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# Increasing Medication Adherence in Young Adults With Latent Tuberculosis Infection: An Intervention for Quality Improvement

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Increasing Medication Adherence in Young Adults With  
Latent Tuberculosis Infection:  
An Intervention for Quality Improvement

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### **Abstract**

*Background:* Tuberculosis (TB) and latent tuberculosis infection (LTBI) affect a large number of persons worldwide. It is estimated that of the 15 million people infected in the United States, many are unaware of their diagnosis. *Purpose:* This quality improvement project focused on a more effective medication and self-management regime for treatment at a federal training program in a small rural community in Maine. The target population included young people who had tested positive for TB, many of whom are foreign born and identified as individuals at high risk for disease. *Results:* Through a supervised and monitored program of education, caring, and support at the conclusion of the project, participants completed their prescribed twelve-week medication regime incorporating Isoniazid and Rifapentine once weekly, and vitamin B6 daily under direct observed therapy. Each patient was given an Omaha KBS (Knowledge, Behavior, Status) ranking upon admission and discharge to evaluate current level of knowledge, their health behaviors, and the status of the disease. *Conclusions:* Prior to the implementation of project the preventative medication completion rates were less than 50% at this facility. Jean Watson's Theory of Caring was utilized to achieve an increase to 100% adherence to the TB and LTBI medication regime. As a result of the increased adherence rates noted during this project, the programs headquarters is looking at implementing this project nationally across all centers.

**Keywords:** *Latent tuberculosis infection, Tuberculosis, medication, improving adherence, Jean Watson, Theory of Caring, programmatic intervention, quality improvement.*

### **Introduction and Background**

Tuberculosis and latent tuberculosis infection affect a large number of persons worldwide. In the United States (US) it is estimated that 15 million people are infected with LTBI, many of whom are unaware of their diagnosis (Stagg et al., 2014). Of those infected individuals, only 300,000 receive treatment annually (Horsburgh et al., 2010). It is estimated that eight billion dollars annually is required to address the global treatment of TB and LTBI in the US (Yukselturk & Dinc, 2013). Improved treatment adherence is the only effective way of curing and reducing TB and the associated cost.

Stagg et al.'s (2014) research has illustrated that less than half of those who initiate LTBI treatment complete the adherence to treatment regimens, with the results of increasing multidrug-resistant TB, as well as LTBI becoming active and thus the individual becoming infectious (Centers for Disease Control [CDC] 2014). Examination of the barriers and methods to increase TB and LTBI medication treatment have demonstrated positive results by increasing the number of patients who adhere to their prescribed TB or LTBI therapy protocols (Stagg et al., 2014).

In 1993 the World Health Organization (WHO) declared TB a global emergency (MacPherson, Houben, Glynn, Corbett, & Kranzer, 2013). In 2013 nine million individuals developed active TB globally, an increase from eight million the previous year, when the lives of more than a million persons globally were claimed. Understanding that TB is a treatable infectious disease with a cure rate of 86%, it is imperative that as public health leaders and healthcare professionals we are dedicated to reducing, if not eliminating, global TB (WHO, 2014).

Currently there are several treatment options ranging from three to twelve months and at times longer depending on the patient's condition and comorbidities (Davis, Gordon, & Davies, 2014). The long duration as well as the side effects of therapy are acknowledged as barriers that result in medication non-adherence. New medication therapies have been developed for those who have multidrug-resistant TB (MDR-TB), including Bedaquiline and Delamanid (MacPherson et al., 2014). In addition there are currently 10 medications that are being developed as well as 15 vaccinations that are in clinical trials. The WHO has set benchmarks with the goal to end the TB epidemic by 2035, seeking a reduction of 95% of TB deaths and a 90% decrease in occurrence (WHO, 2014). In order to meet these set benchmarks it is crucial that medication adherence be strictly followed for those diagnosed with TB and or LTBI.

The risk of medication non-adherence to treatment regimens includes MDR-TB as well as LTBI becoming active and the individual becoming infectious. Examination of the barriers and methods to increase TB and LTBI treatment adherence has demonstrated positive results by increasing the number of patients who adhere to their prescribed TB and LTBI therapy protocols.

### **Review of Literature**

A comprehensive literature search was completed on adherence to prescribed LTBI medication therapy. The literature search included the databases CINAHL, Pub Med, and the Cochrane Collaboration. For all databases the search terms were *Tuberculosis, Latent Tuberculosis Infection, Adherence and Medication*. Inclusion criteria included only full-text articles from the years 2010–2015. The CINAHL database resulted in 79 research studies matching the criteria, five from Pub Med and three from the Cochrane Collaboration for a total of 87 research articles. After review of the articles the list was then reduced to 20 research articles based upon the strength and rigor of the studies.

In order to address the strength and consistency of the studies, the AGREE II Model was used to better define, critique, and summarize the research findings as it applies to LTBI medication adherence. Upon completing the appraisal, only the research studies graded as having strong evidence relating to the clinical practice problem were inserted into the project. The 20 remaining research articles were divided into two sections, both having TB and/or LTBI as a component in the study. The first section was comprised of 10 studies that focused on the treatment of TB and LTBI; these were the strongest studies overall and had a rating of at least 6 out of 7 in the AGREE II overall score. The next group was also made up of 10 studies that, in addition to the basic TB and LTBI background information, placed emphasis upon the barriers to successful medication completion rates.

