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Prevalence of pulmonary tuberculosis among students in three eastern Ethiopian universities

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SUMMARY

SETTINGS : Three universities located in eastern Ethiopia: Haramaya University, Haramaya; Dire-Dawa University, Dire-Dawa; and Jigjiga University, Jigjiga.

OBJECTIVE : To determine the burden of pulmonary tuberculosis (PTB) among university students and to identify risk factors for the development of TB disease.

DESIGN : All full-time university students were screened for symptoms of PTB and sputum was collected for acid-fast bacilli (AFB) examination and culture for *Mycobacterium tuberculosis*.

RESULTS : Of 35 344 students screened, we identified 153 PTB cases that occurred over the 1-year study period, or 433/100 000 students. Of these, 117 (76%) PTB cases were found through passive case finding at student health centres, while 36 (24%) previously undiagnosed patients were identified through active case finding. Sixteen cases detected using active case finding (44%) were smear-positive. Living in a dormitory with ≥ 5 students and attending university for ≥ 2 years were both significantly associated with PTB (adjusted OR 2.49 and 3.79, respectively, $P < 0.001$). In persons who underwent drug susceptibility testing, 11 (30.5%) had resistance to at least one first-line anti-tuberculosis drug.

CONCLUSION : We found a high burden of TB among university students in eastern Ethiopia. Screening for PTB upon university admission and at regular intervals should be considered to minimise TB transmission on university campuses.

RÉSUMÉ

Universités situées dans l'Est de l'Ethiopie : Haramaya University, Haramaya ; Dire-Dawa University, Dire-Dawa ; et Jigjiga University, Jigjiga.

Déterminer le poids de la tuberculose pulmonaire (TBP) parmi les étudiants des universités et identifier les facteurs de risque de développement de la TB maladie.

Tous les étudiants à temps plein ont été dépistés à la recherche de symptômes de TBP et des crachats ont été recueillis à la recherche de bacilles acido-alcool-résistants et mis en culture à la recherche de *Mycobacterium tuberculosis*.

Sur 35 344 étudiants dépistés, nous avons identifié un total de 153 cas de TBP qui sont survenus sur une période d'un an d'étude, soit 433 pour 100 000 étudiants. Les activités de recherche passive des cas dans les centres de santé étudiants ont identifié 117 (76%) cas de TBP dont 36 (24%) n'avaient pas été diagnostiqués et ont été identifiés par recherche active. Seize cas détectés à l'aide de la recherche active de cas (44%) étaient à frottis positif. Vivre dans un dortoir avec au moins cinq étudiants et fréquenter l'université pendant ≥ 2 ans ont été tous deux significativement associés à une TBP (OR ajusté 2,49 et 3,79, respectivement ; $P < 0,001$). Chez ceux qui ont eu un test de pharmacosensibilité, 11 (30,5%) avaient une résistance à au moins un médicament antituberculeux de première ligne.

Nous avons constaté un poids élevé de la TB parmi les étudiants universitaires dans l'Est de l'Éthiopie. Le dépistage de la TBP lors de l'admission à l'université et à intervalles réguliers devrait être envisagé afin de minimiser la transmission de la TB sur les campus universitaires.

RESUMEN

Varias universidades del este de Etiopía a saber: Haramaya University, Haramaya; Dire-Dawa University, Dire-Dawa; et Jigjiga University, Jigjiga.

Determinar la carga de morbilidad por tuberculosis pulmonar (TBP) en los estudiantes universitarios y definir los factores de riesgo de evolución hacia la enfermedad tuberculosa.

Se interrogaron todos los estudiantes universitarios de tiempo completo en busca de síntomas indicativos de TB y se recogieron muestras de esputo para baciloscopia y cultivo de *Mycobacterium tuberculosis*.

En los 35 344 estudiantes examinados se detectaron 153 casos de TBP ocurridos durante el período de un año del estudio, o sea 433 por 100 000 estudiantes. Las actividades de búsqueda pasiva de casos en los centros de salud universitarios detectaron 117 casos de TBP (76%) y 36 (24%) que no se habían diagnosticado antes se reconocieron mediante la búsqueda activa de casos. Dieciséis casos detectados mediante la búsqueda de casos activos (44%) fueron frotis positivos. Los factores que se asociaron de manera significativa con la TBP fueron el hecho de habitar en un dormitorio como mínimo con cinco estudiantes (OR ajustado [ORa] 2,49) y haber asistido a la universidad durante ≥ 2 años (ORa 3,79; $P < 0,001$). En las personas que contaban con pruebas de sensibilidad a los medicamentos, 11 exhibieron resistencia como mínimo a un fármaco antituberculoso de primera línea (30,5%).

