

# Health Care Providers' Knowledge of Tuberculosis and Diabetes Mellitus Comorbidity in Lubumbashi, Democratic Republic of the Congo (DRC)

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**Background:** Tuberculosis-Diabetes mellitus (TB-DM) co-morbidity is a growing scourge in the world. The new approaches and interventions for TB control implemented by the Tuberculosis National Control Program (TNCP) in DRC require the involvement of health care providers for their success.

**Objective:** The objective of this study is to assess the knowledge of health care provider on different aspects of the management of TB-DM co-morbidity and to compare this knowledge according to the health care system, the type of providers and the number of years of experience.

**Methods:** Cross-sectional and analytic study was conducted in 11 health care facilities in the Lubumbashi Health District, selected by reasoned choice, and an electronic questionnaire was administered to health care providers. These providers were interviewed on the different aspects of the management of the TB-DM comorbidity. The data were presented and compared in relation to knowledge about TB, DM, and TB-DM comorbidity.

**Results:** A total of 113 providers were interviewed, predominantly males and physicians. Questions related to knowledge about DM were better answered. Doctors compared to paramedics; tertiary-level providers compared to secondary-level providers had better responses to the different questions. There is a statistically significant correlation between the level of knowledge of TB, DM and the type of health care provider, the number of years of experience.

**Conclusion:** The present study shows that there are gaps in the knowledge of our health care providers and community members on the recommendations of the DRC TB guidelines (*Programme Anti-Tuberculeux Intégré 5: PATI 5*) in general and on the management of TB-DM. It is therefore important and necessary to put in place strategies to improve this level of knowledge, which will focus on the extension of the guidelines, the awareness and the training of the stakeholders involved in the control.

**Keywords:** tuberculosis, diabetes mellitus, comorbidity, healthcare providers, knowledge

## Introduction

Tuberculosis (TB) is a contagious, airborne disease. It is caused by a bacterium called *Mycobacterium tuberculosis* (*M. tuberculosis*) or Koch Bacillus (KB). Despite considerable progress over the years, TB is still a major public health problem worldwide.<sup>1</sup> In 2021, the number of new TB cases was estimated at 10.6 million, equivalent to 134 cases per 100,000 people. This scourge is listed as one of the top 10 causes of death worldwide, and to this day, millions of people continue to fall ill each year.<sup>2</sup>

Worldwide, 30 countries are recognized as bearing the highest burden of this disease, collectively accounting for 85 to 89% of global prevalence. Among these 30 countries is the Democratic Republic of Congo (DRC), with an estimated incidence of 322 cases per 100,000 inhabitants in 2023 and an estimated mortality of 67 cases per 100,000 inhabitants.<sup>3</sup>

Previous studies conducted by Kakisingi et al<sup>4,5</sup> in Haut-Katanga had shown the epidemiological impact in terms of morbidity and mortality of this disease in Lubumbashi in particular.

In the DRC, the prevalence of DM reported by some authors varies between 3.5 and 14% and nearly 23000 deaths are attributable either to diabetes or hypoglycemia. Although there is a national program to combat DM in the DRC, very little data is reported to the national level; and, in view of the spread of scourge throughout the world, our country could not be spared from it as a result of the westernization of our lifestyle.<sup>6–8</sup>

Historically, the association between TB and DM is well known and was already of concern to many clinicians and investigators at the beginning of the 20<sup>th</sup> century. The influence of DM on TB was, however, neglected after the discovery of powerful treatment regimens for both diseases.<sup>9</sup> Currently, TB-DM comorbidity is re-emerging worldwide as it has been found that the number of cases of DM is increasing in poor countries where TB is highly prevalent, and most often, endemic.<sup>10,11</sup>

In the DRC, the different strategies have been translated into national guidelines for TB control in a technical guide called “Tuberculosis Program Integrated into Primary or Basic Health Care” (PATI). This guide has evolved over time, from PATI 1 developed in 1981 to its updated version in December 2017, PATI 5. The updated version considers recent scientific advances, new technologies for diagnosis as well as new approaches to control interventions.<sup>12</sup> Among these new approaches, we have the involvement of all health care providers and the community through a public–private partnership bringing together all health care providers to improve the management of tuberculosis patients and the identification of certain high-risk groups in the population, notably diabetics. These groups require specific care in the fight against tuberculosis.<sup>12</sup> It is therefore necessary to master the national guidelines set out in the guide to ensure better prevention of this comorbidity.