### **Epidemiology of Tuberculosis**

Latent Tuberculosis Infection is the dormant infection of active TB produced by *Mycobacterium tuberculosis*; when activated TB can be lethal, causing almost two million deaths annually and infecting nine million globally (Sultan, Haroon, & Syed et al., 2012, Yukselturk & Dinc, 2013). It is within the LTBI stage that the largest gains can be made in the eradication of TB; if identified and medication treatment is prescribed, the risk of converting to an active TB case is diminished significantly (Rodrigues, Sousa, & Saint Anna, 2014; Sultan et al., 2012). Those who are at greatest risk for being infected with LTBI and hence active TB are more often those individuals who are foreign born from regions with high TB burden rates (MacPherson et al., 2014; Morano, Zelenev, Walton, Bruce, & Altice, 2014; Peluso et al., 2014). This is especially important to the capstone project as a high percentage of the included patients who have been diagnosed with LTBI are foreign born. The average duration of latent disease to active



disease in this population is 18 months with a 10% conversion rate (Morano, Walton, Zelenev, Bruce, & Altice, 2013; Nicholson, Geltemeyer, & Smith, 2015).

Stagg et al. discuss the importance of treatment for LTBI and the different array of regimens available to patients in accordance with their individual needs. In this meta-analysis, traditional modes of therapy consisting of the 9 months of Isoniazid are introduced to new developments including a shorter regimen of Rifamycin for 12 weeks, which are found to be as effective in preventing a conversion to active TB (Stagg et al., 2014). This is a crucial aid in the reduction of barriers to medication adherence regarding length of LTBI treatment (Horseburgh et al., 2010; Nunn, Phillips, & Abubaker, 2013).

### **Barriers to Prescribed Therapy**

Therapy duration, the side effects of the medication, the restriction of alcohol, monitoring, perceived cost and access to healthcare clinics are all recognized as barriers that impact medication adherence rates (Cruz, Starke, & Lobato, 2014; Hartman-Adams, Clark, & Juckett, 2014). The intention of this project was to remove as many barriers as possible in order to have a successful completion rate greater than 90%. Understanding that young adults are faced with additional barriers that children and older adults may not be impacted by, such as pregnancy, the use of alcohol as a social tool, and the overall commitment to the prescribed therapy. The collected studies agree on the principle of LTBI identification and successful treatment completion as an effective means of reducing TB globally (Peluso et al., 2014).

The literature also indicates the crucial role that public health nursing (PHN) plays in the reduction of LTBI, TB, and other infectious diseases (Chang, 2013; Chang, Polesky, & Bhatia, 2013; Nuzzo, Golub, Chaulk, & Shah, 2015). Public health nurses are often deployed to provide direct observed therapy (DOT) to those infected with LTBI and in this project public health

nurses are at the center of LTBI medication adherence, symptom assessment, education, and reduction of barriers through a caring theory model.

In translating recommendations found in studies reviewed into clinical practice, each of the studies mentioned the importance of treatment and adherence to the prescribed therapy in order to reduce the conversion of LTBI into active TB.

### **Theoretical Framework**

Global health and the population affected by this disease were taken into account in this project to control the transmission of active cases and ensure proper treatment of those affected. A theory that not only addressed the needs of the implementation process, but also the direct needs of the individual patient is Jean Watson's Theory of Caring (Watson, 2008). Jean Watson's Theory of Caring is based upon the general belief that the patient is the focus of care and that understanding the individual's community and culture is important to the caring process.

The Theory of Caring (Watson, 2008) includes the belief that effective caring promotes the health of the patient, through understanding and accepting the patient for who he or she is. This community of mostly foreign-born youth, have experienced social and emotional trauma is often looked upon negatively by community members including healthcare providers, and trust issues often exist. In Watson's theory the environment is open and accepting of the patient, creating a world that allows and supports the patient to make the best decisions for them. In an environment that is often hostile and judgmental, the nurse has the opportunity to positively impact the life of the individual patient as well as global health through the science of caring (Watson, 2008).

The science of caring can be described as having 10 curative factors including being sensitive to the patient's individual needs, developing a positive helping-trusting relationship

between the nurse and patient that allows the patient to be open and share questions and fears about their LTBI diagnosis. Creating a genuine caring relationship is critical in establishing quality nursing care and meeting the needs of our patients. Empathy and warmth directed toward the patient as well as open communication supports a successful patient-nurse relationship (Watson, 2008).

Watson's Theory of Caring (2008) is based upon four primary understandings. These beliefs establish that all persons are of value and have much to offer, health is important to life, caring is a universal emotion that is often a product of the environment, and lastly that the nurse is genuinely dedicated to caring for others through education, promotion, and human experiences. Together, a caring environment is created allowing for improved health outcomes and, in this capstone project, increasing LTBI medication compliance (Watson, 2008)).

The Theory of Caring was utilized throughout the nursing process in order to create an environment that places emphasis upon and embraces health (Zaccagnini & White, 2014). Patients in this population have a history of trauma, making the creation of a trusting relationship difficult. Caring is at the heart of the public health nurse's mission; to care for others in a way that changes both the lives of the patient and the nurse is an art.

### **Project Design**

A Quality Improvement project design incorporated primarily quantitative methods with descriptive analyses. The QI project involved meeting with identified patients at the training center individually to offer additional education and support regarding medication adherence. Each week the DNP student met with each of the young adults who were diagnosed with having Latent Tuberculosis Infection. During this hour- long visit the DNP would assess if the patients demonstrated any signs and symptoms of medication toxicity or a conversion to active

Tuberculosis. If the patient did not present with signs and symptoms of medication toxicity and their physical assessment was clear the patient was given their weekly dose of direct observed therapy.

