

*Original Research Article*

# Factors associated with Patient Delay in Diagnosis of Tuberculosis at Tuberculosis Management Units, River Nile State, Sudan, 2019

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## Abstract

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This study aims to determine the factors associated with a patient delay in the diagnosis of tuberculosis in River Nile state- Sudan. An unmatched case-control study was carried out between August 2018 and September 2019. Cases were patients registered at Tuberculosis management units as TB patients and who delay in seeking care from a formal health care provider more than 30 days and controls were the patients who had the same inclusion criteria but not delay in seeking care from a formal health care provider. Fifty-four cases and one hundred fifty-eight controls were interviewed by using a standardized questionnaire. Baseline data were collected from both groups through face-to-face interviews, using a structured close-ended questionnaire. Univariate and multivariate logistic regression were done in the course of the data analyses. The median patient delay was 60 days. The study indicated that chest pain and alcohol consumption were independent predictors of patient delay. However, cough, night sweating, and urban residence were associated with a shorter period of delay. There was no significant association between those who delay seeking care and not delayed in terms of age, gender, level of education, distance, stigma, knowledge, other clinical factors, or health seeking behaviors.

**Keywords:** Tuberculosis, patient delay, factors, diagnosis, River Nile State, Sudan

## INTRODUCTION

Tuberculosis (TB) ranks as the first leading cause of death from an infectious disease worldwide, overtaking the human immunodeficiency virus (HIV) in 2016 (WHO, 2018).

It is estimated that every year there are 10 million new cases of tuberculosis (TB) worldwide and nearly 1.5 deaths from TB. Of the estimated 10 million people who

developed TB, one quarter was in the African Region, which also had the highest rates of cases and deaths relative to the population (WHO, 2018). According to WHO Eastern Mediterranean, Region 15% of the regional TB burden is reported in Sudan. The annual risk of infection for TB is 77 per 100000 populations (WHO, 2015). The detection rate in Sudan was 67%. In River

Nile state the detection rate was 31% for the year 2017 (SMOH, 2017), and the success rate for the positive cases was 91% according to the national TB program report (FMOH, 2017).

Management of TB patients involves early & accurate diagnosis, and appropriate treatment to reduce transmission, morbidity, and mortality (WHO, 2018). Between 2000 and 2017 TB treatment alone saved an estimated 45 million lives among HIV-negative people and saved an additional 9 million lives among HIV-positive patients with the support of anti-retroviral therapy (ART) (WHO, 2018).

Globally End TB Strategy aims to end the tuberculosis epidemic by 2030 using an early diagnosis of tuberculosis including universal drug susceptibility testing, and systematic screening of contact and high-risk groups as the first component of pillar one (WHO, 2019). To meet the global Target the National TB program focus on increasing detection rate from 60.5 % to 76 %, also, to improve the success rate of TB patient from the baseline 79% in 2016 to 90% by the end of 2020 (FMOH, 2017).

The program implements the passive case finding, where the patients present themselves to the health facility to seek care. This approach is affected by patient motivation and health-seeking behavior, in addition to the degree of suspicion by a health care provider. Passive case finding has not led to the targeted case detection rate in Sudan, leaving gap of about one-third of the cases have not been detected (FMOH, 2017). And this issue is more prominent in River Nile State where about two-thirds of TB patients have not been detected (FMOH, 2017). Therefore, in the health care system where this approach is applied, health seeking behavior is fundamental in the timely diagnosis and treatment of TB patients.

One of the most important issues affecting the success of Tuberculosis (TB) control programs is the delay in diagnosis of TB patients (WHO, 2018). In general, the literature on TB diagnostic delay focus on two main areas, patient delay in seeking a health provider from the time of their first symptom and health system delay which refers to health care facility capacity to produce relevant laboratory result and health care provider efficacy of diagnosing the patient promptly (Dag et al., 2008).

Those with undiagnosed pulmonary TB have high levels of TB transmission in the community. Any delay in diagnosis and consequently treatment of TB patient not only increase the infectivity of the disease in the community but may also lead to a more advanced disease state, which may result in more complications and expose the patient to a higher risk of death (Virenfeldt et al., 2014).

Study in River Nile State reported that (71.1%) of the patient delay seeking health care for more than 30 days and the factor associated with it were not investigated

(Sulaiman et al., 2013). Studies in developing countries have noted that personal and psychological factors associated with the delay in TB seeking care including HIV status, gender, age, remote residence, alcohol consumption, and a perceived barrier to treatment (Dag et al., 2008; Esther et al., 2014; Maria and Mari, 2006; Oladayo et al., 2014). A study in Sudan in Algazeira State has noted that there are significant differences by area of residence, occupation, income level, history of contact with a TB patient, history of chronic obstructive pulmonary disease, and having a suspicion of TB (Mohamed et al., 2013).

Currently, early diagnosis and detection of TB require the awareness of the patients of their symptoms and their timely access to the health facilities. In this regard, investigating the determinant of patient delay may help in ensuring early diagnosis and treatment.

