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Preference-Based Assessments

Patient Perspectives and Willingness to Accept Incentives for Tuberculosis Diagnostic Evaluation in Uganda

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ABSTRACT

Objectives: We assessed attitudes and perceptions and willingness to accept (WTA) varying incentive structures for completing tuberculosis (TB) diagnostic evaluation among patients in Uganda.

Methods: We surveyed 177 adult patients undergoing TB evaluation at 10 health centers between September 2018 and March 2019. We collected household sociodemographic information and assessed attitudes and perceptions of incentives. We surveyed patients regarding their willingness to complete TB diagnostic evaluation in exchange for incentives ranging in value from 500 Ugandan shillings (USh) to 25 000USh (~$0.15-$6.75). We compared associations between WTA and patient characteristics using ordered logistic regression.

Results: Participant willingness to return to the health center to complete TB diagnostic evaluation increased proportionally with incentive amount. The median participant accepted between 2000 and 5000 USh. Cash (52%) and transportation vouchers (34%) were the most popular incentive types. Half of respondents preferred unconditional incentives; for a multiday evaluation, 84% preferred conditioning incentive receipt upon returning to the health center. In multivariate models, we found the pairwise difference between the third and lowest income quartile (aOR = 2.38, 95% CI: 1.20-4.69; P = .01), younger age, and difficulty returning to the health center to be significantly associated with WTA higher incentive thresholds.

Conclusions: In Uganda, incentives such as cash transfers or transportation vouchers are an acceptable intervention for facilitating adherence to TB diagnostic evaluation. Household income is associated with preferred incentive structure and amount, especially for those at the cusp of the poverty threshold who are more likely to prefer unconditional and higher valued incentives. Targeted and context-specific socioeconomic supports for at-risk patients are needed to optimize outcomes.

Keywords: tuberculosis, incentives, social protection, willingness to accept.

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Introduction

Tuberculosis (TB) has become the leading infectious killer in the world, and its prompt diagnosis is a priority for national TB programs worldwide.[1] Early diagnosis of active pulmonary TB prevents more severe disease in the individual patient and reduces ongoing community transmission. According to the International Standards for Tuberculosis Care,[2] the diagnostic evaluation process is multistep and consists of (1) clinical evaluation and referral for sputum-based testing for patients with symptoms consistent with TB; (2) completion of sputum-based testing with smear microscopy or rapid PCR assays like GeneXpert MTB/RIF (Xpert) (Cepheid, Sunnyvale, CA); and (3) initiation of TB treatment for those with microbiologically confirmed pulmonary TB. At best, this process can be completed within 1 day, but in low-resource settings may require multiple visits over several days.[3] With approximately 3 million of an estimated 10 million incident cases of active TB not reported in 2018,[1] there is an urgent need for novel strategies to reduce gaps in TB case detection and linkage to care, particularly during the diagnostic evaluation process.[4,5]

Patient-centered barriers to accessing TB diagnostic evaluation are increasingly recognized as a major factor contributing to pretreatment loss to follow-up (LTFU). Patients with TB often incur catastrophic costs while seeking care, amounting to >20% their median household income,[6,7] driven by inefficiencies in the care-seeking pathway.[3,8] Additional socioeconomic barriers including fear of stigma and social isolation, geographic barriers to accessing healthcare centers, fear of income loss, and food insecurity[9-13] can be insurmountable for already impoverished patients. Economic incentives like cash or in-kind transfers are increasingly used to improve uptake of health services in a variety of public health

programs. For example, cash transfers improved diagnostic testing and use of artemisinin combination therapies among patients with malaria in Kenya[14,15] and increased demand for HIV services throughout sub-Saharan Africa.[16-20]

Data supporting incentive use in TB prevention and care remain sparse. Some evidence indicates that monetary incentives can be a useful tool for improving retention in TB care in hard-to-reach populations.[21] Three recent systematic reviews indicate that incentives may improve treatment completion.[22-24] Nevertheless, most of the available reviewed evidence comes from trials in well-resourced, low- to medium-incidence settings. These studies focus on the effect of incentives for patients already diagnosed and initiated on therapy[22] as opposed to their use in targeting pre-treatment LTFU, the most substantial gap in the patient cascade of care.[4,5,25] Finally, there is very limited research on how best to design and implement context-specific incentive interventions that feasibly and sustainably improve TB outcomes.[26] Several studies of incentives for TB treatment adherence were terminated early due to lack of implementation fidelity, suggesting that how best to design and implement these types of interventions is unknown.[23]

Despite a call for socioeconomic support for patients with TB, national TB programs in low-resource settings remain without guidance on how to design incentive structures best suited to their context. Critical features include incentive type and amount, timing of distribution, conditionality, and linkage to TB prevention and care programs.[26] We sought to assess patient acceptance and preferences for incentive structure, and to estimate the likelihood that various incentive strategies could facilitate completion of TB diagnostic evaluation in Uganda.

