99/30	$39.96	(Amazon.com, n.d. i)
Peanut butter Pretzels 55 oz jar (Costco)	4 jars	$10.79	$43.16	(Instacart, n.d. a)
Dessert (Caramels)	3 pack (over 40 each)	$16.09	$48.27	(Amazon.com, n.d. h)
Test drop box with lock	2	$19.95	$39.90	(Amazon.com, n.d. b)
Office lock for home office secure storage of information	1	$8.99	$8.99	(Amazon.com, n.d. f)
Total Cost			$2,261.79	

Timeline

When selecting a project for the peer center, timeline and timing were considered. This project took about one year from Institutional Review Board (IRB) approval until final draft of the paper. The delivery of the intervention and data collection took place over two weeks in December, but the data analysis and completion of the paper was not finished until Summer due to the constraints of school and timing of coursework. As such, the project needed to be

important and helpful to the center, but it could not be urgent, as it would take up to a year for the project to have an impact. TB screening is important, and the timeline of a year until completion was reasonable.

Protection of Human Subjects

A clinician researcher is entering into a partnership with their research subjects just as a clinician would enter into a partnership with their patients. The research subjects are the ones participating in the project, so the results will need to be applicable to them and guide how they will be treated in the future. In that sense, they are just as much clients or patients as they are research subjects. They should be considered in the research process in the same way that they should be considered when it comes to their own care. Their well-being, concerns, thoughts, and autonomy matter, and the researcher attempted to craft the project in a manner that provided maximal benefit to them while meeting the aims and requirements of the project.

There were no foreseeable risks for a physical, social/economic, or legal risk that would result from this project. Possible risks could have been a breach of confidentiality and potential for coercion; however, those risks were minimal. The possible breach of confidentiality was minimized by placing pre- and post-education tests in an envelope and labeling each test with a 1A and 1B, 2A and 2B, and so on for each packet with no identifiers that would match the participant to the pre- or post-education tests. The researcher provided identical pens. The pre- and post-education tests were placed by the participants in a labeled, locked box and sealed at the front of the room after completion. The completed pre- and post-education tests were stored in a locked box located in the researcher's locked file cabinet in the researcher's office that could only be accessed by the researcher. The data that was obtained from the pre- and post-education tests was recorded in a word document within a data collection sheet (see Appendix C). The data

collection sheet was stored on a password protected computer that was located in the researcher's locked office that could only be accessed by the researcher. To minimize the risk of coercion, the participants were informed to drop the uncompleted pre- and post-education tests into the designated boxes if they choose not to participate. All collected data was destroyed after the completion of the project.

The results of this project were printed in a doctoral paper, shared with the researcher's faculty advisor, Maryville University community members, and with personnel at the peer center. The results were also shared at a poster session. All information was presented without identifiers and in aggregate form. All data collected was destroyed after completion of the project.

The implied consent was included in the envelope and handed to the participants upon entering the classroom. The envelope included a pre- and post-test labeled 1A and 1B, 2A and 2B, and so on. The implied consent stated the purpose of the project, participation, risk, benefits, explanation of voluntary participation, dissemination, and confidentiality matters. The acceptance of the implied consent was the action of the participant to voluntarily complete the pre- and post-education tests. The participants were informed to drop the uncompleted pre- and post-education tests into the box if they chose not to participate.

Conclusion

The purpose of this project was to determine if the implementation of a TB educational session would improve post- as compared to pre-education test scores. The primary aims of this project were to increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and TB screening. The secondary aims included validifying the vocation of the peers as healthcare workers,

promoting readiness to talk to a provider about any care steps to stay healthy, and providing a positive educational environment for the peers to promote an excitement and regard for educational opportunities. The methodology, design, data collection instruments and tools, analysis plan, budget, and protection of human subjects were interwoven with the timeline, needs assessment, and resources to craft a project that provided benefit to the peer center and allowed the student to earn her doctorate in nursing degree.

Chapter 4: Data Analysis and Research Findings

The Centers for Disease Control and Prevention (CDC) Tuberculosis (TB) practice guidelines include annual TB education for all healthcare workers (HCWs) regardless of risk. At a peer center for those that struggle with mental health issues and addiction in the Northwest region of the United States, it was found that no TB education was provided to the paid peers employed by the center or volunteers. A quantitative, exploratory design was utilized to determine if the implementation of a TB educational session improved post- as compared to pre-education test scores. The primary aims of the project were to increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and TB screening. The secondary aims included aligning the project with the agendas and values of the peer center, validifying the vocation of the peers as healthcare workers, promoting readiness to talk to a provider about any care steps to stay healthy, and providing a positive educational environment to foster excitement and regard for research and educational opportunities at the peer center.

Participants were engaged from a peer center located in the Northwest region of the United States and were recruited with flyers that were left at the center and by announcing the intervention would begin just prior. The intervention took place daily before lunch over two weeks in December. Participants were administered a pre- education test (see Appendix A), then an education intervention was delivered and participants were given handouts (see Appendix B). The participants were then administered the test again post- education. The education intervention was delivered by an instructor while each participant flipped through a PowerPoint binder that had the information. Some participants chose to interact with the instructor or with one another and others flipped through the PowerPoint binder on their own. The educational

intervention and completion of the pre- and post-education tests lasted approximately sixty minutes from start to finish, but many individuals that chose to do it on their own completed it faster. The researcher recorded the data on a collection sheet (see Appendix C). No participant identifiers were recorded on the pre- or post-education tests, but they were matched to each other by being labeled 1A (pre-education test) and 1B (post-education test), 2A and 2B, and so forth. Important to the researcher was to encourage participation in the research, so informal observations were made regarding recruitment, implementation, and participation throughout the project with the intent of informing the design and protocols of future projects.

Methods of Evaluation

The primary aims of the project were to increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and TB screening. The data from eight questions on the pre- and post- education tests was used to evaluate whether the implementation of the project increased awareness and knowledge about TB risk and the importance of TB screening. There was an additional question on the tests that intended to evaluate readiness to talk to a provider about TB risk and TB screening.

