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Screening for pulmonary tuberculosis in high-risk groups of diabetic patients

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Highlights

- It is feasible but uneconomical to carry out large-scale and regular chest X-ray screening for TB in diabetic patients.
- It is more economical to select a high-risk population for TB screening than to select all diabetes patients.
• It is recommended to select diabetic patients with a low BMI, high FBG and low triglycerides as screening subjects for TB.

Abstract

Background
The double burden of diabetes mellitus (DM) and tuberculosis (TB) has attracted increasing attention because DM not only increases the risk of active TB but also affects treatment outcomes. Screening for TB among diabetic patients has been recommended but requires real-world evidence by considering its cost-effectiveness, cost-utility and cost-benefit.

Methods
We carried out a screening program in Jiangyin City of Jiangsu Province, China. A total of 14869 diabetic patients received regular physical examination for three consecutive years and were followed for the diagnosis of TB. We evaluated the cost of screening and the effectiveness, utility and social benefits attributed to the program. We further conducted a matched case-control study and used the nomogram to identify the high-risk groups that can be the target population for screening.

Results
Among 14869 diabetic patients who participated in this screening program, 22 were diagnosed with TB, resulting in an incremental cost-effectiveness ratio (ICER) of 83,910 CNY per disability-adjusted life year (DALY) gained and a cost-benefit ratio of 0.50. If we limited the screening program to high-risk diabetic patients by considering
body mass index (BMI), fasting blood glucose (FBG) and triglycerides, the ICER decreased to 34,303 CNY per DALY gained, and the cost-benefit ratio increased to 1.22.

Conclusions
Screening TB using regular chest X-ray examination is feasible but not economical in areas with a low incidence of TB. It is recommended to select diabetic patients with low BMI, high FBG and low triglycerides as screening subjects for TB.

Keywords: Diabetes mellitus; Tuberculosis; Economic evaluation; Risk factors

Introduction
There has been a rapid escalation of type 2 diabetes mellitus (DM) in developing countries (Afroz, Alramadan et al. 2018, Yue, Mao et al. 2016). According to the statistics of the International Diabetes Federation (IDF), China accounts for the highest proportion of DM cases in the world (114 million) (IDF 2017). Moreover, China is bearing a double burden of both DM and tuberculosis (TB), while many studies have been carried out on the mutual impact of these two diseases. The incidence of DM is recognized as a high-risk factor that may contribute to TB dissemination. However, mechanisms that favor infection in DM are just starting to emerge (Segura-Cerda, Lopez-Romero et al. 2019). Patients with DM are more susceptible to TB, mainly due to chronic inflammation, which is marked by an increase in pro-inflammatory cytokines and a decrease in immunomodulatory cytokines (Kumar Nathella and Babu 2017). The susceptibility to TB among patients with DM may also be caused by dyslipidemia (Hensel, Kempker et al. 2016, Restrepo and Schlesinger 2013), because host lipids are essential energy sources used by mycobacteria to persist in a latent infection state (Tsai,
Kuo et al. 2017). DM is a common cause of dyslipidemia, particularly if glycemia is poorly controlled.

TB is a chronic infectious disease caused by *Mycobacterium tuberculosis* (MTB). TB typically affects the lungs, causing pulmonary TB, and is spread when patients expel bacteria into the air. Globally, an estimated 10.0 million people fell ill with TB in 2018, a number that has been relatively stable in recent years (WHO 2019). China accounted for 9% of the global cases, second only to India. Current passive case finding strategies are not effective in identifying TB patients, and more than half of individuals with TB symptoms in China fail to seek health care in a timely manner (Chen, Yang et al. 2017). Despite the well-documented association between DM and TB, the evidence for screening TB among diabetic patients remains limited (Lee, Huang et al. 2017).

