Assessing the tuberculosis (TB) screening compliance rates and treatment completion among international students at the University of Kentucky

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Abstract

**Background:** Tuberculosis early screening and diagnosis are cost-effective strategies for infection control. Tuberculosis elimination which is aimed for 2030 requires that both latent tuberculosis and active disease be fully treated. This study measures the tuberculosis screening rates and treatment completion rates among the international students at the University of Kentucky between 2016 and 2018.

**Methods:** This retrospective cohort study included all J1 and F1 student visa holders enrolling from 2016 fall to 2017 fall. To accommodate the nine months treatment completion, the cohort period overlapped to 2018. Data were provided by the University Health Services and the sample size was 645 students. Screening rates and treatment completion rates were determined using Stata version 15 software. Bivariate analysis using chi-squared tests was done to study associations between rates and gender or program of study.

**Results:** The screening rate was 74% of all those eligible, n=645. Rates were higher in 2016 than 2017, 72.8% and 56.3% respectively. Health colleges screened less than the non-health colleges. Among the two testing methods, tuberculin skin test (TST) and interferon gamma release assay (IGRA), the IGRA reported more students indicating that the majority of international students come from high TB risk countries. Treatment acceptance and completion were very low of all the 64 students recommended for treatment. Only 11 students initiated, and completion rate was 3%.

**Conclusion:** The study reported 74% screening rates and very low treatment completion rates indicating barriers in the care cascade. Among the identified potential barriers is the financial costs of doing the blood test,$89 which is not covered by the student health plan. Lack of treatment options especially the short course regimens, may have a significant contribution to the low treatment completion rates. There is need for the University of Kentucky to invest financially to...
improve the student health plan benefits. This will ensure that the shorter regimens are available as options leading to improved rates.

**Keywords:** Screening, tuberculosis, treatment completion, Isoniazid
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List of Abbreviations

ACHA: American College health Association
BCG: Bacillus Calmette-Guerin (tuberculosis vaccine)
CDC: Centers for Disease Control and prevention
DOT: Directly observed treatment
FDA: Food and Administration
HIV: Human Immune Virus
IGRA: interferon gamma release assay
INH: Isoniazid (tuberculosis drug)
IRB: Institutional Review Board
LTBI: latent tuberculosis infection
RIF: Rifampin (tuberculosis drug)
TB: tuberculosis
TST: tuberculin skin test
UHC: Universal health coverage
UK: University of Kentucky
UNAIDS: Joint United Nations Programme on HIV/AIDS
WHO: World Health Organization
Introduction

Tuberculosis (TB), an infectious disease dating back to ancient times is mainly airborne spread, often affecting lungs but may also disseminate to other parts of the host body. Transmission occurs when a person with active disease coughs or sneezes, releasing contaminated droplets into the surroundings which are then inhaled by others (CDC, 2016). The pathophysiology of TB starts with exposure to the infection (inhaling contaminated droplets), followed by the first stage termed latent tuberculosis infection (LTBI). In the latent stage the causal germ (mycobacterium tuberculosis) is sleeping and the host is asymptomatic and non-infectious. Progression to the second stage, termed active TB disease is subject to the immune status and is marked by symptoms, and an infectious host (WHO, 2018). The time from latency to active disease, which is directly related to the immune status, offers a window for cost-effective intervention.

Treating latent TB, is therefore a cost-effective strategy in preventing the progression to tuberculosis disease. Poor intervention result in morbidity and mortality since TB can be fatal. According to WHO, TB cases are reported from all countries and from all age groups thus making it one of the top global public health challenges (WHO, 2018). The Global Tuberculosis Report 2018, (WHO, 2018) identified 30 countries as high risk, with 20 or more incidence cases per 100,000 population annually (figure 1). These countries are distributed in the following world regions; Sub-Saharan Africa, Central Asia, South-East Asia, Pacific, Russian federation and South Americas (WHO, 2018).

The Centers for Disease Control and Prevention (CDC), reported 1,3 million TB related deaths worldwide in 2017 (CDC, 2017) and in the US alone, a total of 9,105 cases of TB were reported, with the incidence rate at 2.8 cases per 100 000 persons. The incidence rate has been
gradually decreasing over the years, however, the report pointed out that the rate of decline remains too slow to achieve TB elimination in the current century in the United States. Out of all reported cases in 2017, 70% occurred among non-US born persons. (CDC, 2017a).