The secondary aims included aligning the project with the agendas and values of the peer center, validifying the vocation of the peers as healthcare workers, promoting readiness to talk to a provider about any care steps to stay healthy, and providing a positive educational environment to foster excitement and regard for educational opportunities at the peer center. There was one test question that was used to analyze readiness to talk to a provider about any care steps to stay healthy. The exclusion of tests from data collection was analyzed to determine how the research process excluded participants so that more could be included for future studies. The willingness

of people at the peer center to participate, reactions of participants to having the researcher at the center, and other informal observations were made to analyze how positive the project was for the peers.

The researcher reviewed many TB education materials and contacted the local county health department before deciding on the primary aims and the content of the knowledge questions intended to inform the primary aims. The test scores for the eight knowledge questions are valid at measuring knowledge, but they are not valid at measuring readiness to talk to a provider about TB risk and TB screening. Behavior change involves many different domains including skills, role and identify, beliefs about capabilities, motivation and goals, beliefs about consequences, memory/attention/decision processes, environmental context and resources (environmental constraints), social influences (norms), emotions, behavioral regulation, and nature of behaviors (Michie et al., 2005). Thus, facilitators and barriers need to be considered when examining behavior change (Atkins et al., 2017). The most valid way to measure readiness to talk to a provider about TB risk and TB screening would be to assess whether the behavior actually happened or not. That level of assessment was beyond the scope of a personally funded student project, and so the researcher had designed the readiness test questions instead. Although the wording of the two questions that intended to measure readiness to talk to a provider about TB risk and TB screening and readiness to talk to a provider about any care steps to be healthy matched with the aims of the project implying face and content validity, there is little known about the extent to which the questions reflect criterion validity or the behavior that was intended. The researcher never asked participants whether they actually talked with their providers about TB risk and TB screening. Thus, little is known about the validity of those questions. If this project were to be performed again in the future and funded with grant money,

it would be important to gather data that assesses whether or not participants actually talked with their providers about TB risk and TB screening.

The reliability of the pre- and post-education tests was not formally assessed for this project, but measures were taken when designing the test to improve its reliability. Considerations were that test subjects had different education levels, some had vision impairments, some had discomfort with taking tests, and some had discomfort with being around other people. Measures that were taken to improve the reliability of the tests were to offer every participant a beef stick to munch on while taking the test to set them at ease, writing the test with simple language, using big print, using simple pictures, reading aloud the test if participants preferred to hear it, allowing participants to take the test wherever they felt like it in the room, and verbally reassuring participants that the scores would be anonymous and there would be no negative consequence to anyone related to how the scores turned out. The researcher administered the test to her husband and eight-year-old son and asked for feedback to assure that it was easy to understand.

This project was performed on individuals that have experienced mental health and/or drug addiction struggles. Many of the participants had experience with unstable housing and homelessness. As this group of people is at risk for being stigmatized and marginalized, it was important to the researcher that maximal efforts be made to include people voluntarily. The study design was approved by the Maryville IRB and the manager and board of the peer center. In addition, anonymity was protected by allowing participants to turn their tests in independently and in sealed and anonymous envelopes. Anyone that expressed interest in participating was given the $10 gift card to Starbucks, even if they did not fill out the tests. The study was offered on ten consecutive business days around the same time so that the more reluctant people could

see firsthand what was involved, and there was flexibility in level of participation from socially involved to independent. In addition, everything was printed out and placed in binders so that those without technological skills could participate. These processes made it easy for people to participate in the project, but some of them also ended up limiting participation in the data analysis as will be discussed in chapter five.

The researcher did not have any authority over the participants but had visited the peer center on a regular basis as a volunteer. The researcher is a member of the board for the center and is a voting member of a workgroup for the Central Oregon Health Council where the center has sought funding. As such, great care was taken to safeguard the autonomy of participants by eliminating identifiers in the data collection process and the tests. While participation in the TB education was mandatory for the paid peers, the inclusion of the pre- and post-education test results for the researcher's project was voluntary.

Data Analysis and Presentation of Data

Participants for this project were paid peers and volunteers at a peer center for those who have experienced mental health and addiction struggles in the Northwest region of the United States. There were thirty-nine participants in the project. Most of the participants have experienced or currently were experiencing homelessness or unstable housing. Most of the participants were Caucasian, but there were also African Americans, Asians, and Latinos.

The data gathered was from participants' answers on matched pre- and post-education test that included eight multiple choice knowledge questions about the risk of TB and importance of TB screening and two Likert scale questions about readiness to talk to a provider about TB risk and screening. Tests were included if participants indicated that they were eighteen and

older, were employed or volunteer at the peer center, and every question on both tests was answered.

There were eight multiple choice knowledge questions on the tests that were each worth one point. Scores for the knowledge questions were calculated between zero and eight. As the tests were matched and the dependent variable was measured at the continuous level, the paired-samples t-test was considered to determine whether there was a statistically significant mean difference between the knowledge scores on the pre- and post- education tests (Laerd Statistics, 2015 a). Using SPSS, a boxplot was made to determine if there were significant outliers, and normality of the distribution of the differences of the dependent variable was determined by examining a Q-Q plot graph and performing the Shapiro Wilk's test. As significant outliers were not detected that were more than 1.5 box-lengths from the edge of the box in a boxplot and the assumption of normality was not violated, SPSS was used to perform the paired-t-test. The effect size or Cohen's d was calculated by dividing the difference in the means by the standard deviation of the difference. This effect size, along with the calculated alpha and sample size were used in G*Power 3.1.9.7 to determine the sample size needed for future studies given the achieved effect size.

There were two Likert scale questions on the tests as well. For these questions, the Wilcoxon signed-rank test was considered because the dependent variable was measured at the ordinal level, but ultimately, the distribution of the differences was not found to be symmetrically shaped and so SPSS was used to perform the sign test instead (Laerd Statistics, 2015 a).

There was a large degree of variability expected in implementation. It was winter, and some of the subjects were actively experiencing homelessness, and were seeking safety, warmth,

food, and shelter at the peer center. They were also more likely to be experiencing active addictions and mental illness flares. It was not expected that they as a group would be able to participate as fully in the education intervention as the others at the peer center who had stable housing and employment and were completing the education intervention as part of their job duties. In addition, baseline knowledge about TB and TB screening was not predetermined for any of the participants. It was expected that some of them had a lot of knowledge about TB and others very little knowledge.