El estudio reveló una alta carga de morbilidad por TB en los estudiantes universitarios del este de Etiopía. Se recomienda considerar la posibilidad de practicar la detección sistemática de la TBP en el momento de la inscripción universitaria y luego con intervalos regulares, a fin de reducir al mínimo la transmisión de la enfermedad en los terrenos de la universidad.

Keywords

PTB; students; active case finding; prevalence

TUBERCULOSIS (TB) REMAINS the leading cause of infectious disease-related mortality worldwide.¹ Ethiopia is considered a high TB burden country, with an incidence of 177 per 100 000 population in 2016, 68% of which were pulmonary TB (PTB) cases.² Early detection of PTB and prompt initiation of effective anti-tuberculosis treatment are critical components of TB prevention in high-burden countries.³

The TB case detection rate in Ethiopia is 60%, with an estimated 80 000 Ethiopians going undiagnosed each year, resulting in ongoing transmission of disease to close contacts.⁴ Focused public health interventions will therefore be necessary to improve early detection of active TB disease and prevent transmission.^{5,6}

University students may be at particularly high risk for the development of active TB disease due to a high proportion of students living in congregate settings (dormitories) and limited health care services on campus for prompt diagnosis.⁷ Crowded student living conditions in universities in many developing countries have been further exacerbated by rapid increases in student enrollment.⁸ In Ethiopia, the number of public universities expanded from five to 37 in less than two decades, with housing infrastructure often lagging behind.⁹ The overall enrollment rate of students in higher education institutions of Ethiopia was about 14 times higher in the 2015–2016 academic year than in 2003–2004.¹⁰

Studies have suggested that TB prevalence may be significantly higher in Ethiopian universities than in the rest of the country.¹¹ However, these estimates of TB prevalence have relied on passive case finding (PCF) from student health clinics, and may underestimate the burden of TB in the student population. We used an active case finding (ACF) approach to determine the prevalence of PTB in three Ethiopian universities. We sought to determine the yield of ACF for the identification of undiagnosed PTB and determine the risk factors for active TB disease among university students.

STUDY POPULATION AND METHODS

Study sites

The present study was conducted in three universities: Haramaya University (Haramaya, Oromia Regional State), Dire Dawa University (Dire Dawa city administration) and Jigjiga University (Jigjiga, Somali Regional State). The Health Sciences campus of Haramaya University is located in Harari Regional State.

Study design

A cross-sectional study was conducted from May 2016 to April 2017 to assess the prevalence of sputum smear- and culture-positive PTB and associated risk factors among students attending one of these three Ethiopian universities. All students attending these universities were screened for symptoms suggestive of PTB by dormitory-to-dormitory visits using the standard World Health Organization TB symptoms screening document.¹²

Students were assessed for the presence of the following symptoms: cough for >2 weeks (score = 2), sputum production (score = 2), loss of weight in last 3 months (score = 1), loss of appetite (score = 1), and chest pain (score = 1). Students with a score of ≥ 5 or a history of anti-tuberculosis treatment in the last 5 years were considered to have a positive screen. All participants with a positive symptom screen were enrolled in the study. Participants who had already received a diagnosis of PTB at student health clinics during the study period were also enrolled.

The study protocol was approved by the College of Natural Sciences Research Ethics Review Board, Addis Ababa University, Addis Ababa, Ethiopia. All students at the three universities involved in this study were aged ≥ 18 years, and all enrolled participants provided written informed consent. Study subjects newly diagnosed with PTB using sputum acid-fast bacilli (AFB) smear and/or *Mycobacterium tuberculosis* culture were enrolled in the DOTS program. Students positive for human immunodeficiency virus (HIV) were also offered linkage to clinics for antiretroviral therapy.