Treating TB does come at a very high cost considering the health expenditure and the loss of income due to disability associated with disease complications. Inadequately treated drug-susceptible tuberculosis progresses into drug resistant TB which has been reported as one of the top emerging global health threats (CDC, 2017b).

The comprehensive intervention approach aims at; prevention, identifying high risk populations, diagnosis and treatment completion. Screening in this context can be understood as a risk assessment process mainly done using a questionnaire containing items specific to TB exposure. The selection of individuals for screening is often based on clinical, social and environmental risk factors; there are two main categories of individuals eligible (ACHA, 2017); those at high risk of being exposed to active TB and those with medical conditions that lowers their immune system response. This includes immigrants from TB endemic regions and employees or residents of high risk institutions such as healthcare facilities, homeless shelters, correctional facilities and crowded informal settlements. Individuals with conditions associated with progression of latent TB to active disease due to low immunity include those living with HIV or any debilitating health condition, those on immunosuppressing treatment such as chemotherapy as well as those in the extremes of age groups (Patel et al., 2018).

Testing, which can be classified under screening as well as diagnosis, uses two procedures; Tuberculin skin test (TST) and Interferon-gamma release assay (IGRA). Tuberculin skin test is an intradermal injection usually administered on the inner surface of the forearm
during the first visit. The individual is expected to have a second visit where the test is read, often after 48 to 72 hours as marked by the immune reaction induration (Patel et al., 2018). Interferon-gamma release assay is the latest TB test approved by the Food and drug administration (FDA) in the US (CDC, 2016). It is a one visit blood test conducted in clinical laboratories at a higher cost compared to the skin test.

Treatment of Tuberculosis depends on the diagnosis because each TB category has a different drug therapy regimen. The categories encountered are; latent TB infection, drug susceptible TB disease and drug resistant TB disease. For this capstone, the focus of treatment regimens will be on the latent TB category since active cases have not been reported for the targeted period. There are three regimens for treating latent tuberculosis namely; Isoniazid (INH) once daily drug for nine months, Rifampin (RIF) once daily drug for four months and a new drug combination recently approved by Food and Drug Administration (FDA) in November 2014, of Rifapentine + Isoniazid, once-weekly for three months (CDC, 2017b). The older regimens in the treatment of latent TB are self-administered while the new regimen is administered under directly observed therapy (DOT). The type of support, either self or observed administration has compliance implications and affects treatment completion rates (CDC, 2017b).

Milestones and challenges in the fight to eliminate tuberculosis started with Dr Robert Kock’s discovery of the bacillus mycobacterium tuberculosis, the microbe causing tuberculosis in May 24th, 1882 (WHO, 2018) hence the annual commemoration of the World TB day, every March 24th. A second important milestone was the development and adoption of TB vaccine by a French bacteriologists Calmette and Guerin, between 1908 and 1921, hence the naming “Bacillus Calmette-Guerin vaccine” (BCG) (Britannica, 2019). The 1940s saw the development and use of antibiotics to effectively treat tuberculosis. The World Health Organization in 1993 came up with
The End TB strategy in their global emergency declaration (WHO, 2018). A development to intensify the fight towards TB elimination globally was endorsed in 2014 and 2015, with a recent additional emphasis of political commitment, on 28th September 2018 (WHO, 2018). The strategy was finally titled “United to End TB”, with projected milestones of reducing TB cases and deaths by 2025 and an end to the TB epidemic by 2030 (WHO, 2014).

Challenges affecting and threatening the “United to End TB” strategy include issues of universal health coverage, socio-economic factors, funding, co-morbidity with HIV and emerging drug-resistance. Universal health coverage (UHC) which means everyone receives required health services regardless of their income status, is key in achieving effective TB prevention, diagnosis and treatment.

**Literature review**

Tuberculosis screening, targeted testing and treatment has compliance challenges which can be categorized as patient level barriers, health provider level barriers and health-care system barriers (Katrat and Flood, 2018). On the patient barriers, personal characteristics, age, mental status, support and general understanding of the condition have the major influence. A qualitative study done by Watkins and colleges (2004), pointed out that an individual’s personality has an influence on treatment adherence. Non-compliance is often reported among certain personalities which providers often refer to as “difficult cases”.