## Problem Statement

It has been estimated that an infectious person can infect between 10 and 15 people each year, and continue to be infectious as patient delay continue. Patient delay may result in more advances and severe disease, higher mortality, and sustain spread of infection in the community (Virenfeldt et al., 2014; Asres et al., 2018; Gebreegziabher et al., 2016). Because most TB transmission occurs between the onset of cough and the initiation of treatment, this period of patient delay is critical in mitigating disease transmission and minimizing the reoccurrence of the TB epidemic. It is generally considered that to achieve effective TB control the total delay to diagnosis should not exceed 3 weeks (Khaled et al., 2008). The study conducted in River Nile State reported that the outcome indicators for the TB program River Nile State for the years 2011-2013 were lagging behind the required target, the case detection rate was 10.3 %, the success rate was 79.6%, treatment failure was 3%, the default rate was 8.1%, and the death rate was 8% (Elmadhoun et al., 2016). Another study in River Nile state assessing the health-seeking behavior of TB patients demonstrated that more than two-thirds of patients delayed seeking health care.

## Rationale

One of the targets of the sustainable developmental goal is to end the epidemic of TB by 2030. The WHO End TB Strategy has stated that early diagnosis and treatment, with a focus on abolishing the barrier that people encounter to seek care among the main component of pillar one of the strategies (WHO, 2019). According to a systematic review about the natural history of Tuberculosis 70% of the patient without treatment could

die (Tiemersma et al., 2011).

Another study conducted in China revealed that patient delay of more than 30 days could exacerbate the disease and lead to serious complication (Lin et al., 2008).

The detection rate in River Nile State is 38%, meaning about two third of TB individuals went undiagnosed (WHO, 2018). A previous study done in River Nile State reported that (42.1%) sought health care services more than 45 days after symptoms onset. This study did not address the factors that determine this delay in seeking care (18-Sulaiman et al., 2013). The State is famous for Gold mining where people from the whole country come for work in the area especially from Red Sea and Kasala States where TB prevalence is High (SMOH, 2017). So, addressing the factors associated with TB patient delay is important for identifying points of intervention for TB control.

## METHODS

### Study design

Unmatched Case control study (facility-based study)

### Study area

The study was conducted in River Nile State which is located between Latitudes 16-22 north and Longitudes 32-35 south. The State's area is 124,000 square Kilometers. The population is 1,393,467. It ranked as sixth state in terms of area among the Sudan states. It has 7 localities. The localities are: Aldamer, Atbara, Barbar, Abuhamad, Shendi, Elmatamma, and Elbuheera.

### Study Population

New TB cases registered at Tuberculosis Management Units (TBMUs).

The selection of cases and control was from the TB cards and registry according to the following:

Case: were patient registered at TBMUs as TB patient and presented delay in seeking care from a formal health care provider more than 30 days.

Control: were patient registered at TBMUs as TB patient and not presented delay in seeking care from a formal health care provider more than 30 days.

New TB patient: confirmed TB patient who has never had TB disease before.

We use 30 days as a cut of point to dichotomize into either delayed or not delayed based on study conducted in China demonstrated that 30 days is a turning point in which the disease become more critical and infectious (Lin et al., 2008). Another study in Ethiopia reported that

delay beyond 30 days associated with poor treatment outcome (Das et al., 2017).

### Inclusion criteria

New TB cases age more than 15 years old.

### Exclusion criteria

Patients who are difficult to communicate with them (deaf, with severe mental illness etc), severely ill patients and transfer patient were excluded.

### Sampling

#### Sampling technique

TB patient attending TBMUs and meet the inclusion criteria were interviewed consecutively till we reached the required sample size. Upcoming patients were recruited and classified into cases and controls based on their delay. The final sample size was 54 cases and 158 controls (total = 212).

To minimize misclassification bias between cases and control cases were interviewed at the same time of presentation. Their responses were matched to the information on TB patient card and registry book. To eliminate the effect of interviewer bias data collectors were trained to ask about the time of delay at the end of the questionnaire so they would not know who the case is and who is control.

### Sample size

The sample size was calculated using the Open Epi Website: -

Entry:

2 sided confidence level 95.

Power of 80.

The hypothetical proportion of exposure (25) among cases and (10) among control.

Cases to controls ratio were 1:2.

The least extreme Odds Ratio to be detected was (3).