### **Setting and Resources**

The education setting in Maine, is one of 125 education centers within the national initiative of providing an education and vocational career training. This education project was directed at young adult's ages 16–24 living in a low-income situation and at risk of social economic complications. More than 60,000 students complete their education at these educational centers throughout the United States and Puerto Rico. The LTBI population in this population project was unique, as 88% were foreign born, 77% are African American, with less than 22% being Hispanic or Caucasian. However, outside this small community in Aroostook County, residents are 95% Caucasian. Poverty in this community was a common variable among all the patients seen for LTBI, and patients at times could be suspicious of outsiders. For the majority, whether they grew up in a foreign village in Africa, the Caribbean, or possibly a large urban city in the US, healthcare was often not an option due to lack of access.

In order to gain the trust and respect of this clinical population, respect and care were first extended to the patient to demonstrate commitment to them as an individual. Many in this population who have been diagnosed with LTBI are experiencing a complete healthcare system for the first time. This complex healthcare system is often difficult to navigate, and assistance must be given to the patient in order to ensure that individuals do not get lost to follow-up. Loss to follow-up is often a reality for those who have been recently diagnosed with LTBI, thus significantly impacting medication adherence (Davies et al., 2014).

In addition to locally advocating for equal healthcare for all those diagnosed with LTBI, it is important for the public health nurse leader to commit to continuing as an active campaigner for health equity and social justice in the political arena. TB is an epidemic globally and without proper acknowledgement and supports, both financial and strategic, the hopes of eradication are disheartening.

### **Methods/Implementation**

Patients who tested positive to a tuberculin skin test upon admission to the campus were given a chest x-ray and baseline blood work. They then were referred to the State of Maine TB Controller, who then notified the local PHN Manager. The State of Maine Patients' Rights and Responsibilities and the Health Insurance Portability and Accountability Act (HIPPA) were reviewed with all participants during the first visit. Education was provided regarding diagnosis, medication, and treatment, and if the patient chose to participate in an annual service agreement was signed.. A professional interpreter service was offered to every patient who English was not the primary language spoken.

Each patient was given an Omaha KBS (Knowledge, Behavior, Status) ranking upon admission, which uses a scale of 1–5 to evaluate a patient's current level of knowledge, their behavior, and the status of the disease (Appendix C). Upon discharge the KBS rating was once again completed, which indicated an increase in knowledge, improvement of behavior regarding LTBI, as well as adherence having been followed and LTBI prescribed therapy completed. Their status indicated whether the patient was free from disease and/or signs and symptoms. The KBS scores were reviewed to assess overall completion, understanding of active TB signs and

symptoms and side effects of medication therapy. Patients were given the opportunity to share any feelings or questions they may have regarding TB.

The project goal was to increase LTBI medication adherence at a rural health clinic in order to improve successful therapy completion as evidenced by a change in KBS scores over the term of the project. The expectation was that anywhere from 10 to 30 patients would be seen during a time frame of six months and treated for LTBI, with a goal of successful medication adherence with no conversions to active TB cases. It was anticipated that 90% of the initial LTBI patient cohort of young adults would be successful in program completion. In order to successfully complete this quality improvement project on the adherence to the treatment regime of LTBI, the Plan, Do, Study, and Act (PDSA) cycle tool was applied (IHI, 2015).

This population was unique as some of the patients were away from their families for the first time. It was essential that each patient was able to verbally relay to the public health nurse whatever signs and symptoms they might notice if they become re-infected or if the medication treatment was not successful and the patient converted to an active TB case.

In order to reduce the likelihood of a severe reaction, patients were monitored and assessed weekly for adverse medication side effects by the medical staff at the clinic. During this time special attention was paid to medication side effects education and what to do if they are experiencing any side effects. Upon admission, patients were given a wallet handout and magnet with pictures and wording of possible medication side effects. It was the goal of the DNP student to increase LTBI medication adherence at the wellness Center Clinic in order to improve successful therapy completion.

In accordance with organizational policy and procedure upon admission to the educational campus, a Tuberculin Skin Test (PPD) was administered by the health clinic's

registered nurse. If after 48–72 hours the patients PPD was positive according to the individual's risk factors and comorbidities such as HIV, the patient would have a two-view chest x-ray, which was examined for abnormalities that may indicate active TB. However, if the patient had a normal chest x-ray, he or she was identified as being infected with LTBI and baseline liver function tests gathered. If the patient was identified as also being infected with HIV, the patient was not allowed to be a part of this twelve-week study due the drug interactions between Rifapentine and antiretroviral medication. Those patients who are infected with both HIV and LTBI were placed on an alternate medication regime as prescribed by the organizations Nurse Practitioner. The cost of the HIV medication was covered by the Infectious Diseases Program at no cost to the patients.

Once the patient had been diagnosed with LTBI they were seen by the campus nurse practitioner who completed a complete physical assessment with history. The preferred course of treatment for this population is the 12-week regimen consisting of Isoniazid and Rifapentine taken once weekly under DOT and vitamin B6 to be taken daily during treatment (Peluso et al., 2014). The nurse practitioner employed by the wellness center then submitted her prescription request for the individual patient to the Maine Center for Disease Control Tuberculosis Control program. Once approved, the prescribed medications were sent to the campus health center at no cost to the individual or organization.