This study was performed daily over two weeks at the peer center. It is unknown if participants discussed and shared information about the study with one another while it was taking place. No analytic methods were used to demonstrate the effects of the study over time as the tests were numbered but they were not ordered. For future studies, it would be helpful to order the tests so that it could be determined if there was a difference in pre-test scores from the beginning of the study to the end of the study.

Results

The peer center provides an inclusive and safe environment for individuals with mental health struggles that are receiving treatment through the county. The staff have experienced living with mental health conditions themselves and are utilized to provide food, group activities, support, and opportunities for connection with clients. The original location had a small patio, art area, laundry machine, shower, kitchen, and tv area. This location was approved to have up to ten people at a time to accommodate social distancing requirements related to COVID. As the pandemic worsened, this location was closed to clients and staff made bag lunches and delivered them to clients. At the time of the study, only one client was able to use the location at a time for showering and laundry, and three staff made and delivered bag lunches. A new location opened

up just prior to the study implementation and it could accommodate up to twenty-five people at a time with several couches, a movie projector, tables and chairs, and a kitchen. The three staff on duty at the new location spent most of their time preparing and serving breakfast and lunch, connecting with clients at the tables or in the parking lot, and cleaning.

In Oregon, peers are considered traditional health workers and are able to bill for their services like other health workers. At the peer center, however, they were not being provided with TB screening and education and so the manager wanted to make sure that all of the staff would be able to attend the education intervention. There were about ten staff and one hundred clients eligible to attend the peer center at the time of the study, and so the TB education was offered to staff and clients. The study implementation took place ten times during the hour before lunch. In order to reach all of the staff, it was offered once at the closed location and nine times at the main location. At the time of study implementation, the subsidized housing clients were not participating at the peer center much but were part of the lunch delivery program. Most of the clients at the peer center were experiencing homelessness and using the center as a safe place to go during the day. Many days, the clients were the same people and so the total number of potential study participants during the course of the study was not much higher than the total number of participants.

For the first day of the study, the researcher brought and prepared lunch so that the three staff working that day would be free from lunch preparation duties and thus could participate in the study. After the first day, the researcher would casually walk around the room to recruit participants for the study. Most were hesitant and so in the beginning few days, only one or two people participated. There was one day that a client advertised for the researcher and he recruited over ten people. He explained that the researcher was not using the correct lingo to recruit

people. Most of the rest of the days following, participants were recruited by word of mouth by peers that had already participated in the study. If the researcher were to carry out other studies at the peer center, funding would be obtained to have a peer recruiter.

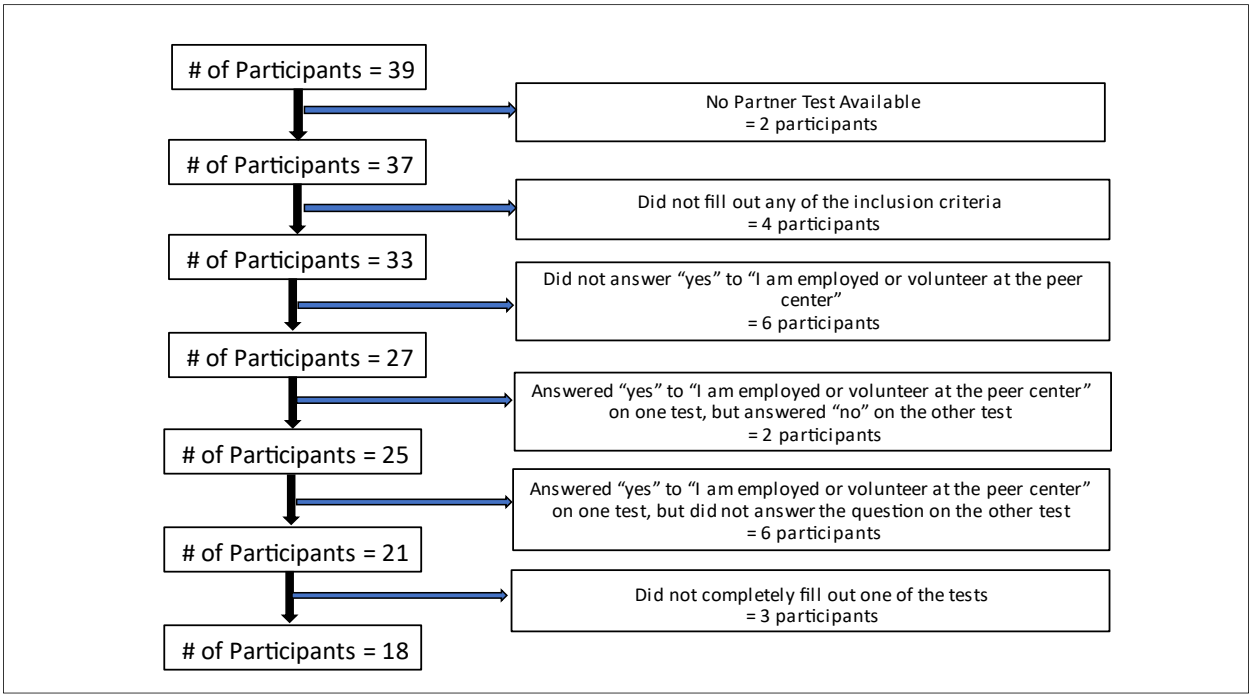
Initially, the researcher had planned to deliver the intervention to a large group but had designed individual binders for people because the peer center did not have computers for a power point presentation and because the researcher wanted to encourage participation from the more reserved people. There was usually one participant each day that wanted the researcher to deliver the presentation to them, but most of the others were going through the Power Point by themselves or with a friend at their own pace. Thus, some of the pre- and post-education tests may have gotten mixed up, and the inclusion criteria did not get filled out completely for many of the tests excluding them from the study.

