Improving Tuberculosis Case Detection and Treatment Adherence in Ethiopia: Using Behavioral Economics to Redefine the Need for Cultural Competence

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Abstract

Tuberculosis case detection and treatment success rates in the country of Ethiopia trail those of neighboring sub-Saharan African countries, despite comparable application of DOTS [1]. This paper is the first of a two-part series to theoretically and practically assess ways in which models of cultural competence and behavioral economics can be implemented to improve TB outcomes in Ethiopia. In this first article, perceived irrationality on the part of the TB patient will be explained via application of behavioral economics. Three tenets of behavioral economics are defined and analyzed: loss aversion, hyperbolic discounting, and social bias. These components are then used to describe the ways in which cultural competence can be re-evaluated in the context of global health, with emphasis on tuberculosis in Ethiopia. The analysis concludes by offering the Purnell Model of Cultural Competence to parse the patient irrationality as perceived by providers (and identified via principles of behavioral economics) from the inherent cultural norms of the patient to better inform TB control efforts.

Keywords: Cultural competence, behavioral economics, global health, Ethiopia, tuberculosis, Purnell model
One must have sympathy. However, this sympathy is true only when one admits rightly and profoundly to oneself that what has happened to one human being can happen to all. Only then can one benefit both oneself and others.

Søren Kierkegaard, 1844

Background
In Ethiopia, tuberculosis (TB) is endemic. The country ranks seventh out of the 22 highest-burden TB countries [1]. The numbers of TB cases have increased every year and a total of 1,166,863 TB patients received directly observed therapy – short course (DOTS) treatment in the last 10 years through the World Health Organization (WHO) initiative [2]. Despite the high number of individuals who have received treatment, a significant number of Ethiopians with active TB remain undetected. The country’s case detection rate (CDR\(^1\)) is 28%, the lowest in sub-Saharan Africa, as compared to its southern neighbor, Kenya, with case detection rates estimated at over 70% [3,4]. Moreover, the treatment success rate (TSR) of DOTS-treated TB in Ethiopia remains relatively low at 78%, with TB representing one of the country’s leading causes of hospital mortality [3,5]. This trend is largely attributed to weak infrastructure and uneven delivery of health services, particularly in rural regions (where 85% of the population live). Indeed, in 2005 only 40% of Ethiopians lived within 10 km of a health center, with physician-and nurse-to-civilian ratios at 1:35,000 and 1:5000, respectively [6]. Previous authors have also demonstrated a lack of disease prevention empowerment at the household and community levels to be at the root of suboptimal TB TSR [6].

This paper is the first in a series investigating the role of cultural competence in global health. The series is focused on the application of culturally competent care among TB patients and susceptibles.\(^2\) The current paper focuses on a brief, but rigorous theoretical understanding of the reasons for poor CDRs and TSRs in Ethiopia using the tenets of behavioral economics. It will be followed with an assessment of how cultural competence – in particular, the Purnell Model of Cultural Competence – may explain and improve these outcomes. The second paper of the series will provide results from intensive in-country observations examining how the Purnell model can be used to improve TB-related outcomes. It will also provide a conceptual framework for re-assessing integration of culturally competent care within a global context.

TB Interventions in Ethiopia
Ethiopia was of particular interest in investigating the utility of cultural competence. The country has experienced at least two unique efforts at TB control within the last two decades. “TB clubs” are a grassroots, cultural-social institution created by former TB patients and endemic to the country. They were first introduced in the Estie district of South Gondar administrative zone, Amhara region of northwestern Ethiopia in January 1997. TB patients in the same kebeles, or families, formed treatment “clubs” in order to arrange their follow-up treatments to take place at

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1 We define case detection (CDR) and treatment success rate (TSR) as other authors have done, in particular Datiko and Lindtjorn (2009). CDR: the number of new smear-positive cases detected divided by the estimated number of incident smear-positive cases, expressed as a percentage; TSR: the number of patients cured or treatment completed divided by the total number of patients reported expressed as a percentage.

2 “Susceptibles” in this series refers to potential future patients: contacts of TB patients who are or have been contagious. Susceptibles may or may not have TB infection. TB patients are not considered ‘susceptibles.’
the same clinic. These “clubs” generally consisted of three to ten community members who elected a leader that would monitor adverse reactions to treatment among patients, track nonadherence and initiate new members who show TB-related symptoms. Their use promulgated one of the most locally innovative and minimal-cost interventions in recent decades with respect to TB control. After initial introduction in the Estie district, they assisted in significantly increasing patient follow-up (p < 0.001), and increased TSR of smear-positive and smear negative TB to 83% and 79%, respectively [7].