Prior to the first dose every LTBI patient meet with the DNP student for an hour long consultation where the patient was presented with education regarding the therapy prescribed by the wellness center's nurse practitioner. Patients who were identified as having LTBI were given the choice to begin prescribed therapy and LTBI medication therapy initiated. The patient was then admitted into the public health nurse program, consents were then signed and release of

information is sought if indicated. The DNP student then completed a complete physical assessment including weight and vital signs in order to obtain a baseline health assessment. This was collected by utilizing the Treatment of Latent Tuberculosis Infection (LTBI) weekly monitoring flow sheet (Appendix B). If at that time the DNP student found no concerns regarding the ingestion of the dose of LTBI medication, the DNP student accompanied the patient down to the health center medication-dispensing section and alerted the organization's registered nurse that the patient has been assessed and has been educated on the risks and side effects of the prescribed medication. The patient then completed direct observed therapy and returned the following Friday.

The DNP student provided education and a physical assessment ensuring no side effects of medication had occurred for the 12 weeks of the project, after participants were seen by the medical clinic staff. If at any time there was a concern about the safety and health of a patient within the program the organization's nurse manager was notified and the patient was seen by the campus nurse practitioner immediately before receiving the next DOT dose. It was during this time that the PHN was able to administer Jean Watson's Theory of Caring (2008) in a personal manner, allowing the patient to see the sincere care and compassion that was held for him or her. Patients were never rushed and time was scheduled in order to allow the patient sufficient time with the DNP student to discuss medication therapy or any other concern the patient may have had. Again, each week the DNP student accompanied the patient to the registered nurse who is dispensing DOT, thank the patient for their time, and making their next appointment as well as looking forward to meeting with them the following week at the same time. Praise and acknowledgement had an ongoing role in this project's foundation of care.



Upon successful completion of prescribed LTBI medication therapy, each patient received a completion incentive reward provided by the organization health center. The successful patient at the last DOT received the reward of their choice (a free large pizza or two movie passes) as well as their gold card indicating that they have successfully completed LTBI therapy (Appendix D).

### **Ethics and Human Subject Protection**

Because of the protected patient information available, a request was sent to the University of Massachusetts at Amherst IRB for exemption, which was granted. Information was gathered from weekly assessments in the patient's individual private health information record. This information is protected by the State of Maine in an encrypted electronic medical record (EMR). Data was de-identified for the purpose of this study and only coded identification numbers were used. In written material regarding this project. No personally identifiable information was removed from the clinic at any time.

### **Results**

Four principal objectives were evaluated in order to determine the level of impact this comprehensive TB/LTBI program has had. A total of nine patients were seen for 12 weeks during this Capstone project for a total of 108 hour long LTBI visits, eight were male (88%) and one female (11%). Two patients chose not to be enrolled in the project and also elected not to begin any treatment for LTBI. The total number of patients seen were less than originally expected due to overall low enrollment in the organizations winter term, and low number of LTBI patient's identified. The ages of the patients ranged from 18-24 years old, with the average age being 19.8 years old. Eight of the nine students were foreign born and represented nations other than the United States (11%) were Jamaica (22%), El Salvador (22%), Haiti (22%), Sierra

Leone (11%), and Rwanda (11%). The projects findings were calculated utilizing the participants admission KBS scores, in comparison to the participants discharge KBS ranking. This allowed for the DNP student to determine the amount of increased knowledge, behavior and status the participant demonstrated within the twelve-week project.

**Objective One:** Increase patient knowledge of TB/LTBI disease and process.

Objective one was met by utilizing each patients Omaha admission KBS (Knowledge, Behavior, Status) score that demonstrated and increase in patient knowledge as related to LTBI/TB disease and process. On admission the average “K” Knowledge score was 2.4, on discharge increased to an average of 4.7 . Behavior or “B” in the KBS ranking maintained an average of 3.1 on admission and improved by 1.7 at discharge for an average score of 4.8. The status or the “S” portion of the KBS score also improved from an average admission score of 4 to an average discharge rating of 5.

**Table 1. KBS Comparison Scores on Admission & Discharge**

<b>Pt. #</b>	<b>On Admission</b>	<b>At Discharge</b>	<b>On Admission</b>	<b>At Discharge</b>	<b>On Admission</b>	<b>At Discharge</b>
<b>1</b>	4	5	4	5	4	5
<b>2</b>	3	5	3	5	4	5
<b>3</b>	2	4	2	5	4	5
<b>4</b>	2	5	2	5	4	5
<b>5</b>	3	5	4	5	4	5
<b>6</b>	3	5	4	4	4	5
<b>7</b>	1	5	3	5	4	5
<b>8</b>	1	4	2	5	4	5
<b>9</b>	3	5	4	5	4	5
<b>Total</b>	22	45	28	44	36	45
<b>Average Score</b>	<b>2.4</b>	<b>4.7</b>	<b>3.1</b>	<b>4.8</b>	<b>4</b>	<b>5</b>

**Average KBS Score on Admission: 234**

**Average KBS Score on Discharge: 445**

**Objective Two:** Increase LTBI completion rates at health center.

This objective was met by increasing the Wellness Centers LTBI completion rates from less than 50% to 100% completion at the close of the project. All patients successfully followed treatment orders, thus increasing their final “B” or behavior KBS score. In order for the KBS “B” score to be rated as a four or five the patient must demonstrate ongoing compliance with the prescribed treatment regime and keeping all scheduled appointments.

**Objective Three:** Enable all patients to recall signs and symptoms of active TB.

Objective three was also met, on discharge when each patient was able to recall and verbalize the signs and symptoms of active TB as well as sign and symptoms of an adverse reaction to prescribed medication regime. This was demonstrated through the patients K or knowledge KBS score. The “S” or Status score showed that all doses were taken as well as no complication of therapy. During this project the most common medication side effects experienced by patients were mild stomach upset as well as change in urine color one to three days after DOT administration.

