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Factors Associated with Delay in Diagnosis of Pulmonary Bacilliferous Tuberculosis in Ouagadougou, Burkina Faso

Facteurs associés au délai diagnostique de la tuberculose pulmonaire bacillifère à Ouagadougou, Burkina Faso

Clarisse Balima[1,2], Pauline Kiswendsida Yanogo [2,3], Oumar Sangho[4], Nicolas Méda[2,3]

[1] Ministry of Health, Burkina Faso
[2] Burkina Field Epidemiology and Laboratory Training Program, Faculty of Medicine, Joseph KI-ZERBO University, Ouagadougou, Burkina Faso
[3] Department of Public Health, UFR/SDS, Joseph KI-ZERBO University, Ouagadougou, Burkina Faso
[4] Département d'Enseignement et de Recherche des Sciences Biologiques et Médicales de la Faculté de Pharmacie, de l'Université des Sciences, des Techniques et des Technologies de Bamako

Corresponding author:
Pauline Kiswendsida Yanogo
E-mail: y_poline@yahoo.fr
Tel: (+226) 70709379

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ABSTRACT

Objective. Identifying the factors associated with delays in diagnosis of bacilliferous pulmonary tuberculosis is a key component of its control. **Methods.** An analytical cross-sectional study of 384 microscopy-positive pulmonary tuberculosis patients in 2018 was conducted to address this objective. Median patient, system and total diagnostic times were estimated. ORs were calculated in logistic regression to identify factors associated with long patient (> 30 days), system (> 15 days), and total (> 45 days) diagnostic delays. **Results.** Being diagnosed at the Kossodo center [OR= 7.10, 95%CI (2.42–20.85), p= 0.03], fever [OR= 0.54, 95%CI (50.32–0.91), p= 0.02] and consulting traditional medicine before going to the referral facility [OR= 1.88, 95%CI (1.09–3.24), p = 0.02] were associated with patient diagnostic delay. Being a health worker [OR = 25.43, 95%CI (1.79–359.49), p = 0.02], and self-medication [OR = 2.36, 95% CI (1.16 –5, 22), p = 0.01] were associated with prolonged system diagnostic delay. Consulting traditional medicine [OR = 1.65, 95%CI (1.01–2.70); self-medication [OR= 2.46, 95%CI (1.18 – 5.11); p= 0.01] and negative HIV serology status [OR= 3.30, 95%CI (1.20–9.02), p= 0.01] were associated with the increased total diagnostic time. **Conclusion.** The factors associated with longer diagnostic times in our study are all modifiable. Awareness of the signs of tuberculosis and the urgency of consulting a health center must be intensified among the population to help reduce these delays.

RÉSUMÉ

Objectif. Identifier les facteurs associés aux délais de diagnostic de la tuberculose pulmonaire bacillifère est un élément clé de sa lutte. **Méthodes.** Une étude transversale analytique a été menée auprès de 384 tuberculeux pulmonaires à microscopie positive de l'année 2018 pour répondre à cet objectif. Les délais médians diagnostiques liés aux patients, au système et au deux ont été estimés. Des OR ont été calculés dans une régression logistique pour identifier les facteurs associés aux longs délais diagnostiques patient (>30 jours), système (>15 jours) et total (>45 jours). **Résultats** : Nous avons relevé au centre de Kossodo [OR=7,10, $IC_{95\%}$ (2,42 -20,85), p=0,03], la fièvre [OR=0,54, $IC_{95\%}$ 50,32-0,91), p=0,02] et une consultation en médecine traditionnelle avant la structure de référence [OR=1,88, $IC_{95\%}$ (1,09 -3,24), p=0,02] comme étant associés au délai diagnostique patient. Le fait d'être agent de santé [OR=25,43, IC95% (1,79 -359,49), p=0,02], et l'automédication [OR=2,36, IC95% (1,16 -5,22), p=0,01] étaient associés à l'allongement du délai diagnostique système. La consultation en médecine traditionnelle [OR=1,65, $IC_{95\%}$ (1,01 -2,70) ; l'automédication [OR=2,46, $IC_{95\%}$ (1,18 -5,11) ; p=0,01] et la sérologie VIH négative [OR=3,30, $IC_{95\%}$ (1,20 -9,02), p=0,01] étaient associés à l'allongement du délai diagnostique total. **Conclusion** : Les facteurs associés à l'allongement des délais de diagnostic dans notre étude sont tous modifiables. La sensibilisation sur les signes de la tuberculose et l'urgence de consulter dans un centre de santé doit être redoublée à l'endroit des populations pour contribuer à réduire ces délais.