Health provider knowledge gaps are also a major contributor to patient non-compliance since they affect the trust that the patient should have in their provider especially when their treatment concerns are not adequately addressed (Katrat and Flood, 2018). Health care system barriers for the tuberculosis program include insufficient promotion of effective diagnostic tests, treatment options, and poor policy reinforcement strategies. Financial barriers add to the burden
of compliance because they affect access to care leaving uninsured individuals with high rates of non-compliance (Derose and colleagues, 2009). Migrating individuals were noted to take a longer time to secure insurance coverage, meanwhile, they are under pressure to comply with the immigration and refugee health policy on issues of tuberculosis.

**Knowledge**

Latent TB is challenging because it is asymptomatic, and individuals are non-infectious. The absence of symptoms means it demands a great deal of convincing on the patient side by the treatment provider. How the information is packaged and relayed is very important and often determines compliance because different cultures interpret illness and wellness differently, hence the need for culture competent healthcare providers (ACHA, 2017). Findings from a study done in rural China (Fong, 2004), revealed that good understanding of a disease condition and the care process resulted in high motivation for care and compliance. In that study, patients were eager to take their latent tuberculosis treatment way beyond the stipulated time frame because they wanted to ensure that TB was completely uprooted. Compliance to care is also reported to be high among individuals who experience severe symptoms prior to treatment initiation (Tomas et al., 2013).

Knowledge, therefore, should include the individual’s understanding of treatment options, duration of treatment, adverse effects of medication, outcome benefits, and consequences of defaulting (Stuurman et al., 2016). Misconceptions about TB encountered, often can be linked to cultural understanding and native language meanings. In a study to assess the benefit of interpreter services in TB care (Khan et al., 2005), it was revealed that the cultural understanding of the model of disease often paints a different picture from what the interpreter
relays. Misconceptions about a disease often lead to the utilization of alternative therapies such as religious based and traditional based (Edginton and colleagues, 2002).

*Tuberculosis screening among college students*

College students are at risk to contracting communicable diseases such as tuberculosis infection within their campuses. Infection control measures are very important in preventing outbreaks especially since tuberculosis is airborne. Colleges have a high degree of person-to-person interactions because of the dormitory settings (Jewett et al., 2016). The American College Health Association (ACHA) Guidelines have issued college student health screening requirements among U.S. resident and international students for tuberculosis (TB) and vaccine-preventable diseases (ACHA, 2017).

The risk of exposure can be determined by the academic activities, certain study programs have more exposures to the public especially the high risk populations in settings such as hospitals, correctional facilities, shelter homes and others). Students are at a higher risk of exposure when volunteering, conduction research, mentoring, studying abroad, travelling and employed (Jewett et al., 2016). Health professions students due to their high risk of exposure to TB have an academic programmatic requirement to screen annually for TB (ACHA, 2017).

*Stigma and Support*

Compliance in the TB care process requires support from care providers, family, peers and community as a whole (Coreil et al., 2004). The complexity of the care process especially the duration of treatment and the associations with HIV and drug-use, attracts a stigma towards infected individuals. Stigmatized persons feel ashamed, socially isolated and profiled leading to fears of losing jobs, housing and other anticipated opportunities (Tomas et al., 2013). Fostering a functional relationship between provider and patient has proved to be beneficial. The directly
observed therapy (DOT) popular with TB cases offers treatment support, however, it also creates stigma. Patients under DOT, in a study done in Vietnam, complained that they felt degraded from adults to minors because they are prevented from managing their own treatment process (Johansson and colleagues, 1996). The use of interpreters in the TB care process for migrant populations has been reported to create stigma due to loss of privacy, and can lead to non-compliance (Coreil et al., 2004).

Monthly reviews, home visits and phone discussions offered are supportive and assist to retain individuals in care (Tomas et al., 2013). Incentives such as small rewards and treatment milestone certificate have been reported to encourage and motivate patients (Lutge et al., 2015). These can be anything of interest to the patient such as pizza vouchers or movie tickets especially for the college student population, enhancing a buy-in towards care (ACHA, 2017).