**Objective Four:** Create an environment of support and caring for the family.

The fourth objective was considered met, all patients thanked the DNP student at the end of the program and many stated that they would miss coming and seeing the DNP student each week. After discharge patients were asked by the organizations nurse if they felt supported and cared about by the DNP student providing care and the reaction was positive. Several of the students returned to the Wellness Center following Fridays after the close of the project to be seen by the DNP were reminded by staff that the program had ended as they completed their regime.

**Facilitators and barriers**

As with any quality improvement project there were barriers and facilitators. The organization and all individual stakeholders were supportive of the project and the desired outcomes. Effective, caring, and thoughtful communication were always the standard among team members, allowing for the highest standard and quality of care for our patients. There was a significant barrier that negatively influenced successful completion of prescribed medication and that was past life trauma. Many of the patients came into this educational setting via Refugee or Asylum status and the traumatic events experienced in their young lives were extensive.

The majority of patients are originally from remote villages that did not have regular healthcare services. When they arrived in the United States they were overwhelmed with an array of medical test and assessments. This was the first time that most had been provided care in an established environment. Each patient was invited and has shared with the DNP student life events that have impacted their lives negatively and positively. Sex trafficking, domestic abuse (sexual and physical), religious prosecution, area violence and war were most often discussed events. Each of the patients were asked if they would like to speak with a trained mental health counselor, only half agreed to services.

Another barrier was the perceived cost of the medication and treatment; many patients believed that they would not be able to pay for treatment, which was alleviated when it was explained that all costs would be covered by the State of Maine, as it is the responsibility of the State of Maine Center for Disease Control. The language barrier was also an issue, however a certified translator was offered to those who English was not the primary language.

### **Discussion**

The importance of adherence to the prescribed medication regime was given precedence throughout the project. Special attention was placed upon Jean Watson's Theory of Caring as the

foundation to demonstrate genuine care and respect of each patient. One of the most important findings from this project was the impact that genuine caring and respect had on healthcare outcomes. The 100% completion rate for young adults prescribed a LTBI medication regime at the Wellness Center was more than expected and probably in part due to the continued reinforcement of the necessity to take this medication in a caring environment.

The patient population was unique as they were young adults, mostly foreign born and away from their families for the first time. All patients involved had experienced extreme trauma in their lives from poverty to all forms of abuse. Three of the nine patients entered the United States under Refugee status and one was granted citizenship through being an asylum seeker. The others entered the United States through adoption or legal migration. It was critical to be mindful of the importance of being culturally competent when caring for patients from other cultures. Asking questions was key to meeting the needs of this population as many wanted to talk about their past experiences. Speaking of the overall physical health of the patients, it could be said that all patients were in great physical health, even with their recent diagnosis of LTBI. More concerning however was the overwhelming poor mental health of a majority of the patients within this project. If a mental health concern arose during one of the weekly visits, the patient was referred immediately to the mental health provider for the organization.

The admission and discharge KBS scores from this project demonstrated the ability to educate, care for and have a positive impact on health outcomes of our patients with a LTBI diagnosis. With significant gains in Knowledge, Behavior and Status being met across the continuum, the importance of sincere caring cannot go unrecognized as being a crucial component to affect change through the nursing process. For young adults the prescribed regime

should be the shortest in duration as determined by the safety of each individual patient's needs and requirements.

This project demonstrated the essential role of the Public Health Nurse in the successful completion and adherence to LTBI and TB prescribed medication regimes. The Public Health Nurses role in caring for those with a LTBI or TB diagnosis is crucial in increasing adherence rates, as well as identifying adverse medication side effects in patients sooner, in which outcomes are improved. The recommendations taken from this project would include incorporating the Theory of Caring into practice and the need to; increase the number of Public Health Nurses globally in order to meet the needs of those infected with LTBI and TB.

### **Conclusion**

The introduction of a LTBI clinic in Northern Maine focusing on these at risk young adults individual needs was a first for the area. The majority of affected patients were foreign born and a small percentage having the comorbidity of HIV. Tuberculosis and LTBI are almost always curable if proper attention and medication therapy is followed as prescribed by a healthcare provider. Patient education is an important aspect of reducing the spread of the disease. Many patients do not understand the importance of completing their medication therapy. Without appropriate knowledge LTBI patients often stop their treatment in the middle of their therapy course placing themselves at risk for the development of active and multidrug-resistant TB. It is of the utmost importance that TB and LTBI awareness is promoted publicly in order to make the greatest impact on meeting the WHO goals and benchmarks to end TB by 2035, with a reduction of 95% in TB deaths and a 90% decrease in occurrence (WHO, 2014).

The goal for this project was to significantly improve LTBI medication adherence in young adults ages 16–24 in this educational setting. This goal has been met with a significant

increase in medication adherence within this project. Another key finding was the importance of how the science and art of nursing is demonstrated through the genuine caring process for our patients. This project was submitted and accepted for poster presentation at the 20<sup>th</sup> Annual TB Conference in Denver Colorado February 2016.

Throughout this project the DNP student was overwhelmed by the positive responses received from the patients in the project. Repeatedly patients thanked the DNP student for caring and listening to them. These patient actions and behaviors were very different than what other care providers and community members had spoken so poorly of. It was during the experience of caring for this high-risk population intensely for twelve weeks that the understanding was made that, it is a true privilege to care for all patients.