INTRODUCTION

Tuberculosis (TB) is one of the top ten causes of death in the world and the leading cause of death from a single infectious agent, ahead of HIV/AIDS [1]. The World Health Organization (WHO) estimated that 10 million people have contracted tuberculosis in 2019 including 25% of cases in Africa with the number of deaths estimated at 1.4 million including 208,000 people living with HIV [2]. In Burkina Faso, 6194 cases of tuberculosis were detected during the year 2018 (according to an activity report).

Several actions are undertaken by the National Tuberculosis Control Program (NTCP) strategic plan covering the period 2018-2022 and aimed to reduce the incidence of tuberculosis in Burkina Faso and the mortality related to this disease. The incidence of tuberculosis fell from 52 cases per 100,000 inhabitants in 2015 to 49 cases per 100,000 inhabitants in 2018

according to this plan. Despite the considerable successes recorded, the challenges of controlling tuberculosis remain major.

Early detection and diagnosis of tuberculosis is a global priority for TB control efforts and is highlighted in the World Health Organization's tuberculosis control strategy [3]. Indeed, the rapid identification of cases depends, on the one hand, on the rapid recognition by patients of the symptoms of tuberculosis and the search for appropriate health care, and, on the other hand, on the capacity of the healthcare system to diagnose the disease [4]. Thus, long diagnostic delays can occur either at the patient level or at the health system level. However, long delays in diagnosis and therefore in the treatment of tuberculosis patients not only increase infectiousness in the community, but also lead to a more advanced disease state which may result in more complications and expose a higher risk of death [5].

The last study carried out in Burkina Faso, which is relatively old (2006), is not sufficient to guide the measures to be put in place to reduce the diagnostic delay in our country. Indeed, we did not clearly distinguish between patient and health system diagnostic delays, nor did they identify the factors associated with each of these diagnostic delays [6], making it necessary to conduct new studies on this subject in Burkina Faso. This study aims to identify the factors associated with diagnostic delays in tuberculosis diagnosis and treatment centers in Ouagadougou in order to help guide the national tuberculosis control program.

MATERIALS AND METHODS

Type and period of study

We conducted a cross-sectional study with an analytical focus on patients diagnosed with bacciliferous pulmonary tuberculosis during the year 2018 over a period of six (06) months from July 1 to December 31, 2018.

Study population and non-inclusion criteria

The study population consisted of patients aged 15 years or older diagnosed with bacteriologically confirmed pulmonary tuberculosis in the central region and who gave their consent to participate in the study. Patients whose clinical condition did not allow for answers to the questions were not included. And patients with MDR-TB were excluded because MDR-TB most often results from previously poorly treated pulmonary TB. This could increase the risk of recall bias to the different dates.

Data collection

The collection questionnaire was pre-tested, and a suitable collection form was obtained. The collection was done in the five (5) CDTs and the National Center for Tuberculosis Control (NCTC) during working days. The informations was collected from registers in the respective patient follow-up centers and by means of a questionnaire administered during a face-to-face interview. For each patient, data were collected by means of an individual sheet providing information on the socio-demographic, clinical and microbiological characteristics, the place of referral / patient's history.

Operational definitions:

The diagnostic timeline for pulmonary tuberculosis is composed of 2 sub timelines defined as follows:

The patient diagnostic delay, which is the time interval between the date of onset of signs and the date of the first medical consultation [5,7–13]. In case of various complaints, we considered the longest lasting symptom. As for the system diagnostic delay, which represents the time interval between the date of the first medical consultation and the date of diagnosis [5,11,13–18]. The actual date of diagnosis rarely differed from the date of treatment initiation. In fact, in the medical data where the date of diagnosis was omitted, we considered the date of the start of treatment. And the total diagnostic delay which is defined as the time interval between the date of onset of signs and the date of diagnosis [5,8,17–21]. Employment has been defined as an income generator. As for the urban environment, it refers to the city and rural refers to the countryside. The community brings together life in prison, mine and boarding schools.