Clinical sample and data collection procedures

Questionnaires were provided and sample collection was performed by study staff (trained physicians, public health officers and nurses) during visits to student dormitories. Dormitory visits were conducted during times when few students were in class to maximise study participation. Individual appointments were made for students who were absent during the first dormitory visit. Students with prolonged absences from campus were excluded from the study. Data on demographics, medical history and TB risk factors were collected from students with a positive TB symptom screen using a standard questionnaire. All data collection forms were examined for quality by the lead investigator. Participants were also requested to give two spot sputum samples for microscopic examination and culture. Students received instruction on how to collect appropriate sputum specimens, and all specimens were collected in Falcon™ tubes (Fisher Scientific, Pittsburgh, PA, USA). For students already diagnosed with PTB and receiving treatment, no additional sputum samples were collected. All students diagnosed with PTB were tested for HIV after consent and appropriate pre-test counseling.

Laboratory methods

AFB examination with Ziehl-Neelsen (ZN) staining was performed by trained laboratory technicians following the guidelines of the International Union Against Tuberculosis and Lung Disease.¹³ All smear-positive and 10% of smear-negative slides were re-examined by senior laboratory technicians at the Harari Health Research and Regional Laboratory (HHRRL), Harar, Ethiopia. The second spot sputum samples were temporarily stored at -20°C until transport to HHRRL within 1–2 days using a cold box at 4°C . At HHRRL, cultivation of *M. tuberculosis* was done on Löwenstein-Jensen (LJ) medium following the standard operational procedure.¹⁴ Cultures with *M. tuberculosis* growth on LJ medium were transported to the National TB Reference Laboratory, Addis Ababa, for drug susceptibility testing (DST) in a liquid MGIT™ 960™ System (Mycobacterium Growth Indicator Tube; BD, Sparks, MD, USA) using the MGIT SIRE kit as described by the manufacturer.¹⁵

Data analysis

Data were double-entered into an Excel™ (MicroSoft, Redmond, WA, USA) sheet and exported to SPSS v23 (IBM, Armonk, NY, USA) for statistical analysis. The association between participant characteristics and PTB status was assessed using univariate logistic regression. All variables significantly associated with PTB were included in the multivariate logistic regression model. Population proportions were compared using the χ^2 test.

RESULTS

We identified 153 students diagnosed with PTB during the 1-year study period (433 per 100 000 students). The proportion of students diagnosed with PTB at different university campuses ranged from 206 to 569/ 100000 (Table 1). Students diagnosed with PTB included 117 (76%) who were identified through PCF at student health centres. Of PTB patients diagnosed at student health centres, 76 (65%) had a positive AFB sputum smear and 41 (35%) were diagnosed clinically. Because AFB sputum culture is not routinely available at student health centres, these cases could not be confirmed by AFB culture. ACF was used to screen 35 344 students for PTB using the WHO TB symptom screening criteria and 1097 students had a positive symptom screen (Table 1). Thirty-six PTB patients (24%) were identified through ACF, all of whom were sputum culture-positive for *M. tuberculosis*. Of students diagnosed by ACF, 16 (44%) had a positive AFB sputum smear. The prevalence of sputum smear-positive PTB and sputum culture-positive PTB was calculated to be respectively 46 and 102/100 000. PTB patients were screened for HIV, and the prevalence of HIV co-infection among students with PTB was 1.96% (3/153).

Characteristics of study participants

Of the 1097 students with a positive PTB symptom screen, 831 (75.8%) were male. The mean age was 21.4 years (standard deviation 1.74); 63.1% were rural residents. Many of the participants came from Oromia Regional State (42.4%), followed by Southern Nations and Nationalities (17.1%), and the Amhara Regional States (16.5%). Participants enrolled in their first to sixth year at university were captured: 54.6% were in Year 1 or Year 2 (Table 2).

Participant characteristics associated with pulmonary tuberculosis

Univariate analysis showed that male sex and previous rural residence were significantly associated with PTB (respectively crude odds ratio [OR] 1.85, 95% confidence interval [CI] 1.17–2.93 and OR 1.65, 95%CI 1.13–2.41; $P < 0.05$ for both). Students from Dire-Dawa University had greater odds of PTB than students at Haramaya University (OR 1.74, 95%CI 1.15–2.64; $P < 0.05$) (Table 2).

The odds of having PTB were higher in students attending university for >2 years (OR 2.70, 95%CI 1.88–3.87), and students sharing a room with >5 people (OR 2.18, 95%CI 1.53–3.10) ($P < 0.001$ for both). Close contact with a student coughing for ≥ 2 weeks and previous contact with a known TB patient at home were both associated with PTB among university students (respectively OR 1.85, 95%CI 1.24–2.75 and OR 2.46, 95%CI 1.74–3.48; $P < 0.05$ for both) (Table 2). There was no association between PTB and *khat* and tobacco use,

although there were few participants who used either substance heavily. Those with a previous history of TB did not have an increased risk of PTB (Table 2).