A second, more widespread initiative has marginalized the growth of “TB clubs” in Ethiopia. The government has been in the process of implementing a Health Sector Development Plan (HSDP), divided into stepwise 3-5 year rolling plans, since 1993 to address health access and care issues [5]. The second and most recent portion of the HSDP, known as the Health Extension Program (HEP), was initiated in 2003 to resolve ongoing challenges in improving access to preventive and basic curative interventions, particularly in poor and rural communities [5]. This program deploys two salaried Health Extension Workers (HEWs) to each kebele (village) [5]. Each of these workers receives a year of training at Technical and Vocational Training and Education Centers, which prepares them to: manage operations of health posts; conduct home visits and outreach services to promote preventive health actions; refer cases to health centers; and identify, train, and collaborate with voluntary community health workers. Once deployed, HEWs are responsible for conducting a baseline survey of the village, mapping households, and ultimately submitting to the kebele council an action plan based upon the specific health priorities of the village [6]. Over 30,000 HEWs have been employed by the HEP since its inception. The program selection criteria require that HEW be females over 18 years of age, have at minimum a 10th grade education, and speak the language of the kebele to which they will be assigned [6]. Overall, the program has been considered a significant enhancement in the delivery of health services in Ethiopia. It has demonstrated improvement in multiple measures including the health care worker:civilian ratios, sanitation and vaccination rates (including Bacillus Calmette-Guérin vaccines for TB prevention in children), and malaria morbidity and mortality [8,9].

While a more intensive critical review of each intervention in Ethiopia (“TB clubs” versus the HEW model) is outside the scope of this paper, it is useful to keep in mind the systems within which TB patients and susceptibles face health crises and make health care decisions. Most important is the dichotomy between the active case detection approach of the “TB clubs” versus the more passive strategy of the HEW model. Culturally competent care may take different forms when applied in each system. However, given the growth of the HEW model, we focus on the integration of culturally competent care within that framework. We return to this point when applying the principles of behavioral economics.

Assessment of Health Extension Package: TB Intervention Impact

With regard to culturally competent care, limitations to the implementation of the HEP exist. General criticisms have included disparate success rates between regions, inadequate training facilities, and irregular adherence to the selection criterion that candidates be from the kebele of future assignment (most were from larger woreda (district) towns and not the rural kebeles to which they were ultimately assigned) [6,10]. Each of these points implicates a concern that appears largely overlooked by the implementation of the HEP: that the program has yet to
adequately address the disparities between all regions of Ethiopia in a way that not only achieves proportional equality in resource administration, but just as importantly, cultural sensitivity, a criterion repeatedly demonstrated to be imperative to achieving sustainable outcomes [11-13]. One reason for this exclusion may be due to a lack of a comprehensive, integrated approach to balancing community input with management of the initiative, which has been previously implemented [14] (pg. 13) and demonstrated to improve initiative efficacy [7].

The concerns regarding cultural competency given above are especially important when we consider recent alternative delivery systems to minimize the effects of cultural barriers on TB control. Patient Centred Tuberculosis Treatment (PCT) in Tanzania allowed patients to choose between having their drug intake supervised at the health facility or at home by a supporter of their choice [15]. However, this system also suffered from poor training of health workers, which was a clear impediment to sustainability. Over a quarter of the patients reported not being given a choice and an eighth stated they had not been given enough time to make a decision. Another system in Nepal tested the efficacy of family-oriented DOTS versus community DOTS programs [16]. The authors found similar treatment adherence rates, but noted reduced smear-positive case detection rates for family DOTS (48 and 33 cases per 100,000 population, respectively). These findings suggest that attempting to minimize the effects of cultural differences on TB detection and treatment outcomes using protocols involving people that patients know and are culturally similar to is not necessarily the optimal solution. Instead, a robust and formalized investigation of the reasons for how and why cultural disparities exist may be in order to foster a greater level of relational empathy between patient and provider that improves TB treatment outcomes [17].

To do so, we give additional background of the HEP in Ethiopia to highlight broad areas where cultural factors likely play a significant role in TB control.

Assessments of the impact of HEP implementation on TB CDR and TSR have demonstrated equivocal results. A randomized trial to investigate the improvement of CDR and TSR obtained with use of HEWs showed, at face-value, significantly improved rates, especially among women [18]. There were, however, several important limitations to the study. First, the difference between intervention and control kebeles was small, as HEWs were in fact assigned to both groups. Moreover, the only difference in the training of these workers was that HEWs in the control kebeles “did not received [sic] on job training about how to collect sputum samples and how to support patients to adhere to treatment… [but] provided health services, including health education about TB, to the people living in their kebeles.” DOTS was also provided for patients in both groups, and control and intervention kebeles were neighboring such that cross-over of services between groups could not be excluded. Thus, the significant lack of distinction between the control and intervention groups makes the study’s conclusion that HEWs improved TB CDR and TSR a tenuous one.