Data management

An input mask was created, and the data collected was entered as it was received on a computer and using the Epi Info software in version 7.2.2.6. We searched for and integrated missing data and corrected outliers. An anonymous database was created for the statistical analyses, which were carried out using the STATA software.

Statistical analysis

First, a simple descriptive analysis of tuberculosis patients was performed. It concerned the socio-demographic, clinical, microbiological characteristics, and the place of referral/patient pathways of the patients. The median delays were calculated in days and categorized into short and long delays according to the following definitions: A threshold of 30 days was considered acceptable for patient diagnostic delay [5,7–10]. Thus, a delay of more than 30 days was deemed unacceptable, and we categorized this delay as short ≤30 days and long >30 days. A 15-day threshold has been applied for the system diagnostic delay [5,8]. We split it into short delay ≤15 days and long >15 days. For the total diagnostic delay, it is short when it is ≤45 days and long >45 days. The results were tabulated as proportions and ratios.

In etiological analysis, we looked for the various factors associated with these various long delays.

First, we performed a univariate logistic regression to calculate the Odd Ratio (OR) of the association between the different factors and the long diagnostic delays. These ORs were tested using the Wald test. The 95% confidence interval (CI) was also estimated. Then, the variables associated with diagnostic delays with a P <20% on univariate analysis, as well as the various confounding factors found in the literature were included in a multivariate logistic regression to find the factors independently associated with diagnostic delays. ORs and their confidence interval (95% CI) were estimated. For the interpretation of the variables, the significance threshold $\alpha = 0.05$ was used. Statistical analyzes were performed using the Stata software.

RESULTS

In total, 384 patients were interviewed during the study period (Table 1), and all gave their voluntary consent to participate in the study. Subjects aged 25 to 44 were predominant.

Among these 384 patients, 74.74% were male with a sex ratio of 2.95. The patients resided in urban areas in 336 cases (87.5%) and 48 (12.5%) in rural areas. Among the patients interviewed, 298 (77.6%) had a job, 327 (85.16%) were living at home and 57 (14.84%) in a community.

Forty point nine percent of the patients had a history of tuberculosis and 16.67% a chronic disease. Cough was the most common symptom reported by our patients (79.7%). HIV serology was positive in 30 patients (7.8% of cases). Bogodogo district had the sickest patient in our sample. The National Center for Tuberculosis Control, a reference center, diagnosed 29.68% of the patients. Among the 384 patients; the primary care facilities (CSPS) requested sputum microscopy or GeneXpert in 46 patients. Before entering the referral health facility, 206 patients (53.65%) first consulted in another health facility.

In univariate analysis, factors associated with long patient diagnostic delay were patient district (p= 0.02, 95%CI = [1.58-15.68]); diagnostic center (p= 0.04); the location consulted prior to accessing the referral health facility (p= 0.04) and fever (p= 0.01).

Table 1: Sociodemographic, clinical, and biological characteristics of bacilliferous pulmonary tuberculosis patients in Ouagadougou, Burkina Faso

Characteristics	Count (n = 384)	Percentage (%)
Age		
[15-24]	94	24.48
[25-44]	196	51.04
[45-64]	81	21.09
≥65	13	3.39
Gender		
Female	97	25.26
Male	287	74.74
Occupation		
Employed	298	77.60
Unemployed	80	20.80
Health worker	6	1.60
Residence		
Urban	336	87.5
Rural	48	12.5
Housing		
Residence	327	85.16
Community	57	14.84
Clinical signs		
Cough	19	2.46
Fever	210	27.24
Sputum	164	21.27
Weight loss	121	15.69
Hemoptysis	109	14.14
Chest pain	149	19.20

Table 1 (cont.): Sociodemographic, clinical, and biological characteristics of bacilliferous pulmonary tuberculosis patients in Ouagadougou, Burkina Faso

