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Patients' Perception of a Community Pharmacist-Managed Multidrug-Resistant Tuberculosis Program in Peru: A Public Health Perspective

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Abstract

Objectives: The primary objective is to investigate the public's perception about the role of the community pharmacist in Peru's directly observed treatment, short course (DOTS) program. The secondary objective is to assess perceived barriers that would prevent the public from utilizing community pharmacists in order to identify future opportunities for community pharmacists to increase adherence to multidrug-resistant tuberculosis (MDR-TB) therapy. **Design:** Qualitative study comprised of an 8 close-ended survey questionnaire.

Setting: Healthcare clinics established by a medical mission group in Lima and surrounding communities, Peru, from July 13 to July 27, 2015. **Participants:** Patients 15 years of age and over who sought healthcare at the clinics. **Main outcome measures:** Public's perception about the role of the community pharmacist in Peru and barriers that would prevent the public from seeking a community pharmacist. **Results:** Out of the 445 patients approached, 438 patients completed the survey, resulting in a 98% response rate. More than half (52%) of the respondents were likely to seek a community pharmacist to assist them in completing a MDR-TB medication regimen. Almost half (48%) of the respondents felt comfortable with assistance of a community pharmacist in completing an MDR-TB regimen. The physician was the first health care professional that was contacted for all medical situations, including drug-related questions (61%). Lack of privacy in the pharmacy (53%) and busyness of the pharmacists (52%) were the top perceived barriers for asking community pharmacists questions. **Conclusion:** This study highlights the need for pharmacist participation in Peru's DOTS program. Furthermore, this investigation has identified several issues of concern related to current community pharmacy practice in Peru. Therefore, future efforts may be necessary to address these identified areas of opportunity to promote the community pharmacist's role in health screening, drug therapy monitoring, and counseling to decrease the public health burden of MDR-TB.

Keywords: Community pharmacists; Multidrug-resistant tuberculosis; Perceptions; DOTS; Barriers; Peru

Introduction

Tuberculosis (TB) is one of the oldest diseases known to man, caused by the bacteria *Mycobacterium tuberculosis* that affects the lungs and other parts of the body, such as the spine, kidneys and brain. In most cases, TB is treatable and curable, given proper and timely treatment. However, if left untreated or improperly treated, TB causes progressive tissue destruction and, eventually, death.¹ The first drug to be used for TB was streptomycin, initially providing successful clinical improvement. However, drug-resistance was recognized shortly after its introduction in the 1940s, demonstrated by treatment failure following the first three months of therapy in 82 percent of patients being treated with streptomycin.² The term drug-resistant TB refers to cases of TB caused by an isolate of *M. tuberculosis* that is resistant to one of the first-line treatment options, including ethambutol, isoniazid, pyrazinamide, rifampin or streptomycin.³ Multidrug-resistant tuberculosis (MDR-TB) refers to an isolate of *M. tuberculosis* that is resistant to at least isoniazid and rifampin, the two most effective first-line medications.^{1,2,3} Extensively drug-resistant tuberculosis (XDR-TB) is a type of MDR-TB that is resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line medications (amikacin, kanamycin, or capreomycin).⁴

TB remains a concerning global infectious disease, and a leading cause of morbidity and mortality in the world.⁵ In fact, TB is second only to HIV/AIDS as the greatest global killer due to a single infectious agent.⁶ The World Health Organization (WHO) reported 9 million cases of TB and 2 million deaths in 2013. Of these cases, approximately 480,000 developed MDR-TB and 210,000 deaths occurred. Globally, MDR-TB incidence has decreased between 1993 and 2013 from 2.4 percent to 1.3 percent. Despite the overall decline, surveys of worldwide drug resistance indicate MDR-TB is a major and increasing crisis, with increasing rates in the country of Peru.² It is necessary to emphasize that MDR-TB is a man-made public health issue.^{7,8} As previously mentioned, TB is treatable and curable. Inadequate health systems, however, contributes to delayed diagnosis and insufficient and incomplete treatment.⁹ The development of MDR-TB is precipitated by an inadequate course of treatment. The reason for this is multifactorial, including improper health care provider prescribing practices, poorly supervised treatment programs, inadequate infectious disease control in hospitals and prisons, patient medication noncompliance, and limited access to health care.¹⁰

The epidemiology of MDR-TB is complex, needing control efforts targeting the multi-level factors. There are several public health interventions necessary for the reduction of MDR-TB including diagnosis, treatment, and medication adherence promotion. Directly observed treatment, short-