Thus, the objectives of this study are to assess the knowledge of health care providers on different aspects of the management of TB-DM comorbidity and to compare this knowledge according to the health care system, the type of providers and the number of years of experience.

## Methods

### Design, Setting and Study Population

A cross-sectional and analytic study was conducted in 11 health care facilities in the Lubumbashi Health District (Haut-Katanga Province), which are categorized as secondary and tertiary-level facilities. These health care facilities were selected, by reasoned choice, according to their primary health care activity package. The health care facilities visited were: Cliniques Universitaires de Lubumbashi, Hôpital Général Provincial de Référence Janson Sendwe, Shalina Polyclinic, Centre Médical du Centre-Ville, Centre Médical Diamant, Polyclinique de Lubumbashi, Centre Médical Baraka, Centre de Référence Mzee, Polyclinique Les Mels, Polyclinique Medpark, Centre de Santé Ste Scholastique.

The study population consisted of health care providers with a variety of qualifications, including:

- Physicians: these are health professionals who have obtained a medical degree.
- Nurses: these are health professionals who have a nursing degree at any level.
- Laboratory technicians: these are health professionals who have a diploma of laboratory technician.
- Pharmacists: health professionals who have a degree in pharmaceutical sciences.
- Community relays: volunteers who collaborate with the health center team in community activities. They have no basic medical or paramedical training.
- Other health care providers such as those with a degree in clinical biology or nutrition (biologists, nutritionists, etc.)

### Data Collection

An electronic questionnaire was presented to the health care providers after explaining the nature and objectives of the survey. The latter consisted of 10 et 11 items addressing aspects of general information, diagnosis and treatment of TB and DM, respectively. Their answers were guaranteed to be anonymous and confidential.

The validity of this questionnaire was ensured by comparing the different questions with those of similar studies previously conducted, adapting them to the stated objectives. Beforehand, a copy of the questionnaire was made available to the study supervisors for verification, amendments, and necessary corrections. Also, a reliability test was carried out to

measure the degree of reliability of the said questionnaire after a pre-test was conducted with 20 health care providers from other health care facilities not included in the study to ensure the reliability of the instrument.<sup>13,14</sup>

Interviews were conducted during duty hours and on even days of the week. Care providers who volunteered were interviewed in an office setting with discretion. Participants were thanked for their participation in the study.

## Statistical Analysis

The various data collected were coded and then entered the computer and statistical analyses were performed using SPSS 23.0 software. Socio-demographic characteristics are presented as frequency and proportion. Statistical comparisons between categories of providers and type of responses obtained; level of knowledge and categories of providers, technical facilities of health facilities, number of years of experience, participation in training organized by the TNCP were performed. The Fisher Exact Test, Student's *t* test or Chi-square test was used for frequency comparison and the significance level was set at  $P < 0.05$  and the Cronbach 'alpha coefficient was measured to estimate reliability or consistency of the questionnaire.

## Ethical Considerations

The approval of the ethics committee of the University of Lubumbashi (UNILU/CEM/113/2022) was obtained after administrative authorization from the Provincial Health Division (N° DPS/H KAT/900/PX 000962/JMK/2022). Informed consent was obtained from the respondents beforehand. The respect of anonymity in our study allowed us to guarantee confidentiality.

## Results

One hundred and thirteen providers participated in the study and the level of knowledge about TB and DM of these providers was 44% et 70.5%, respectively.

Table 1 shows the socio-demographic characteristics of the providers interviewed. More than half of the study population was male (56.4%), the most common age group was between 30 and 39 years old (46.9%) and the most common professional category was physicians (36.3%).

Figure 1 shows the assessment of knowledge about TB, DM ( $n = 113$ ) and also shows that very few providers answered correctly the questions related to TB knowledge (22/113 or 19.5%) compared to those related to the DM (90/113 or 79.6%).

Table 2 and Table 3 provide information on comparisons of correct TB responses by provider type and primary health care activity package in the health facilities visited.