There were two questions that needed to be marked “yes” on both tests for the tests to be included in the data collection: “I am eighteen years of age or older” and “I am employed or volunteer at the peer center”. In addition, both the pre-test and the partner post-test needed to be filled out completely to be included in the data collection.

There were forty people that expressed desire to participate in the study. One of them was the nine-year-old son of the person conducting the study, and as he was younger than eighteen, he could not be included. The remaining thirty-nine people all were given test packets to fill out and turn in. According to the manager, anyone that was at the peer center could choose to identify as either an employee or a volunteer at the center, but some of the participants did not mark that they identified as such, and thus were not included in the study (see Figure 2).

Figure 2

Inclusion of Participants



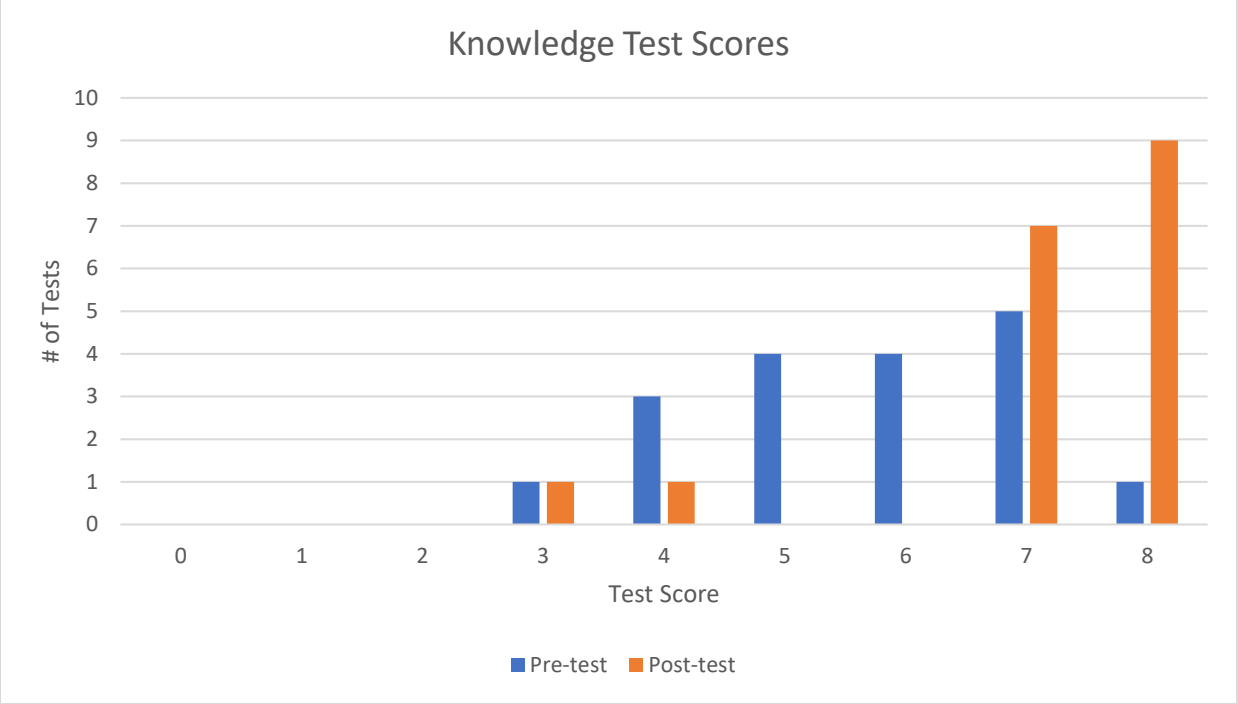
For two of the participants, no partner test was available because it did not get turned in or both tests were labeled as post-tests. Four of the remaining participants did not fill out any of the inclusion criteria questions, eight participants did not answer "yes" to "I am employed or volunteer at the peer center" on at least one of the tests, and six answered "yes" to the inclusion criteria on one test but then did not fill them out on the other test (see Figure 2). Of the remaining twenty-one participants, three did not completely fill out one of the tests leaving eighteen total participants for the data collection of the study (see Figure 2).

If the researcher were to carry out other studies at the peer center, funding would be obtained to have a peer available to hand out study materials and collect tests. It would also be helpful to only have the inclusion criteria on the pre-education test and for an available peer to help people fill it out.

Differences between pre- and post- TB knowledge test scores were investigated to assess whether the TB education intervention improved TB knowledge. A histogram of pre- and post-education knowledge test scores pictorially shows the distribution of scores (see Figure 3).

Figure 3

Histogram of Pre- and Post-test Knowledge Scores



Participants scored higher on the post-education test (m=7.11, SD=1.410) compared to the pre-education test (m=5.67, SD=1.372). The education intervention elicited a mean increase of 1.444, 95% CI [.737, 2.152] in post-education test scores compared to pre-education test scores (see Table 2).

Table 2

Paired Samples Statistics: Knowledge Questions

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	5.6667	18	1.37199	3.4457
	Post-Test	7.1111	18	1.40958	3.4801

As the scores were paired, reported at the scale level, and differences in test scores were normally distributed, a paired t-test was calculated to assess the significance of the change between pre- and post- test scores (Laerd Statistics, 2015 a), and it was found that the education intervention resulted in a statistically significant increase from the pre-test to the post-test ($t(17) = 4.305$, $p < 0.001$) (see Table 3).

Table 3

Paired Samples t-Test: Knowledge Questions

		Paired Differences					t	df	Sig (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-test-Pretest	1.4444	1.42343	0.3350	0.73659	2.15230	4.305	17	<0.001

The effect size was calculated using cohen's d and was found to be 1.015. G*Power 3.1.9.7 was then used to calculate a-priori what sample size would be needed to achieve 80% power and alpha level of 0.05 with this effect size and it was determined that 10 participants would be needed.

Question nine was designed to reflect confidence in talking to a provider about care steps to be healthy, and question ten was designed to reflect readiness to talk to a provider about TB risk and TB screening. Originally, the researcher planned to make the education intervention interactive giving participants the opportunity to practice talking to their providers about TB risk and screening and care steps to be healthy. As the implementation proceeded, it became clear that participants were not very interested in role playing and were much more concerned with the knowledge questions. As there was little interest and effort in this part of the education

intervention, questions nine and ten became less relevant. The researcher also noticed that participants did not spend much time on those questions before answering them.