Multivariate analysis of the variables that showed a statistically significant association with the occurrence of PTB on univariate analysis remained significant ($P < 0.05$), except for the previous residence of the student being urban or rural ($P > 0.05$) (Table 3). The significant difference in occurrence of PTB between the universities studied was indicated not only in Dire Dawa University, but also in Jigjiga University (adjusted OR 1.77, 95% CI 1.11–2.83) (Table 3).

Drug susceptibility testing

Phenotypic DST for first-line drugs (FLDs) was conducted on 36 *M. tuberculosis* isolates. Eleven isolates (30.5%) were resistant to at least one FLD. The most common anti-tuberculosis drugs to which *M. tuberculosis* was resistant were streptomycin (19.4%) and isoniazid (16.7%) (Table 4). None of the students identified using ACF for whom full DST results were available had multidrug-resistant TB (MDR-TB). Of the 11 students with resistance to at least one FLD, four (36%) reported a previous history of anti-tuberculosis treatment. Of the 117 PTB cases already on anti-tuberculosis treatment, two (1.7%) were diagnosed with rifampin (RMP) resistance based on results from the Xpert® MTB/RIF assay (Cepheid, Sunnyvale, CA, USA).

DISCUSSION

We identified a high prevalence of PTB among students who were not diagnosed by current PCF activities in eastern Ethiopian universities. The number of annual PTB case notifications through PCF was 331/100 000 students, nearly three times greater than the estimated annual number of PTB cases occurring nationally.² Furthermore, we found that an additional 102 students/100 000 had prevalent culture-positive PTB that had not been identified by PCF. This is, to our knowledge, the first large-scale study in Ethiopian universities to assess the utility ACF to identify previously undiagnosed cases of PTB among students. These findings suggest that Ethiopian universities may be sites of high TB transmission and, given the increasingly crowded living conditions of students, should be a focus of future public health interventions to limit the spread of TB.

The burden of PTB found among students in this study was comparable with other estimates of TB prevalence at Ethiopian universities, which also demonstrated a high burden of disease. The number of TB cases identified in a 6-month PCF study from Jimma University, Jimma, Ethiopia, was 158/100 000,¹⁶ which is similar to the 331 PTB cases/100 000 identified by PCF over a 1-year period in the present study. A 5-year retrospective study conducted at the University of Gondar, Gondar, Ethiopia, found a slightly lower number of annual PTB case notifications among students, ranging from 211 to 275/100 000.¹⁷ However, these studies did not employ an ACF strategy, and our study suggests that at any one time there is likely to be a high number of prevalent sputum smear- and culture-positive TB cases not identified by existing PCF activities. Differences in annual reported PTB cases between universities may reflect differences in regional TB prevalence within Ethiopia, as well as changes in PTB prevalence over time. A study conducted at Adama Science and

Technology University, Adama, Ethiopia, showed a decline in the number of annual reported PTB cases from 1187/100 000 students in the 2009/2010 academic year to 347/100 000 in the 2013/2014 academic year.¹¹

About a quarter of PTB cases were identified using ACF. Among students with a positive symptom screen, 3.7% had a positive sputum culture for *M. tuberculosis*, suggesting that this is a high-yield intervention measure to identify infectious TB cases living in dormitories. Furthermore, 44% of those diagnosed using ACF had a positive AFB sputum smear. This finding suggests that students identified by active screening may have been highly infectious and highlights the urgent need for employing infection control mechanisms in congregate settings such as universities.

In the three universities studied, students shared a dormitory with up to 20 people, and room size varied widely. Moreover, students spent a great deal of time in crowded lecture rooms, libraries and dining halls with hundreds to thousands of students.¹⁷ Living in crowded dormitories (>5 students) and living at the university for >2 years were both independently associated with a diagnosis of PTB. Furthermore, we found those reporting close contact with a student with cough of ≥ 2 weeks had significantly greater odds of PTB. These observations support the conclusion that the higher TB prevalence rate in students was due to high transmission on university campuses. The more time students spend in crowded university living environments, the greater their risk of developing PTB.