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course (DOTS) refers to a TB control strategy outlined by the WHO, with the following components: increased financing, case detection, supervised standardized treatment and monitoring, effective drug supply and management. The program requires a laboratory confirmed TB diagnosis by a trained clinician, procurement of TB drugs, and medication adherence enforcement through direct observation by a health care provider.¹¹

The disease imposes an economic and social burden on societies. It is estimated that about 2 billion dollars per year is required for the proper detection and treatment of MDR-TB; an additional 2 billion dollars is required for research and development for novel vaccinations, drugs and diagnostics for TB.^{12,13} Managing MDR-TB cases is extremely challenging. Current treatment regimens of MDR-TB use drugs that are less effective, more toxic and often must be administered for 12 to 18 months.¹ Directly observed therapy (DOT) refers to a strategy in which a patient takes each prescribed dose of a medication in front of a health care provider. MDR-TB programs that include DOT have reduced the transmission of the disease in communities in Baltimore and New York.¹⁴

In 1990, Peru's National Tuberculosis Control Program (NTP) made revisions to follow the WHO's DOTS approach, including case detection, diagnosis, and directly observed therapy. The composition of the teams included a doctor, a nurse, a social worker, a trainer, a nutritionist, a lab technician, a nurse technician, and a logistics coordinator. Nurses administered the drugs in a health care facility, incentivizing the patients with food packages, employment training, and free transportation.¹⁵ Despite these achievements, Peru continues with a high prevalence of MDR-TB and XDR-TB, concentrating in Lima and El Callao. Over the 2006-2013 period, morbidity from TB was 108.5 per 100,000. In 2013, there were 27,504 new TB cases reported and 1,462 laboratory-confirmed MDR-TB cases, with 80% of cases diagnosed in the age group from 15 to 59 years old. Furthermore, 59% of the drug-sensitive TB cases, 82% of the MDR-TB cases, and 93% of the XDR-TB cases occurred in Lima and El Callao.^{16,17}

The current DOTS program exists in an effort to control morbidity and mortality of tuberculosis, with no participation of community pharmacists. The rising rates of MDR-TB in Peru demonstrate its shortfalls. Therefore, methods of DOTS in the country need to be improved so that every at-risk individual is reached. In addition, DOTS programs should also be scaled up to ensure that every at-risk MDR-TB patient in the community is targeted. This is not currently common practice, nor the intention of DOTS programs around the world, but a campaign for eradication—not just control—should entail all members of the population afflicted by TB.¹⁴

As previously mentioned, the most important preventative measure against MDR-TB is adherence and completion of the

prescribed TB medication regimen, and proper medication counseling by health care professionals including expected side effects, duration of treatment, and pertinent information increases medication compliance in MDR-TB patients.¹⁸ Failure of patients to follow medication directions has been well established regardless of age or social standing.¹⁹ The reasons for non-compliance are multifactorial, including adverse effects, drug-drug interactions, and misunderstanding of directions by patients.²⁰ Medication compliance is the extent to which the patient takes medications as directed. Failure of medication compliance, or non-compliance, has been well established regardless of age or social standing.^{21,22} Factors that cause MDR-TB non-adherence and incompleteness of the prescribed medication regimen include length of treatment and drug-related problems, including adverse effects and interactions, contribute to patient non-compliance.^{18,23} As previously mentioned, treatment regimens for MDR-TB must be administered for 12 to 18 months. Podewils, Gler, Quelapio, and Chen²⁴ found that patients were 3 to 4 times more prone to interrupt their MDR-TB treatment between 6 and 12 months and 12 to 18 months after initiating treatment. Hirpa et al.¹¹ concluded that proper medication counseling by health care professionals, including expected side effects, duration of treatment, and pertinent information increases medication compliance, the most important preventative measure against MDR-TB, in these patients. Pharmacists, drug experts, are in a unique position to provide this crucial counseling of MDR-TB medications to ensure adherence and completion of the regimen.²⁵ However, if pharmacists are not perceived as essential or indispensable, and patients do not seek a community pharmacist for medication advice to improve compliance, their role seems to be uncertain.