Methods

Study Setting and Population

Between September 2018 and March 2019, we enrolled participants at 10 community health centers in peri-urban and rural Uganda. Included health centers were those that used standard sputum smear microscopy and/or Xpert testing as their primary TB diagnosis method. We excluded health centers that demonstrated low volume of TB testing and diagnosis, which were those that (1) performed sputum-based TB diagnostic evaluation on $<$150 patients/year, or (2) diagnosed $<$15 smear positive TB cases/year.[27]

We surveyed consecutive eligible participants who presented on randomly chosen days and who provided informed consent. Eligible participants included adults $\geq$18 years old undergoing first-time evaluation for TB. We excluded participants who (1) had sputum collected for monitoring response to anti-TB therapy; (2) had sputum collected as part of active, community-based case finding; (3) had a documented prior TB treatment history; (4) were referred to the health center for TB treatment after a diagnosis was established elsewhere; (5) initiated treatment for presumed extrapulmonary TB only; or (6) were clinically diagnosed with TB. Trained laboratory staff identified potential participants at the time of sputum submission for TB microbiologic testing and referred them to study staff for eligibility assessment and informed consent.

The study was approved by the University of California San Francisco Committee on Human Research, the Makerere University School of Medicine Research Ethics Committee, and the Uganda National Council for Science and Technology.

Study Procedures

Patient Barriers Survey

Trained study staff surveyed participants in their native language using a standardized tool. We measured individual- and household-level demographics as well as household and individual income. We collected data on potential barriers to healthcare access including distance, travel time, inconvenience, and transportation availability; barriers assessed related to healthcare affordability included costs and potential job loss associated with clinic visits. Finally, we evaluated (1) the acceptability of incentives by the participant and their community, (2) preferences for incentive type and frequency, and (3) conditionality that would facilitate completion of TB diagnostic evaluation.[28]

Willingness-to-Accept Survey

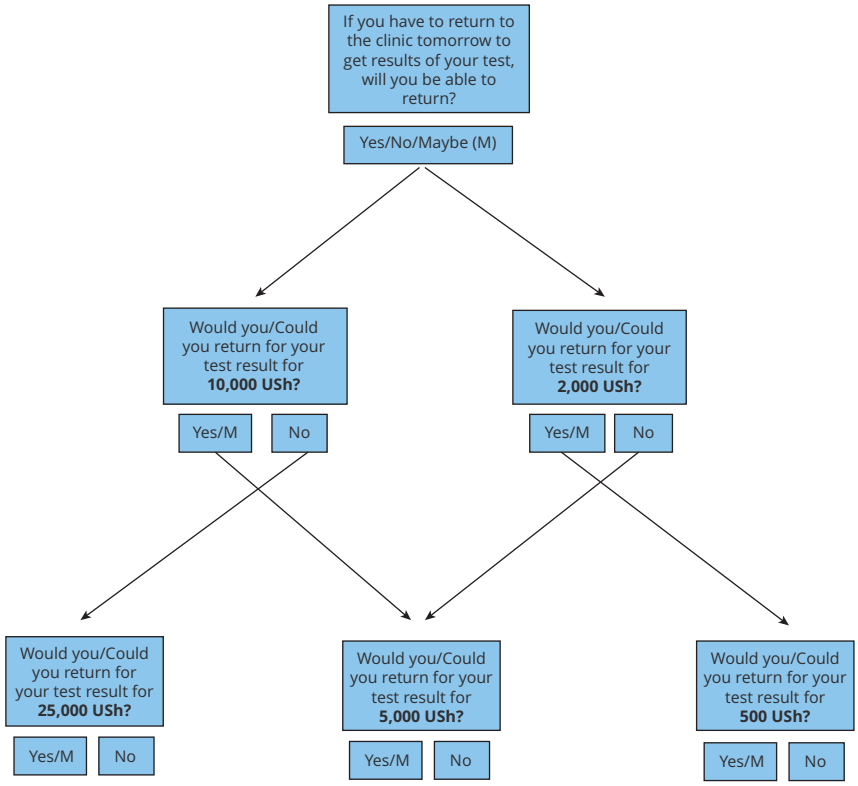
Embedded within the Patient Barriers Survey were hypothetical choice survey questions used to gauge participants' willingness to accept (WTA) varying intensities (ie, amounts) of incentives to facilitate completion of TB diagnostic evaluation. WTA and willingness to pay are well-established survey-based contingent valuation tools and are useful for ascribing demand for a product or attaching a value to goods or services.[29,30] In the health economics literature, WTA methods have been used to elicit individuals' monetary valuation of health programs, benefits, and behaviors. Examples from the literature include HIV testing among high-risk populations in Tanzania,[31] engaging in HIV risk reduction behaviors among male sex workers in Mexico,[32] and discontinuation of drug usage among older aged long-term prescription drug users.[33] We adapted these tools by developing closed-ended, hypothetical choice questions to elicit the lowest stated acceptable amount of a cash incentive for completing TB diagnostic evaluation among patients with presumptive TB in Uganda. The interviewer randomly alternated between 2 starting values of 10 000 Ugandan shillings (USh) and 2000 USh to avoid anchoring bias.[34] The initial question "Would you/could you return for 2000/10 000 USh?" would be followed by another that increased the offered amount if the participant declined the first value or reduced the amount if the participant accepted (Fig. 1). In doing so, the lowest value of an incentive that the participant deemed sufficient to facilitate health center return would be reached. This design (see Supplemental Materials found at https://doi.org/10.1016/j.vhri.2020.12.005) followed the structure of similar studies conducted for other public health conditions.[31,32]