Characteristics	Count (n = 384)	Percentage (%)
History of tuberculosis		
Staff	85	22.1
Family	69	18.0
Professional	3	0.8
No history	227	59.1
Medical History		
HIV	24	6.27
Other chronic disease	40	10.41
No history	320	83.33
Diagnostic tool		
GeneXpert	17	4.4
Microscopy	367	95.6
HIV status		
Positive	30	7.81
Negative	354	92.19
Health district		
Bogodogo	111	28.9
Nongr-Massom	64	25.5
Sig-Noghin	94	24.5
Boulmiougou	98	16.7
Baskuy	14	4.4
Diagnostic center		
NCTC*	81	21.10
MCSA** of pissy	75	19.53
MCSA of Paul VI	67	17.44
UH*** Bogodogo	26	6.78
MCSA of Kossodo	11	2.87
UH Yalagdo	9	2.34
MCSA of Samandin	1	0.26
Referral health facility****		
Spontaneous access to the diagnostic center	223	58.07
HSPC	46	11.98
MCSA	60	15.63
Private structure	38	9.89
UH	17	4.43
Procedure performed before accessing the referral health facility		
Health facility	206	53.65
Self-medication	43	11.2
Occupational medicine	135	35.15

**NTCC: National tuberculosis control center; **MCSA: Medical center with surgical antenna; ***UH: university hospital; HSPC: Health and social promotion centers; ****Referral health facility: the facility which sent the patient to the diagnostic centers. They don't do TB diagnosis*

Factors associated with increased time to diagnosis due to the system were occupation (p= 0.01); patient's district (p= 0.02); HIV status (p= 0.01) and factors associated with increased time to total diagnosis time were HIV status (p= 0.01); the location visited prior to accessing the referral health facility (p= 0.02); the patient's district (p= 0.01); the diagnostic center (p= 0.01); and occupation (p= 0.02).

In multivariate analysis, factors associated with long delay in diagnosis due to patient were Kossodo diagnostic center [OR= 7.10, 95% CI= (2.42-20.85), p= 0.009] and fever [OR= 0.54, 95% CI= 0.32-0.91), p= 0.02] (Table 2).

Table 2: Factors associated with the delay in diagnosis of bacilliferous pulmonary tuberculosis due to patient in Ouagadougou in Burkina Faso, in multivariate analysis.

Patient diagnostic delay	OR	95% CI	P-value
Diagnostic center 0.009			
NCTC*	1		
MCSA** of Kossodo	7.10	[2.42-20.85]	
UH Yalagdo	0.79	[0.13-4.53]	
MCSA of Paul VI	0.83	[0.32-2.10]	
MCSA of Pissy	0.84	[0.35-2.04]	
Charles de Gaulle Pediatric	1		
MCSA of Samandin	2.38	[0.26-21.48]	
UH Bogodogo	0.68	[0.28-1.64]	
Fever			
No	1		
Yes	0.54	[0.32-0.91]	0.02

**NTCC: National tuberculosis control center; **MCSA: Medical center with surgical antenna; UH: university hospital; HSPC: Health and social promotion centers;*

The factors associated with increased time to diagnosis due to the health system were age (25-44 years) [OR= 1.95, 95% CI= (1.05-3.63), p= 0.02] and occupation (Health worker) [OR= 25.43, 95% CI= (1.79-359.49), p= 0.02] (Table 3).

Table 3: Factors associated with delays in diagnosis bacilliferous pulmonary tuberculosis due to the system in Ouagadougou, Burkina Faso, 2018 in multivariate analysis

System diagnostic delay	OR	95% CI	P-value
Age range			0.02
15-24	1		
25-44	1.95	[1.05-3.63]	
45-64	1.45	[0.68-3.09]	
> 65	0.15	[0.01-1.33]	
Occupation			0.02
Employed	1		
Health worker	25.43	[1.79-359.49]	
Unemployed	1.55	[0.85-2.82]	

Factors associated with longer total diagnostic time were the diagnostic center (Kossodo) [OR= 3.35, 95% CI= (1.29-9.19), p= 0.002]; occupation (Unemployed) [OR= 1.75, 95% CI= (1.20-3.06), p= 0.02]; the place consulted before accessing the referral health facility (self-medication) [OR= 2.46, 95% CI= (1.18-5.11)]; (traditional medicine) [OR= 1.65, 95% CI= (1.01-2.70)] p= 0.01 and HIV status (negative) [OR= 3.30, 95% CI= (1.20-9.02), p= 0.02] (Table 4).