Pharmacy Practice in Peru

Approximately 10,000 pharmacies serve the population of Peru, and must be registered with the Ministry of Health. There are currently 17 schools of pharmacy in the country. The curriculum is five years followed by six to twelve months of practice. The duration of this internship is different for each university because there is no formal accreditation process. After graduation, pharmacists can attend continuing education programs that are provided by the National Pharmacy Board and universities.²⁶

The Ministry of Health issues the norms for dispensing drugs in pharmacies in Peru. The *Good Practice of Dispensing Manual* outlines, regulates, and establishes the dispensing process. The norms require a safe distribution and dispensing process to reduce negative clinical outcomes. The law mandates that a pharmacist must be on the premises to dispense medications. However, this function is often performed by pharmacy technicians or assistants. In Peru, it is uncommon for information, including a medication monograph with expected side effects, instructions on missed doses, and other pertinent details, to be provided when a patient is dispensed a

drug. Although patients seek the advice of pharmacists regarding their disease states and medication use, there are no protocols for this activity. Medication counseling by a pharmacist is rarely performed to patients because the offer to counsel is not mandated by law. Thus, a patient may not be aware of such a service, and may lead to medication non-compliance.¹⁶ If a patient does request counseling, pharmacists are required by the law to inform patients about the reason(s) for use of the medications and what effect to expect, the correct use of the medication, necessary actions for missed doses, and the use of devices such as asthma inhalers or insulin injections.²⁶

Objectives

To our knowledge, no other research has been published assessing the public's attitudes toward the community pharmacist's role in Peru. The present study aimed to investigate the public's perception about the potential role of the community pharmacist in Peru's DOTS program. Furthermore, it served to assess perceived barriers that would prevent the public from utilizing community pharmacists in order to identify future opportunities for community pharmacists to increase adherence to MDR-TB therapy.

Methods

Participants

The survey canvassed 445 patients in 5 different communities outside of Lima, where clinics were established to serve the medical needs of several communities. The participants included in this project were the patients that the primary researcher, a registered pharmacist, served during the clinic days. A non-probability, convenience sampling technique was used. This investigation attempted to provide insight regarding the patients' perception of community pharmacists to find ways to reduce the incidence of MDR-TB; patients that are representative of the entire population will not be considered. Therefore, participants were selected because of their convenient accessibility and proximity to the researcher.²⁷ Des Moines University Institutional Review Board approved all survey procedures prior to survey commencement.

Instruments

The in-person surveys utilizing a questionnaire (Appendix 1) were developed to assess the patients' perception of community pharmacists and barriers that would prevent the patients from seeking medical expert advice from a pharmacist. Six pharmacists were invited to assess the content validity of the questionnaire. In addition, the survey was translated into Spanish, and pretested in Peru by a translator to examine participants' responses to the survey and to evaluate the reliability of the data yielded by the questionnaire.

The current survey consisted of eight close-ended, comprehensible, and easy to understand questions. The close-ended questions provide easier categorizations and quantification of findings, and minimize inadvertent bias in interpreting specific responses. These questions were adaptations from the questionnaires used in the study performed by Al-Arifi,²⁸ and El Hajj, Salem, and Mansoor,²⁹ that surveyed patients to gain insight about the population perception regarding pharmacist's performance as health care providers in the community setting. A 5-point Likert scale (not at all, slightly, somewhat, very, extremely) was utilized for four questions to measure the extent to which patients agree with statements regarding accessibility of healthcare clinics and pharmacists, and the likelihood and comfort level of the patients to seek the advice and expertise of a community pharmacist for MDR-TB (Table 2). One question assessed barriers that would prevent the participants from asking any questions to a community pharmacist by selecting all applicable statements from a list. Three questions included close-ended questions asking respondents about what healthcare professional they would choose for certain medical situations and conditions.

Data collection and analysis

Portable clinics were implemented by a medical mission group, and provided primary care, optometry, dental, and pharmacy services. The pharmacy in the clinics mirrored the design of a community pharmacy, in that medications were dispensed from a prescription written by a health care provider. Functionally, the portable clinics mimicked community pharmacies, therefore, it is reasonable to assume patients' expectations for the role of community pharmacies and pharmacists, as well as the services received between the two types of sites, would be similar. After providing medications to the patients, the translator and researcher asked every fifth patient that sought pharmacy services from the established clinics to participate in the study. The in-person surveys utilizing a questionnaire were anonymous. Responses were coded and reviewed for accuracy. Descriptive statistics, including percentages and frequencies, were computed to summarize survey findings, with all computations performed using SPSS version 22.0.

Results

Survey sample

During the two week study period, 445 patients were approached, and 438 (Table 1) of them answered the survey, resulting in a 98% response rate. Respondents varied in age from 15-88 years, with a mean age of 43 years. Approximately half of the respondents were from age groups of 36-45 (24.7%) and 56 and above (24.7%). Male respondents are 52%, while female respondents are 48%. Additionally, married respondents are greater in number (58.4%), compared to single and others.