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**Appendix A**

**Costs and Benefits**

Table 1  
*Itemized Program Cost Outline for Physical Materials*

<b>Item Description</b>	<b>Cost</b>
<b>Physical Materials</b>	
Latent Tuberculosis Infection (LTBI) Brochures and Educational Handouts.	\$0.00 – Federal and State CDC
LTBI Completion Gold Cards	\$0.00 – Federal and State CDC
LTBI Medication	\$0.00 – State of Maine TB Control Program
TST Solution	\$0.00 – State of Maine TB Control Program
Two Reams of Recycled White Paper	\$32.00 - DNP (c)
Two Packets of Mechanical Pencils no.2	\$7.50 – DNP (c)
Two Packets of Medium Ballpoint Pens Blue	\$5.60 – DNP (c)
O2 Saturation Monitor	\$57.60 – DNP (c)
Manual Blood Pressure Cuff Adult size Large and X-Large	\$87.00 – DNP (c)
Stethoscope	\$159.00 – DNP (c)
Incentive Pizza	\$200 – Wellness Center
Weight Scales	\$0.00 – Wellness Center
DOT Medication Cups	\$0.00 – Wellness Center
Water	\$0.00 – Wellness Center
Applesauce	\$0.00 – Wellness Center
<b>Total Physical Material Cost</b>	<b>\$548.70</b>

Table 2  
*Itemized Program Cost Outline for Computer Information Systems*

<b>Item Description</b>	<b>Cost</b>
CareFacts EHR	\$0.00 – Owned by State of Maine Public Health Nursing
Omaha and KBS Rating	\$0.00 – Owned by State of Maine Public Health Nursing
Personal Laptop with current Microsoft Programs	\$0.00 – Owned by DNP (c)
<b>Total Computer Information Systems</b>	<b>\$0.00</b>

**Appendix A continued**

Table 3  
*Itemized Program Cost Outline for Personnel*

<b>Item Description</b>	<b>Cost</b>
Wellness Center RN's (2)	\$0.00 – Wellness Center Salaried
Wellness Center Nurse Manager (1)	\$0.00 – Wellness Center Salaried
Wellness Center Nurse Practitioner (1)	\$0.00 – Wellness Center Salaried
Project Manager – DNP (c)	\$0.00 – Maine CDC Salaried
Public Health Nurse, PHN II	\$0.00 – Maine CDC Salaried
TB Controller RN (1)	\$0.00 – Maine CDC Salaried
TB Epidemiologist (1)	\$0.00 – Maine CDC Salaried
<b>Total Personnel Cost</b>	<b>\$0.00</b>

Table 4  
*Itemized Program Cost Outline for Transportation and Travel*

<b>Item Description</b>	<b>Cost</b>
PHN II (.44 per mile 17 miles for 12 weeks)	\$89.76 – State Of Maine TB Control
Project Manager DNP (c)	\$0.00 – No Millage will be Submitted To TB Control \$40.00 - Self
Wellness Staff ( Nurse Manager and RN (2) )	\$0.00 - Self
<b>Total Travel Cost</b>	<b>\$129.76</b>

Table 5  
*Itemized Program Cost Outline for Project Space and Implementation*

<b>Item Description</b>	<b>Cost</b>
Wellness Center Exam Room	\$0.00 – Wellness Center
Home Office	\$0.00 – DNP (c)
Work Office (Charting KBS Rating)	\$0.00 – Public Health Nursing
<b>Total Space for Implementation</b>	<b>\$0.00</b>

Table 6  
*Overall Project Cost*

<b>Item Description</b>	<b>Cost</b>
Total Physical Material Cost	\$548.70
Total Computer Information Systems	\$0.00
Total Personnel Cost	\$0.00
Total Travel Cost	\$129.76
Total Space for Implementation	\$0.00
<b>Total Program Cost</b>	<b>\$678.46</b>