The confidence and readiness scores were higher on the post-education test (M = 3.61, SD = .502) compared to the pre-education test (M = 3.44, SD = .616) resulting in a mean increase of .17 (see Table 4 and Table 5).

Table 4

Paired Samples Statistics: Readiness Question 9

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	3.4444	18	0.61570	0.14512
	Post-Test	3.6111	18	0.50163	0.11824

Table 5

Paired Samples Statistics: Readiness Question 10

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	3.2778	18	0.89479	0.21090
	Post-Test	3.5556	18	0.51131	0.12052

The Shapiro Wilk Test was performed to determine if the differences in the scores of the ordinal data was normally distributed, and it was not found to be normally distributed so the sign test was used to determine if the difference was statistically significant or by chance alone (Laerd Statistics, 2015b). For question nine, a sign test did not show any difference between the two medians, exact binomial p (1-tailed) = 0.125. There were three tests that improved, zero tests that got worse, and fifteen tests that scored the same answers pre- and post- test. For question ten, the sign tests did not show any difference between the two medians, exact binomial p (1-tailed) = 0.063. There were four tests that improved, zero that got worse, and fourteen tests that scored the same answers pre- and post- test (see Table 5).

Summary

A quantitative, exploratory design was utilized to determine if the implementation of a TB educational session improved post- as compared to pre-education test scores. Participants were engaged from a peer center located in the Northwest region of the United States, and of the thirty-nine people that participated, the test scores for eighteen of them were utilized for data analysis. A paired *t* test was conducted to compare the pre-test to post-test scores after the educational program. There was a significant difference in the scores of the pre-tests (M = 5.6667, SD = 1.37199) and post-tests (M=7.1111, SD = 1.40958). This gain was statistically significant at $(t(17) = 4.305, p < 0.001)$ by paired *t* test. The results demonstrated there was a significant increase in participants' knowledge after the completion of the TB education intervention. The sign test did not demonstrate statistically significant difference in readiness to talk to a provider about care steps to be healthy, exact binomial p (1-tailed) = 0.125 or TB risk and TB screening, exact binomial p (1-tailed) = 0.067.

During the process of conducting the project, lessons were learned about recruitment, participation, and inclusion. For future projects, these lessons could be applied to improve methods of evaluation, data collection, and analysis.

Chapter Five: Discussion

The primary aims of the project were to increase awareness and knowledge related to the risk of Tuberculosis (TB) and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and TB screening. The secondary aims included aligning the project with the agendas and values of the peer center, validifying the vocation of the peers as healthcare workers, promoting readiness to talk to a provider about any care steps to stay healthy, and providing a positive educational environment to foster excitement and regard for educational opportunities at the peer center.

As the student began the implementation process, it became clear that the secondary aims were more important to the student than the primary aims. The outcomes of the primary aims of the project were not important because the success of the data analysis would not have any bearing on whether or not the student obtained her degree. Meanwhile, the student was earning a degree with the hopes of performing future projects as a career path. Thus, the secondary aims became more important during implementation of the project.

This project was performed for individuals that have experienced mental health and/or drug addiction struggles. Many of the participants had experience with unstable housing and homelessness. As this group of people is at risk for being stigmatized and marginalized, it was important to the researcher that maximal efforts be made to include people. The study design was approved by the Maryville IRB and the manager and board of the peer center. In addition, anonymity was protected by allowing participants to turn their tests in independently and in sealed and anonymous envelopes, anyone that expressed interest in participating was given the $10 gift card to Starbucks, even if they did not fill out the tests, it was offered on ten consecutive business days around the same time so that the more reluctant people could see firsthand what

was involved before deciding to participate, and there was flexibility in level of participation from socially hands on and involved to independently. In addition, everything was printed out and placed in binders so that those without technological skills could participate. These processes made it easy for people to participate.

It was found that knowledge about TB risk and screening was significantly increased by the intervention. In addition, the researcher was informed that the peers enjoyed participating in the project and the researcher would be invited back to the peer center to perform future projects if desired. Although many of the tests did not end up being included in the data analysis, there was a very high level of participation in the project which was found to be a huge barrier for the other study that worked with the homeless population (Aldridge et al., 2015). Although some peers chose to informally help with implementation by recruiting others to participate, instructing others about what was involved in participating, and directing people on the protocols and procedures, there was no formal process for their participation and they were not recruited or formally compensated for their efforts like in the other studies involving peers (Adane et al., 2019; Aldridge et al., 2015; Spruijt et al., 2020). The peers naturally tended to be involved in the intervention as the format became very casual in the desire for people to feel welcome to participate, but they were not formally involved.

This project involved a lot of assessment but also involved an intervention (Adane et al, 2019; Aldridge et al., 2015; Bella et al., 2019; Bisallah et al., 2018); Cabral et al., 2017; Chen et al., 2019; Ekeke et al., 2020; Kyaw et al., 2020; Marks et al., 2019; Ngo et al., 2019; Scott et al., 2019; Spruijt et al., 2020; Visser et al., 2019; Wieland et al., 2019) as opposed to many of the studies that simply involved assessment (Alotaibi et al., 2019; Engelbrecht et al., 2019; Felix et al., 2019; Gebretnasae et al., 2020; Joseph et al., 2019; Lukman et al., 2019; Penaloza et al.,

2019; Ramathebane et al., 2019; Shiferaw et al., 2019; Sima et al., 2019). By performing a goal-directed activity, the researcher was able to assess many aspects of working with the population of interest in the setting of interest that would otherwise not have been assessed to inform future projects.