Patients' perception on accessibility of healthcare and community pharmacists, and involvement of community pharmacists in MDR-TB therapy

Table 2 summarizes the patients' perception of burden in accessing healthcare and community pharmacists and the patients' perception of the community pharmacist's involvement in MDR-TB therapy. These results showed 6.4% of participants were not at all burdened, 34.7% slightly burdened in accessing a healthcare clinic with a doctor or nurse, 33.8% were slightly burdened, 17.6% were very burdened, and 7.5% were extremely burdened. Furthermore, the results showed 22.6% were not at all burdened, 26% were slightly burdened in accessing a community pharmacist, 24% were slightly burdened, 21.9% were very burned, and 5.5% were extremely burdened.

Additionally, when asked if the respondents already had tuberculosis, 34% were very likely and 17.8% were extremely likely to seek a pharmacist to help them complete their medication regimen. Only 21.9% were somewhat likely, 24% were slightly likely, and 2.3% were not at all likely to seek a pharmacist to assist them complete their TB medication therapy. Furthermore, 30.8% of the respondents were very comfortable and 17.4% were extremely comfortable with the pharmacist's involvement of ensuring the completion of an MDR-TB medication therapy, while 24.4% were slightly comfortable, 22.1% were slightly comfortable, and 5.3% were not at all comfortable.

Patients' choice of a healthcare professional for obtaining medications

As shown in Table 3, more than half of the survey respondents (58.4%) seek a doctor to provide them with their medications, while only 18.7% seek a community health worker, 13.7% seek a pharmacist, and 9.1% seek a nurse. Furthermore, a majority of survey respondents (82.2%) of survey respondents would seek a doctor for tuberculosis medications if diagnosed with the disease state, while only 7.1% would seek a community health worker, 6.4% would seek a nurse, and 4.3% would seek a pharmacist.

Potential barriers of asking questions to a community pharmacist

As shown in Table 4, survey respondents most frequently cited busyness of pharmacists (52.1%) and lack of privacy in the pharmacy (53%), and a higher trust in doctors compared with pharmacists (45.7%). Other barriers included lack of awareness of the ability of the pharmacist to answer drug and disease related questions (38.4%), fear or intimidation of asking the pharmacist (30.1%), unavailability of the pharmacists to answer my questions (30.1%), and lack of the pharmacist's knowledge to answer drug and disease related questions (25.6%). It is important to note that multiple responses were permitted for this question; therefore, the

percentages cannot be added together. The results basically represent rankings of the potential barriers.

Patients' choice of a healthcare professional for various health reasons

As shown in Table 5, for all five situations, survey respondents chose doctors as the first healthcare professional they would visit for mental and emotional problems (67.1%), questions regarding medication side effects (54.6%), how to properly take medications (51.8%), drug-related questions (61.2%), and selecting over-the-counter medication products (41.8%).

Discussion

This study was the first of its kind in Peru to examine the general public's perception regarding community pharmacy services in an attempt to identify areas of opportunity for pharmacists to increase adherence to prescribed MDR-TB treatment. Several issues of concern, however, related to current community pharmacy practice in Peru were raised in this study. An overwhelming 82.2% of participants would seek a doctor first for medications for MDR-TB, and 55% rated the physician as their primary source of medication-related information. Furthermore, when asked about different barriers preventing them from asking the community pharmacist drug-related questions, 45.7% of patients felt higher trust in doctors compared to pharmacists. This agrees with a study by El Hajj et al.,²⁹ who found physicians were considered the first healthcare professional contacted by patients to answer drug-related questions by 50% of respondents. Unfortunately, this suggests a problem with the patient-pharmacist relationship in Peru, reinforcing the importance of comprehensive and regular medication counseling by pharmacists; obligations rarely offered in community pharmacies in Peru. The respondents who did not consider the community pharmacist as their primary source of medication-related questions may not be aware that the pharmacists are trained and capable of providing such services. Therefore, Peru's community pharmacists should participate in MDR-TB public health campaigns to raise expectations from the public and other healthcare professionals about their professional role. This campaign must demonstrate the potential benefits of MDR-TB medication adherence and completion with pharmacists' involvement by extending their contributions to medication use beyond ensuring accurate dispensing.

The results of this investigation showed the patients' perceived accessibility to community pharmacists and healthcare clinics with a provider or nurse to be about equal. Approximately 73% of respondents were not burdened or somewhat burdened in seeking a pharmacist. Therefore, community pharmacists in the country are ideally positioned to serve as a public health resource to diagnose and treat ailments, including MDR-TB. However, from the patients' perspective of this study, it does not appear that community