At the time of data collection, $1.00 was equivalent to 3745 USh. In 2019, TB-affected households in Uganda had a median annual household income of $1001 (interquartile range [IQR]: 500-1668) and spent a median of $243 (IQR: 118-483) on TB-related costs.[35] Assessed incentive values ranged from 500 to 25 000 USh. The respective lower and upper limits of 500 USh and 25 000 USh were selected based on previous studies documenting direct and indirect costs of health center visits for this population[3] and stakeholder assessment of programmatic feasibility at scale.

Statistical Analysis

Descriptive analyses included demographic and socioeconomic participant data reported as medians and IQRs for continuous variables and proportions and 95% confidence intervals (CIs) for categorical variables. Missing survey data included household income (n = 27; 17%) and participant rating of ease of next-day return to the health center (n = 6; 4%). We estimated the missing data by fitting an imputation model, repeated 100 times to

Figure 1. Willingness-to-accept survey algorithm. Participants were asked whether they would be willing to accept a randomly assigned starting value of either 2000 Ugandan shillings (USh) or 10 000 USh to facilitate return to the health center for completion of diagnostic evaluation. Subsequent offered values would either be increased or decreased, depending on whether the participant declined or accepted the initial or previous offered value. Overall values offered ranged from 500 USh to 25 000 USh.



USh indicates Ugandan shillings.

account for statistical uncertainty in the imputed estimates. We considered a wide range of variables in our imputation model that would be potentially predictive of missingness, in addition to all variables in the substantive analysis.[36] These included age, sex, marital status, educational level, and health center location.

We used ordered logistic regression[37] with robust standard errors to account for clustering by health center to assess acceptability of incentives across participant demographic and socioeconomic characteristics. We assumed that the relationship between each pair of outcome groups is the same and thus probabilities for each category in the ordered outcome were cumulative (the proportional odds assumption). We can thus describe the probability that an individual gives a response in a category or higher compared to lower categories.[37] We established 5 ranked categories for our outcome: (1) 500 USh, (2) 2000 USh, (3) 5000 USh, (4) 10 000 USh, and (5) 25 000 USh.

Income as a socioeconomic characteristic was incorporated in the ordered logistic regression model as household income quartile. We also considered health center characteristics including whether the health center location was urban or rural.[38] Additional factors considered for the regression model were participant characteristics selected based on a priori hypotheses of causal relationships with our outcome of interest as well as variables which were significant at $P<.20$ in bivariate analyses. The 0.20 threshold was selected based on recommendations for purposeful selection of variables for multivariable models.[39,40] Other variables considered based on these criteria included sex, age, marital status, and difficulty of next-day return to the health center. The assumption of proportional odds for the final multivariable model was assessed using a likelihood ratio test.