In other TB community interventions, Shargie et al. [19] found somewhat disappointing results in their clinical trials assessment of two rural districts in the Hadiya zone of Ethiopia, Lemo and Misha, from 2003 to 2004. In their analysis, although these community-based activities helped to

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3 The authors noted that HEWs provided direct observation of DOTS therapy in the intervention group. However, HEWs operational units (classified as “health posts”) did not provide DOT for TB treatment. Thus it is unclear how HEWs actually observed the DOT therapy.
reduce the time delay of treatment after presenting with symptoms, the initiative did not significantly ($p = 0.12$) improve the extent of case finding of those with TB disease.

There are a number of weaknesses, both broad and specific, associated with this study’s approach to detecting active TB cases in the Hadiya zone. First, the authors did not include smear-negative, symptomatic individuals in their measurement of CDR or in prescribing treatment follow-up protocol, aside from recommending these individuals “to seek further medical attention if their symptoms persisted.” Given that up to one-third of all smear-negative patients with symptoms will likely develop further disease [20], it is somewhat concerning that the authors did not implement a formal system to follow-up with these patients.

Since most Ethiopians feel that it is unproductive to see a Western doctor or pursue Western treatments if no medication is dispensed [21], defining CDR only by the number of smear-positive patients found can have unintended, yet important adverse consequences, since confirming a TB diagnosis in the context of a smear-negative result can take several visits to occur. Moreover, we should not expect smear-negative patients to return for treatment if symptoms persist or become more intense, given their cultural leanings. Thus the authors’ efforts at encouraging symptomatic TB suspects to visit health facilities for evaluation without guarantee of any medication need to be re-considered when assessing the reliability of their case detection rates.4

Within the broader context of modeling incident TB cases, the cultural argument carries potential importance when considering a specific WHO modeling strategy to estimate incidence; that is, the prevalence to incidence method.5 The WHO estimates the duration of TB disease among non-notified cases to be between one and four years, whereas the duration of disease among notified TB cases spans from roughly three months to two years [22]. However, the report also notes that the proportion of incident cases that remains untreated is unknown.6 Thus, we do not have a good understanding of the behavior or follow-up probability of patients with smear-negative TB, particularly when their cultural propensities can dictate their acclimation (or lack thereof) to Western therapies. Particularly striking is the extended time for which these initially smear-negative patients can potentially expose TB to others if they go on to develop disease, as about a third of them likely will.

Use of Behavioral Economics to Explain Patient Outcomes in TB Control

Behavioral economics is a new subfield of economics that seeks to identify and explain why individuals do not behave in ways society considers rational. In other words, once we remove all

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4 This observation can be applied generally as well, since calculation of the CDR frequently involves only smear-positive cases.

5 Incidence is estimated as the prevalence of TB divided by the average duration of disease. This formula has been used to model TB incidence in Ethiopia (in the 2012 WHO report, as one example).

6 The proportion in the analysis by Shargie et al. [19] was about 20%. The authors’ result that the CDR among smear-positive cases in the control group was roughly two-thirds of the estimated national incidence of smear-positive TB cases in 2003 (98.1 versus 155 per 10^5); the comparison of that national incidence with their intervention group CDR was (155 versus 125 per 10^5), leaving roughly 20% incident cases untreated. We hypothesize this to include the ‘disease-status disparity,’ or the proportion of untreated TB cases due to their initial diagnosis as a smear-negative case.
barriers to access of a good or service, be them in terms of high costs, poor distribution channels, knowledge or otherwise, we would normally expect those consumers to take full advantage of those new-found resources to maximize their utility. In terms of important global health issues of the day, behavioral economics can help us to identify when certain interventions might not succeed either in total or in part; assess why they did not succeed; as well help to re-structure the interventions to account for the fact that humans often behave reflexively (i.e., automatically) and therefore do not always act in their own best interests.

Its use in global health, especially TB, is in its infancy. From a global standpoint, why are some patients less inclined than others to seek out and/or complete treatment for TB? The economic rational justifying TB treatment is as follows: since drug-susceptible TB is a curable condition, it behooves individuals to initiate and complete treatment so they may quickly return to their prior level of activity to support themselves and their families. Stated more formally, if the income the patient receives after being cured of TB is more than the investment to treat the disease, it is rational to seek out and complete treatment. There are three elements of behavioral economics that would be useful to consider from the patient-centered perspective as to why patients do not behave rationally when diagnosed with TB: (1) loss aversion, (2) social bias, and (3) hyperbolic discounting.