pharmacists are taking full advantage of this benefit of accessibility. Although 10,000 pharmacies serve the population of Peru, 52.1% and 30.1% of respondents in this study perceived busyness of the pharmacists and unavailability of the pharmacists to answer drug-related questions, respectively, as barriers of communicating with community pharmacists. This agrees with the results of Al Akshar, Metwaly, and Shamssain,³⁰ which showed 35% and 36% of respondents perceived the same barriers, respectively. These perceived barriers appear to support the findings that in Peru few pharmacists are on location, and the dispensing is often performed by assistants who are not always technicians, even though the law requires a pharmacist on the premises during business hours. Additionally, patients are not regularly offered medication counseling by a pharmacist because the law does not require it. Therefore, in order for Peru's pharmacists to allocate adequate and quality time with their patients, more pharmacy technicians need to be hired; delineating the roles between pharmacists and technicians. Thus, pharmacists can devote more time to patient-centered activities, including MDR-TB medication counseling, while technicians focus on the dispensing processes. Furthermore, medication counseling by a pharmacist must be legally offered to every patient that obtains medications.

Privacy in the pharmacy was another issue raised in this study. Of particular note, 53.0% of respondents stated that a lack of privacy in the pharmacy was a barrier to seek the help of a community pharmacist. This can be attributed by the lack of private consultation areas in the majority of community pharmacies in Peru, as shown in a study by Alvarez-Risco, et al.²⁶ Additionally, 30.1% of the respondents were fearful or intimidated of asking a pharmacist medication related questions. Perhaps, if community pharmacies invested in consultation rooms or areas, more patients would seek pharmaceutical care counseling without the perceived fear or intimidation.

The last issue of concern was the patients' lack of awareness of the ability of the pharmacist to answer drug and disease related questions. Approximately 40% of the participants viewed this issue as a barrier of seeking the help of community pharmacists. The study by Alvarez-Risco, et al.,²⁶ evaluating the pharmaceutical care in Peruvian community pharmacies, provides insight on this issue. First, Peru's community pharmacists are trained from diverse curricula; some not adequately preparing graduates to assume the role of pharmaceutical care providers. Second, pharmacy continuing education is rarely offered to Peru's community pharmacists, and is not required for licensure. Future recommendations to address these deficiencies include development of uniform concepts in research and training, development of protocols for pharmaceutical care activities, laws mandating a minimum number of continuing education credits for licensure renewal

to ensure participation in inter-professional pharmacy programs.

The results of the survey are promising in terms of advancing the community pharmacist's role in Peru. More than half (51.8%) of the patients would be extremely/very likely to visit a pharmacist for assistance in completing an MDR-TB medication regimen. Furthermore, almost half (48.2%) would be extremely/very comfortable with a pharmacist's involvement in completion of an MDR-TB medication treatment. These findings support the claim that patients seek the advice of pharmacists regarding their disease states, including MDR-TB, and medication use. Although patients may not consider the pharmacist as their first choice to answer their medication-related questions, they view pharmacists as capable of integrating disease state management with medication compliance. This shows the public's awareness of the various professional services that community pharmacists can provide; beyond the duty of accurately dispensing medications. These findings contradict the results of other studies, including Iverson et al.,³¹ where participants did not expect the community pharmacist to monitor their long-term illnesses. Additionally, El Hajj et al.²⁹ claimed that more than 70% of participants disagreed with the expectation of a pharmacist to assess the patient's health progress to ensure safe and effective medication use. As previously mentioned, these tasks are the precise elements necessary to increase the adherence and ensure completion of an MDR-TB medication regimen. Promisingly, the results of this study show that if community pharmacists in Peru were to expand their role to cognitive pharmaceutical care, the patient would be likely and comfortable to seek pharmacist-involved MDR-TB services. Therefore, from the patients' perspective, pharmacists could assume the role of administering MDR-TB medications in Peru's DOTS program to ensure adherence and completion with proper medication counseling, including expected side effects, duration of treatment, and pertinent information.

Limitations

This study had several limitations. First, a convenience sample was used, and may not fully represent the whole population in Peru. Second, the surveys were conducted after participants sought pharmaceutical care at the clinics established by the medical mission team. This could lead to potential bias in responses, as patients may have felt obligated to respond positively after receiving such care. Third, the survey was conducted in a direct questioning manner, potentially causing the patients to feel rushed in answering the questions. Finally, the study relied on translation and interpretation. As it was culturally appropriate to do so, it is possible that there was an imperfect translation, even though careful planning, piloting, and consideration were given prior to beginning the study.

Conclusion

This study is the first known attempt to investigate the public's perception about the role of the community pharmacist in Peru in order to identify future opportunities for pharmacists to increase adherence to MDR-TB therapy. Despite its limitations, this study provided valuable data, on which future investigations can be built. The study suggested a strong likelihood and comfort of the public in seeking the community pharmacist if they were diagnosed with MDR-TB. Therefore, from the patients' perspective of this study, participation of the pharmacist in the Peru's DOTS program could potentially increase patients' adherence to an MDR-TB medication regimen, thus decreasing this public health burden in a country with rising rates of this disease state.