Additional analyses explored associations between participant socioeconomic and demographic characteristics or health center characteristics and (1) barriers to daily, weekly, and monthly health center visits; and (2) perceptions of incentive acceptability and preferences for conditionality. Bivariate analyses were conducted using Pearson's χ^2 test of association between independent variables and outcomes of interest. All analyses were conducted using Stata v14.2 (StataCorp LP, College Station, TX).

Results

Study Sample Characteristics

We enrolled 177 consecutive adults being evaluated for pulmonary TB at participating health centers on randomly selected days to participate in the study. Of the 177 enrolled participants, we included and analyzed 161 who completed the full survey. Of the 16 participants not included, 9 started the survey but stopped before completion, and 7 were not asked WTA questions. Of the 161 included participants, 88 (55%) were female and the median age was 38 years (IQR: 28-48). Most accessed care at a rural health center (n = 110, 68%) and were informally employed (n = 132, 82%). The median reported household income was 150 000 USh/month (IQR: 70 000-300 000) (Table 1), which is consistent with prior income estimates for this population.[3,41]

Table 1. Patient demographic and socioeconomic characteristics, Uganda 2018 (N = 161).

	Overall (N = 161) No. (%) or median (IQR)
Sex	
Male	73 (45.3)
Female	88 (54.7)
Age	38 (28-48)
Community health center location	
Rural	110 (68.3)
Urban	51 (31.7)
Marital status	
Single	11 (6.8)
Married (monogamous)	69 (42.9)
Married (polygamous)	18 (11.2)
Divorced/separated/widowed	63 (39.1)
Has children	145 (90.1)
Number of children (n = 144)	4 (2-6)
Adults in household	2 (1-3)
Education level	
None	20 (12.4)
Primary	104 (64.6)
Secondary	33 (20.5)
Tertiary	3 (1.9)
Vocational/other	1 (0.6)
Employment status	
Unemployed	17 (10.6)
Informal	132 (82.0)
Formal	9 (5.6)
Student	2 (1.2)
Civil servant/other	1 (0.6)
Household income per month (USh) (n = 134)*,†	150 000 (70 000-300 000)
Personal income per month (USh) (n = 141)†	100 000 (50 000-200 000)

IQR indicates interquartile range; USh, Ugandan shillings.
*16.8% of participants missing information on household income.
†At the time of data collection, $1.00 was equivalent to 3745 USh.

Barriers to Health Center Visits for TB Care

Participants who indicated that they would be unable to return for daily, weekly, or monthly health center-based TB care most frequently reported lack of transportation as their largest barrier (for daily medication adherence: n = 84 [62%]; weekly: n = 15 [58%]; monthly: n = 2 [67%]; Table 2). Although 155 (96%) participants indicated that they would be able to return to the health center the following day to retrieve test results, 40% (n = 62) stated that it would be difficult to do so.

Self-reported barriers to health center visits among participants who indicated they would be unable to return for health center-based TB care differed by income quartile. Participants in lower-income quartiles indicated transportation difficulties as their main challenge to health center visits compared to those in higher-income quartiles, who cited a mixture of concerns including transportation, inconvenience, and possible job loss (P=.02) (Table 2). Participants in rural locations noted lack of transportation as their main barrier to health center return (urban: 37%; rural: 73%), whereas those in urban locations were more likely to indicate inconvenience (urban: 29%; rural: 18%) or possible job loss (urban: 24%; rural: 4%) as their primary concern ($P < .001$). Health center visit barriers varied slightly by sex ($P = .07$) but did not vary by other sociodemographic characteristics like age (results not shown).

Attitudes and Perceptions Regarding Incentives

We evaluated attitudes and perceptions regarding incentives among participants and their communities (n = 161) (Table 2). Seventeen participants (11%) had received some form of incentive before, primarily as cash or food as a part of a study-based program to support health outcomes. Participants almost unanimously agreed that incentives were acceptable to themselves and within their communities (cash: n = 160, 99%; transportation vouchers: n = 158, 99%; food: n = 156, 97%). When asked to compare incentive types, most participants preferred cash (n = 84; 52%) or transportation vouchers (n = 54; 34%) to facilitate health center return to complete diagnostic evaluation. Although the preferred incentive type did not vary by income quartile, age, occupation, and health center location, women were more likely to choose transportation vouchers (n = 48; 55%) compared to men, who preferred cash (n = 31; 43%; $P = .04$).