**Table 1** Distribution of Health Care Providers by Socio-Demographics Characteristics

	N= 113	Percentage
<b>Sex</b>		
Female	49	43.4
Male	64	56.4
<b>Age (year)</b>		
< 25	13	11.5
30–39	53	46.9
40–49	25	22.1
>50	22	19.5
<b>Professional category</b>		
Nurse	39	34.5
Medical doctor	41	36.3
Pharmacist	6	5.3
Community health workers	15	13.3
Laboratory technician	6	5.3
Others	6	5.3

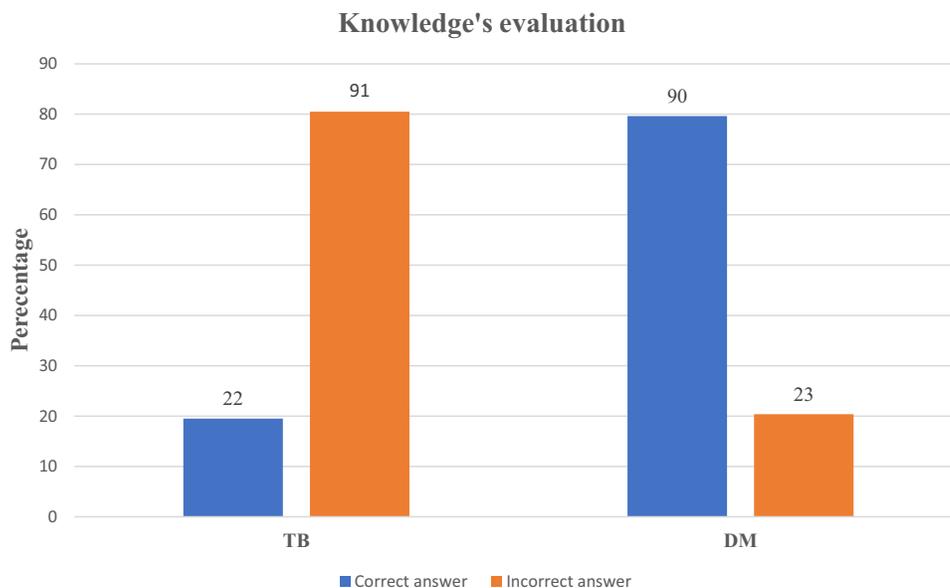


Figure 1 Assessment of the level of knowledge about TB and DM.

Table 2 shows that there is a statistically significant difference between the responses obtained from physicians and paramedics for items 2 (p = 0.001) and 3 (p = 0.004).

Table 3 indicates that a statistically significant difference is found in item 6 (p = 0.032) of this questionnaire.

Table 4 and Table 5 report comparisons of correct responses on the ROI obtained by providers according to provider type and primary health care activity package.

Table 4 allows us to observe a significant statistical difference between the different answers given by the different professional categories to items 3 (p = 0.01), 7 (p = 0.011), 9 (p = 0.0001) and 11 (p = 0.005).

Table 5 shows that there is a statistically significant difference between the responses of health care providers working in tertiary-level health facilities and those working in secondary-level health facilities (item 9 p = 0.005).

Figure 2 shows the comparison of the average knowledge score among health care providers.

Figure 2 shows that the average scores obtained by our interviewed providers show that doctors perform better than the other professional categories for the two themes addressed in the study.

Figure 3 shows the comparison of the average knowledge score between 2nd and 3rd level health facilities and the results show that providers working in 3rd level health facilities have better results in terms of knowledge about the DM.

Figure 4 shows the comparison of average knowledge score by job tenure and from this figure, it appears that seniority influences these scores.

Table 2 Comparison of Correct Responses of TB by Health Care Providers

	Medical Doctor n=41	No Medical Doctor n=72	p
1. Tuberculosis is an infectious disease	38 (92.7%)	67 (93.1%)	0.94
2. Anyone who contracts the TB germ can develop the disease	28 (68.3%)	22 (30.6%)	0.001
3. Tuberculosis is sometimes diagnosed only by a chest x-ray	22 (53.7%)	19 (26.4%)	0.004
4. Three sputum samples are needed to diagnose tuberculosis	14 (34.1%)	17 (23.6%)	0.23
5. Two bacteriological examinations are required for bacteriological evaluation of a microscopy-positive TB patient	5 (12.2%)	17 (23.6%)	0.22
6. OCT should be initiated as soon as the TB patient is diagnosed as positive	34 (82.9%)	57 (79.2%)	0.63
7. A 6-month course of treatment is recommended for all TB patients	12 (29.3%)	11 (15.3%)	0.08
8. Certain population groups such as diabetics require special management for TB control	30 (73.2%)	40 (55.6%)	0.06
9. Active detection of index cases is part of curative TB control methods	6 (14.6%)	15 (20.8%)	0.42
10. The fastest possible treatment of the tuberculosis patient and his or her hospitalization ensure better control of the tuberculosis infection	10 (24.4%)	13 (18.1%)	0.42