Table 4: Factors associated with delays in total diagnosis of bacilliferous pulmonary tuberculosis in Ouagadougou, Burkina Faso, in multivariate analysis.

Total diagnostic time	OR	95% CI	P-value
Occupation			0.02
Employed	1		
Health worker	4.48	[0.67-29.97]	
Unemployed	1.75	[1.20-3.06]	
Diagnostic center			0.002
NCTC*	1		
UH*** Bogodogo	1.36	[0.60-3.08]	
UH Yalagdo	0.49	[0.08-2.70]	
MCSA** of Pissy	1.48	[0.66-3.34]	
MCSA of Kossodo	3.35	[1.29-9.19]	
MCSA of Paul VI	0.89	[0.40-1.96]	
MCSA of Samandin	0.97	[0.15-6.03]	
Procedure performed before accessing the referral health facility****			0.01
Health training	1		
Traditional medicine	1.65	[1.01-2.70]	
Self-medication	2.46	[1.18-5.11]	
HIV status			
Positive	1		
Negative	3.30	[1.20-9.02]	0.02

**NTCC: National tuberculosis control center; **MCSA: Medical center with surgical antenna; ***UH: university hospital; HSPC: Health and social promotion centers; ****Referral health facility: the facility which sent the patient to the diagnostic centers. They don't do TB diagnosis*

DISCUSSION

This study identified that the factors associated with the extension of patient diagnostic delay were the diagnostic center (Kossodo). On the other hand, the presence of fever reduced this delay. Age (24-44 years) and profession (health worker) were associated with a longer system diagnostic delay. The factors associated with the lengthening of the total diagnostic delay were: Profession (unemployed), diagnostic center (Kossodo), the procedure performed before accessing the reference health facility (traditional medicine and self-medication) and the HIV serology (Negative)

Factors associated with patient-induced delay in diagnosis

Diagnostic center

The diagnostic center only was associated with longer patient delay. Indeed, having been diagnosed at Kossodo increased the risk of having a long patient delay by a factor of 7 compared to those diagnosed at the National Center for Tuberculosis Control (p= 0.009). This could be because the National Center for Tuberculosis Control is the reference level for tuberculosis control, where patients may not hesitate to seek help when they have symptoms, especially coughing. On the other hand, Kossodo, belonging to the Nongre-Massom district where traditional medicine is very much rooted among the populations (165 traditional practitioners were counted in the Nongre-Massom district during the census in 2016) could explain it. Thus, it is common for these patients to consult these traditional practitioners first before resorting to the health structures, which will delay

the first contact with the health services and by extension lengthen the total diagnosis time. Awareness of the importance of early health-seeking in health facilities and education of traditional healers in referral could be improved.

Fever

The presence of fever decreased the time to diagnosis due to the patient (OR= 0.54; p= 0.02). Our results corroborate with those of Tattevin et al. in France in 2011 (OR= 0.42; p= 0.03) [22]. This could be explained by the fact that fever is perceived by the general population as a worrying symptom that may indicate a serious disease, which is not the case for other symptoms such as cough, weight loss and night sweats.

Factors associated with increased diagnostic time due to the system

Age

We observed several factors associated with the increased time to diagnosis delay due to the healthcare system.

In terms of socio-demographic characteristics, being in the 25-44 age group increased the risk of having a long system delay by 1.95 (p= 0.02). This could be explained by the fact that young people are not among those at risk for tuberculosis. Consequently, health workers may have a low index of suspicion when young people come to them. In addition, it is the active age group which means that these people will always be concerned about their activity which is most often hard work more than their health. Our results differed from the study conducted in Europe by Bojovic et al. [23] in Montenegro in 2018 who found that people over the age of 47 were more likely to experience delays in the health care system compared to younger people (OR= 2.61; p= 0.042). This could be due to comorbidities associated with advanced age and differential diagnostic problems.