With the advent of the World Health Organization End TB Strategy, there has been renewed interest in screening for active TB in high-risk populations in China (Zenner, Hafezi et al. 2017). A screening program conducted in four cities in China showed that the TB case notification rate per screened population (range 31–111/100,000) was consistently higher than that in the general population of the catchment areas (Lin, Li et al. 2012). Data from ten community health centers in China showed that the notification rate per screened population was 102/100,000, which was 2.8 times higher than that in the general population (Lin, Innes et al. 2015). Another study conducted in Shandong province also showed that integrating TB screening into annual health examinations for the rural elderly could significantly improve the case detection rate (Zhang, Li et al. 2015).
Although active screening helps to identify more patients, the cost of screening should not be neglected. In rural Sichuan, China, an active TB finding project yielded 146 TB cases per 100,000 seniors screened, with a cost of $4,897 per detected case (Zhang, Xia et al. 2019). A study carried out in Hong Kong reported that screening for TB in elderly patients at admission was valuable, based on the WTP threshold of 50,000 US$ per QALY gained (Li, Yip et al. 2018). A study in Shandong, China, reported that the cost was 17,954.88 CNY per QALY for a community-based strategy among DM patients, while the cost was 38,360.26 CNY per QALY for a clinic-based strategy (Zhao 2014). As the cost of a community-based strategy was significantly lower than the national annual GDP per capita (38459.47 CNY), it could be defined as a very cost-effective strategy. The cost of a clinic-based strategy was similar to the national annual GDP per capita but lower than three times the GDP per capita; thus, this strategy could still be regarded as cost-effective.

Screening for TB among patients with DM has been recommended but needs real-world evidence by considering its costs and outcomes. The present study described the detection rate, cost-effectiveness, cost-utility and cost-benefit of a community-based active case finding program with aims to provide low-cost and high-effective strategies for the active detection of TB (Zhao 2014).

**Methods**

**Study population and data collection**

We carried out a massive screening program in Jiangyin City of Jiangsu Province, China, from 2016 to 2018. Jiangyin is a county-level city on the southern bank of the Yangtze River and one of the most developed cities in China. A total of 14869 diabetic patients
who received regular physical examination at 46 medical institutions for three consecutive years were selected as the study subjects and followed for the diagnosis of TB. All participants were interviewed with a simple questionnaire and received routine blood examination; a test for fasting blood glucose (FBG), total cholesterol (TC), triglycerides (TG) and high-density lipoprotein (HDL); electrocardiogram; and chest X-ray examination. The baseline questionnaire was designed to gather information on age, sex, body mass index (BMI), waist circumference, tobacco smoking, alcohol drinking and physical activity. Patients with suspected TB cases detected through chest X-ray examination were referred to the designated hospital for a sputum smear test and culture. The diagnosis of TB followed the National Tuberculosis Guidelines of China (MOH and CDC 2009). The flow chart of the study is shown in Fig 1.

**Statistical analysis**

**Data description**

Data were entered with EpiData 3.1 (EpiData Association, Odense, Denmark) and analyzed using Stata 15.0 (Stata Corp., College Station, TX, USA) and R version 3.5.1 (https://www.r-project.org/). Continuous variables were summarized as medians with interquartile ranges (IQRs). Categorized variables were described by frequency (n) and proportion (%).

**Economic evaluation**

We used three types of economic evaluation: cost-effectiveness analysis (CEA), cost-utility analysis (CUA) and cost-benefit analysis (CBA). All three are identical in their approach to capturing costs; however, they differ in health effects assessment (Luyten, Naci et al. 2016). CEA is a method to examine both the costs and health outcomes of
interventions. Health outcomes in CEA are expressed in terms of specific clinical, patient-centered or other “natural” end points that are considered important within a particular clinical or health domain (Luyten, Naci et al. 2016). In this study, we used the number of healthy people who had avoided infection to reflect the social effectiveness. Combining both costs and effects, the findings of a CEA are usually reported as an “incremental cost-effectiveness ratio” (ICER). An ICER is calculated as the incremental change in costs divided by the incremental change in health outcomes. This ratio provides an intuitive metric, which is the cost per life year gained, that enables decision-makers to judge the value of the intervention (Firth, Cooper et al. 2008). If the ICER is lower than three times the GDP per capita, the intervention can be regarded as cost-effective (ICER 2016, WHO 2003). A CUA is a broader form of economic evaluation in which health outcomes are translated into a generic measure of health, such as the quality-adjusted life years (QALYs) and the disability-adjusted life years (DALYs) (Luyten, Naci et al. 2016). CBA is the process used to measure the benefits of a decision or taking action minus the costs associated with taking that action. It involves measurable financial metrics such as revenue earned or costs saved as a result of the decision to pursue a project. We used the cost-benefit ratio to evaluate the social benefits of the screening project. If the cost-benefit ratio is greater than 1, the screening project is worth promoting.