**Loss aversion** refers to the individual preference of avoiding losses more than obtaining gains. We become “risk-seeking” when faced with potential losses in an earnest attempt to avoid experiencing them. More formally, the utility from death (zero) is less than the utility of life, even if it is perhaps poor quality. Losses and gains are frequently denominated in monetary terms, mostly for experimental convenience. However, we can use the principles in our analysis of global TB control. Loss aversion might be one explanation for deteriorating adherence to TB treatment. When the intensity of symptoms increases, individuals may eagerly seek out various treatments to avoid the prospect of death. When TB treatment begins to improve their physical well-being, the alternative of gaining more health (i.e., being cured) seems less important by comparison, especially when other constraints, such as poverty or access to healthcare, are present. Alternatively, Sagbakken et al. [26] (pg. 1361) described a scenario in Addis Ababa where patients pursued experimental treatment early on that frequently left them so ill and weak that it negatively affected their ability to attend the clinic on a daily basis and be adherent.

The cultural attitude in Ethiopia towards Westernized medicine may even amplify this disparity. Given that many Ethiopians expect immediate treatment with medicine if they are sick, not receiving medication may prolong and exacerbate the symptoms the patient experiences. This delay may promote a particularly sensitive aversion to death and lessen emphasis on the importance of later stages of treatment. Such an aversion could impart erroneous thinking that any treatment is better than nothing to start, even if its effectiveness is strongly questionable (as in the case of monotherapy for active TB) and the patient knows or soon realizes that is the case. In other words, the desire to avoid loss (i.e. death) may not grow at the same rate as the desire to

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7 Examples include pregnant women living in a malaria-endemic area in Kenya that receive free bednets to prevent malaria, but do not use them [23] (see Figure 2) or individuals who receive free condoms to prevent HIV transmission, but do not engage in less unprotected sex [24] (see Table 1).
8 The Center for Global Development has already begun inquiry into the value of behavioral economics in health and development (see [25]).
obtain gains (i.e. healthy years of life). Thus, the greater the inefficiency of care at diagnosis as perceived and experienced by the patient, the greater the likelihood the patient may exhibit loss aversion tendencies and engage in what a provider may interpret as irrational behavior. This sequence is exacerbated by the unfortunate fact that patient delay in seeking treatment has been correlated with severity of illness [27].

Hyperbolic discounting is a natural extension to this previous argument of loss aversion as described above. This type of discounting occurs when an individual’s preference for an outcome (i.e., avoiding death, being cured) changes as the outcome approaches closer in time [28, 29]. The phenomena is typically described as a problem of impatience. It is the human tendency to prefer smaller payoffs in the present over larger payoffs in the future. Although similar to the principle of loss aversion, it is distinct. A visual way of demonstrating this difference is given in Figure 1. The colored categories provided are “value,” “risk-seeking,” and “costs.” “Value” refers to the value the patient places on receiving the effective treatment (“effectivetx”) prior to getting it or on the value of being cured prior to being so. It describes hyperbolic discounting: a higher value indicates lower discounting. “Tx1” through “Tx3” (increasing losses) represent the unsuccessful attempts at initial treatment and is the major focus of supply-side incentives; “effectivetx2” through “curedtx9” (increasing gains) represent the effective treatments leading up to being cured and is the major focus of the demand-side incentives. In both cases, the value increases (or the discount factor decreases) the closer one gets to the outcome of interest. The value hits a pinnacle close to 1 when receiving the effective treatment since it prevents oncoming death. The value drops precipitously in the proceeding months of treatment since death has been averted, yet a cure is a relatively long way off.

The risk-seeking variable describes the loss aversion principle. Put simply, a patient’s risk-taking to find appropriate treatment climbs the worse he or she feels, but fades as he/she improves. Note how before effective treatment is accessed, we hypothesize decreasing discounting yet higher risk-seeking, whereas after effective treatment is initiated (“effectivetx2”), we project increasing discounting and decreasing risk-seeking. The costs are shown in green. It is highly possible that a patient and his/her family may spend more than half of what they have just to get a diagnosis and start effective treatment, running completely out of money by the fourth month of effective treatment, if not sooner (costs > 1).

A hypothetical field example of the distinction between these principles is the case of a rural patient who becomes extremely sick and risks his/her life and family’s economic status by making a long, dangerous trip to the hospital. The patient may be treated and recover enough to leave the hospital, but not come back or pursue further treatment on account of the risks he/she has already taken. In a case like this, when poverty and illness combine, it can be devastatingly costly for the patient to be loss averse.