**Appendix C**  
**Knowledge, Behavior, Status (KBS) Information**

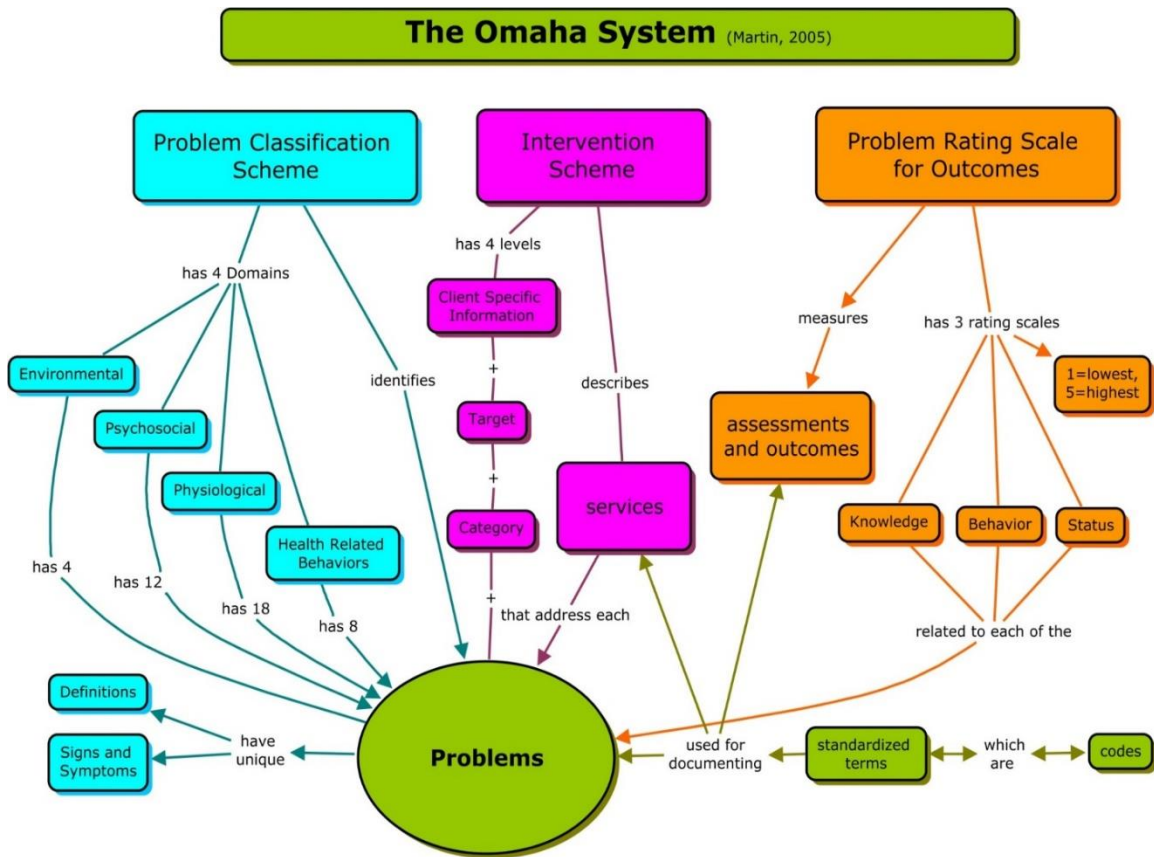


Figure 1. Schematic diagram of the omaha system, knowledge, behavior, status (kbs) rating metrics.

**Communicable/Infectious Condition (KBS Prepared for Tuberculosis)**

Definition: State in which organisms invade/infest and produce superficial or systemic illness with the potential for spreading or transmission:

Signs/Symptoms:

- Infection
- Infestation
- Fever
- Biological hazards
- Positive screening/culture/laboratory results
- Inadequate supplies/equipment/policies to prevent transmission
- Does not follow infection control regimen
- Inadequate immunity

- other

**Appendix C continued**

Table 1

KBS Rating Considerations

<b>Knowledge (What the client knows)</b>	<b>Behavior (What the client does)</b>	<b>Status (How the client is)</b>
<b>Consider knowledge of:</b> <ul style="list-style-type: none"> <li>• Prevention measures</li> <li>• Treatment regimen</li> <li>• Adverse effects</li> <li>• Follow-up appointments</li> </ul>	<b>Consider if client is:</b> <ul style="list-style-type: none"> <li>• Following isolation and quarantine measures</li> <li>• Following treatment orders</li> <li>• Following exposure precautions</li> <li>• Keeping scheduled appointment</li> </ul>	<b>Consider:</b> <ul style="list-style-type: none"> <li>• Signs and symptoms</li> <li>• Complications</li> <li>• Diagnostic tests</li> <li>• Doses completed</li> </ul>

**Guidelines and Notes:**

- Treatment guidelines will vary depending upon the type of communicable disease or infection condition. Apply the specific guidelines to the percentages used in the rating guide
- A status of 5 may be appropriate when diagnostic testing have stabilized but will not return to normal, when signs and symptoms are stable but will not return to normal, or when a treatment regimen will need to be continued long term.
- Do not use this problem for immunizations. Immunizations are addressed under medication regimen.

<b>Rating</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Knowledge</b>	<b>No knowledge of:</b> <ul style="list-style-type: none"> <li>• Disease and need for treatment</li> <li>• Potential for transmission</li> <li>• Of prevention measures</li> <li>• Importance of good health</li> </ul>	<b>Minimal knowledge of:</b> <ul style="list-style-type: none"> <li>• Disease and need for treatment</li> <li>• Disease transmission</li> <li>• Willing to learn of prevention and treatment measures</li> <li>• Importance of good health</li> </ul>	<b>Basic Knowledge of:</b> <ul style="list-style-type: none"> <li>• Disease and need to complete treatment regimen</li> <li>• Protective measures to prevent spread</li> <li>• Prevention measures</li> <li>• Importance of good health</li> </ul>	<b>Adequate knowledge of:</b> <ul style="list-style-type: none"> <li>• Disease and treatment plan, guidance still needed</li> <li>• Side effects to be reported</li> <li>• Verbalizes need for required protective measures</li> </ul>	<b>Superior Knowledge of:</b> <ul style="list-style-type: none"> <li>• Significance of communicable or infectious disease</li> <li>• Modes of transmission</li> <li>• Importance of completing treatment</li> <li>• Importance of completing contact investigation</li> </ul>