Occupation

In our study, being a health worker increased the risk of having a long delay due to the health system by a factor of 25 (p= 0.02). Our results are similar to those of Belkina et al. [13] in Uzbekistan in 2014 who found being a healthcare worker was significantly associated with long system delay (p= 0.01). The association between tuberculosis/poverty has existed for centuries and still holds true today, indeed it is an affliction of misery and poor hygiene. It can be stated that health care providers do not perceive their counterpart as being at risk for tuberculosis and therefore may delay making a diagnosis of tuberculosis. In addition, it can be hypothesized that health workers do not always think when examining their counterparts to assess their risk of contracting nosocomial or even community-acquired tuberculosis. However, we cannot make a firm conclusion because there were only 6 health workers.

Factors associated with the increased total diagnostic time

Occupation

Occupation was significantly associated with a long total diagnostic delay. Inability to pay for health care is a barrier to seeking it [14]. Indeed, the level of income was found to be an important determinant of early diagnosis of tuberculosis in the patient. This was also the result of this study, where unemployed patients had a 1.75-fold increase in the risk of having a long delay in total diagnosis compared with those employed. Indeed, although tuberculosis screening and treatment tests are free, patients still pay the rest of the expenses: food, transport, and the other associated costs. For example, studies conducted in Africa by Mauch et al. [24] in Kenya in 2011, estimated these expenses at 7.1% of median annual household income. This economic pressure may cause patients to delay their first visit to a doctor if symptoms seem mild.

HIV status

In our study, there was a significant association between HIV status and the lengthening of the total diagnostic time. Indeed, being HIV-negative increased by a factor of 3 the risk of having a long total diagnosis delay compared to HIV-positive patients. This could be because people living with HIV are routinely and actively screened for tuberculosis at every contact with a healthcare team and at every home visit. It is also possible that health workers have a high index of suspicion of tuberculosis when examining HIV-infected people. It is also possible that HIV-infected people are more aware of the various symptoms of tuberculosis and therefore take less time to seek medical attention. Belkina et al. [13] in Uzbekistan in 2014 found that HIV infection was significantly associated with a longer total delay with a p= 0.02. This could be because the symptoms were less specific and could be considered by the patients to be associated with HIV, which could lengthen the total time to diagnosis. In addition to influencing patient diagnostic delay, Kossodo influenced the total diagnostic delay. Indeed, being diagnosed at Kossodo increased the risk of having an extension of the total diagnostic delay by a factor of 3 with a p= 0.002. Because the Kossodo Diagnostic Center influenced these delays, further studies may help to better understand this phenomenon.

Traditional Medicine

In our study, there was a significant association between traditional medicine and the increased total diagnostic delay; in the sense that the first visit to traditional medicine multiplied the risk of having a long total diagnosis delay by 1.65 times (p = 0.01). Indeed, the increase in the total delay in patients who first turn to traditional medicine from the onset of the signs is also consistent with the results of Santos et al. [25] in Angola in 2018 (p= 0.001). This could be explained by the fact that traditional medicine plays an important role in TB care delivery, as a significant proportion of our patients or 35.2%, had used it. Health officials must improve the involvement of traditional medicine to detect and refer TB patients to health centers.

Self-medication

Self-medication doubled the risk of having a long total diagnostic delay (p= 0.01). Our results were similar to those of Belkina et al. [13] in 2014 in Uzbekistan and

Bonadonna et al. [26] in Peru in 2018 who found the association of long total diagnosis delay with this variable with p values of 0.005 and 0.003 respectively. This could be explained by the fact that self-medication, which only temporarily relieves the symptoms, will help mask the symptoms, thus leading the health worker to focus on tuberculosis. This can lead to multiple visits to the health services, thus extending the total diagnostic time.

Limitations of the study

The limitations of our study include a possibility of memory bias, particularly with regard to the date of onset of symptoms, their duration and the date of first seeking care. Indeed, tuberculosis being a chronic disease with an insidious onset, it would make it difficult for some to remember exactly when symptoms started.

In addition, the fact that the study did not take into account extra-pulmonary tuberculosis cases and negative bascilloscopy cases constitutes a limitation for generalization to all TB cases.