Patient adherence and completion of a prescribed TB medication regimen is the most important preventative measure against MDR-TB. It is clear that comprehensive medication counseling to include expected side effects, duration of treatment, and pertinent information increases medication compliance. Community pharmacists in Peru are in a unique position to provide this vital information to MDR-TB patients. Additionally, the results of this investigation reveal that pharmacists are perceived as important members of the healthcare team, as demonstrated by their awareness of their various roles and services. Therefore, community pharmacists should provide comprehensive counseling to all patients with MDR-TB.

The investigation revealed several perceived barriers that would prevent the public from utilizing community pharmacists, including lack of privacy in the pharmacy, unawareness of pharmacist abilities to answer drug and disease related questions, and inadequate pharmacist-patient contact time. Future studies focusing on the pharmacists' perception regarding these barriers would be necessary and revealing. These investigations would likely provide insight on the challenges of the community pharmacist, including daily operations in the pharmacy that prevent comprehensive medication counseling.

References

1. Helms RA, Quan DJ, Herfindal ET, Gourley DR. In: Zeind CS, Hardy H, Gourley GK. *Textbook of Therapeutics: Drug and disease management*. 8th ed. Philadelphia, PA: Lippincott Williams & Williams;2006:1940-1966.
2. World Health Organization. Multidrug-resistant tuberculosis. http://www.who.int/tb/challenges/mdr/mdr_tb_factsheet.pdf?ua=1. Accessed February 3, 2015
3. Levy SB, Marshall B. Antibacterial resistance worldwide: Causes, challenges and responses. *Nat Med*. 2004;10(12):122-129.

4. Centers for Disease Control and Prevention. Extensively drug-resistant tuberculosis fact sheet. <http://www.cdc.gov/tb/publications/factsheets/drtb/xdrtb.htm>. Accessed August, 30, 2017.
5. Centers for Disease Control and Prevention. Multidrug-resistant tuberculosis fact sheet. <http://www.cdc.gov/tb/publications/factsheets/drtb/mdrtb.htm>. Accessed March 22, 2015.
6. Andrews J, Shah NS, Weissman D, Moll AP, Friedland G, Neel NR. Predictors of multidrug- and extensively drug-resistant tuberculosis in a high HIV prevalence community. *PLoS One*;5(12):157-164.
7. Kliiman K, Altraja A. Predictors of extensively drug-resistant pulmonary tuberculosis. *Ann Intern Med*. 2009;150(11):766-775.
8. Manjourides J, Lin H, Shin S, et al. Identifying multidrug resistant tuberculosis transmission hotspots using routinely collected data. *Tuberculosis*. 2012;92(3):273-279.
9. Casal M., Vaquero M, Rinder H, et al. A case-control study for multidrug-resistant tuberculosis: Risk factors in four European countries. *Microb Drg Resist*. 2009;11(1):62-67.
10. Singla N, Singla R, Jain G. Tuberculosis among household contacts of multidrug-resistant tuberculosis patients in Delhi, India. *Int J Tuberc Lung Dis*. 2011;5(10):1326-1330.
11. Hirpa S, Medhin G, Girma B, et al. Determinants of multidrug-resistant tuberculosis in patients who underwent first-line treatment in Addis Ababa: A case control study. *BMC Public Health*. 2013;13:782-789.
12. Mahmoudi A, Iseman, MD. Pitfalls in the care of patients with tuberculosis. Common errors and their association with the acquisition of drug resistance. *JAMA*. 1993;270(1):65-68.
13. Wilke MH, McShane H. TB vaccine development: where are we and why is it so difficult? *Thorax*. 2015;70(3):299-301.
14. Brudney K, Dobkin J. Resurgent tuberculosis in New York City. Human immunodeficiency virus, homelessness, and the decline of tuberculosis control programs. *Am Rev Respir Dis*. 2011;144(4):745-749.
15. Bonilla C, Bayona J. Building political commitment in Peru for TB control through expansion of the DOTS strategy. *Bull World Health Organ*. 2007;85(5):402.
16. Mitnick C, Bayona J, Palacios E. Community-based therapy for multidrug-resistant tuberculosis in Lima, Peru. *N Engl J Med*. 2003;348(2):119-128.
17. Suarez PG, Watt CJ, Alarcon E, et al. The dynamics of tuberculosis in response to 10 years of intensive control in Peru. *J Infect Dis*. 2001;84(4):473-478.
18. Srivastava S, Pasipanodya JG, Meek C, et al. Multidrug-resistant tuberculosis not due to noncompliance but between-patient pharmacokinetic variability. *J Infect Dis*. 2011;204(12):1951-1959.