A major catalyst for behavior attributable to the hyperbolic discounting principle is the lack of financial resources, which can reduce a person’s patience and mitigate desires to have their future preferences satisfied [30]. In this respect, the individual may question their ability to earn resources after being cured of TB. They may re-calculate that only one or two months of follow-up medication is appropriate and rational according to our previous definition.
To correct this preference inconsistency that occurs as a function of time, the operation of patient Figure 1: Hypothetical representation of loss aversion and hyperbolic discounting in TB control

(demand-side) and public/private provider (supply-side) incentive programs in TB has occurred with moderate success in various countries [31]. Examples of demand-side incentives include “direct payment, deposit return, food (hot meals, dry rations, or food vouchers), transportation subsidies (reimbursement, tokens, passes, or vouchers), vouchers for material goods other than food, and packages of personal hygiene products” (pg. 243). Impact on TB control from these incentives has included both greater case detection and treatment success in Asia, Eastern Europe, some areas of Latin America, and the United States [32,33]. However, improvements were generally small, with magnitude changes of or less than ten percent in TB outcome measures. Additionally, these effects did not last after the incentives were withdrawn. Finally, it is not understood if these incentive programs have multiplicative effects (i.e., patients receiving two incentives have better outcome measures than patients receiving only one) or if any one incentive works better than another (money versus food, for example).

A recent Cochrane review [34], using randomized samples of mostly American drug users, the homeless, and prisoners, found no evidence to suggest that incentives increase the number of patients who complete treatment active or latent tuberculosis. Yet, the use of material incentives to follow through on a diagnosis of TB or to start treatment was significant. Such incentives may be effective when offsetting high discount rates and declining risk-seeking behavior (“effectivetz2” from Figure 1). However, when discounting declines so that the value of therapy is greater than the riskiness it poses from a patient perspective (value > risk-seeking at “effectivetz6” from Figure 1), incentives may no longer work. Thus, it is a notable point that

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9 Only one study using an international sample from Timor-Leste was included in the review [35]. This study included the only general adult population with TB in the meta-analysis. The outcome was adherence to treatment for active TB. The experimental incentive was a daily hot meal since most of the participants were malnourished. The outcome, treatment completion, was not significantly different between the two groups.
material incentives might have a role in TB control, but they may be variable and appropriate for only certain segments of the treatment regimen. Cases of perverse incentives have arisen where patients intentionally prolonged treatment longer than necessary to continue receiving monetary incentives [31] (pg. 247). Such behavior may in fact be rational for them, considering the increasing costs they experience to complete treatment.\footnote{We hasten to note that from Figure 1, the point at which the value of treatment becomes greater than the risk it poses occurs the month after the patient has exhausted all internal resources to pay for the therapy (costs > 1). Thus, the treatment then becomes valuable because the patient can no longer afford to pay for it. This may be one explanation for the perverse incentives.}

The effectiveness of patient (demand-side) incentives on TB control in sub-Saharan African nations is comparatively non-existent. The reasons for this are not entirely clear. However, we hypothesize one reason could be that money is not the universal motivator in African countries or other destitute or marginalized populations as judged by Western economies. Instead, ‘in-kind’ incentives or care packages are given when demand-side incentives are used. To improve maternal and child health in Rwanda, for example, care packages consisted of “… a bar of soap, most include water purification products, and recipients are given the option to decide between an umbrella, adult clothing, and a well-baby package” [36]. In TB control, Beith and colleagues [31] described how Russian prisoners with TB being released stated they mostly desired assistance with obtaining a national identity card in return for completing treatment outside the prison (pg. 245). To effectively design such non-monetary incentives might take great care and intense effort to understand the culture of the population. Although the provider may have an impression of what the population or individual’s needs are, those impressions may not effectively translate into incentives the population or individual wants.

Social bias describes how individuals modify their actions or thoughts to align more with the views of bigger group. Within this investigation, social bias may incite individuals with active TB to delay seeking treatment or comply irregularly with treatment so as not to experience the stigmatization of their family and neighbors. With this principle, it is insufficient to focus only on the stigma that exists and causes individuals to avoid seeking care for TB. We dig deeper by placing this stigma within the context of the disease that generates it. More specifically, we investigate social bias within the framework of economic epidemiology, a principle which suggests that individuals change their behavior as the prevalence of a disease changes [37]. The rational argument is as follows: increased demand for prevention follows a rise in prevalence (supply) of disease. In our global focus on TB, we take “demand for prevention” to mean reducing exposure to an imperfect assessment of diseased contacts. We presume any display of stigma is a manifestation of that demand. To re-orient ourselves back to the focus on rationality, we ask the following: when does this not hold and why does it matter?