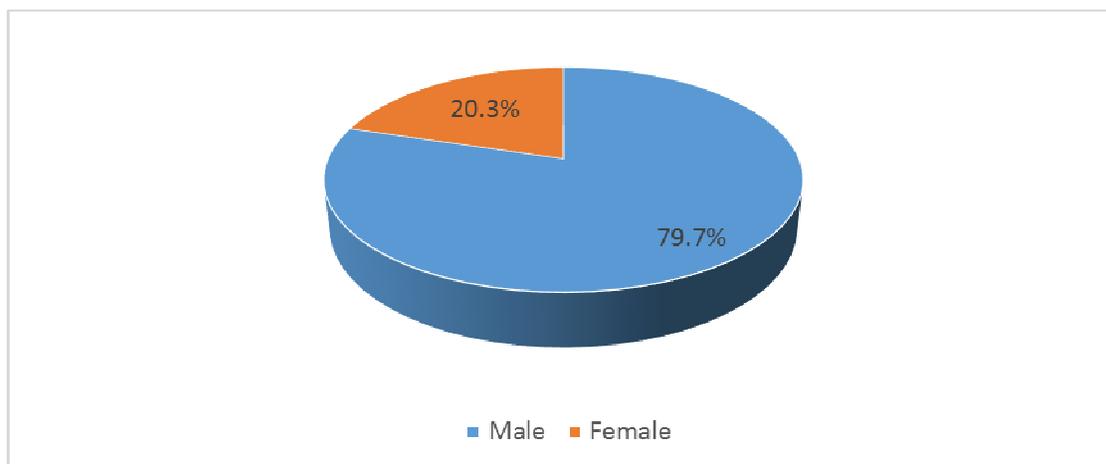
The sample size result with the Kelsey method was:

67 cases, 134 controls.

The total sample size was 201.

### Data collection tools and Techniques

Data were collected via a questionnaire that was adapted from a previously validated United States Agency for



**Figure 1.** Distribution of study group by gender at River Nile State 2019

International Development (USAID) questionnaire on socio-demographic characteristics, knowledge, and other interesting factors associated with patient delay. The questionnaire consisted of separate two parts; the first part was in a separate paper, including one question about the period of delay. The other part includes questions about socio-demographic factors, clinical characteristics, health seeking behavior, and Knowledge. Initially, the questionnaire was prepared in English then it was translated into the Arabic language. A pilot study was done to test the questionnaire with the same data collectors in a different patient at TBMs (not included in the study). Data collectors were health workers at the same tuberculosis management units (TBMs). They had one-day training on how to obtain necessary data. They were trained to ask the second part of the questionnaire then the first part (period of delay). There were 3 supervisors to check the accuracy of data and matching of the questionnaire with the patient card. If there were any discrepancy or missing data, it has been corrected via telephone call to the patient.

### Data management and analysis

After completion of the field work, data was entered and cleaned using Standard Package of Social Services (SPSS) software version (20). Data was analyzed using the same software. Frequency distribution tables and figures were formulated as appropriate to give clear description of characteristic of cases and controls. Median patient delay was measured with IQR. The magnitude of association of each variable of study with patient delay were measured by univariate analysis using binary logistic regression with odd ratio, to control the effect of confounding variables multivariate logistic

regression was applied, with forward stepwise Wald method. We included the variables which were significant at 10% significance level in the univariate analysis. The statistically significant was tested by 95% CI and P-value.

### Ethical consideration

Ethical clearance from the Sudan Medical Specialization Board (SMSB), and approval from River Nile State Ministry of Health was obtained. The TB patient were informed about the objectives of the study and written consent was obtained from them. Rights of respondents and confidentiality was assured.

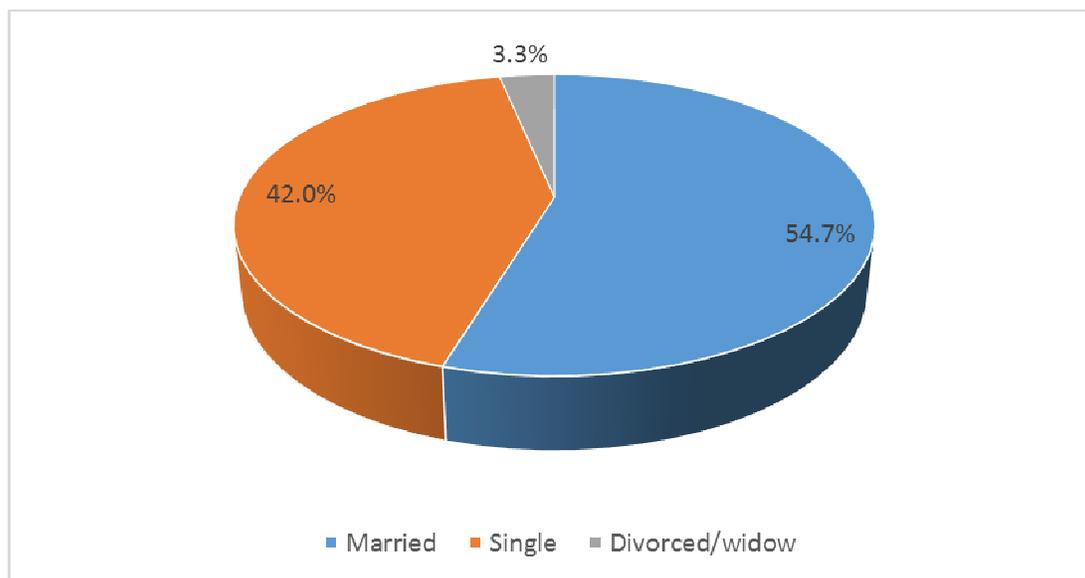
### RESULTS

A total of 217 TB patients were interviewed during the period from August 2018 to September 2019 in River Nile State from seven localities. 5 patients were excluded from the analysis due to the incomplete information on TB registration books and questionnaire. Thus, the data of 212 TB patients were analyzed, out of which (54) were the cases and (158) were the control.