CONCLUSION

This study revealed that several factors are associated with the increased delay in diagnosis pulmonary tuberculosis. To reduce patient delay, it is crucial to increase public awareness of the signs and symptoms of the disease, and to ensure that consultations are made between traditional healers and the health system for effective collaboration in TB control and to pay particular attention to disadvantaged groups. Health system delay can be further reduced through training, supervision and ongoing support of health workers as well as improving TB diagnostic services. Regulations prohibiting the dispensing of antibiotics, including anti-tuberculosis drugs, without a prescription, should be enforced because the diagnostic center, especially the one in Kossodo, influenced both patient and total diagnostic delay, further studies should be conducted to better explore this.

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Authors' contributions

Pauline Kiswendsida YANOGO and Clarisse BALIMA wrote the study protocol, analyzed the data, interpreted the data analysis.

Oumar SANGHO wrote the study protocol, analyzed the data, interpreted the data analysis and corrected the manuscript.

Pauline Kiswendsida YANOGO proposed the draft of the manuscript, corrected the manuscript, validated the manuscript.

Nicolas MEDA corrected the manuscript and gave final approval of the version to be published.

All authors have agreed to publish the manuscript.

Conflicts of Interest

The authors declare that they have no competing interests

REFERENCES

1. OMS | Rapport sur la tuberculose dans le monde [Internet]. WHO. World Health Organization; [cité 26 mars 2021]. Disponible sur: http://www.who.int/tb/publications/global_report/fr/
2. OMS. Rapport sur la tuberculose dans le monde 2020 : résumé d'orientation [Internet]. Organisation mondiale de la Santé; 2020 [cité 26 mars 2021]. Disponible sur: https://apps.who.int/iris/handle/10665/337571
3. Lönnroth K, Castro K, Chakaya J, Chauhan L, Floyd K, Glaziou P. . Tuberculosis control and elimination 2010–50: cure, care, and social development. The Lancet. 2010;375(9728):1814-29.
4. Abuchahama S, paula SG, Mohsin S, James B. Retard du patient et du système de santé chez les patients atteints de tuberculose pulmonaire à Beira, Mozambique. BioMed Central. 2013;13:559.
5. Osei E, Akweongo P, Binka F. Facteurs associés au retard de diagnostic chez les patients atteints de tuberculose dans la municipalité de Hohoe au Ghana. BMC Public Health. 2015;15:721.
6. Ouédraogo, M, Kouanda S, Boncoungou K, Dembélé M, Zoubga ZA, Ouédraogo SM, et al. Itinéraire thérapeutique des tuberculeux bacillifères dépistés dans deux centres de traitement de la tuberculose au Burkina Faso. INT J TUBERC LUNG DIS. 2006;10(2):184-7.
7. Kudakwashe T, Harries AD, Nyathi B, Ngwenya M, Apollo TM, Sandy C. Retards dans le traitement de la tuberculose et facteurs associés dans le cadre du programme national de lutte contre la tuberculose au Zimbabwe. BMC Santé pub. 2015;15(29):1471-2458.
8. Lusignani LS, Quaglio G, Atzori A, Nsuka J, Grainger R, Palma MDC, et al. Facteurs associés au retard du système de soins de santé et des patients dans le diagnostic de la tuberculose dans la province de Luanda, en Angola. BMC Inf Dis. 2013;13:168.
9. Ravahatra K, Michel Tiaray H, Rakotondrabe ID, Rasoafaranirina MO, Nandimbiniaina A, Rakotomizao JR, et al. Facteurs De Retard Diagnostique De La Tuberculose Pulmonaire Vus À l'Unité De Soins, De Formation Et De Recherche De Pneumologie Befelatanana. European Scientific J. 2017;13(27):413.
10. Yimer SA, Bjune GA, Hansen CH. Temps pour la première consultation, le diagnostic et le traitement de la tuberculose chez les patients fréquentant un hôpital de référence dans le nord-ouest de l'Ethiopie. BMC Infect Dis. 2014;14:19.
11. Nerges M, Sheela R, Yatin D, Eunice L, Shimoni S, Akshaya P. Durées et retards dans la recherche de soins, le diagnostic et l'initiation du traitement chez les patients atteints de tuberculose pulmonaire non compliquée à Mumbai, en Inde. J Int Mycobactériol. 2016;5(1):172-3.
12. Selvam P, Bina T, Priya C, Javakrishnan T, Biju G, Cp S. Retard diagnostique et facteurs associés chez les patients atteints de tuberculose pulmonaire au Kerala. .J Family Med Prim Care. 2017;6(3):643-8.
13. Belkina TV, Khojiev DS, Tillyashaykhov M, Kudenov MU, Tebbens JD, Vlcek J. Retard dans le diagnostic et le traitement de la tuberculose pulmonaire en