Adland and colleagues [38] showed mathematically how the exposure rate among susceptibles is based on behavioral responses to changes in disease risk. They investigate such a behavioral response in the context of the individual’s knowledge (or lack thereof) of their own immune status. They conclude that knowing one is not immune to a disease increases the number of contacts (who may or may not spread disease) with which they are willing to engage by a factor equal to the expected discounted cost of their own acquired immunity (Equation #14). For these individuals, the benefit of future life-long immunity means more willingness to accept risk of
exposure in the present. However, for TB in the developing world, such immunity generally does not exist.\(^\text{11}\) Rather, the problem is an inability to confirm one’s own infection status (i.e., LTBI).

Knowing one’s LTBI status and duration of that status might give an individual a sense of his or her innate immunity towards TB (immunity is conferred by presence of LTBI instead of active disease). Thus, knowing one’s infection status may be considered a type of observable immunity.\(^\text{12}\) Andrews et al. [40] calculated incidence rate ratios for progression to active TB among persons identified with LTBI versus people uninfected. They concluded that individuals with LTBI had 79% lower risk of progression to active disease after reinfection than uninfected individuals. Thus, this perception of infection as immunity may, in fact, represent some element of rationality on the part of the patient.

Assessment of a positive LTBI status may reduce an individual’s demand for prevention (stigma) since their immune system has kept the infection in a dormant state. We use Adland et al.’s [38] analysis to briefly argue why knowing or believing one is not infected\(^\text{13}\) with *Mycobacterium tuberculosis* (the default for people who do not know their LTBI status) would irrationally increase the number of contacts, thereby increasing the chance for infection.

The key difference here is the focus on innate immunity instead of Adland’s reliance on acquired immunity, which comes at an assumed cost to the individual. Innate immunity happens subconsciously and virtually immediately, with almost no cost or inconvenience to the susceptible individual. Indeed, multiple simultaneous TB infections may occur from repeated exposures [41,42], yet never cause disease. Hence there is almost no cost to accumulate innate immunity, regardless of the number of exposures or infections. Such a negligible cost to confer immunity inadvertently increases an individual’s number of contacts beyond a level with which the individual may be comfortable. This might explain why there exists a prevalence of LTBI estimated at 31% in sub-Saharan Africa [43]: individuals are not very successful at avoiding infection because they do not recognize the value of their own immunity. In other words, they expect a cost for acquired immunity that never materializes. The result is a production of fear and stigma to deflate their number of contacts to a level chosen by someone with observable immunity. In terms of the economic epidemiology argument, the presence of stigma (and not a demand for prevention via acquired immunity) might arise as a result of increasing disease prevalence. The results of that stigma hinder efforts at case detection and treatment success in TB control.

**Interplay of Culture and TB**

Sub-Saharan Africa (SSA) is considered to have among the largest scale of human diversity on the planet. Posner [44] and Fearon [45] have described, in particular, how countries in SSA have

\(^{11}\) Although the BCG vaccine is widely used in developing countries, its protectiveness is mainly to preclude the more dangerous forms of TB disease in children. Its effectiveness wanes significantly by adulthood, with minimal to no additional protection given by booster vaccines.

\(^{12}\) Knowing one’s LTBI status may be assessed simply from an absence of disease despite having exposure to someone with suspected TB. Routinely performing a TST test is not considered practical in developing countries since in many African countries, the infection prevalence has been greater than one in four [39].

\(^{13}\) The first author traveled to Ethiopia in Autumn 2011. In his assessment, there is not much distinction between “infection” and “disease” when discussing TB. If you do not have TB, you are assumed to not even be infected or diseased.
substantial ethnic and cultural diversity. Posner [44] finds that Ethiopia is the 11th (out of 45) most ethnically fractionalized sub-Saharan country on the continent. Alesina et al. [46] produced separate global estimates of the level of fractionalization, according to ethnic diversity, languages spoken and religion. Their respective rankings for Ethiopia were 30 (out of 190 countries), 15 (out of 199 countries), and 54 (out of 214 countries). Thus, there are considerable cultural and ethnic differences within Ethiopia.

Keeping in mind these sizable cultural differences that exist within Ethiopia, the main principles from the previous analyses of behavioral economics are summarized in Table 1 to understand how and why culture matters in TB control. With each question, answers are not provided by only field detection and treatment of TB. As long as providers view patients as being irrational or irresponsible for noncompliant behavior, there will always exist a cultural divide that will continually dilute the likelihood that TB will be eradicated. To address these questions, we propose use of the Purnell Model of Cultural Competence to help transition providers’ interpretations of irrational behaviors into logical patient choices that dutifully account for their economic and/or cultural constraints.