19. Migliori GB, D'Arcy Richardson M, Sotgiu G, Lange C. Multidrug-resistant and extensively drug-resistant tuberculosis in the West. Europe and United States: Epidemiology, surveillance, and control. *Clin Ches Med*. 2009;30(4):637-655.
20. O'Donnell MR, Wolf A, Werner L, et al. Adherence in the treatment of patients with extensively drug-resistant tuberculosis and HIV in South Africa: A prospective cohort study. *J Acquir Immune Defic Syndr*. 2014;67(1):22-29.
21. Pierre-Jacques M, Safran DG, Zhang F, et al. Reliability of new measures of cost-related medication nonadherence. *Med Care*. 2008;46(4):444-448.
22. Schuz B, Marx C, Wurm S, et al. Medication beliefs predict medication adherence in older adults with multiple illnesses. *J Psychosom Res*. 2011;70(2):179-187.
23. Bell JS, Whitehead P, Aslani P, et al. Drug-related problems in the community setting: Pharmacists' findings and recommendations. *Clin Drug Investig*. 2006;26(7):415-425.
24. Podewils LJ, Gler MT, Quelapio MI, Chen MP. Patterns of treatment interruption among patients with multidrug-resistant TB (MDR TB) and association with interim and final treatment outcomes. *PLoS One*. 2013;8(7):1-8.
25. Schommer JC. Patients' expectations and knowledge of patient counseling services that are available from pharmacies. *Am J Pharm Educ*. 1997;61:402-406.
26. Alvarez-Risco A, Foppe van Mil JW. Pharmaceutical care in community pharmacies: Practice and research in Peru. *Ann Pharmacother*. 2007;41(12):2032-2037.
27. Issel, L.M. (2009). *Health program planning and evaluation: A practical, systematic approach for community health* (2nd ed.). Sudbury, MA: Jones and Bartlett Publishers.
28. Al-Arifi MN. Patients' perception, views and satisfaction with pharmacists' role as health care provider in community pharmacy setting at Riyadh, Saudi Arabia. *Saudi Pharm J*. 2012;2(4):323-330.
29. El Hajj MS, Salem S, Mansoor H. Public's attitudes towards community pharmacy in Qatar: A pilot study. *Patient Prefer Adherence*. 2011;5:405-422.
30. Al Akshar S, Metwaly Z, Shamssain M. Patients' perceptions of community pharmacy practice in UAE: An overview. *IOSR J Pharm Biol Sci*. 2014;4(11):8-14.
31. Iversen L, Mollison J, MacLeod TN. Attitudes of the general public to the expanding role of community pharmacists: A pilot study. *Fam Pract*. 2001;18(5):534-536.

Appendix 1

Participants' Demographics:

Age	Gender		Marital Status			
	M	F	Single	Married	Divorced	Widow

Question 1:

Rate your burden on getting to a healthcare clinic with a doctor or nurse from 1 (not at all burdensome) to 5 (extremely burdensome):				
1 Not at all Burdensome	2 Slightly Burdensome	3 Somewhat Burdensome	4 Very Burdensome	5 Extremely Burdensome

Question 2:

Rate your burden on getting to a community pharmacist from 1 (not at all burdensome) to 5 (extremely burdensome):				
1 Not at all Burdensome	2 Slightly Burdensome	3 Somewhat Burdensome	4 Very Burdensome	5 Extremely Burdensome

Question 3:

What healthcare professional do you seek to provide you with medications? (Choose one)			
Doctor	Nurse	Pharmacist	Community health workers

Question 4:

If you already had tuberculosis, who would you go see first for your medications? (Choose one)			
Doctor	Nurse	Pharmacist	Community health workers

Question 5:

If you already had tuberculosis, how likely would you seek a community pharmacist to help you take all of your medications from 1 (not at all likely) to 5 (extremely likely)?				
1 Not at all Likely	2 Slightly Likely	3 Somewhat Likely	4 Very Likely	5 Extremely Likely

Question 6:

If you already had tuberculosis, rate your comfort level of a community pharmacist to help you take all of your medications from 1 (not at all comfortable) to 5 (extremely comfortable)?				
1 Not at all Comfortable	2 Slightly Comfortable	3 Somewhat Comfortable	4 Very Comfortable	5 Extremely Comfortable

Question 7:

What barriers prevent you from asking any question to a community pharmacist? (Choose all that apply)