*Treatment duration and side effects*

The main intention of screening and testing is to treat those found to be positive either as active cases or as latent TB infection. There is a direct relationship between treatment completion and knowledge of TB, however the two other major factors affecting treatment are the duration and side effects of medication (Katrak and Flood, 2018).

A systematic review of the interventions for improving TB treatment adherence, revealed that a shorter course of regimen has higher completion rates as compared to the longer regimens (Stuurman et al., 2016). This can be viewed on the basis of stigma, pill burden, general inconvenience as well as the developments of medication side effects. TB drugs and alcohol are both metabolized in the liver, and intake of both synergizes towards liver problems. Alcohol intake, therefore, is discouraged during the TB treatment course and it can be a serious social
inconvenience when one is enrolled into the long regimen (Munro et al., 2007). This inconvenience has an effect on treatment acceptance and completion rates.

Medication side effects, real or anticipated, have a cultural interpretation as evidenced by findings from a TB treatment adherence study. The study revealed non-compliant patients having more knowledge about possible side effects than about the benefits of treatment (Sebastian and Bothamley, 2000). Strategies and investments in research towards developing shorter course options should be considered to improve treatment completion rates.

Gender and Tuberculosis

Gender plays a role in accepting treatment and completion while rates vary among males and females. In some countries, men show commitment and better outcomes than women, but in other countries it is the opposite (UNAIDS and Stop TB, 2016). Motivation in care which has a positive influence on compliance, has been reported more among females than males (Munro et al., 2007). Females, therefore, are often more receptive to health programs, provided there are no cultural misconceptions discouraging them from the program. In that same study, it was revealed that the red colored urine which is a result of one of the TB drugs, led to non-compliance in a population which associated urine abnormalities with sexual rejection by the partner. There seem to be a higher incidence rate of TB among males as compared to females in general, due to social and work-related exposures as well as differences in health seeking behaviors (Fazlul, 2007). Females were however, noted to delay seeking care due to stigma issues, access issues and religious issues.

Study purpose:

• To measure the TB screening, testing and treatment compliance rates among the International students enrolled at the University of Kentucky between 2016 to 2018.
• To evaluate the effect of gender and study program on screening rates
• To identify gaps in the processes: (screening, testing and treatment completion) and make recommendations for improvement.

Methods

The purpose of the study was to measure TB screening, testing and treatment compliance rates among international students enrolling at the University of Kentucky between 2016 fall semester to 2018 spring semester. In the first section are research questions, research design and the TB program workflow. The second section details the methodology of the study which includes a description of the study population, inclusion criteria, data variables, data coding, data analysis and research question. The third section is about ethical considerations.

Research questions

Do TB screening rates differ based on gender or with study program?

a) $H_1$: the screening rates are higher among females than males

b) $H_1$: the screening rates are higher among the health programs than non-health programs

Research design and TB screening workflow

A cohort retrospective empirical study was chosen to address the research questions. The study subjects are enrolled in a nine months long program but for some, it can be shorter depending on the outcomes of each step because there are progressive losses at all stages of the care cascade. This period starts with risk assessment, followed by testing and finally treatment hence it qualifies as a cohort design. The TB screening program workflow is a long cascade with several steps marked by outcomes after each step. The workflow events are shown in figure 2. Compliance is marked by responding positively to the process within the first six weeks of
enrollment for that semester. In this study, risk assessment and testing were lumped together as two phases under screening.

Methodology

Study Population

The target population were international students holding a J1 and F1 visas. J1 visa is based on exchange by specific agreements between the US and home countries, F1 visa is generally for non-exchange programs, independent students often self-sponsored with no agreement between their countries and the US (US Embassy, 2019).

Inclusion and exclusion criteria

In addition to J1 and F1 student visa, enrollment considered was between 2016 fall and 2018 spring with no discrimination on the basis of race, age, gender and study program. Students were enrolled if they were in a study program with duration that could enable TB program completion. Exclusion criteria included students holding other types of visas other than J1 and F1 such as the visitor’s visa.