Table 1: Isolating cultural variants using principles from behavioral economics

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<th>Behavioral Economic Principle</th>
<th>Applicable cultural questions</th>
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| **Loss aversion**            | (1) What explains risk-seeking tendencies when symptoms of TB become more serious?  
                              | (2) How is death perceived in the culture?  
                              | (3) How are gender roles and/or economic status changed when death looms? |
| **Hyperbolic discounting**   | (1) How is self-sufficiency and/or self-care perceived in the context of disease states and how does this change over time?  
                              | (2) What are the incentives individuals care about?  
                              | (3) Why and when may they be reluctant (or not) to receive these incentives? |
| **Social bias**              | (1) Why do patients feel stigma?  
                              | (2) Why do susceptibles feel the need to inflict stigmatizing behaviors upon TB patients?  
                              | (3) What are the communities’ views of prevention in TB control and how might that influence stigma towards the disease? |

**Purnell Model of Cultural Competence**

The Purnell Model of Cultural Competence was derived from research based on theories of multiple disciplines, including anthropology, sociology, psychology, anatomy and physiology, biology, religion, history, economics, political science, and linguistics, with a particular focus on utility for health care applications [47]. It is founded upon central assumptions that recognize the core similarities and inherent differences that exist both between cultures and within cultures, and that these attributes are always in a dynamic state of change. The model’s assumptions also highlight the importance of enhancing health care practitioner and system efficacy through understanding and application of unique and shared cultural characteristics [48]. The model is
represented by a circle schematic with concentric rings representing the four levels of community assessment, from global society in the outermost rim, to community, to family, and finally to the individual person in the innermost level of assessment.

Each of the community levels is viewed as dynamically influential upon their adjacent rims (see Image 1). At the core of these rims is a central circle divided into the twelve major cultural domains, identifying the major characteristics for which each of the community levels should be

**Image 1: Purnell Model of Cultural Competence [47, 48, 49]**
assessed. As represented by the continuity of the circle schematic, these domains are likewise recognized to be fluidly related to and affected by the other domains. In their adaptation to specific applications, certain cultural domains may also be selected for more focused evaluation.

An important advantage to using the Purnell model in culturally relevant assessments and implementations is its ability to establish a foundational framework that is thorough and inclusive in perspective. It primes the investigator to approach a project with methodology that is at once adequately broad to avoid situational and observational bias [50] (pg. 1314), adequately detail-oriented to actively elicit unique characteristics of the community of interest that may not otherwise be discerned, and adequately dynamic in principle to allow for flexibility in one’s use of the model. It also is unique in recognizing that the cultural interplay of a project with the different scales of society, from the individual to global society, vary and are therefore key to consider.

The Purnell model can be used to address each of the principles of behavioral economics presented earlier. With respect to loss aversion, the concept of risk-seeking has importance in at least two slices represented in Image 1: “death rituals” and “health-care practices (responsibility for health).” Tadesse and Brans [51] discuss how micro-insurance initiatives can assist Ethiopia’s poor to better tolerate and recover from negative financial shocks, such as being diagnosed and treated with TB. The authors note how Ethiopian culture places high value on a respectable funeral, sometimes at a cost equal to 25% of yearly consumption (pg. 82). To not adhere to tradition in this sense might cast a long shadow over the family in the future. Community-based risk management arrangements in Ethiopia include iddir, which are burial societies designed to cover the costs associated with a funeral for families who cannot afford to cover the entire expense alone. Interestingly, however, the authors added that these arrangements “are likely to fail in the face of correlated shocks unless [the] household has systems to transfer the risk outside of their community/village.” Since TB is often spread rapidly in families through ‘micro-epidemics’ [52], these correlated disease outcomes in families are likely to render any community initiatives to treat such transmission improbable. As a result, a TB patient may feel the need to treat TB at a minimal expense to respect cultural traditions at the community and family levels.

The maintenance of health and self-care over the entire duration of TB treatment is important to overcome the principle of hyperbolic discounting. The interaction of factors related to “heritage” and “spirituality” from Image 1 may be a distraction for patients who are completing a TB treatment regimen. Sumartojo [50] (pg. 1313) noted how competing celebratory cultural activities in a Somalian refugee camp can be a distraction for patient adherence. She suggested the potential value of employing social incentives so as to improve adherence instead of detracting from it. Such a discussion of how cultural distractions may induce discounting behavior carries importance when determining how TB treatment is administered (via the more socially-defined “TB clubs” versus the personal dynamic offered with the HEW model). That is, are TB patients within “TB clubs” more or less able to resist the distraction posed by cultural activities while maintaining their treatment compared to patients who receive treatment through the HEW model?
Overcoming stigma is perhaps the major hurdle to removing social bias. Two important slices of the Purnell model to consider here might include “communication” and “biocultural ecology.” Ho [53] discussed how “lay beliefs about illness are often juxtaposed with biomedical knowledge about disease” (pg. 754) as a reason to correct the misinformed individual or patient. The example given is the understanding of LTBI among a population of immigrants: “Many respondents incorrectly believed that asymptomatic latent infection is not possible” (qtd. in [53]). The solution offered was an education intervention to correct these erroneous beliefs “…and to help ensure adherence to prescribed treatment regimens” (qtd. in [53]). However, in many developing countries, treatment for latent TB is not practiced or even available if requested.