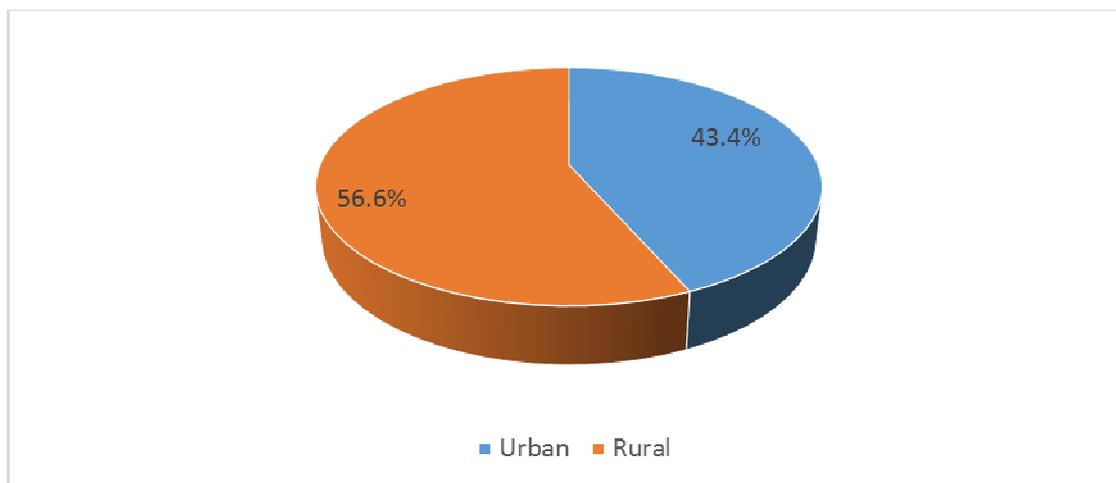
The median patient delay among control was 21 days [(IQR 7.5) range from 5 to 30 days] while among cases was 60 days [(IQR 18.75) range from 35 days to 360 days] p. value less than (0.001).

### General description of socio-demographic characteristics of study group

The descriptions of gender, age, marital status and residence have been illustrated in the figures (1, 2 and 3).



**Figure 2.** Distribution of study group by marital status at River Nile State 2019.



**Figure 3.** Distribution of study group by residence at River Nile State 2019.

(32.5%) of the participants were in the age group (25 to 34) years. (79.7%) of the study participants were male, (56.6%) were rural residents, (54.7%) were married. Most of the study participants were primary school education (42%). (65%) were freelancer. (70.8%) had low income (less than 2707 SDG). (65.1%) spent less than one hour to access the health facility. (14%) were Alcohol drinker.

#### **Description of socio-demographic characteristics of cases and controls**

There were no significant differences between cases and

controls in term of gender, age group, marital status, occupation, knowledge and payment to the health services. However, there was significant difference by level of education where (1.9%) of cases and (13.3%) of control were university education level. (53.7%) of cases and (38%) of control were primary school education level P.Value (0.049). (29.6%) of cases and (48.1%) of control were urban P.value (0.018). Those who took less than one hour to get to the health facility were (53 %) of cases and (69 %) of control P.value (0.042). (25 %) of cases and (10.4%) of controls were alcohol drinkers P.value (0.005). Clinical characteristics and health seeking behaviors of cases and controls have been represented in table (1 and 2)

**Table 1.** Description of clinical characteristic of Tuberculosis patients in River Nile State- Sudan 2019 (cases 54- control 158)