**Table 3** Comparison of Correct Responses of TB by Facility Level

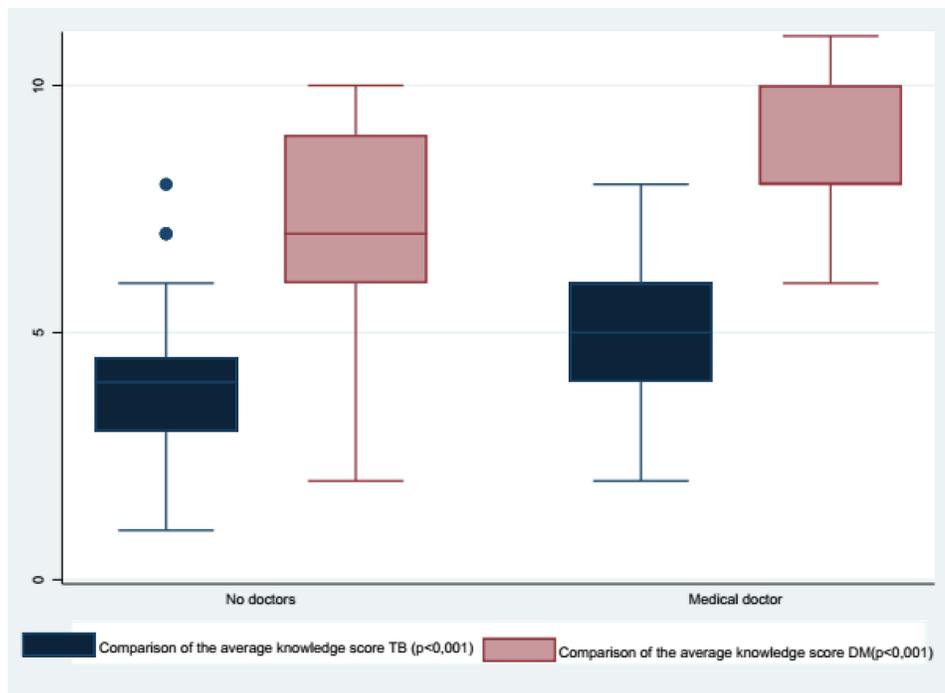
	Level 3 n= 31	Level 2 n= 82	p
1. Tuberculosis is an infectious disease	29 (93.5%)	76 (92.7%)	0.87
2. Anyone who contracts the TB germ can develop the disease	18 (58.1%)	32 (39.0%)	0.07
3. Tuberculosis is sometimes diagnosed only by a chest x-ray	12 (38.7%)	29 (35.4%)	0.74
4. Three sputum samples are needed to diagnose tuberculosis	10 (32.3%)	21 (25.6%)	0.48
5. Two bacteriological examinations are required for bacteriological evaluation of a microscopy-positive TB patient	5 (16.1%)	17 (20.7%)	0.58
6. OCT should be initiated as soon as the TB patient is diagnosed as positive	29 (93.5%)	62 (75.6%)	0.032
7. A 6-month course of treatment is recommended for all TB patients	8 (25.8%)	15 (18.3%)	0.38
8. Certain population groups such as diabetics require special management for TB control	19 (61.3%)	51 (62.2%)	0.23
9. Active detection of index cases is part of curative TB control methods	4 (12.9%)	17 (20.7%)	0.34
10. The fastest possible treatment of the tuberculosis patient and his or her hospitalization ensure better control of the tuberculosis infection	8 (25.8%)	15 (18.3%)	0.38