Discussion of Limitations

The biggest flaw that would affect generalizability was that the inclusion criteria were biased towards people that are good at following directions. The researcher would have needed formal assistants to help people follow directions due to the research implementation being casual and relaxed. As such, a lot of the data ended up needing to be thrown out because some people did not completely fill out the tests or mixed up the pre- and post- tests. While some people chose not to fill out the tests, the researcher suspects that most of the tests that were thrown out were thrown out because the participants had difficulty following all the directions. Although all of the tests were filled out anonymously, common sense suggests that a higher proportion of the tests that were thrown out were ones filled out by those struggling with housing. While some of the people experiencing homelessness seemed relatively energetic, organized, and quite capable of following directions, there were quite a few that appeared haggard, exhausted, and confused when participating in the project. Most of the paid peers with stable housing also appeared relatively energetic, organized, and capable of following directions. As such, this study is probably more generalizable to the general population than to the peer center at that time as the researcher suspects more tests from the people experiencing homelessness were thrown out than for the people experiencing stable housing. A majority of the people at the peer center were experiencing homelessness while a minority of the tests from those experiencing homelessness were probably included in the data analysis. December 2020,

however, was unusual for the peer center due to the COVID-19 pandemic. Most of the people experiencing stable housing that would typically attend were not coming, and because many of the places where people experiencing homelessness would gather to find shelter during the day were closed, they ended up using the peer center at higher rates than usual. The general population in the community is not experiencing homelessness, and typically the peer center tends to serve a much higher percentage of people that are in stable housing, so the results of the study are probably more generalizable to the typical population served by the peer center than to the population that was involved during study implementation in December of 2020.

The researcher suspects that the results can be sustained. The peer center plans to make the education a requirement to be a paid peer, so the education materials will continue to be available for the new-hires at the peer center. In addition, the handouts provided to participants give them the opportunity to look back at the education to remember key points. The results would be more sustainable if there were someone to champion the education annually at the peer center.

Post-Implementation Insights

It was found that the peers had an interest in being engaged in the implementation of the project, but because there was limited funding to be used to partner with them when planning the implementation, their informal help was not as useful as it could have been. For future projects, it would be desired by the researcher to obtain funding to hire peer recruiters to explain what was involved in the project to participants and get the peers started on the education intervention. In addition, it would be helpful if there were peer monitors to assure that people understood the inclusion criteria, provide ongoing clarification about the benefits of them answering every question to the research process, and assure that people know where to place the pre- and post-

education tests. In addition, when preparing the research materials, it would have been helpful to be able to hire peers to print out and organize the materials. With formal recognized involvement, it is suspected that the peers would be more engaged and could be the gateway for increasing their participation in future projects including choosing the topics of interest, deciding which aspects of those topics to focus on, and deciding on the most effective delivery strategies.

This was the first research project to be implemented at the peer center. As such, the peers did not know what to expect or what was involved. For instance, many of them had never read an informed consent for research, and the researcher suspects that on the first day, it resulted in them feeling hesitant to participate. By implementing the project daily over several days at the same time, the hesitant peers were able to observe what was involved on one day and decide to participate on a different day. If these projects were to become more routine, they would probably also run more smoothly because the peers would know what to expect.

Although the logistics of the project could have been arranged by phone or email, the researcher chose to visit the peer center when deciding on the topic of interest, planning the project, and to prepare for the project implementation. As such, the researcher was given many opportunities to establish a presence at the center, learn about the personalities at the center, observe the culture at the center, and see how logistics are managed at the center. Without these frequent short visits, the researcher would not have missed out on opportunities for small informal assessments that were used to craft the project. Performing multiple projects at the same place would surely benefit project design and results.

Compared to what the researcher had anticipated, relatively more of the participants preferred to participate in the project on their own instead of socially. As such, the design of the second and more interactive half of the education intervention that focused on the skills of

talking to a provider about care steps to be healthy and talking to a provider about TB risk and screening did not suite many of the participants. Technology and apps are advancing to the point where they would have been useful for the interactive half of the education intervention for the more socially shy participants. Utilization of this resource would be helpful when trying to work on skills such as talking to a provider about care steps to be healthy.

Perhaps the biggest barrier to the project is the lack of transparency for medical coverage and costs in our health system. In theory, the participants were all in the high risk for TB category established by the CDC, all were covered by the Oregon Health Plan, and all were established with primary care providers. As such, all of them should be able to access free latent TB screening from their primary care providers (CDC, 2020). In reality, many of them could run into barriers when attempting to get access to these services. For instance, sometimes providers are not knowledgeable about what is covered by insurance and the latest screening guidelines, and sometimes a piece of data is missing from the chart note that leads to insurance denying coverage. The researcher attempted to partner with Mosaic to assure that this would not happen by sending them materials and requesting to meet with the medical director, but because of the COVID-19 pandemic, Mosaic was unable to become more involved in this project. The researcher left a binder with information about medical coverage at the center and included diagnosis codes that should be utilized and references to the law. For many of the peers, however, this level of advocation was not something they would be prepared to do if they ran into difficulties with coverage. Offering TB screening services on site was also not an option due to legal constraints and regulations.

Interpretation

It was expected that knowledge would improve from the education intervention and the data analysis reflects that it did, but the readiness to talk to a provider about TB risk and screening and care steps to be healthy data analysis did not show improvement. It was casually observed by the researcher that participants were much more focused on the knowledge questions than the self-rating questions. The knowledge questions are concretely correct or incorrect whereas the self-rating questions are neither correct nor incorrect so are more like opinions. The researcher suspects that this reflects societal values and an education system that administers a lot of knowledge and skills tests instead of opinions tests. If readiness to talk to a provider as a skill were measured instead of the self-rating, the results may have been different. Additionally, the pre- education test ratings were already very high, making improvement from a single simple intervention less likely.

There should have been a knowledge question related to insurance and insurance coverage on the tests. That would be added for future projects. In addition, the second half of the education session needs to be modified to promote more participation in learning the skill of talking to a provider about care steps to be healthy and TB risk and TB screening. If iPads were available, the education could be interactive without forcing people to role play as a group. People could watch a video on talking to a provider about TB risk and TB screening, then they could interactively practice choosing questions to have their avatar ask the computer provider. If this format were pursued, there would need to be peer helpers that were technologically savvy and could assist with navigating the iPads. In addition, funding needs to be obtained to promote increased engagement from the peers in the research process. Repeated studies with similar formats would also promote increased comfort and engagement from the peers in the research process.