		Delay				P-Value	
		> 30 days(cases)		(<=30 days) (control)			
		Count	Column N %	Count	Column N %		
symptoms of someone infected with TB	Cough	Yes	37	68.5%	139	88.0%	0.191
		No	17	31.5%	19	12.0%	
	Sputum with blood	Yes	16	29.6%	41	25.9%	
		No	38	70.4%	117	74.1%	
	Fever	Yes	45	83.3%	113	71.5%	
		No	9	16.7%	45	28.5%	
	Weight loss	Yes	40	74.1%	99	62.7%	
		No	14	25.9%	59	37.3%	
	Tired_ weak	Yes	7	13.0%	25	15.8%	
		No	47	87.0%	133	84.2%	
	dizzy	Yes	1	1.9%	3	1.9%	
		No	53	98.1%	155	98.1%	
	Chest pain	Yes	14	25.9%	17	10.8%	
		No	40	74.1%	141	89.2%	
	Night_ sweat	Yes	9	16.7%	49	31.0%	
		No	45	83.3%	109	69.0%	
other	Yes	4	7.4%	5	3.2%		
	No	50	92.6%	153	96.8%		
type of TB	smear positive pulmonary TB	28	65.1%	96	62.7%	0.315	
	smear negative pulmonary TB	8	18.6%	42	27.5%		
	extra pulmonary	7	16.3%	15	9.8%		
HIV status	yes	4	7.4%	3	1.9%	0.124	
	no	25	46.3%	85	53.8%		
	Un known	25	46.3%	70	44.3%		
Chronic disease diabetes	yes	4	7.4%	18	11.5%	0.393	
	no	50	92.6%	138	88.5%		
Pulmonary co-morbidity	yes	1	1.9%	9	5.7%	0.259	
	no	52	98.1%	149	94.3%		
History of contact with TB patient	yes	7	13.0%	29	18.6%	0.344	
	no	47	87.0%	127	81.4%		

**Table 2.** Description of health seeking behaviors and knowledge of Tuberculosis patients in River Nile State- Sudan 2019 (cases 54- control 158)

Variable		Delay				P-Value
		> 30 days (cases)		(<=30 days) (control)		
		Count	Column N %	Count	Column N %	
First place for seeking health care	Self-treated	5	9.4%	15	9.5%	0.092
	Traditional healer	6	11.3%	5	3.2%	
	Public clinic, hospital, health center	30	56.6%	111	70.3%	
	Private practitioner	6	11.3%	20	12.7%	
	Pharmacist	4	7.5%	4	2.5%	
	other	2	3.8%	3	1.9%	
Reason for seeking care at the first place	was cheaper	10	18.9%	24	15.4%	0.468
	was closer	16	30.2%	30	19.2%	
	more convenient schedule	2	3.8%	13	8.3%	

Table 2. Continue

	better care received	9	17.0%	28	17.9%	
	better attitude from health worker	0	0.0%	1	.6%	
	trusted more	15	28.3%	59	37.8%	
	other	1	1.9%	1	.6%	
Those who sought care from somewhere else	yes	38	70.4%	98	62.0%	0.270
	no	16	29.6%	60	38.0%	
Second choice of seeking health care	Traditional healer	4	10.5%	4	4.2%	
	Public clinic, hospital, health center	16	42.1%	38	39.6%	
	Private practitioner	15	39.5%	53	55.2%	
	Pharmacist	3	7.9%	1	1.0%	
	other	0	0.0%	0	0.0%	
Knowledge about TB	Non satisfactory	31	57.4%	86	54.4%	0.704
	Satisfactory	23	42.6%	72	45.6%	

Table 3. Distribution of socio-demographic factors in relation to patient delay in diagnosis of Tuberculosis patients in River Nile State- Sudan 2019, univariate analysis (cases 54- control 158)

Variables	Delay		P-Value	Odd Ratio	95% CI				
	Case: >30 days	Control: <= 30 days			Lower	Upper			
	Count	Column N %	Count	Column N %					
sex	male	46	85.2%	123	77.8%	0.250	1.636	0.707	3.788
	female	8	14.8%	35	22.2%		Ref		
AGE_GROU	15 - 24	37	23.4%	12	22.2%	0.952	0.973	0.40	2.366
P	25 -34	54	34.2%	15	27.8%	0.668	0.833	0.362	1.916
	35 - 44	25	15.8%	13	24.1%	0.334	1.560	0.632	3.848
	45 +	42	26.6%	14	25.9%		Ref		
Marital status	married	29	53.7%	87	55.1%	0.862	0.947	0.509	1.760
	Not married	25	46.3%	71	44.9%		Ref		
education	post graduate	0	0.0%	0	0.0%				
	education								
	university	1	1.9%	21	13.3%	.126	.184	.021	1.611
	secondary school	17	31.5%	50	31.6%	.594	1.311	.484	3.554
	primary school or khalwa	29	53.7%	60	38.0%	.195	1.864	.727	4.783
	illiterate	7	13.0%	27	17.1%		Ref		
occupation	employee	3	5.6%	9	5.7%	.357	2.133	.426	10.864
	freelancers	40	74.1%	98	62.0%	.063	2.612	.950	7.185
	housewife	6	11.1%	19	12.0%	.295	2.021	.542	7.532
	unemployed	5	9.3%	32	20.3%		Ref		
residence	urban	16	29.6%	76	48.1%	0.02	0.454	0.234	0.881
	rural	38	70.4%	82	51.9%		Ref		
INCOM	<= 2707	40	74.1%	110	69.6%	0.535	1.247	0.621	2.502
	>2707	14	25.9%	48	30.4%		Ref		
Distance	Less than one hrs	29	53.7%	109	69.0%	0.044	0.521	0.277	0.981