**Table 4** Comparison of Correct Responses of DM by Health Care Providers

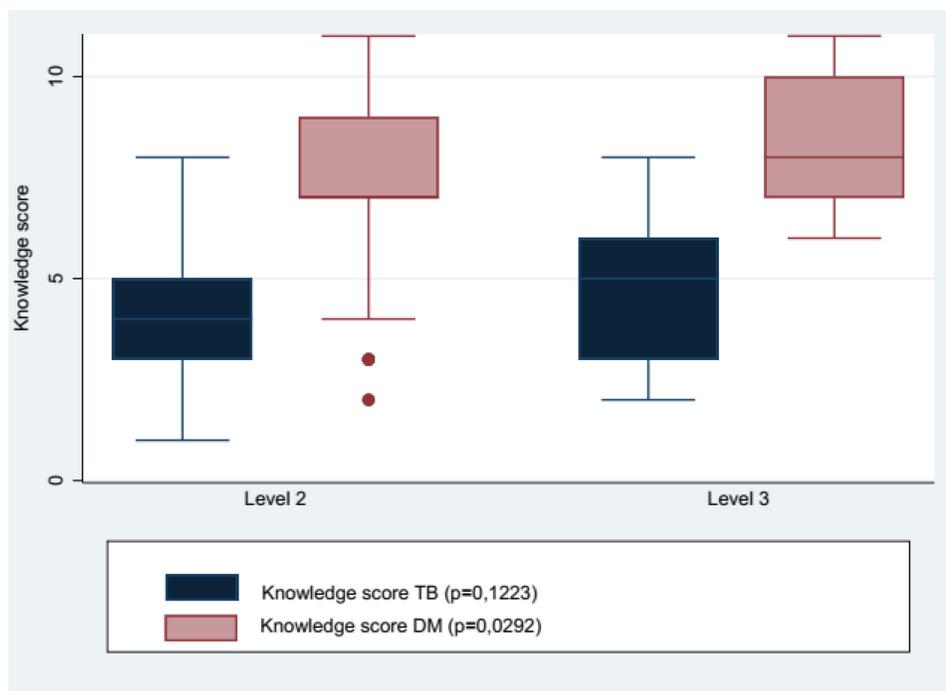
	Medical Doctor n=41	No Medical Doctor n=72	p
1. Diabetes mellitus is a chronic disease with no treatment to date	17 (41.5%)	29 (40.3%)	0.90
2. Diabetes mellitus is a contagious disease	41 (100.0%)	66 (91.7%)	0.60
3. Poorly controlled diabetes mellitus increases the risk of contracting tuberculosis	26 (63.4%)	22 (30.6%)	0.01
4. High calorie food intake and lack of regular exercise are risk factors for the development of diabetes mellitus	34 (82.9%)	55 (76.4%)	0.41
5. Obesity is also considered a modifiable risk factor for the development of diabetes mellitus	39 (95.1%)	67 (93.1%)	0.66
6. A hereditary and/or collateral history of diabetes mellitus is a risk factor for developing the disease	40 (97.6%)	69 (95.8%)	0.63
7. Diabetes mellitus can be diagnosed only by the following symptoms: polyuria, polydipsia	25 (61.0%)	26 (36.1%)	0.011
8. A patient with a random blood glucose level of more than 200 mg/dl may be considered diabetic	21 (51.2%)	44 (61.1%)	0.31
9. HbA1c measurement can be used for the diagnosis of diabetes mellitus	37 (90.2%)	43 (59.7%)	0.0001
10. The discovery of diabetes mellitus may occur in an asymptomatic patient with existing complications of diabetes mellitus	36 (87.8%)	61 (84.7%)	0.65
11. Poor management of diabetes mellitus in a patient with diabetes mellitus-tuberculosis comorbidity may lead to an unfavourable outcome of antituberculosis treatment	34 (82.9%)	41 (56.9%)	0.005