Data source and Variables

The dataset was provided by the University of Kentucky, University Health services and only the requested variables were provided. These included study program, type of screening tests, test results, additional testing, gender, treatment regimen status, treatment completion status and hold list for non-compliance. All variables were categorical, three of them were dichotomous while the rest had more than two categories. Screening, results and treatment completion are dependent variables while, gender and study program are independent variables. Data were received already de-identified from the source and the University of Kentucky, Institutional
Review Board (IRB) determined the study to be exempted from review. The sample size was 645 participants.

*The study program*

Study programs were assessed individually across the colleges in the University of Kentucky making 18 categories under the variable. The “other” category included students enrolled for non-degree programs such as post baccalaureate and short programs. Health colleges were also assessed and compared to non-health colleges.

*Screening, testing and results*

Screening was initiated via an online questionnaire (figure 3) by all eligible for the TB program and reviewed by the nurse who assessed for risk factors. Individuals coming from low risk countries and who showed no risk factors on the questionnaire were discharged from the process. Testing is done using two methods: the tuberculin skin test (TST) and the Interferon gamma release assays (IGRA) which is a blood test. The two tests are assumed to have comparable sensitivity and specificity hence each is considered independently (WHO, 2011).

Coding for the tests; TST= 1, IGRA = 2, low risk country = 3 and none-compliant = 4

The choice between the two tests is based on prior exposure to the TB vaccine, and individuals who had prior exposure are recommended to have the blood test, IGRA (WHO, 2011).

Results for testing were reported as positive/significant, negative/non-significant, none and low risk country. Positive results indicate TB infection in either latent or active form, hence the need for further testing to rule out active TB. Individuals with no risk factors and originating from low risk countries are exempted from proceeding with the process because TB infection is less likely. Coding for testing variable; positive= 1, negative = 2, low risk country = 3, n/a = 4

Gender: gender was coded as either female or male. Coding for gender; female =1 , male =2
Treatment completion status

A positive test means the individual was exposed to TB infection, and additional tests and clinical evaluation leads to the conclusion on whether it is latent or active TB Disease. Latent TB infection requires treatment just like TB disease (WHO, 2011). Some decline initiating treatment, some start and never complete while others start and complete. Coding for treatment: Completed = 1, incomplete = 2, declined = 3 and N/A = 4.

Hold list for non-compliance

Responding to the TB screening order is a university requirement in alignment with the refugee, immigrant health policy (CDC, 2012). Students not responding to screening online questionnaire within the first six weeks of the enrollment semester, are electronically flagged as non-compliant in their student account. This further activates a “hold” on their account impeding registration for courses in the following semester. This “hold”, acts as a reinforcement for the screening program. Coding for hold: compliant = 1 and non-compliant = 2

Data analysis

Data were analyzed with Stata version 15 software. Descriptive statistics were generated, and tables were produced. Bivariate analysis using chi-square tests was performed to examine, (1) the relationship between screening rates and gender, and (2) the relationship between screening rates and study program.

Threat to Validity

The main threat to external validity lies with the fact that data recording was not completely standard in all the semesters. Internal validity was threatened by the handling of the study program variable which has many groups spread out with a possibility of affecting analysis.
Results

Descriptive Statistics

The study population in this data analysis consisted of 645 international students eligible for TB screening, who were enrolled at the University of Kentucky between 2016 and 2018. There were 375 students in 2016 and 270 in 2016. Among total sample, 42% of students were female and 58% were male. Both 2016 and 2017, individually showed the same trend of male predominance, 55.7% and 61.1% respectively. Colleges with more females compared to males were the college of health sciences, agriculture fine art and public health. The rest of the colleges had more males than females.

Eighteen categories of study program were recognized and the participating individuals were distributed across (figure 4). The top 5 study programs in the period 2016 to 2018 with the highest number of students were the college of engineering at 20.8%, college of art and science at 20.2%, the “others” group at 13.5% which included non-degree programs not otherwise specified, the college of business & economics at 12.1% and the college of agriculture at 10.2%. Study programs with less than 1% of students included the college of; communication and information, dentistry, design, nursing and health sciences among others. There were no students at the college of law.