Preference for Incentive Conditionality

We assessed preference for incentive conditionality within the context of both single and multiday TB evaluations. For hypothetical single-day evaluation scenarios, where testing and treatment initiation could be completed on the same day, participants in the second and highest income quartiles preferred an incentive conditioned upon completion of diagnostic testing (n = 24 [71%] and n = 17 [65%], respectively). Participants in the lowest and third income quartiles preferred unconditional incentives provided at the beginning of the diagnostic process, and the receipt of which was not dependent on completion of testing (n = 12, 33%; and n = 14, 39%, respectively; $P < .01$). For hypothetical multiday evaluation scenarios, the proportion of participants who preferred conditional incentives provided only after completion of diagnostic evaluation was high overall but varied slightly by income quartile (overall: n = 134 [84%]; Table 2). We assessed preference for conditionality by patient self- reported ease or difficulty in next-day return to receive their test results and initiate treatment. For multiday evaluations, almost all participants (n = 57; 95%) who indicated return to the health center would be difficult agreed that conditioning incentive receipt upon return would be helpful in finishing their evaluation. Nevertheless, only 37% (n = 22) felt that conditionality would be helpful for same-day evaluations. Preference for conditionality did not differ by age, sex, or health center location.

WTA Incentives for TB Testing

Participants' WTA varying incentive amounts to return to the health center are shown in Figure 2. Forty (40) participants (25%) accepted 500 USh, 69 participants (43%) accepted ≤2000 USh, 112 (70%) accepted 5000 USh, and the remainder (n = 49; 30%) required ≥10 000 USh to facilitate TB diagnostic evaluation (Fig. 2). Participants' WTA different amounts of incentives varied by income quartile, particularly for midrange incentive values of 2000 USh ($P = .06$) and 5000 USh ($P = .02$). Specifically, participants in the third income quartile were less likely than other income quartiles to accept midrange amounts (Table 3).

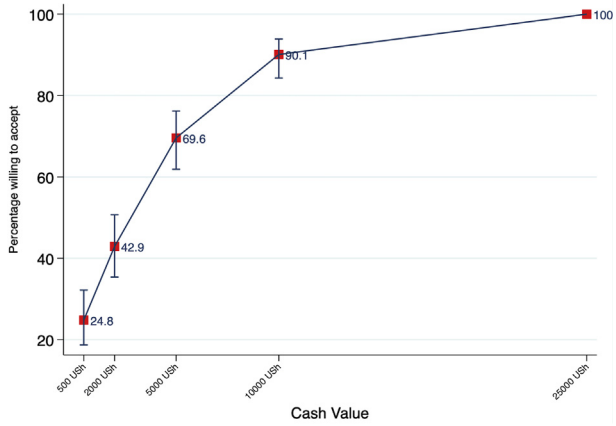
Bivariate ordered logistic regression analyses revealed that participants who reported that next-day return to the health center would be difficult were more likely to require higher incentive amounts compared with those who responded that

Table 2. Patient-perceived barriers to TB medication and community health center visits and experiences and attitudes toward incentives by income quartile (N = 161).*