**Table 5** Comparison of Correct Responses of DM by Facility Level

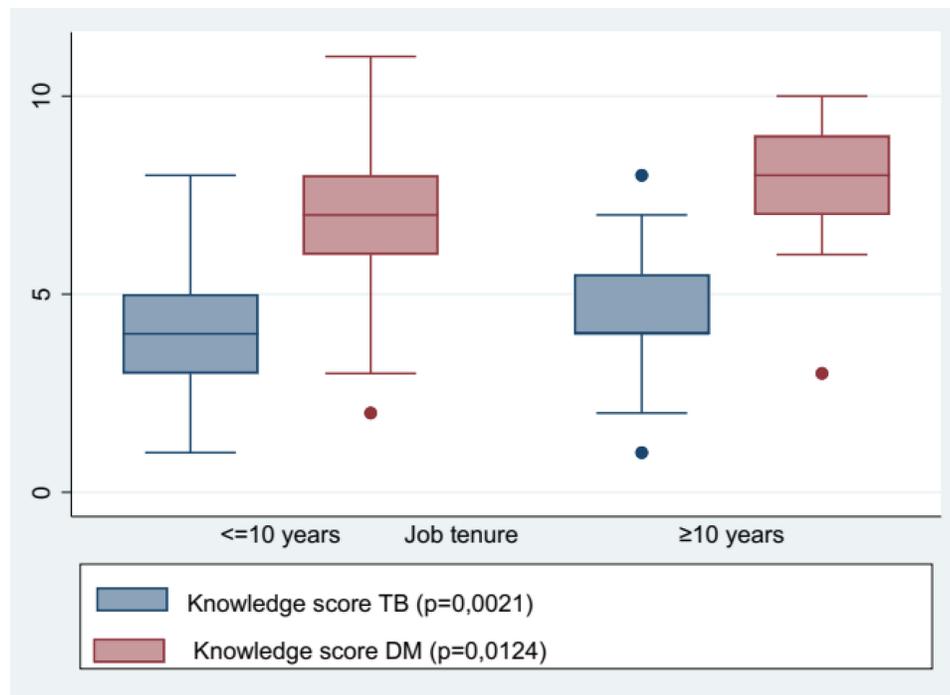
	Level 3 n=31	Level 2 n=82	p
1. Diabetes mellitus is a chronic disease with no treatment to date	13 (41.9%)	33 (40.2%)	0.87
2. Diabetes mellitus is a contagious disease	31 (100.0%)	76 (92.7%)	0.12
3. Poorly controlled diabetes mellitus increases the risk of contracting tuberculosis	19 (61.3%)	29 (35.4%)	0.013
4. High calorie food intake and lack of regular exercise are risk factors for the development of diabetes mellitus	21 (67.7%)	68 (82.9%)	0.08
5. Obesity is also considered a modifiable risk factor for the development of diabetes mellitus	29 (93.5%)	77 (93.9%)	0.94
6. A hereditary and/or collateral history of diabetes mellitus is a risk factor for developing the disease	30 (96.8%)	79 (96.3%)	0.91
7. Diabetes mellitus can be diagnosed only by the following symptoms: polyuria, polydipsia	17 (54.8%)	34 (41.5%)	0.20
8. A patient with a random blood glucose level of more than 200 mg/dl may be considered diabetic	18 (58.1%)	47 (57.3%)	0.94
9. HbA1c measurement can be used for the diagnosis of diabetes mellitus	28 (90.3%)	52 (63.4%)	0.005
10. The discovery of diabetes mellitus can be made in an asymptomatic patient with existing complications of diabetes mellitus	27 (87.1%)	70 (85.4%)	0.81
11. Poor management of diabetes mellitus in a patient with diabetes mellitus-tuberculosis comorbidity may lead to an unfavourable outcome of anti-tuberculosis treatment	24 (77.4%)	51 (62.2%)	0.13



**Figure 2** Comparison of the average knowledge score among health care providers.



**Figure 3** Comparison of the average knowledge score between 2nd and 3rd level health facility.



**Figure 4** Comparison of the average knowledge score by job tenure.

## Discussion

The objective of this study was to assess the knowledge of health care providers and community members on the different aspects of the management of TB-DM comorbidity. It therefore allowed us to make several observations on this scourge, which is growing rapidly in low-income countries.<sup>15,16</sup>

Based on the results observed in this evaluation, we find that the level of knowledge about TB is low. These results appear to be consistent with observations in several low-resource, high-TB-burden African countries such as Uganda, Tanzania, the Republic of South Africa, Kenya, and Mozambique,<sup>17–21</sup> but are at variance with those observed by Temesgen et al<sup>22</sup> in Ethiopia, who found better performance among the providers interviewed. At this stage, it is difficult to suggest explanations or justifications for this discrepancy or similarity in results; however, we believe that the different methods used in these studies may be a reason. Nevertheless, other authors believe that the poor performance of our study and others among health professionals reflects the multiple difficulties that some national TB control programs have in providing ongoing training and regular refresher courses for providers, especially in low-resource countries.<sup>23</sup> As far as our national program is concerned, it may be difficult to make assumptions based on these results, but we believe that the strategies for sensitization and popularization of the recently revised TB management guide, which is focused on providers working in the screening and treatment centres (STC) of the country's Health Districts, should be adapted to the context of "medicine for all" to allow wider access to information, improved knowledge of TB management in general and a reduction in the morbidity and mortality of this disease. The guide should be adapted to the context of "medicine for all" in order to allow wider access to information, improved knowledge of TB management in general, and a reduction in the morbidity and mortality of this scourge in our country in particular. Thus, Wahab et al<sup>24</sup> believe that it is necessary and urgent to implement strategies aimed at improving the level of knowledge of health care providers because this affects not only the quality of care to be provided to individual patients, the quality of the services provided by these professionals, but also the vital prognosis of the population in general.