Screening rates

Screening compliance rate was 73.9%, and non-compliance was 26.1%. Individuals from low risk countries, with no risk factors 8.1% (table 1), were exempted from testing after the risk assessment and they are considered to have completed screening. Comparing the two consecutive years, 2016 had higher rates, 72.8% than 2017, 56.3% (table 2). Two testing methods were offered, skin test and blood test and in both years, the blood tests rates were
higher: 57% in 2016 and 87.5% in 2017. This may indicate that the number of students from high risk countries is higher compared to those from low risk. In 2016, health colleges screening rate was 63.1% compared to 73.3% of non-health colleges. In 2017, health colleges screened at 22.6% compared to non-health colleges at 60.7%. The general trend was health colleges were screening at a lower rate, yet they are assumed to have a knowledge advantage as well as a specific academic program requirement to screen for tuberculosis annually. The total positive test rates between 2016 to 2017 were 15.1% and they were all latent TB infection, no active TB cases were found.

Bivariate analysis

When screening rates were compared by gender, there was no significant difference between male and females (p=0.495). There was, however, a significant difference when screening rates were analyzed by study program (p=0.002) (table 3). Screening rates were higher in those programs with less number of students, the college of communication and information only had two students in total and both were compliant with screening scoring them 100%, while programs with a high number of students tends to have lower screening rates (figure 5). The college of engineering, even though ninety one students screened, but because they were a big group, they scored 67%.

Treatment completion rates

Individuals recommended for treatment are all those who tested positive, n=64 in 2016 to 2017. Compliance rate with initiating treatment was 17.2% while declining treatment rate was at an alarming 82.8%. Incomplete treatment rates were 14.1% and completion rates were very low at 3.1% (figure 6). Comparison was not done between the two years because 92% of all those who tested positive were in 2016, hence there was a very small number of positive individuals in
Since only one treatment regimen, isoniazid course was offered, treatment completion rates could not be compared among other regimens. Of the two students who completed treatment, one was from a health college and the other from a non-health college. Treatment acceptance and initiation rates were very low in both years, while declining treatment was very high, indicating an opportunity for an intervention.

Discussion

This retrospective cohort study found screening rates to be 74% of all those who were eligible (n=645). That 26% were non-complaint indicates barriers associated with screening; these barriers can occur on the patient side, provider side, the system, as well as other stakeholders. International students have financial barriers to care because processing the student health insurance for some may have delays meaning they should pay out of pocket for their screening. Knowledge and understanding of the need and benefits of screening varies among the population of students especially for those with no previous health related professional background. Some study programs have an academic requirement of TB screening such as the health professions where students are mandated to screen annually and that may have a reinforcing effect.

Health provider related barriers include lack of culture competency skill which is important in engaging individuals towards a buy-in (ACHA, 2017). Potential barriers revealed by the study can be associated with the sensitization and awareness process. TB screening sensitization takes place once during the orientation when the semester begins. Students that miss that orientation session, may not have another opportunity to hear about it until they encounter a hold in their student account when registering for courses in the following semester. A financial barrier was also identified and has potential to affect the TB program activities. The blood test (IGRA) costs
$89 and is not covered by the student health insurance, while the skin test (TST) cost $49 and is covered. What determines the choice of a test is previous exposure to the TB vaccine which is routinely given in high risk countries as a national policy. Therefore, students coming from high risk countries may need to pay out of pocket for their test. IGRA test has a higher specificity at 95-100% compared to TST at 60% because it does not cross react with the TB vaccine. Previous exposures are discouraged from skin testing since it may affect the quality of the results.

The most commonly preferred regimen is Isoniazid self-administered for nine months and has been considered the standard in the US. It is preferred because it is more efficacious and cheaper than the shorter six months regimen (CDC, 2017b). The downside of this regimen is low treatment completion rates which averages at 30-50% in the US (Horsburgh, 2010). Shorter regimens are reported to have higher completion rates at 85-90%. The study findings showed 15.1% of all those who tested were recommended for treatment (n=64) and they are the same individuals who tested positive. Of those recommended to receive treatment, 17.2% initiated treatment, while 82.8% declined treatment. It is important to treat latent tuberculosis to prevent reactivation and further spread of the disease. The isoniazid regimen has been reported in previous studies to be associated with poor treatment acceptance and low treatment completion rates often due to the inconvenience of a long duration treatment.