By referring to the results in the 4th National TB Epidemiological Survey, one infectious patient was estimated to infect 9 healthy people in areas with DOTS and 15 healthy people in areas without DOTS, so that the timely detection and treatment of one bacterial-positive patient could avoid six infections. The cure rate of TB was defined as 90%, and the rate of self-healing was 25% [19, 20]. We used the following formula to
estimate the number of healthy people (N) that avoided infection due to active screening: 
\[ N = M \times (15 - 9) \times 90\% \],
where M is the number of infectious patients. As reported, patients with smear-positive TB lost 10 DALYs, while discovering and curing one TB patient could restore 7.0 DALYs [21, 22]. The retrievable DALYs by active screening (D) were estimated by the following formula: 
\[ D = M \times 7.0, \]
where M is the number of infectious patients.

The social benefits were calculated in RMB, including the direct and indirect benefits. The direct social benefits refer to the medical expense savings of new patients that avoided by active screening. The indirect benefits refer to the social and economic values that a patient recovered to avoid the loss of productivity. The incidence of active TB among infected people was estimated to be 10%, and the ratio of the working population was 0.7 [20]. We used the following formulas to calculate the direct social benefits (B) and indirect social benefits (E): 
\[ B = N \times 10\% \times C \quad \text{and} \quad E = D \times R \times 0.7, \]
where C is the medical expenses per patient, and R is the real GDP per capita. The total costs for the TB screening program included transportation fees, labor costs and examination costs. The cost of each examination, including chest X-ray, sputum smear and sputum culture, was estimated based on the market price.

**Identifying high-risk diabetics prone to TB**

To identify high-risk diabetic patients prone to TB and save the cost of massive screening, we performed a 1:4 matched case-control analysis using a propensity score and generated the nomogram of risk factors. The nonparametric Spearman's rank correlation coefficient was used to measure the association between variables. The receiver operating characteristic (ROC) curve was used to assess the discriminative
power. We used the odds ratio (OR) and 95% confidence interval (CI) to estimate the strength of the relation. All statistical tests were two-tailed, and the significance level was set at 0.05.

**Results**

**Screening for TB using chest X-ray examination**

Based on the regular health examination, we screened 14869 diabetic patients and detected 22 active TB cases. The three-year cumulative incidence rate was 147.96/100,000. During the same time period, the reported annual incidence of TB was 29.15/100,000 among the general population in the study area, much lower than the estimated incidence of 63/100,000 in China (WHO 2018). The summarized costs for our three-year screening program were 5,286,343 CNY, including 3,581,690 CNY for chest X-ray, sputum smear or sputum culture (Table 2). There were 49 persons estimated to have avoided infection, with a total of 63 averted DALYs. From a health system perspective, the CER was 83,910 CNY/DALY.

The 5th National Tuberculosis Epidemiological Survey suggested that the average treatment cost of TB was 3,400 CNY (The office of the Fifth National TB Epidemiological Survey 2012) and the GDP per capita was 59,200 CNY in 2017. According to the formula described in the Methods section, the estimated social benefit was 2,627,380 CNY, including 16,660 CNY in direct benefits and 2,610,720 CNY in indirect benefits. The cost-benefit ratio was 0.50 when the screening was conducted in general DM patients.

**Identifying high-risk diabetics prone to TB**
Based on the 1:4 matching method, a total of 22 TB cases and 88 controls were involved in the analysis, with the age ranging from 51 to 75 years and the male-to-female ratio at 7:4. The chest X-ray examination showed that 72.7% of the cases and 4.5% of the controls had abnormalities in the lungs. BMI (OR: 0.77, 95% CI: 0.64-0.92) and TG (OR: 0.37, 95% CI: 0.17-0.80) were negatively related to TB. FBG was positively related to the risk of TB, with an OR (95% CI) of 1.18 (1.00-1.38). No significant difference was observed between cases and controls in tobacco smoking, alcohol drinking or physical activity (Table 3).

As the correlation between lipid profiles and BMI was smaller, the collinearity could be ignored (Supplementary file Table S1). As shown in Fig 2, we constructed a multivariable prediction model by considering BMI (adjusted OR [aOR]: 0.791; 95% CI: 0.639-0.979; \( P < 0.05 \)), FBG (aOR: 1.323; 95% CI: 1.007-1.739; \( P < 0.05 \)), TC (aOR: 2.031; 95% CI: 0.857-4.809; \( P = 0.107 \)), TG (aOR: 0.251; 95% CI: 0.080-0.791; \( P < 0.05 \)), and HDL (aOR: 0.416; 95% CI: 0.092-1.885; \( P = 0.255 \)).