	Overall	Bottom quartile	Second quartile	Third quartile	Highest quartile	*P* value
	N = 161	(n = 37)	(n = 35)	(n = 35)	(n = 26)	
	N (%)					
Would you return to take free medication:						
Daily (yes)	17 (10.6)	2 (5.4)	6 (17.1)	0 (0.0)	6 (23.1)	.02
Weekly (yes)	76 (48.4)	18 (50.0)	18 (52.9)	12 (34.3)	14 (53.9)	.47
Monthly (yes)	151 (96.2)	32 (88.9)	34 (100.0)	34 (97.1)	26 (100.0)	.13
Barriers to health center visits						
Transportation	84 (62.2)	25 (75.8)	18 (64.3)	22 (62.9)	6 (35.3)	.02
Inconvenience	29 (21.5)	8 (24.2)	6 (21.4)	4 (11.4)	4 (23.5)	
Possible job loss	14 (10.4)	0 (0.0)	3 (10.7)	5 (14.3)	5 (29.4)	
Other	8 (6.0)	0 (0.0)	1 (3.6)	4 (11.4)	2 (11.8)	
Able to return tomorrow for test results (yes)	155 (96.3)	36 (97.3)	32 (91.4)	34 (94.4)	26 (100.0)	.40
If yes, will it be easy/difficult to return						
Easy	93 (60.0)	20 (55.6)	22 (68.8)	18 (52.9)	17 (65.4)	.51
Difficult	62 (40.0)	16 (44.4)	10 (31.3)	16 (47.1)	9 (34.6)	
Received incentive before	17 (10.6)	5 (13.5)	7 (20.0)	3 (8.3)	0 (0.0)	.09
Incentive helped	17 (100.0)	5 (100.0)	7 (100.0)	3 (100.0)	-	-
Any negative feelings towards incentives (yes)	9 (5.6)	34 (91.9)	34 (97.1)	33 (91.7)	26 (100.0)	.37
Cash would be accepted in community (yes)	160 (99.4)	36 (97.3)	35 (100.0)	36 (100.0)	26 (100.0)	.45
Transportation vouchers would be accepted in community (yes)	158 (98.8)	37 (100.0)	33 (97.1)	36 (100.0)	26 (100.0)	.40
Food would be accepted in community (yes)	156 (96.9)	36 (97.3)	34 (97.1)	35 (97.2)	25 (96.2)	.99
Preferred incentive type to return to finish evaluation (self)						
Cash	84 (52.2)	19 (51.4)	19 (54.3)	17 (47.2)	13 (50.0)	.92
Transportation vouchers	54 (33.5)	13 (35.1)	9 (25.7)	15 (41.7)	8 (30.8)	
Food	15 (9.3)	4 (10.8)	4 (11.4)	2 (5.6)	4 (15.4)	
Insurance	3 (1.9)	0 (0.0)	1 (2.9)	1 (2.8)	1 (3.9)	
Other	5 (3.1)	1 (2.7)	2 (5.7)	1 (2.8)	0 (0.0)	
Preferred incentive type to return to finish evaluation (community)						
Cash	62 (38.5)	14 (37.8)	12 (34.3)	12 (33.3)	12 (46.2)	.93
Transportation vouchers	73 (45.3)	17 (46.0)	15 (42.9)	18 (50.0)	9 (34.6)	
Food	22 (13.7)	5 (13.5)	6 (17.1)	5 (13.9)	5 (19.2)	
Other	4 (2.5)	1 (2.7)	2 (5.7)	1 (2.8)	0 (0.0)	
Prefer incentive conditional on diagnostic evaluation completion: same-day (yes)	79 (50.0)	12 (33.3)	24 (70.6)	14 (38.9)	17 (65.4)	.003
Prefer incentive conditional on diagnostic evaluation completion: multiday (yes)	134 (84.3)	35 (94.6)	24 (70.6)	32 (88.9)	19 (73.1)	.02
Would take medication if doctor prescribed it for free (yes)	158 (98.1)	37 (100.0)	22 (94.3)	35 (97.2)	26 (100.0)	.59

USh indicates Ugandan shillings.
*16.8% of participants missing information about household income. At the time of data collection US$1.00 was equivalent to 3745 USh.

Figure 2. Percentage of participants willing to accept varying incentives for receiving TB test results, N = 161.



TB indicates tuberculosis; USh, Ugandan shillings.

return would be easy (odds ratio [OR] = 2.12; 95% CI: 1.48-3.05). Older participants were less likely to require higher incentive amounts to complete TB diagnostic evaluation compared to their younger counterparts (OR = 0.55; 95% CI: 0.32-0.94) (Table 4). Sex (OR = 0.98; 95% CI: 0.50-1.96), marital status (OR = 1.31; 95% CI: 0.77-2.22), and health center location (OR = 0.64; 95% CI: 0.22-1.86) were not associated with accepted incentive amount.

Perceived difficulty in returning to the health center (aOR = 2.53, 95% CI: 1.59-4.02) and age (aOR = 0.44, 95% CI: 0.22-0.91) remained significant associations in our multivariable analysis (Table 4). The pairwise difference between the third income quartile and the reference income quartile (aOR = 2.38, 95% CI: 1.20-4.69) was associated with WTA higher incentive thresholds (P = .01). The association between income and preferred incentive amount trended toward statistical significance in our final multivariate model, indicating that participants in higher-income categories were more willing to complete TB diagnostic evaluation only at higher incentive amounts compared to those in lower-income categories (P = .08).

Discussion

These results demonstrate the acceptability of incentives as a public health intervention for improving adherence to TB diagnostic evaluation in a high-burden, low-resource setting. Most participants expressed that incentives including cash transfers, transportation vouchers, and food rations were socially and culturally acceptable to both themselves and their communities (99%, 99%, and 97%, respectively). In our study setting, overall incentive acceptability did not differ greatly based on income or other demographic characteristics. Our results demonstrate that all incentives types are acceptable to these participants and their communities, as has been shown in other public health contexts.[42-44] Although all incentive types were universally acceptable, our results indicate that not all incentives are alike. Participants preferred cash or transportation vouchers over food for TB diagnostic evaluation (52%, 34%, and 9%, respectively). Even in a setting with high rates of impoverishment (median household income $<$ $1.90/day),[41] participants expressed clear preferences for how incentives should be structured to support their needs. These preferences could translate into different responses to incentives and diagnostic outcomes among different populations. In low-resource settings such as Uganda, TB programs can use this information to guide resource allocation and targeting of incentive programs tailored to the needs and preferences of patient populations that overcome their specific barriers to care.