Side effects also contributes to non-completion, but in the isoniazid regimen, they are rare, yet serious at 1.8% (Kunst, 2010). Alcohol restriction during TB treatment may also contribute to declining treatment and low completion rates associated with a long treatment course such as isoniazid regimen. Lack of symptoms in Latent TB makes it hard to convince patients of the need and benefits of preventative treatment especially considering the cultural and language differences. Among the individuals who initiated treatment (n=11), 15.1% could not proceed
beyond the first month of initiation, they were all lost to follow up without any reasons. The study could not conclude on the occurrence of side effects. Only 3.1% (n=2), completed treatment of all those who tested positive and were recommended for treatment (n=64). One student was from a health college while the other was from a non-health college.

The motivation behind treatment completion is expected to be more for those in health colleges because they are assumed to have a better understanding of the need and benefits of TB treatment. In addition to knowledge, students from health colleges are academically mandated to have TB screening annually. There is often an inverse relationship between completion rates and treatment duration (Horsburgh, 2010). Factors aiding treatment completion, are educating students in their primary language, ensuring confidentiality, provider competency and offering incentives to mark milestones (ACHA, 2017). Educating all international students in their primary language, may not be always achievable since some of them come from minority ethnic groups of the world with limited representation in the US.

The TB program in the University of Kentucky has no known incentives other than a certificate at the end of the treatment duration to mark completion. Social interventions such as adherence coaching often benefit patients who are struggling with remaining in care and the study did not find evidence of such interventions. The other contributing factor to completion, is how the provider relays the information to the patient, information that requires the patient to ‘opt in’ to care is often associated with refusal of care, while information that automatically ropes the patient in and the incentive is to opt out, often have a high acceptability of care. Screening rates did not vary among the males and females even though literature reported females to be more receptive and motivated in most health programs (UNAIDS and Stop TB, 2016).
Analyzing treatment completion rates was impeded by the fact that only one treatment type is offered. It is important to find out how students behave with other treatment types so that the one with positive outcomes is invested in by the program.

Evidence gaps and future directions

How students are sensitized about the TB screening may need to be strengthened, with such communication happening once during the orientation, it may not be adequate. Communication needs to be ongoing considering that at the beginning of a semester new international students may face a lot of challenges both academically as well as adjusting socially. Some periodic email reminders may prove to be helpful and not even costly. There may be a financial barrier in this program with limitation on the tests as well as the treatment regimens all connected to what the student health insurance covers. Students need not pay out of pocket for services that are not luxury but a necessity such as the blood test (IGRA). This test is indicated for all who were prior exposed to TB vaccine which a significant number of international students are. In this study, of all those who tested, the majority of them had the blood test (IGRA) (figure 7), which further supports the demand. The student’s health plan only supports the long course regimen, Isoniazid with its documented poor acceptability and completion rates, the outcome can almost be easily predicted. The argument is that the shorter regimens are more costly and may need staff supervision, yet even though, cost effectiveness is not only on the basis of cost per pack, it can be viewed on the basis of a significant reduction on TB cases due to greater uptake, completion and less toxic side effects. To improve the treatment completion, shorter regimens must be covered by the student health plans and this will require the University of Kentucky, Health services to invest more funding towards the success of the TB program.
Incentives have been reported to have a positive effect in motivating and it is a known reality that people respond to incentives. Non-cash incentives such as movie tickets or pizza vouchers may be appealing to students. There is need to invest in incentivizing the program cost-effectively.

Targeted adherence counselling does improve completion rates by trying to address individual’s challenges and also gives the sense of social interaction with the provider. This can also be done telephonically to ensure less discomfort, confidentiality and time saving. Another opportunity that can be considered to aid adherence is the video directly observed therapy (v-dot). This is when a provider connects with patient at specific times to observe them take their meds via a video call. It also embraces the sense of social intervention and offers a window to address quick concerns (Holzschuh, 2017).

Limitations and strengths

The strengths of the study involve the direct communication with the implementors of the program which also was the data source, it enabled clarity on the process and aided with more information. As an international scholar, I personally went through TB screening at some point and that aided understanding of the process and findings. The limitation in this study is the fact that only one treatment regimen is offered and that affected comparison when analyzing the completion rates and further impeded the bivariate analysis.