Table 3. Continue

	More than one hrs	25	46.3%	49	31.0%		Ref		
Payment for the Health services	yes	6	11.8%	33	21.3%	0.138	0.493	0.194	1.255
	no	45	88.2%	122	78.7%				
Alcohol consumption	yes	14	25.9%	16	10.4%	0.007	3.019	1.357	6.711
	no	40	74.1%	138	89.6%				

Table 4. Distribution of clinical characteristics factors in relation to patient delay in diagnosis of Tuberculosis patients in River Nile State- Sudan 2019, univariate analysis (cases 54- control 158)

Variables	Delay									
			Case: >30 days		Control: <= 30 days		P- Value	Odd Ratio	95% CI	
			Count	Column N %	Count	Column N %			Lower	Upper
symptoms of someone infected with TB	Cough	Yes	37	68.5%	139	88.0%	0.001	0.298	0.141	0.629
		No	17	31.5%	19	12.0%			Ref	
	Sputum with blood	Yes	16	29.6%	41	25.9%	0.599	1.202	0.606	2.381
		No	38	70.4%	117	74.1%			Ref	
	Fever	Yes	45	83.3%	113	71.5%	0.089	1.991	0.899	4.408
		No	9	16.7%	45	28.5%			Ref	
	Weight loss	Yes	40	74.1%	99	62.7%	0.130		Ref	
		No	14	25.9%	59	37.3%		1.703	0.855	3.390
	Tired weak	Yes	7	13.0%	25	15.8%	0.613	0.792	0.322	1.952
		No	47	87.0%	133	84.2%			Ref	
	dizzy	Yes	1	1.9%	3	1.9%				
		No	53	98.1%	155	98.1%				
	Chest pain	Yes	14	25.9%	17	10.8%	0.008	2.903	1.318	6.394
		No	40	74.1%	141	89.2%			Ref	
Night sweat	Yes	9	16.7%	49	31.0%	0.045	0.445	0.202	0.981	
	No	45	83.3%	109	69.0%			Ref		
other	Yes	4	7.4%	5	3.2%					
	No	50	92.6%	153	96.8%					
type of TB	smear positive pulmonary TB	28	65.1%	96	62.7%	.353	.625	0.232	1.684	
	smear negative pulmonary TB	8	18.6%	42	27.5%	.134	.408	0.126	1.319	
	extra pulmonary	7	16.3%	15	9.8%			Ref		
Symptom at disease onset	Single	4	7.4%	31	19.6%	0.045	0.328	0.110	0.976	
	Multiple	50	92.6%	127	80.4%		Ref			
HIV status	yes	4	7.4%	3	1.9%	(.099)+	3.733	.781	17.856	
	no	25	46.3%	85	53.8%	.551	.824	.435	1.559	
	Not done	25	46.3%	70	44.3%		Ref			
Chronic disease diabetes	yes	4	7.4%	18	11.5%	0.397	0.613	0.198	1.900	
	no	50	92.6%	138	88.5%		Ref			
(Pulmonary co-morbidity)	yes	1	1.9%	9	5.7%	0.283	0.318	0.039	2.574	
	no	52	98.1%	149	94.3%		Ref			
History of contact To TB patient	yes	7	13.0%	29	18.6%	0.347	0.652	0.268	1.589	
	no	47	87.0%	127	81.4%					

**Table 5.** Distribution of health seeking behaviors and knowledge in relation to patient delay in diagnosis of Tuberculosis patients in River Nile State- Sudan 2018-2019, univariate analysis (cases 54- control 158)

Variables			Delay				P-Value	Odd Ratio	95% CI	
			Case: >30 days		Control: <= 30 days				Lower	Upper
			Count	Column N %	Count	Column N %				
First seek care at		Self-treated	5	9.4%	15	9.5%	.509	.500	.064	3.906
		Traditional healer	6	11.3%	5	3.2%	.592	1.800	.210	15.407
		Public clinic, hospital, health center	30	56.6%	111	70.3%	.335	.405	.065	2.538
		Private practitioner	6	11.3%	20	12.7%	.436	.450	.060	3.353
		Pharmacist	4	7.5%	4	2.5%	.725	1.500	.156	14.420
		Other	2	3.8%	3	1.9%		Ref		
Knowledge about TB		Non satisfactory	31	57.4%	86	54.4%		Ref		
		Satisfactory	23	42.6%	72	45.6%	0.704	0.866	0.475	1.653

**Table 6.** Determinants of patient delay in diagnosis of Tuberculosis patient in River Nile State- Sudan 2019, multivariate logistic regression (cases 54- control 158)