If this knowledge adjustment cannot generally lead to a behavior modification for the self, does this void the value of communicating this knowledge regarding the latency aspect of TB? The concept of ambiguity aversion is helpful to debate this point [54].14 In a profound, yet very simple experimental finding, Fox and Tversky [55] demonstrated in their comparative ignorance hypothesis the following: “…ambiguity aversion will be present when subjects evaluate clear and vague prospects jointly, but it will greatly diminish or disappear when they evaluate each prospect in isolation” (pg. 588). In other words, ambiguity is only a problem when there is a known risk to which to compare it. As applied to TB, once infected with the bacterium, the probability of developing active disease thereafter is about one in ten over the lifetime [56] (assuming no HIV infection, which would multiplicatively increase that probability). However, the probability of progressing to active disease when not infected is much harder to discern, since that probability itself depends on the probability of exposure, which can be a known or unknown quantity.15 Thus, relying on the hypothesis above, it may very well hold that individuals prefer a positive LTBI status instead of the uncertainty imposed by the exposure likelihood.

Thus, we have demonstrated that there may be biologic and economic reasons justifying the theoretical case for raising awareness of LTBI in TB-endemic areas, even if treatment for the condition is not practical. Further experimental work incorporating cultural components would be necessary to further substantiate or reject this conceptual result. In this way, better communication of disease ecology can minimize the detrimental impact of subconsciously achieved innate immunity (discussed earlier) on the persistence of stigma associated with TB. Thus, when taken holistically, the Purnell model can help providers and patients think about the disease in new and unique ways that may at first seem tangential to achieving significant reductions in TB not only in Ethiopia, but across the globe.

**Conclusion**

The reliance on principles of behavioral economics to frame an argument for culturally competent care in global TB control is motivated by a realization that developed nations cannot simply strong-arm the battle against TB in developing countries with only medicine. One of the biggest and costliest dangers associated with TB has been drug resistance. To combat this

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14 Ambiguity aversion refers to the preference for risks with known probabilities as opposed to risks with unknown probabilities. Such an aversion may promote violations of expected utility theory (as the next footnote demonstrates) in a fashion similar to loss aversion, which makes its relevance to behavioral economics even more relevant.

15 Note that unless the probability of exposure is 1 (for which there would be no violation of expected utility theory), the a priori probability of progressing to active disease for a person not infected with LTBI will always be less than the probability for a person already infected.
resistance, medicine should be a partial solution since biology is only a proximate cause of drug resistance. Human behavior among both providers and patients is the more distal – and perhaps relevant – cause of such resistance.

The use of several principles from behavioral economics outlined in this paper – *loss aversion*, *hyperbolic discounting*, and *social bias* – to identify the reasons for noncompliant behavior should be considered. Interventions to change behavior should also consider the principles we have outlined to decode the ‘irrational’ tendencies of patients working from a different cultural template with constraints we may not have previously envisioned. As described, the Purnell Model provides an invaluable way in which to re-examine the cultural norms that may be responsible for the incongruency of desired outcomes and actual patient behavior. In other words, behavioral economics can help to recognize patterns of behavior, and the Purnell model facilitates an explanation of those patterns and therefore helps in re-designing treatment delivery to accommodate those patterns. Therefore, we conclude that these tools are inextricably linked when considering matters of global health.

A major limitation of this work is the policy input available from a merging of these seemingly disparate disciplines (i.e., behavioral economics and health care) on a global scale. Whether this is an approach that the WHO could scale up to all countries with a high TB incidence rate seems rather doubtful, given the intricate attention to cultural detail that is required. Furthermore, the focus of our investigation was only in Ethiopia, and we cited cultural differences within that country alone. Thus, the generalizability of such a merger of disciplines (even in a single country setting) needs to be weighed heavily on a case-by-case basis in these early stages. Additionally, the emphasis on cultural competency in this paper is overly simplified. It most likely cannot be achieved via the importation of one cultural competence model for all countries. As stated previously, our work is exploratory in nature. However, we believe that there is value in pursuing the work we have started, both in a theoretical and experimental in-country framework.

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