Conclusion

The goal of the study was to assess how the TB program is performing by analyzing the screening rates and treatment completion rates. There were potential weaknesses identified on treatment acceptance and completion. The findings and conclusions from this study could reflect any public health TB program in other institutions and further research is necessary to evaluate best practices from a cost effective standpoint. Future studies may need to assess the provider
culture competency and the effect of a hold for non-compliance. Academic institutions need to align with the Immigrant and refugee health policy and improve TB screening which is the main strategy towards TB elimination in the United States.
References:


6. Center for Disease Control and Prevention (CDC, 2012). Immigrant refugee health; medical examination of immigrants and refugees
   https://www.cdc.gov/immigrantrefugeehealth/exams/medical-examination.html


Biographical Sketch

This capstone was completed by Bongiwe Malinga. Bongiwe earned her Bachelor of Medicine and Bachelor of surgery (MBChB) from the University of Zimbabwe and has been a practicing physician in family medicine for several years in Swaziland, Southern Africa. Bongiwe received the Fulbright scholarship to come and study public health in the United stated, University of Kentucky and concentrate in Population Health policy and management.

Contact email: malingabongiwe15@gmail.com
Appendices

Figure 1: Global tuberculosis incidence by regions

Estimated TB incidence rates, 2017

WHO 2018 Report

Figure 4: Descriptive statistics across the Study programs
Figure 2: Tuberculosis screening workflow at the University of Kentucky (UK)

1. *J1 & F1 visa holders list compiled by the UK international students center*  
   (Sensitization about TB screening done during orientation)

2. Online risk assessment and appointment schedule accessed through MYUK platform and filled by the students in the first 6 weeks of semester, failure to do so, result in a HOLD on student account.

3. Nurse reviews online forms; → if no risk factors & from low risk countries → discharge  
   If risk factors present, or from high risk countries  
   (eligible for the TB testing)

4. screening tests; TST (skin test) or IGRA (blood test) → negative result; → discharge  
   Positive result  
   (schedule physician visit; diagnostic work-up)

5. treatment regimens; for latent TB (LTBI)  
   - 9months with isoniazid; self-administered daily

6. termination; can take any of the three;  
   - completion  
   - non-completion  
   - decline
Figure 3: Risk assessment online screening form
### Table 1: Summary of Results

<table>
<thead>
<tr>
<th>Category</th>
<th>(N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
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<td>100</td>
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<td>Gender</td>
<td>F 271, M 374</td>
<td>F = 42, M = 58</td>
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<tr>
<td>Screening</td>
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<td>74</td>
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<tr>
<td>Non-compliant (HOLD)</td>
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<tr>
<td>Testing rate</td>
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<td>Treatment completion</td>
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### Table 2: Comparing the two years; 2016 and 2017

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<td>Total eligible for study</td>
<td>N= 375</td>
<td>N= 270</td>
</tr>
<tr>
<td>Screening (total)</td>
<td>72.8 %</td>
<td>56.3 %</td>
</tr>
<tr>
<td>Health colleges Screening</td>
<td>63.1 %</td>
<td>23.3 %</td>
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<tr>
<td>Non-health colleges screening</td>
<td>73.3 %</td>
<td>60.7 %</td>
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<tr>
<td>Skin test (TST)</td>
<td>42.0 %</td>
<td>12.5 %</td>
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<tr>
<td>Blood test (IGRA)</td>
<td>57.8 %</td>
<td>87.5 %</td>
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<tr>
<td>Declined treatment</td>
<td>88.1 %</td>
<td>80 %</td>
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<tr>
<td>Completed treatment</td>
<td>1.7 %</td>
<td>20 %</td>
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Table 3: Stata bivariate analysis output

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. tab Screentest Gender, col chi2

Key

frequency  column percentage

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Pearson ch2(3) = 2.3600  Pr = 0.501
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. tab Screentest Pstudy, col chi2

Key

frequency  column percentage

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35
Figure 5: Screening rates by study program
Figure 6: Showing treatment completion status for all recommended for treatment

![Pie chart showing treatment completion status (N=64). Complete: 83%, Incomplete: 14%, Decline: 3%.]

Figure 7: Screening tests for all eligible for the screening

![Pie chart showing screening tests: IGRA (blood test) 39%, TST (skin test) 27%, Low risk country 8%, Non-compliance 25%.]