	B	S.E.	P-Value	Odd Ratio Exp(B)	95% C.I. for OR	
					Lower	Upper
occupation2			.207			
Employee	.921	.923	.319	2.511	.411	15.329
freelancer	1.137	.602	.059	3.119	.959	10.141
Housewife	.353	.785	.653	1.423	.305	6.628
Residence	-.527	.460	.252	.590	.240	1.455
Distance	-.497	.431	.249	.608	.261	1.416
symptoms	-.204	.869	.814	.815	.149	4.474
Drink alcohol	.976	.493	.048	2.654	1.009	6.981
Cough	-1.486	.467	.001	.226	.091	.565
Chest pain	1.346	.488	.006	3.844	1.476	10.006
Fever	.496	.650	.445	1.643	.460	5.869
Night sweat	-1.606	.498	.001	.201	.076	.532
Constant	-.539	.898	.549	.584		

### Univariate analysis of factors associated with patient delay

The univariate analysis of the distribution of delay periods in relation to socio-demographic, clinical, health seeking behaviors and knowledge variables are shown in Table (3, 4 and 5).

### Multivariable logistic regression models:

Multiple logistic regression for delay for all variable significant at 10% significance level were represented in table (6) Multiple logistic regression for delay using

forward stepwise Wald method were represented in tables (7). We performed logistic regression using stepwise method to know if significant variables were included in the model or not. The logistic estimates using stepwise method showed that only 5 variables are associated with patient delay, those who were urban residence, drink Alcohol, having chest pain, cough and night sweating.

Variables which were significant at 10% significance level were included in the multivariate model, but were excluded by multiple regression using forward stepwise method. These variables were freelancer, employee, housewives; as occupation and sputum with blood, fever, weight loss; as symptoms, in addition to distance.

**Table 7.** Determinants of patient delay in diagnosis of Tuberculosis patient in River Nile State-Sudan 2018-2019, multivariate logistic regression- using forward Stepwise Wald method (cases 54-control 158)

	Coefficients B	S.E.	P-Value	Odd Ratio Exp(B)	95% C.I. for OR	
					Lower	Upper
Residence [urban]	-.902	.385	.019	.406	.191	.862
Drink alcohol	1.170	.474	.014	3.222	1.271	8.163
Cough	-1.459	.442	.001	.232	.098	.552
Chest pain	1.319	.469	.005	3.741	1.493	9.374
Night sweat	-1.324	.464	.004	.266	.107	.661
Constant	.482	.433	.266	1.619		

## DISCUSSION

Early diagnosis and treatment are a key in the control and prevention of tuberculosis. This could be achieved by the patient timely seeking care from formal health provider.

Our study assesses the determinant factors associated with patient delay in River Nile state. Regarding description of different variables, males were more affected than female (79%) this is comparable to other studies in River Nile State-Sudan and India (Elmadhoun et al., 2016; Van Ness et al., 2017). Most patients in the study population were in the age group (24 to 34). This is in agreement with study conducted in China (Osei et al., 2015). Most of the study participants were of low economic and educational level (70%) and (42%) respectively. This finding is similar to study in River Nile State (Elmadhoun et al., 2016). 17% of the participants had history of contact to TB patients. A similar finding was also reported in the River Nile State study (Elmadhoun et al., 2016). This might be due to weak TB contact tracing activities at the NTP level or the fear of the stigma from the patient side. Regarding health seeking behaviors most of the study participants first sought care at public health facilities. This is in line with other studies conducted in Sudan, China and Ethiopia (Mohamed et al., 2013 ; Elmadhoun et al., 2016; Getnet et al., 2019; Osei et al., 2015). However, it is not in agreement with other studies in Nigeria, Malaysia where visiting private clinic, drug shops and traditional healer were the first choice (Kingsley et al., 2013; Rodrigues et al., 2011). Our findings indicated that patients sought care from private practitioner (53%) or traditional healer (4%) at the second visits. This might be due to the low level of satisfaction of those patients, at their first visit, with the services provided by the public health facilities.

In the current study the median delay among cases and controls were 60 days and 21 days respectively. This is consistent with the studies done in Nigeria and Amhara-Ethiopia (Asres et al., 2018; Kingsley et al.,

2013). Also, a previous study in River Nile State demonstrated that about (42%) of the TB patient sought care after the 45 days of appearance of symptoms (Sulaiman et al., 2013). However, our findings are higher than studies conducted in Algazira State- Sudan, Ethiopia, Iran and Italy where the median patient delay was reported at 4, 50, 13 and 30 days respectively (Mohamed et al., 2018; Getnet et al., 2019; Kalan et al., 2018; Quattrocchi et al., 2017). These 60-days prolonged period of delay was twice the accepted delay in this study. This might be due to existence of nomadic people and the gold mining worker at River Nile State where the access for health center is rather difficult. The finding obtained in this study was lower than that period of delay observed in Afghanistan (199 days) (Getnet et al., 2017). The variations in the reported results might be due to the different health care system and cultural background in the different countries, in addition to the different study designs.

In the univariate analysis of this study, 7 factors showed association with patient delay. These include distance, residence, symptom at disease onset (single symptom), cough, night sweating, chest pain and alcohol consumption.