**Nomogram performance in individual patients**

Significant risk factors (BMI, FBG and TG) observed in the multivariate conditional logistic regression model were selected for nomogram construction (Fig 4). We defined BMI\( \leq 18.5 \text{ kg/m}^2 \) as group 1 (lower), 18.5 kg/m\(^2 \)\( \leq \)BMI\( \leq 24 \text{ kg/m}^2 \) as group 2 (normal), and BMI\( \geq 24 \text{ kg/m}^2 \) as group 3 (higher); TG\( \leq 1.7 \text{ mmol/L} \) as group 1 (normal), 1.7 mmol/L\( \leq \)TG\( \leq 2.3 \text{ mmol/L} \) as group 2 (critical value), and TG\( \geq 2.3 \text{ mmol/L} \) as group 3 (higher) (Thomas, Ho et al. 2005); FBG\( \leq 6.1 \text{ mmol/L} \) as group 1 (normal), 6.1 mmol/L\( < \)FBG\( \leq 7.22 \text{ mmol/L} \) as group 2 (controlled value), and FBG\( > 7.22 \text{ mmol/L} \) as group 3 (higher) (Martinez, Zhu et al. 2017). To display the application of the
nomogram, we took one diabetic patient who had received active TB screening as an example. Given that the patient’s BMI was 19.84 kg/m$^2$ (50 points), FBG was 13.73 mmol/L (86 points), and TG was 0.61 mmol/L (40 points), this patient’s risk of active TB was approximately 0.45 (total points: 176). The ROC curve is shown in Fig 5, and the AUC was 0.759 (95% CI: 0.647-0.871).

**Evaluation of the screening program among high-risk diabetic patients**

If we limited the target subjects to high-risk patients (BMI <24 kg/m$^2$, FBG >6.1 mmol/L and TG ≤2.3 mmol/L), the eligible number of DM patients was 4059. Among them, we detected 7 TB cases, including 2 infectious patients. The total screening cost was 480,242 CNY, and the CER decreased to 34,303 CNY/DALY. The ICER was 98,083.69 CNY, much smaller than three times the GDP per capita, indicating that it was more cost-effective to screen high-risk patients than to screen all diabetic patients. The total social benefits were 583,832 CNY, including 3,672 CNY in direct benefits and 580,160 CNY in indirect benefits. The cost-benefit ratio increased from 0.50 to 1.22.

**Discussion**

In this study, we demonstrate that the community-based massive screening for TB in diabetic patients can identify TB cases but with high costs, which are predominantly driven by the low incidence of TB. Focusing on high-risk groups of diabetic patients prone to TB is a more economical strategy than massive screening.

Rapid case detection and early treatment are the most effective methods to prevent the spread of TB and reduce its burden (Zhang, Zhao et al. 2019). The link between TB and
DM has long been documented (Baker, Lin et al. 2012, Young, Wotton et al. 2012). Observational studies have confirmed a strong relationship between these two diseases (Lee, Fu et al. 2018). Due to the severity of DM complicated with TB, the treatment of two diseases is facing great difficulties (Chang, Dou et al. 2011, Viswanathan, Vigneswari et al. 2014). If glycemia is not well controlled, the risk of developing active TB will increase (Baker, Lin et al. 2012, Lee, Fu et al. 2016). The interaction may be affected by congenital and adaptive immune dysfunction caused by blood glucose abnormalities among patients with DM (Hensel, Kempker et al. 2016).

The key advantage of our study is that it is based on a community DM cohort with a large sample size. We took advantage of the database of the National Essential Public Health Service (NEPHS) program, which was launched by the Chinese government in 2009 (Yip, Hsiao et al. 2012). The NEPHS program is delivered through publicly funded health facilities, predominantly by general practitioners as the cadre at primary-level centers. It provided basic services, including health records management, health education, elderly health management, infectious disease reporting and treatment, health management for patients with hypertension and DM, and management for patients with TB. In the current study area, the incidence of TB among diabetic populations was relatively lower than that in other areas of China (Liu, Li et al. 2019, Mao, Zhang et al. 2018). This finding may be attributed to a strong primary health care system, good glycemic control and the effective management of comorbidities among patients with DM in the study area (Pealing, Wing et al. 2015).