Perceived barriers to TB diagnostic evaluation influence incentive preference. The strong preference reported for cash transfers or transportation vouchers as the incentive type most likely to facilitate completing TB diagnostic evaluation is consistent with the most frequently described barrier to TB care: high transportation costs and lost wages. Transportation costs are a known driver of patients' costs in accessing TB care in Uganda and worldwide,[3,6,35] and a pervasive structural barrier for vulnerable patients seeking services for a variety of other healthcare needs in sub-Saharan Africa.[45-56] In our study, participants in higher-income categories more frequently reported a mixture of barriers to returning to the health center, including possible job loss or inconvenience. This corresponds to more recently described barriers to care reflected by high indirect costs of TB prevention and care services.[3,6,35] Our findings also suggest that heterogeneity in preference for different incentive structures may be driven by a difference in the relative importance of these barriers to completing TB diagnostic evaluation. For example, men indicated a preference for cash (42%) compared to women, who preferred transportation vouchers (55%; P = .04). This suggests that men and women in these communities may view the use of cash and vouchers differently based on local sex dynamics.

Willingness to return to the health center increases proportionally with incentive amount, such that 25% of participants would return for an incentive of 500 USh and 100% would return for 25 000 USh. This result suggests that the provision of a modest cash incentive of 5000 USh could motivate up to 70% of patients who otherwise would not return to the health center to complete their diagnostic evaluation, increasing testing completion from a baseline of 56%[57] to $>$80%. This change would substantially reduce patient attrition in the TB cascade of care. Further, the median participant's WTA amount was between 2000 and 5000 USh ($0.53-$1.34), an incentive range that may be acceptable to national TB programs and reasonable to implement at scale. Combined, these findings could have significant program and policy implications for reducing pretreatment LTFU among presumptive TB patients.

Nevertheless, we describe a nonlinear relationship between income and WTA incentives for returning to the health center to receive TB test results, suggesting that incentives may drive behavior differently among participants with different income or SES. Study participants on the extreme ends of income (ie, bottom and highest quartiles) accepted incentive values less than those in the second- and third-income quartiles. Most participants in the lowest-income quartile agreed to an incentive valued $\leq$ 5000 USh, corresponding to the amount required to directly offset the cost of 1-way transport for a health center visit.[3] Seventy-five percent of participants in the highest-income quartile were also willing to return to the health center for diagnostic evaluation for $\leq$5000 USh, less than 5% of their weekly income. This group also preferred conditional incentives provided after completion of diagnostic evaluation, suggesting that incentives may increase motivation and adherence.[58] In contrast, participants in the lowest-income quartile preferred unconditional incentives provided immediately, suggesting that they were not willing to accept uncertain payment and may view incentives as funds to pay for or offset costs of care that would exacerbate poverty. Research on the various mechanisms by which incentives alter behavior and health outcomes is an ongoing area of research for economists and public health experts.[59] One meta-analysis of the use of behavioral

Table 3. Willingness to accept incentives for receiving TB test results by household income quartile (N = 161).*

	Overall (N = 161)	Bottom quartile (n = 37)	Second quartile (n = 35)	Third quartile (n = 35)	Highest (n = 25)	*P* value
	N (%) or median (IQR)					
Monthly household income (USh)*	150, 00 (70 000-300 000)	50 000 (30 000-50 000)	100 000 (80 000-150 000)	255 000 (200 000-300 000)	460 000 (400 000-550 000)	<.001
Accepted 500 USh	40 (24.8)	10 (27.0)	11 (31.4)	4 (11.1)	7 (26.9)	.20
Accepted ≤2000 USh	69 (42.9)	17 (46.0)	18 (51.4)	8 (22.2)	12 (46.2)	.06
Accepted ≤5000 USh	112 (69.6)	30 (81.1)	22 (62.9)	18 (50.0)	20 (76.9)	.02
Accepted ≤10 000 USh	145 (90.1)	33 (89.2)	33 (94.3)	30 (83.3)	23 (88.5)	.54
Accepted ≤25 000 USh	161 (100.0)	37 (100.0)	35 (100.0)	36 (100.0)	26 (100.0)	-

IQR indicates interquartile range; TB, tuberculosis; USh, Ugandan shillings
*16.8% of total participants missing information on household income. At the time of data collection $1.00 was equivalent to 3745 USh.

economics in the design of financial incentives for health promotion showed that while incentives typically increased the odds of eliciting behavior change, different demographic and socioeconomic characteristics of targeted populations predicted the success of different incentive structures.[60] Our study reinforces this conclusion.