Statistically significant differences in the prevalence of PTB between universities in the present study suggested that certain university characteristics may have increased the risk for PTB. Students in Dire-Dawa and Jigjiga Universities had significantly greater odds of PTB than students at the Haramaya University. This finding could be explained, in part, by differences in institutional infrastructure, as these two universities were established more recently than Haramaya University. Another potential difference between universities included variability in implementing TB prevention and control programs. For example, Dire-Dawa and Jigjiga Universities did not have well-established laboratory services at student health clinics, and AFB smear microscopy was generally unavailable.

The risk of TB exposure in students' home communities also had a role in the risk of developing PTB at universities. Students from rural communities had greater odds of PTB than urban residents. These findings are similar to a study conducted in eastern Ethiopia communities which demonstrated that rural residents were at about 1.6 times greater risk for PTB than their urban counterparts.¹⁸ This finding may be a reflection of lower health literacy and limited access to health facilities for individuals living in rural areas.¹⁹

Phenotypic DST conducted on 36 isolates from students showed there were no cases of MDR-TB among students with sputum culture for *M. tuberculosis*. Two students at Haramaya University (1.3% of total) were positive for RMP resistance based on the Xpert assay. Of students with a culture for *M. tuberculosis*, 30% had resistance to at least one FLD. This result was higher than that noted in previous studies conducted in Ethiopian communities, which demonstrated FLD resistance to be present in 22–23% of *M. tuberculosis* isolates.^{20,21} These findings suggest drug resistance could be an emerging

problem among university students with PTB, and further highlights the need to address the spread of TB on university campuses to limit the transmission of more drug-resistant strains.

The present study had several limitations. We could only evaluate PTB among students living on university campuses. Some students with symptoms of PTB may have left their campus to seek medical care in their home communities, resulting in an underestimation of TB cases. Moreover, sputum samples were not collected from students already being treated for PTB. Because persons on anti-tuberculosis treatment may still have a positive AFB sputum smear and culture, this may have resulted in an underestimation of smear- and culture-positive PTB. Finally, as only cases of PTB were studied, the burden of extra-pulmonary TB was not assessed. In future studies, longer follow-up periods and more detailed health assessments may improve estimation of TB prevalence among students.

CONCLUSIONS

The present study revealed a high burden of PTB among students attending eastern Ethiopian universities. The high TB prevalence rate may have been due to ongoing TB transmission among students living in crowded, congregate facilities. We found that active TB screening efforts can be an effective intervention to diagnose previously unrecognised PTB. Improving infrastructure and establishing TB control policies within Ethiopian universities, including a requirement for PTB screening upon university admission and at regular intervals, will be important to limit TB transmission among students.

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Table 1
Number of students diagnosed with PTB disease by PCF and ACF among University students, eastern Ethiopia, May 2016–April 2017

Universities	Total currently enrolled	Total screened for PTB	Positive for symptom screening	PTB cases by PCF	PTB cases by ACF	Total PTB cases	PTB cases /100 000
Haramaya University	15 875	14 344	610	52	18	70	488
Main Campus	7 286	6 701	287	28	8	36	537
Institute of Technology Campus	3 628	3 337	195	12	7	19	569
Veterinary Campus	2 040	1 876	95	7	3	10	533
Harar Campus	2 921	2 430	33	5	0	5	206
Dire Dawa University	11 402	10 603	228	34	8	42	396
Jigjiga University	11 038	10 397	259	31	10	41	394
Total	38 315	35 344	1 097	117	36	153	433

PTB = pulmonary tuberculosis; PCF = passive case finding; ACF = active case finding.

Table 2

Univariate analysis of study participants' characteristics and occurrence of PTB among University students, eastern Ethiopia, May 2016–April 2017