Our study showed that distance had association with delay; TB patients who took less than one hour to get to the health facility were less likely to delay than those who took more than one hour to access the health facility. This is similar to studies done in Italy, Nigeria and Ethiopia (Getnet et al., 2019; Quattrocchi et al., 2017; Kingsley et al., 2013; Yirgu et al., 2017). This may be attributed to transportation factors. Particularly prominent in rainy season when the road travel time might increase and some area might be gulfed by floods.

Our study found that patients who reside in urban area were less likely to postpone seeking health care. This finding is comparable to studies from Ethiopia, Rwanda and a systematic review from China and Asia (Getnet et al., 2019; Li et al., 2013; Bogale et al., 2017; Lorent et al., 2008). This might be due to availability of health

facilities in urban area. In addition, health centers in rural area with low services may drive local people to trust other accessible care provider like traditional healers. In our study the reasons for seeking care at the first place were the closeness of facilities or the provider and the patient trust in the provider (35.5%) and (56.2%) among cases respectively. However, our result is in contrast with study done in Algazira Sudan and Nigeria which reported high patient delay among those residing in urban area (Mohamed et al., 2013; Kingsley et al., 2013). The researchers suggested that the reason for high delay among patient living in urban area might be due to that stigmatize patient seeking care in rural health setting.

We found that patients who had single symptom were less likely to delay than those who had multiple symptoms. This finding is not in agreement with a systematic review and study done in Ethiopia indicating that multiple symptoms prevent patient delay. Our finding might be because patients believe that a single symptom was a cause of other diseases than TB. Higher delay was observed among alcoholic patients. This finding was comparable to result from other studies conducted in India and London (Van Ness et al., 2017; Evenden et al., 2019). It is documented that the risk of Tuberculosis increases in alcoholic individuals (Silva et al., 2018). Study of Risk factors of TB demonstrated that TB patients with alcohol use disorder (AUD) are more infectious and had higher rate of treatment default and relapse (Silva et al., 2018).

In multivariate logistic regression using forward stepwise Wald method five factors were associated with patient delay. Patients residing in urban area and patients who reported cough and night sweating, as the first symptom at disease onset, were less likely to postpone approaching health care centers. On the other hand, patients who drink alcohol and who reported chest pain as the first symptom at disease onset were more likely to delay.

Our finding regarding cough and night sweating are comparable with finding from other studies conducted in the Republic of Armenia (Dana et al., 2010). This might be because patients are aware of the typical symptoms of TB. Therefore, they sought early care. However, our result is not in agreement with studies done in Uzbekistan and a systematic review in (LMIC) which reported that the presence of cough was a factor for the patient delay (Getnet et al., 2017; Tatiana et al., 2014).

In the current study, chest pain was associated with prolonged patient delay. This is not in line with a systematic review observed chest pain as a protective factor for the delay (Getnet et al., 2017).

In the current study other socio-demographic, health-seeking behavior or other clinical factors did not show association with patient delay. Study conducted in Algazira- Sudan reported that housewives, unemployment, low income, history of TB contact and patient

who had chronic obstructive pulmonary disease (COPD) were more likely to delay. Other studies reported that low level of education, unsatisfactory knowledge about TB, smoking, self-medication, visiting traditional healer, pulmonary co-morbidity, smear negative, extra-pulmonary Tuberculosis and HIV status were among the factors that associated with patient delay.

Strengths of the study: This study conducted over one year so it eliminates the seasonal variation. To the best of our knowledge, this is the first study in River Nile State that assesses the determinants of Tuberculosis patient delay. Meanwhile, there were previous studies exploring the epidemiology and health seeking behavior of TB patients but not addressing the factors for delay. In our study data was collected by trained health workers using standardized questionnaire and we used logistic regression in analysis to eliminate confounders.

Limitation of the study: during the period of the study the numbers of cases interviewed were 54 which is less than the calculated sample. This is due to exclusion of some questionnaires with missing data from the analysis. There were some questionnaires with minimal missing data were dealt with expectation. Another limitation is that we had no measure to assess the amount of Alcohol consumption. We asked participants whether they drink or not.

## CONCLUSION

Patient delay is unacceptably high among TB patient in River Nile State with a median delay of 60 days and some patients delay for approximately one year. Alcohol consumption and having chest pain were independent predictors of patient delay. On the other hand, urban residence, coughing and night sweating were associated with shorter period of patient delay. There were no association between those who delay seeking care and not delaying in term of age, gender, level of education, profession, distance, knowledge and other clinical factors or health seeking behaviors.

## RECOMMENDATIONS

Timely diagnosis and treatment are a key in the prevention of Tuberculosis. Efforts are needed to mitigate the effects of patient delay barriers. For the State TB program Special prevention programs are required for people residing in rural area. Raising community awareness about atypical presentation of TB has to be considered. We also suggest Strengthening Contact tracing activities in collaboration with civil societies and volunteers. For researcher More studies are needed to explore the association of alcohol consumption and TB patient delay.

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