Our multivariate analysis found that participants in higher-income quartiles were more likely to accept TB diagnostic evaluation for higher incentive values compared to those in the lowest quartile (aOR = 2.38, 95% CI: 1.20-4.69). Participants in the third income quartile, whose household incomes fall at or below the poverty threshold of $1.90/day,[41] were more likely to prefer unconditional incentives and have a higher WTA threshold. Preference for relatively higher-valued incentives in this marginally wealthier population may reflect decision making by individuals trying to prevent impoverishment. Incentives may work by mitigating the negative financial effects of direct and indirect (opportunity) costs associated with accessing health services.[61] The provision of cash or transportation vouchers to those already most impoverished or those at the brink of falling into poverty may act as a social protection intervention. Nonetheless, 40% of all study participants reported that next-day return to the health center would be difficult, making them 2.53 times as likely to only accept the highest incentive values compared to those who said it would be easy. This suggests that there are challenges for individuals regardless of relative wealth—and that cash or other forms of incentives could act as an important motivational or protective intervention for improving access to the health center and TB outcomes overall.

Our study has some limitations. Some data were incomplete; for example, 17% of household income data were missing, usually because participants were unable to recall this information. We addressed this limitation using multiple imputation, a well-known, flexible method to achieve improved precision and remedy biases resulting from data not missing at random.[62] We acknowledge that self-reported income is an imperfect and potentially unreliable measure of wealth, particularly in low-resource settings where asset ownership and property might be a better indication of relative wealth.[63] Another potential source of bias was the use of only 2 starting values for the WTA negotiation, making it such that only some of the WTA outcomes were possible depending on which amount the participant was initially offered. Finally, because the willingness-to-accept questions were asked in a survey format that was a subset of a larger study, by design we did not have the power to detect meaningful differences between groups. Even so, we were able to describe some important

Table 4. Factors associated with increased incentive values to return to the health center to complete diagnostic evaluation, based on ordered logistic regression.

	Unadjusted		Adjusted	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Age >38 years	0.55 (0.32-0.94)	.03	0.44 (0.22-0.91)	.03
Male sex	0.98 (0.50-1.96)	.97	-	
Urban community health center	0.64 (0.22-1.86)	.41	0.46 (0.16-1.35)	.16
Married	1.31 (0.77-2.22)	.32	-	
Difficult to return to health center	2.12 (1.48-3.05)	<.001	2.53 (1.59-4.02)	<.001
Income quartile				
Second highest	1.06 (0.51-2.21)	.87	1.13 (0.51-2.47)	.76
Third highest	2.34 (1.23-4.45)	.01	2.38 (1.20-4.69)	.01
Lowest income quartile	1.00 (0.39-2.63)	.99	1.15 (0.50-2.65)	.73

CI indicates confidence interval; OR, odds ratio.

associations among incentive structure, acceptability, and patient social and demographic characteristics.

Conclusions

The use of hypothetical choice contingent valuation tools such as willingness to accept can be useful in designing a complex intervention such as social protection interventions for public health.[31,64,65] Social protection interventions are meant to protect patients from serious social and financial risk and are a core component of the World Health Organization's End TB strategy,[66] which cites their potential for improving TB outcomes among vulnerable populations.[67] Despite some differences in the level of acceptable incentive amounts, we found that modest cash transfer values may be sufficient to facilitate and motivate up to 70% of patients who would otherwise not return to the health center to complete TB diagnostic evaluation in this resource-limited setting. This finding suggests that the implementation of cash transfer programs such as this one on a broader scale could have a substantial effect on reducing pretreatment LTFU, the largest gap in the patient cascade of care. Further, these methods can be further leveraged to inform the design and evaluation of other social protection interventions for vulnerable populations. By suggesting characteristics such as incentive type, duration, value, and conditionality that predict successful TB outcomes for specific populations, we provide a systematic approach for national TB programs to operationalize social protection interventions as a core pillar of TB prevention and care activities.

Supplemental Material

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