Implications for Future Research

Interventions in the community are becoming increasingly important in promoting health. Identifying communities that are at high risk for health inequities and establishing a partnership with them to do research, education, and interventions is an important and cost-effective avenue to utilize health resources. This pilot study at a peer center for those with mental health and drug addiction struggles demonstrates that a small intervention with limited funding can be effective at increasing knowledge about TB risk and screening. With added funding to promote increased engagement from the community and increase utilization of technology, it is proposed that skills could be developed to further build capacity and promote downstream interventions with the study population.

Practice and Future Research

The researcher originally intended to promote TB control at the peer center, but during the implementation of the project realized that from a clinical perspective, it was even more important to establish a relationship with the peer center and be invited back for future projects. Nurses and healthcare providers can have a special role in the research arena when their clinical skills are fully utilized to partner with a population to promote health. Their assessment and other clinical skills can be used to promote community engagement, provide education, and collect and analyze data. In the future, the researcher would like to work with the peer center to apply for grants to do more projects with the goal of increasing capacity at the center and promoting downstream interventions.

Healthcare Policy

The lessons learned from this project set forth the need for healthcare policies that analyze value from a macro-perspective. While the primary aims of the project were important to

increase awareness and knowledge related to the risk of TB and the importance of TB screening, and to promote readiness to talk to a provider about TB risk and TB screening, the secondary aims seemed even more important as the project was underway. The secondary aims included aligning the project with the agendas and values of the peer center, validifying the vocation of the peers as healthcare workers, promoting readiness to talk to a provider about any care steps to stay healthy, and providing a positive educational environment to foster excitement and regard for research and educational opportunities at the peer center. The secondary aims of the project will ultimately promote community engagement and build capacity at the peer center, which has large downstream value. Funding needs to be available that promotes the community engagement process in research and needs to support research that is flexible to meet the perceived needs of the community of interest.

Quality

Quality education addresses more than knowledge but also skills, processes, motivation, emotions, context and resources, and more. Quality research and education involves community engagement and support and needs to be carried out routinely over a long period of time to provide quality benefit. A one-time intervention is not going to reap large benefits, but regular interventions have the potential to influence culture and build capacity. For instance, when it comes to health care in the hospital system, daily management systems (DMS) are becoming popular (Donnelly, 2014). These are thought to be effective because they add routine structure and communication between leadership and staff promoting a culture of innovation and change and naturally lend to building teams, coordinating efforts, and developing a culture of trust (Donnelly, 2014). Leadership is being moved from the office to the location where care is delivered and research should do the same. DMS are designed so problems can be identified and

front-line staff are empowered to fix them while problems that they cannot fix are escalated and countermeasures created quickly (Donnelly, 2014). Likewise, when the research process is carried out with community engagement and consistent feedback, the research increases in quality and problems can be fixed.

Recommendations and Conclusions

Tuberculosis education is an essential priority to stopping TB. A standardized TB education intervention increased TB knowledge for participants at a peer center but did not increase readiness to talk to a provider about TB risk and TB screening. This capstone project demonstrates that more than a standardized education intervention is needed to prepare people in the community to talk to their providers about their risk for TB and TB screening. In the future, funding would be applied for to further promote engagement from the peers in the education process. In the process of stopping TB, capacity can be built in the intervention community by engaging them in the implementation process so that other problems can be addressed downstream.

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Appendix A: Pre- and Post-Education Test

Tuberculosis (TB) Test #_____

Why this project?

We want to see if this TB education helps people know more about TB and gets them ready to Stop TB. Test A is for before the education and test B is for after the education.

Your Choice

You choose if you want to be part of this project.

1. Step 1: You will fill out test A and then put it in the locked box at the front of the room labeled "Test A". This will take around 5 minutes.
2. Step 2: You will get the TB education. This will take around 50 minutes.
3. Step 3: You will fill out test B and put it in the locked box at the front of the room labeled "Test B". This will take around 5 minutes.

Do NOT write your name anywhere on the tests. This is so that no one will know which test is yours. If you decide you DO NOT want to be part of this project, you can put the test in the box without filling it out and NO ONE will know that you did not want to be part of this project.

Instructions

- There are 10 Questions
- Please answer the questions in order (DO NOT GO BACK)
- Circle ONE answer for each question.
- If you DO NOT want to participate in the study, you can put this test in the drop box blank and no one will know.
- The questions will be read out loud

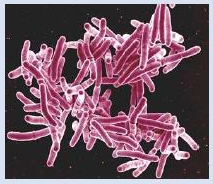
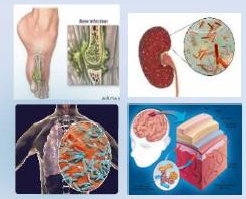
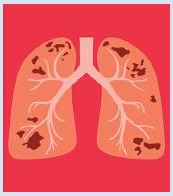
INCLUSION IN THE STUDY

The answers to these questions must be "yes" to be included in the study

- I am eighteen years of age or older.
  - A. Yes
  - B. No

- I am employed or volunteer at the peer center.
  - A. Yes
  - B. No

TB KNOWLEDGE

1. What is TB?		
		
A. a germ	B. an infection	C. a problem of the lungs

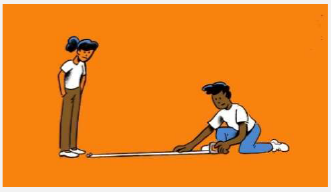
2. How do you get TB?		
		
A. a germ from touching others	B. a germ from food or water	C. a germ in the air

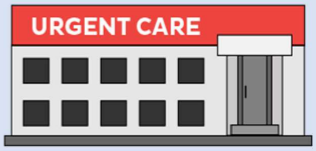
3. What is common to have when you are SICK from TB?		
		
A. a long term cough	B. belly pain	C. weight gain

4. Does everyone with TB get sick?	
	
A. Yes, everyone with TB gets sick	B. No, some people with TB get sick and some stay healthy

5. Who is MOST at risk for TB?		
		
A. Long term heavy smokers.	B. Healthcare workers and volunteers that work with people at high risk for TB.	C. People who have multiple sexual partners.