					<ul style="list-style-type: none"> <li>• importance of good health</li> <li>• Ability to repeat what is taught</li> </ul>
<b>Behavior</b>	<p><b>Not appropriate</b></p> <ul style="list-style-type: none"> <li>• Refuses care</li> <li>• Refuses to follow through with treatment plan</li> <li>• Fails to follow infection control guidelines</li> <li>• Uncooperative with contact investigation</li> </ul>	<p><b>Rarely appropriate</b></p> <ul style="list-style-type: none"> <li>• Reluctantly agrees to care</li> <li>• Misses 7 days or more of initial treatment</li> <li>• Must restart treatment</li> <li>• Misses 20% of medical appointments</li> <li>• Does not reschedule missed appointments</li> <li>• Follow through with infection control guidelines</li> <li>• Unwilling to give complete list of contacts</li> </ul>	<p><b>Inconsistently appropriate</b></p> <ul style="list-style-type: none"> <li>• Agrees to care</li> <li>• Misses 7 days of treatment</li> <li>• Must restart treatment</li> <li>• Misses 10% of medical appointments</li> <li>• Sometimes calls to reschedule appoints</li> <li>• Follow through with infection guidelines</li> <li>• Unwilling to assist with locating contacts</li> </ul>	<p><b>Usually appropriate</b></p> <ul style="list-style-type: none"> <li>• Misses less than 7 days of treatment</li> <li>• Misses fewer than 5% of medical appointments</li> <li>• Proactive about rescheduling missed appointments</li> <li>• Follow through with infection control guidelines</li> <li>• Willingly shares information for contact investigation</li> </ul>	<p><b>Consistently appropriate</b></p> <ul style="list-style-type: none"> <li>• Completes appropriate amount of treatment in the appropriate time frame</li> <li>• Present for 95-100% of medical appointments</li> <li>• Follows infection control guidelines</li> <li>• Shares and assists in locating contacts</li> </ul>
<b>Status</b>	<p><b>Extreme signs /symptoms</b></p> <ul style="list-style-type: none"> <li>• Invasion of organism causing illness with potential to transmit</li> <li>• Experiencing multiple intense or severe signs and symptoms</li> <li>• Unable to tolerate treatment</li> <li>• Abnormal diagnostic tests</li> <li>• Isolation required</li> </ul>	<p><b>Severe signs/symptoms</b></p> <ul style="list-style-type: none"> <li>• Invasion of organism causing illness with potential to transmit</li> <li>• Experiencing multiple signs/symptoms</li> <li>• Experiencing severe side effects but continuing treatment with symptomatic relief.</li> <li>• Abnormal diagnostic tests</li> <li>• Isolation required</li> </ul>	<p><b>Moderate signs/symptoms</b></p> <ul style="list-style-type: none"> <li>• Experiencing a few signs &amp; symptoms on occasion</li> <li>• Experiencing moderate side effects but continuing treatment with symptomatic relief.</li> <li>• Improving diagnostic tests from previous testing</li> <li>• Isolation may still be needed</li> <li>• Decreased potential to transmit</li> </ul>	<p><b>Minimal sign/symptoms</b></p> <ul style="list-style-type: none"> <li>• Rarely has any signs/symptoms</li> <li>• Feels well most of the time</li> <li>• Rarely experiencing side effects and continuing treatment.</li> <li>• Improving Diagnostic tests from previous testing</li> <li>• Isolation Lifted</li> <li>• No potential to transmit</li> </ul>	<p><b>No signs/symptoms</b></p> <ul style="list-style-type: none"> <li>• No communicable/ infectious disease</li> <li>• Not experiencing any signs or symptoms</li> <li>• Tolerating treatment regimen without side effects</li> <li>• Diagnostic tests within therapeutic range for condition or returned to normal</li> <li>• Radiology normal or stable</li> <li>• No isolation needed</li> <li>• No potential to transmit.</li> </ul>

**Appendix D**

**Plan, Do, Study, and Act (PDSA) Tool**

Name of Project	The Loring LTBI and TB Prevention Clinic
Start Date	September 2015
End Date	Spring 2016
Objectives	<ol style="list-style-type: none"> <li>1. Witness an increase of the KBS ranking score for each patient addressing TB/LTBI disease and process knowledge.</li> <li>2. To increase LTBI completion rates at the Loring TB/LTBI health center.</li> <li>3. To have all patients able to recall the signs and symptoms of active TB.</li> <li>4. To create an environment of support and caring for the patient and their family.</li> </ol>
Plan	<p>See timetable</p> <p><b>Questions to be answered:</b>          How will the DNP student know if the program is an improvement?          What driver does the change impact?          What does the DNP student predict will happen?</p>
Do	<p><b>Test the changes:</b>          Was the cycle carried out as planned?          Record data and observations.          What was observed that was not part of the plan?</p>
Study	<p>Did the results make the DNP students predictions?          Compare the result of your test to your previous performance, what was learned?</p>
Act	<p><b>Decide to Abandon, Adapt, or Adopt</b>  <u>Abandon</u>: Discard this change idea  <u>Adapt</u>: Improve the change and continue to test, describe what changes are to be made.  <u>Adopt</u>: Select changes to implement on a larger scale</p>

<b>Title</b>	<b>Role on Team</b>	<b>Task Assigned /Implementation</b>
DNP Student	Project Manager, Change Agent, PHN	Implementation plan, policies and procedure as well as benchmarks and timelines. Data Collection. Research. Omaha and Nightingale notes.
CEO	Director of Educational Center	Review
Wellness Center Nurse Manager	Health Wellness Center Nurse Manager	Implementation plan, policies and procedure as well as benchmarks and timelines
Family Nurse Practitioner	Primary Care Provider	Physical assessment, dx, prescribed therapy.
Staff RN	DOT	Record and administer DOT
Staff RN	DOT	Record and administer DOT
Office Associate	Office Clerk	Scheduling
Nurse Epidemiologist	TB Controller State of Maine	Prescription approval and supply dispensing
Epidemiologist Director	Director of Infectious Diseases, State of Maine CDC	Review
Maine CDC Medical Director	Medical Director State of Maine CDC	Mentor for DNP (c)