To reduce the costs of massive screening, we tried to narrow the target population to DM patients with higher risks of TB. DM patients with low BMI, high FBG,
decreases TG were classified as the risk group. Obesity is a major independent risk factor for developing DM, but DM patients with a lower BMI (group 1) have an increased risk of TB (Anuradha, Munisankar et al. 2016, Cai, Ma et al. 2017, Skowronski, Zozulinska-Ziolkiewicz et al. 2014). DM is associated with dyslipidemia caused by high dietary fat intake and disordered hepatic lipid metabolism, while TB is associated with malnutrition and wasting syndrome. The high level of insulin stimulates de novo lipogenesis in hepatocytes while failing to inhibit lipolysis in the insulin-resistant adipocytes of DM patients, resulting in increased free fatty acid flux to the liver and the overproduction of large triglyceride-rich and very-low-density lipoprotein particles (Vrieling, Ronacher et al. 2018). The TG level is related to the severity of TB disease (Sahin and Yildiz 2013). Studies have shown that cholesterol plays an important role in cellular immunity (Chan, Mehta et al. 2014, Garcia, Uhia et al. 2012, Gatfield and Pieters 2000). Low TC concentrations have detrimental effects on lymphocytes and macrophages, which facilitate the activation of TB (Deniz, Gumus et al. 2007). Lower levels of TC and HDL are responsible for increased lipid metabolism during inflammation or infection and the immune response (Lin, Chen et al. 2015).

We further used a nomogram to facilitate decision making and to minimize unnecessary tests and expenses (Lionte, Sorodoc et al. 2017). A nomogram is a graphical representation of a mathematical formula or algorithm that incorporates several predictors modeled based on traditional statistical methods, such as multivariable logistic regression and Cox proportional hazards analysis. In this study, we used the nomogram to make the association between predictors (BMI, FBG and TG) and TB visible at a glance and to help us to choose the target population quickly and precisely.
The application of active screening should consider the screening interval, target population, screening methods and other logistic issues. A reasonable screening frequency can be determined based on the infection rate and the incidence rate of TB and financial affordability. We recommend that active TB screening be implemented every 2 years (The Office of the Fifth National TB Epidemiological Survey 2012) rather than every year in the current study. We also found that focusing on the high-risk groups (cost-benefit ratio: 1.22) will achieve a better benefit than performing a massive screening on all DM patients (cost-benefit ratio: 0.50). As is well known, if the cost-benefit ratio is greater than 1, the intervention is beneficial and is worth promoting. In addition, the CERs and ICER also showed that after we limited screening to patients with a low BMI, high FBG and decreased TG, the new screening strategy might be more cost-effective. Currently, there is no sensitive and simple method to screen active TB. Screening with symptoms and sputum smear tests may lead to missed diagnosis, and chest X-ray examination is generally easier to implement, but caution is warranted given the side effects caused by radiation (Murthy, Chatterjee et al. 2018).

In conclusion, chest X-ray examination is a feasible but uneconomical measure for massive TB screening among DM patients in areas with a low incidence of TB. It is more economical to limit screening to patients with a low BMI, high FBG and decreased TG.

**Authors contributions**

YJ, HC and JW conceived, initiated and led the study. YJ, HC, QL, ZL, HS, DX, BQ and DT collected the data. YJ, HC and QL analyzed the data with input from all the
authors. YJ and JW prepared the manuscript. All authors reviewed and approved the manuscript.

Data availability

All data generated or analyzed during this study are included in this published article.

Funding

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Conflict of Interest

The authors declare no conflict of interest.

Patient consent for publication

Not required.

Data sharing statement

All data generated or analyzed during this study are included in this published article.
Ethical Approval

This study was approved by the ethics committee of Nanjing Medical University.
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Figure legends

Fig 1. Roadmap for the active tuberculosis screening process
Fig 2. Multivariate conditional logistic regression analysis on the risk factors for tuberculosis among diabetic patients.
Fig 3. Nomogram used to predict the risk of tuberculosis among diabetic patients
Fig 4. Receiver operating characteristic curve validating the discriminatory power of the nomogram.
**Table 1.** Demographic characteristics of diabetic patients