- Fear or intimidation of asking the pharmacist
- Lack of awareness of the ability of the pharmacist to answer drug and disease related questions
- Lack of pharmacist’s knowledge to answer drug and disease related questions

- Busyness of the pharmacists
- Lack of privacy in the pharmacy
- Unavailability of the pharmacists to answer my questions
- Doctors are trusted more than pharmacists
- Doctor will be offended if I ask the pharmacist

Question 8:

For each of the following, who would you go to first?		
a. Talk to me when I am fearful, distressed, concerned, or sad mentally or emotionally		
Doctor	Pharmacist	Nurse
b. Talk to me about serious side effects of my medications		
Doctor	Pharmacist	Nurse
c. Talk to me about how to take medications		
Doctor	Pharmacist	Nurse
d. Talk to me about my drug related questions		
Doctor	Pharmacist	Nurse
e. Talk to me about products I can get over-the counter, such as cough and cold medicine		
Doctor	Pharmacist	Nurse

Table 1. Demographics of survey respondents (n=438)

Characteristics	No. (%) (unless otherwise indicated)
Age	
Mean (range)	43 (15-88)
15-25	67 (15.3)
26-35	95 (21.7)
36-45	108 (24.7)
46-55	60 (13.6)
56 and above	108 (24.7)
Sex	
Male	228 (52)
Female	210 (48)
Marital status	
Single	172 (39.3)
Married	256 (58.4)
Divorced	3 (0.69)
Widowed	7 (1.6)

Table 2. Survey respondent perceptions of accessibility of healthcare and community pharmacists, and involvement of community pharmacists in MDR-TB therapy (n=438)

Item	No. (%)
Rate your burden on getting to a healthcare clinic with a doctor or nurse.	
Not at all burdensome	28 (6)
Slightly burdensome	152 (35)
Somewhat burdensome	148 (34)
Very burdensome	77 (18)
Extremely burdensome	33 (7)
Rate your burden on getting to a community pharmacist.	
Not at all burdensome	99 (23)
Slightly burdensome	114 (26)
Somewhat burdensome	105 (24)
Very burdensome	96 (22)
Extremely burdensome	24 (5)
If you already had tuberculosis, how likely are you to seek a community pharmacist to help you take all of your medications?	
Not at all likely	10 (2)
Slightly likely	105 (24)
Somewhat likely	96 (22)
Very likely	149 (34)
Extremely likely	78 (18)
If you already had tuberculosis, rate your comfort level of a community pharmacist to help you take all of your medications.	
Not at all comfortable	23 (5)
Slightly comfortable	97 (22)
Somewhat comfortable	107 (25)
Very comfortable	135 (31)
Extremely comfortable	76 (17)

Table 3. Survey respondent opinions about choice of healthcare professional for obtaining medications (n=438)

Item	No. (%)
What healthcare professional do you seek to provide you with medications?	
Doctor	256 (58)
Nurse	40 (9)
Pharmacist	60 (14)
Community health worker	82 (19)
If you already had tuberculosis, who would you go see first for your medications?	
Doctor	360 (82)
Nurse	28 (7)
Pharmacist	19 (4)
Community health worker	31 (7)

Table 4. Survey respondent opinions about potential barriers for asking questions to community pharmacists (n=438)

Item	No. (%)
Fear or intimidation of asking the pharmacist	132 (30)
Lack of awareness of the ability of the pharmacist to answer drug and disease related questions	168 (38)
Lack of the pharmacist's knowledge to answer drug and disease related questions	112 (26)
Busyness of the pharmacists	228 (52)
Lack of privacy in the pharmacy	232 (53)
Unavailability of the pharmacists to answer my questions	132 (30)
Doctors are trusted more than pharmacists	200 (46)

Note: Multiple responses were permitted for this question; therefore, the percentages cannot be added together. The results basically represent rankings of the potential barriers.

Table 5. Survey respondent opinions about choice of healthcare professionals (n=438)	
Item	No. (%)
For each of the following, who would you go to first?	
Talk to me when I am fearful, distressed, concerned, or sad mentally or emotionally.	
Doctor	294 (67)
Pharmacist	40 (9)
Nurse	104 (24)
Talk to me about how to take medications.	
Doctor	239 (55)
Pharmacist	143 (33)
Nurse	56 (12)
Talk to me about how to take medications.	
Doctor	227 (52)
Pharmacist	131 (30)
Nurse	80 (18)
Talk to me about my drug related questions.	
Doctor	268 (61)
Pharmacist	106 (24)
Nurse	64 (15)
Talk to me about products I can get over-the-counter, such as cough and cold medicine.	
Doctor	183 (42)
Pharmacist	152 (35)
Nurse	103 (23)