The present survey allowed us to identify some factors associated with a good level of knowledge about TB, namely the type of health care workers and seniority in the profession.

It is not surprising to find that doctors have a better knowledge than other professional categories given the level of training provided at university level. Although some authors such Temesgen et al did not observe any significant difference compared to our finding and the one observed in Russia,<sup>25</sup> in the Republic of South Africa<sup>26</sup> and Gabon.<sup>27</sup> It is also important to note that this professional category represents only a small proportion of the total staff in our health facilities.

Seniority in the profession is also reported as a factor influencing the level of knowledge in relation with TB.<sup>17,18,28–31</sup> However, these results should be considered because knowledge about TB is evolving. The fact that seniority is sometimes linked to routine in our settings, it is important to focus on refresher training.

Our results also show that the technical facilities of our health facilities do not directly influence the knowledge of our health providers, unlike the results of Vingeschour et al in Gabon.<sup>27</sup> However, these results are still interesting and suggest that the 2nd level health facilities should benefit from special support from the DRC TNCP in terms of continuous training.

In relation to the assessment of knowledge about DM, we also found that several factors can influence this level of knowledge, namely the professional category and the level of technical facilities applied in the health facilities. Babelgaith et al<sup>32</sup> in Yemen seem to have found no difference in the level of knowledge between physicians and other health professionals. However, Ogbera et al<sup>13</sup> in his study conducted in Nigeria confirm that a technical platform provided in a health care facility could have a positive influence on the quality of providers' knowledge and we believe that the health care facilities in our country that have a sufficiently equipped technical platform (university hospitals and provincial general hospitals), and this in view of our observations made in this evaluation effectively reflect the role that is assigned to them. It is also important to note that the results observed in this study give us new insight into this public health problem, which is growing rapidly in low-income countries, including the DRC. And despite the inexistence of a standard national protocol for the management of diabetes in our country, the level of knowledge is very high and we believe that the fear of the devastating impact of this growing scourge and all the co-morbidities surrounding it would probably push health care providers and community members to have more information directly or indirectly on this pathology, in order to improve their personal knowledge and the quality of management of diabetic patients.

## Strengths and Limitations of the Study

Numerous knowledge assessment studies on TB-DM comorbidity have been conducted throughout the world. However, the present study is among the first to be conducted among health care providers in Lubumbashi (DRC). Although our sample size is relatively small, the study population represents all actors involved in disease control in the Health Medical District of Lubumbashi.

It is also worth noting that the survey was conducted in the form of an individualized interview by a single interviewer. This allowed for an optimal response rate to the items presented, but also for comparable response because all questions were approached in the same way.

This method of data collection used in the present study, thus, allowed us to obtain a real insight into the level of knowledge of our interviewed health care providers compared to other methods of administering a multi-choice self-administered questionnaire that could be imagined.

## Conclusion

Assessing the knowledge level of health care providers is one of the essential and fundamental pillars of improving disease management and control. Our study shows that there are gaps in the knowledge of our health care providers and communities on the recommendations of the PATI 5 in general and on the management of TB-DM comorbidity, although some factors such as the type of health care providers and seniority in the profession that may influence the level of knowledge have been observed. This observation could be one of the factors contributing to the increase in morbidity and mortality related to TB and its comorbidities, including that associated with DM in our setting. It is therefore important and necessary to put in place strategies to improve this level of knowledge.

Therefore, we suggest that the mechanisms to be put in place should consider the realities of our environment and should also be based on the following actions:

- To set up a joint organisation chart for the management of TB-DM comorbidity between the two national programmes for fight against TB and DM, following the example of the one carried out for the fight against HIV/AIDS.
- To ensure the popularization of the guidelines for the management of TB and its co-morbidities, including that associated with the DM, particularly.
- To proceed to a sensitization of all the actors involved in the control of this disease.
- Provide extensive training on TB control and its co-morbidities to all health actors in all Health District health facilities without distinction and at all operational levels of the health pyramid.

Thus, we believe that these recommendations suggested above, accompanied by a clear policy, supervision, monitoring, and regular evaluation of all operational-level actors involved in the fight against TB, will contribute significantly to the reduction of morbidity and mortality linked to the growing scourge.

## Disclosure

The authors report no conflicts of interest in this work.

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