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Proportion (%)</th>
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<td>Sex</td>
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<tr>
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<td>9684</td>
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<td>Drinking history</td>
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<tr>
<td>Ever</td>
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<tr>
<td>Physical activity</td>
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<tr>
<td>Seldom</td>
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<tr>
<td>Often</td>
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Table 2. Costs of active screening for tuberculosis

<table>
<thead>
<tr>
<th>Items</th>
<th>Unit price (CNY)</th>
<th>Number of participants</th>
<th>Total cost (CNY)</th>
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</thead>
<tbody>
<tr>
<td>Chest X-ray</td>
<td>80</td>
<td>44607</td>
<td>3568560</td>
</tr>
<tr>
<td>Sputum smear</td>
<td>10</td>
<td>223</td>
<td>2230</td>
</tr>
<tr>
<td>Sputum culture</td>
<td>50</td>
<td>218</td>
<td>10900</td>
</tr>
<tr>
<td>Labor cost</td>
<td>38</td>
<td>44607</td>
<td>1700869</td>
</tr>
<tr>
<td>Publicity</td>
<td>60</td>
<td>46</td>
<td>2760</td>
</tr>
<tr>
<td>Transportation</td>
<td>128</td>
<td>8</td>
<td>1024</td>
</tr>
</tbody>
</table>
Table 3. Factors related to active tuberculosis among diabetic patients based on a 1:4 matched case-control study

<table>
<thead>
<tr>
<th>Variables</th>
<th>Case N (%)</th>
<th>Control N (%)</th>
<th>Odds Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>8 (36.4)</td>
<td>32 (36.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14 (63.6)</td>
<td>56 (63.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (Median, IQR) years</td>
<td>67 (60-69)</td>
<td>67 (60-69)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BMI (Median, IQR) kg/m²</td>
<td>20.90 (19.95-24.55)</td>
<td>24.60 (22.25-26.18)</td>
<td>0.77 (0.64-0.92)</td>
<td>0.005</td>
</tr>
<tr>
<td>FBG (Median, IQR) mmol/L</td>
<td>8.83 (6.66-12.00)</td>
<td>7.89 (6.68-9.54)</td>
<td>1.18 (1.00-1.38)</td>
<td>0.044</td>
</tr>
<tr>
<td>TC (Median, IQR) mmol/L</td>
<td>5.07 (4.58-5.96)</td>
<td>4.94 (4.36-5.63)</td>
<td>1.25 (0.78-2.00)</td>
<td>0.352</td>
</tr>
<tr>
<td>TG (Median, IQR) mmol/L</td>
<td>1.09 (0.76-1.51)</td>
<td>1.70 (1.13-2.64)</td>
<td>0.37 (0.17-0.80)</td>
<td>0.012</td>
</tr>
<tr>
<td>HDL (Median, IQR) mmol/L</td>
<td>1.45 (1.15-1.83)</td>
<td>1.25 (1.08-1.55)</td>
<td>2.10 (0.77-5.75)</td>
<td>0.149</td>
</tr>
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<tr>
<td>Never smoked</td>
<td>19 (86.4)</td>
<td>62 (70.5)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Ever smoked</td>
<td>3 (13.6)</td>
<td>26 (29.5)</td>
<td>0.33 (0.09-1.29)</td>
<td>0.112</td>
</tr>
<tr>
<td>Drinking history</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never drank</td>
<td>18 (81.8)</td>
<td>69 (78.4)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Ever drank</td>
<td>4 (18.2)</td>
<td>19 (21.6)</td>
<td>0.79 (0.22-2.77)</td>
<td>0.712</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>17 (77.3)</td>
<td>69 (78.4)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Seldom</td>
<td>1 (4.5)</td>
<td>3 (3.4)</td>
<td>1.34 (0.14,13.15)</td>
<td>0.802</td>
</tr>
<tr>
<td>Often</td>
<td>4 (18.2)</td>
<td>16 (18.2)</td>
<td>1.02 (0.30-3.45)</td>
<td>0.975</td>
</tr>
<tr>
<td>Chest X-ray examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>6 (27.3)</td>
<td>84 (95.5)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Abnormal</td>
<td>16 (72.7)</td>
<td>4 (4.5)</td>
<td>56 (14.18-221.15)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

IQR: interquartile range; BMI: body mass index; FBG: fasting blood glucose; TC: total cholesterol; TG: triglycerides; HDL: high-density lipoprotein; OR: odds ratio; CI: confidence interval