6. If you have TB germs, can you get rid of them?	
	
A. Yes, you can take medicine to get rid of TB germs.	B. No, there is nothing you can do to get rid of TB germs

7. What is the BEST way to protect yourself and others from TB?		
		
A. Wash your hands	B. Get checked for TB	C. Avoid ANYONE with TB

8. What is the BEST way to get checked for TB?		
		
A. Talk to your primary care provider	B. Go to the hospital	C. Go to urgent care

4

You are finished with the KNOWLEDGE questions.

Please DO NOT go back.

TALK TO YOUR PROVIDER READINESS

For each question, circle the answer that BEST describes YOU. Be honest.

9. In general, I feel CONFIDENT about talking to my providers about care steps to be healthy.
   A. Strongly agree
   B. Agree
   C. Neither agree nor disagree
   D. Disagree
   E. Strongly disagree

10. I'm READY to talk to my provider about my risk for TB and TB screening.
   A. Strongly agree
   B. Agree
   C. Neither agree nor disagree
   D. Disagree
   E. Strongly disagree

Appendix B: Handouts

Talking to your providers about <u>care steps</u> to be healthy.

1. Care step or procedure:

   What is it? What does it entail?

2. Benefits:

   Why do I need this?
   What happens if I don't do anything?

3. Risks:

   What are the risks?

4. Choices:

   Are there other choices or options?
   Are there alternative procedures?

5. Cost and Coverage:

   How much does it cost?
   Will my insurance pay for it?

6. Follow-up:

   What is the follow up?

Confused? ..... Just Ask!

<u>I'm not understanding</u>

1. Slow down please.

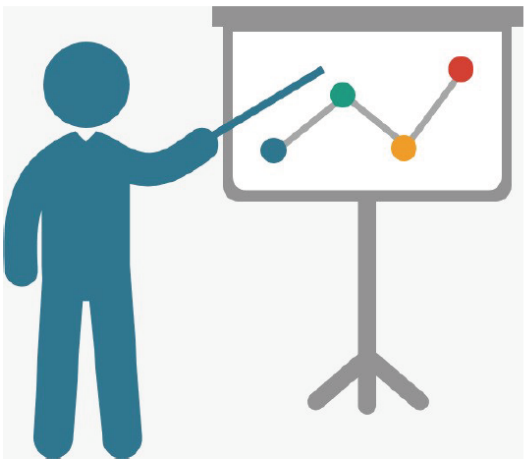
2. Use plain language please.

3. Show me please.

4. I need more time to understand.
   May I have another appointment please?

Slow Down Please

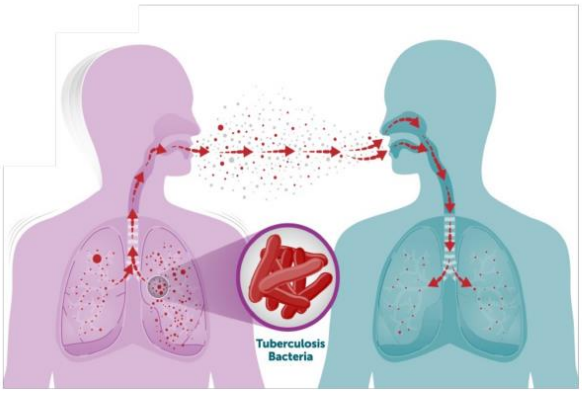
Use Plain Language Please



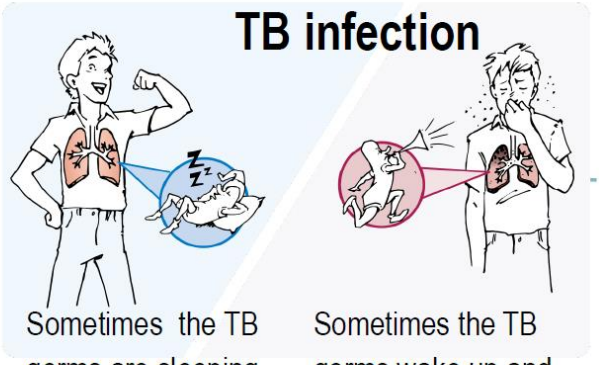
Show Me Please

May I have another appointment Please?

STOP Tuberculosis = TB



TB is an infection you get from breathing in TB germs.



Sometimes the TB germs are sleeping and you feel healthy.

Sometimes the TB germs wake up and make you **VERY sick**.

You can get rid of the TB germs by taking medicine.
It is much easier to get rid of TB germs when they are sleeping.

The only way you will know if you have TB is if you get checked for TB germs.

Talk to your Primary Care Provider about your risk for TB and getting Checked for TB germs.

STOP Tuberculosis = TB

EVERYONE is at Risk for TB, but some have more risk than others.

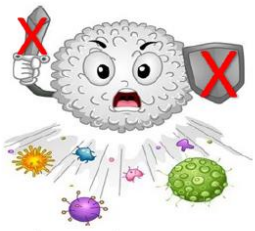
Know your risk!

High Risk Includes:

Spend a lot of time in countries where TB is common: Asia, Africa, Central America, Mexico, or Russia.

Use IV drugs

Work or volunteer in healthcare with high TB risk clients.



Weakened Immune system. Especially from HIV.

Close contact with people who are sick from TB.

Live or work in group living spaces where TB is more common: homeless shelters, jails/prisons, nursing homes.

Talk to your Primary Care Provider about your risk for TB and getting Checked for TB germs.

Appendix C: Data Collection Sheet

Key Q1-Q8	**Key Q9-Q10**	2=Neither agree nor Disagree	Participant answers will be recorded as per the example below
1 = Correct	4= Strongly Agree	1=Disagree	
0 = Incorrect	3= Agree	0= Strongly Disagree	

Data Collection Sheet

Pre/Post Test Questions	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
Participant 1 Pre-test Answer Post-test Answer	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 4	0 4
Participant 2										
Participant 3										
Participant 4										
Participant 5										
Participant 6										
Participant 7										
Participant 8										
Participant 9										
Participant 10										
Participant 11										
Participant 12										
Participant 13										
Participant 14										
Participant 15…100										