Variables	<i>n</i> (%)	OR (95%CI)	<i>P</i> value
Higher education institution			
Haramaya University	610 (55.6)	1	
Dire-Dawa University	228 (20.80)	1.74 (1.15–2.64)	0.009
Jigjiga University	259 (23.6)	1.45 (0.96–2.20)	0.080
Sex			
Male	831 (75.8)	1	
Female	266 (24.2)	1.85 (1.17–2.93)	0.009
Age, years			
18–20	379 (34.5)	1	
21–23	559 (51.0)	1.28 (0.88–1.88)	0.199
≥24	159 (14.5)	1.02 (0.58–1.78)	0.955
Place of residence before joining University			
Tigray	90 (8.2)	1	
Afar and Benishangul	12 (1.1)	2.40 (0.56–10.22)	0.238
Amhara	181 (16.5)	0.99 (0.46–2.15)	0.987
Oromia	465 (42.4)	1.19 (0.60–2.35)	0.621
Somali	49 (4.5)	1.20 (0.43–3.32)	0.729
Harari	16 (1.5)	1.66 (0.41–6.75)	0.481
SNNP	188 (17.1)	1.20 (0.57–2.55)	0.627
Addis Ababa	68 (6.2)	1.39 (0.56–3.42)	0.478
Dire Dawa	28 (2.6)	0.86 (0.22–3.34)	0.830
Previous residence			
Urban	405 (36.9)	1	
Rural	692 (63.1)	1.65 (1.13–2.41)	0.009
Year of student at the university			
Years 1 and 2	593 (54.1)	1	
Year 3 and above	504 (45.9)	2.70 (1.88–3.87)	<0.001
Number of students per dormitory			
1–5	574 (52.4)	1	
>5	523 (47.7)	2.18 (1.53–3.10)	<0.001
Close contact with a student with cough of ≥2 weeks			
No	369 (33.6)	1	
Yes	728 (66.4)	1.85 (1.24–2.75)	0.003
Smoking habit			
None	925 (84.3)	1	
Yes	172 (15.7)	0.84 (0.51–1.37)	0.474
<i>khat</i> chewing habit *			
None	840 (76.6)	1	

Variables	<i>n</i> (%)	OR (95%CI)	<i>P</i> value
Yes	257 (23.4)	0.77 (0.50–1.18)	0.230
Sharing a dormitory room with TB case at the university			
No	1047 (95.4)	1	
Yes	50 (4.6)	1.19 (0.55–2.58)	0.668
History of diagnosis for TB			
No	982 (89.5)	1	
Yes	115(10.5)	1.44 (0.87–2.39)	0.160
Contact with known TB patient at home?			
No	694 (63.3)	1	
Yes	403 (36.7)	2.46 (1.74–3.48)	<0.001

*
A locally grown plant commonly chewed due to its stimulant effects.

PTB = pulmonary tuberculosis; OR = odds ratio; CI = confidence interval; SNNP = Southern Nations, Nationalities, and Peoples' Region.

Table 3

Multivariate analysis of study participants' characteristics and occurrence of PTB among university students, eastern Ethiopia, May 2016–April 2017

Variables	n (%)	aOR (95%CI)	P value
Higher education institution			
Haramaya University	610 (55.6)	1	
Dire Dawa University	228 (20.8)	2.61 (1.65–4.15)	<0.001
Jigjiga University	259 (23.6)	1.77 (1.11–2.83)	0.016
Sex			
Male	831 (75.8)	1	
Female	266 (24.2)	1.67 (1.03–2.72)	0.039
Previous place of residence			
Urban	405 (36.9)	1	
Rural	692 (63.1)	1.38 (0.92–2.07)	0.125
Year of student at the university			
Years 1 and 2	593 (54.1)	1	
Year 3 and above	504 (45.9)	3.79 (2.55–5.62)	<0.001
Number of students per dormitory			
1–5	574 (52.4)	1	
>5	523 (47.7)	2.49 (1.69–3.67)	<0.001
Close contact with a student with cough of ≥ 2 weeks			
No	369 (33.6)	1	
Yes	728 (66.4)	1.64 (1.06–2.53)	0.026
Contact with known TB patient at home?			
No	694 (63.3)	1	
Yes	403 (36.7)	2.01 (1.38–2.93)	<0.001

PTB = pulmonary tuberculosis; aOR = adjusted odds ratio; CI = confidence interval.

Table 4

Summary of drug susceptibility testing of isolates for first-line anti-tuberculosis drugs among university students, eastern Ethiopia, May 2016–April 2017

Drug	Result	<i>n</i> (%)
Streptomycin	Susceptible	29 (80.6)
	Resistant	7 (19.4)
Isoniazid	Susceptible	30 (83.3)
	Resistant	6 (16.7)
Rifampin	Susceptible	36 (100)
	Resistant	0
Ethambutol	Susceptible	36 (100)
	Resistant	0
Resistant to ≥ 1 FLDs	No	25 (69.4)
	Yes	11 (30.5)
MDR-TB	No	36 (100)
	Yes	0

FLD = first-line drug; MDR-TB = multidrug-resistant tuberculosis.