Ouzbékistan: une étude transversale. BMC Inf Dis. 2014;14:624.
14. Nathan BWC, Changming Z, Chikondi MC, Chanceux M, Vinod KD, Biao X. Obstacles au diagnostic de la tuberculose - une étude comparative entre le nord du Malawi et la Chine rurale orientale. Transactions de la Société royale de médecine et d'hygiène tropicales. 2018;111(11):504-11.
15. Das S, Basu M, Mandal A, Roy N, Chatterjee S, Dasqutpa A. Prévalence et déterminants du retard dans le diagnostic de la tuberculose pulmonaire dans le district de Darjeeling au Bengale occidental. J Family Med Prim Care. 2017;6(3):627-35.
16. Xu X, Liu J, Cao S, Zhao Y, Dong X, Liang Y, et al. Retards dans la recherche de soins, le diagnostic et le traitement chez les patients atteints de tuberculose pulmonaire à Shenzhen, en Chine. J Int Tb Mal Resp. 2013;17(5):615-20.
17. Akrim A, Bennani K, Essolbi A, Sghiar M, Likos A, Benmamoun A, et al. Déterminants des délais de consultation, de diagnostic et de traitement pour les nouveaux patients tuberculeux pulmonaires à microscopie positive au Maroc : étude transversale. East Mediterranean Health J. 2014;20(11).
18. Williams E, Cheng AC, Lane GP, Guy SD. Retards dans la présentation et le diagnostic de la tuberculose pulmonaire: une étude rétrospective d'un service de santé tertiaire dans l'ouest de Melbourne, 2011-2014. Int Med J. 2017;48(2):184-93.
19. Massenet D, Diop N, Fall D, Kante S, Ndoye B. Évaluation du « Health system delay » chez les patients tuberculeux à Saint-Louis du Sénégal. Public health. 2015;108(3):188-90.
20. Anteneh A, Wondu T. Retard total dans le traitement des patients atteints de tuberculose pulmonaire à frottis positif dans cinq centres de santé primaires, sud de l'Éthiopie: une étude transversale. plosOne. 2014;47(8):e 0102884.
21. Rodriguez D, Verdonck K, Bissell K, Victoria J, Khogali M, Marin D, et al. Suivi des retards dans le diagnostic de la tuberculose pulmonaire dans huit villes de Colombie. Panam Salud Publica. 2016;39(1):12-8.
22. Tattevin P, Che D, Fraisse P, Paty MC, Guichard C, Gatey C, et al. Etude du délai diagnostique et de ses déterminants au cours de la tuberculose maladie en France. BMC Public healh. 2011;16.
23. Bojovic O, Medenica M, Zivkovic D, Rakocevic B, Traikovic G, Tepavcevic DK, et al. Facteurs associés aux retards des patients et du système de santé dans le diagnostic et le traitement de la tuberculose au Monténégro, 2015-2016. PLoS One. 2018;13(3):e0193997.
24. Mauch V, Woods N, Kirubi B, Kipruto H. : Évaluation des obstacles à l'accès aux soins de la tuberculose avec l'outil d'estimation des coûts des patients: résultats pilotes de deux districts au Kenya. 2011;11(43):750-90.
25. Santos E, Felgueiras O, Oliveira R, Duarte R. Diagnostic du retard de la tuberculose dans la province de Huambo, Angola. Rev Portug Pneumol. 2018;10:17.
26. Bonadonna LV, Saunders MJ, Guio H, Zegarra RO, Evans CV. Facteurs socio-économiques et comportementaux associés au retard diagnostique de la tuberculose à Lima, Pérou. Am J Trop Med Hyg. 2018;10:96.