Assessment of factors associated with Tobacco smoking among patients with pulmonary TB attending health facilities in Rwanda: A case control study

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Abstract

Introduction

The World Health Organization reported that one third of global population was tobacco smoker. In countries with a high tuberculosis burden, a big proportion was attributed to tobacco smoking. In the general population of Rwanda, the prevalence of tobacco smoking was higher among males (14%) compared to females (3%). We conducted a second analysis to assess factor associated with tobacco smoking among patient with TB attending Health Facilities.

Methodology

A retrospective case-control study in Centres of Diagnosis and Treatment of tuberculosis (CDT). Cases were patients with bacteriological TB confirmation; controls were persons with signs and symptoms without TB confirmation. Proportions and logistic regression were used in data analysis.

Results

The total number of tobacco smokers was 680. Among tobacco smokers, 88.1% tobacco smokers were males, 94.3% tobacco smokers had at least 25 years old and 64.6% were living in union. By education, 84.9% tobacco smokers were illiterate or attained primary school. Almost all tobacco smokers (97.0%) ever drunk alcohol while 67.9% used illicit drugs and 25.3% had low BMI (≤ 18.5) with increased proportion among cases (29.1%). A proportion of 38.3% in tobacco smokers had history of imprisonment. In multivariable logistic regression data analysis, males compared to females (aOR = 3.49[95%CI:1.76–6.94]), ever drunk alcohol compared to never drunk alcohol (aOR = 6.39[95%CI:2.67–15.31]) and ever used illicit drugs compared to never used illicit drugs (aOR = 9.89[95%CI:3.87–25.25]) were associated with high odds of tobacco smoking. In addition, illiterate people or people who attained only primary school education level compared to people having primary education level and above (aOR = 0.39[95%CI:0.23–0.69]) were associated with low odds of tobacco smoking.

Conclusion

Tobacco smoking is common in pulmonary TB patients. Males were more likely using tobacco smoking compared to females. Alcohol drinkers and illicit drug users were associated to tobacco smoking. A campaign on tobacco cessation, focusing on males, should be conducted in the general population starting by people on TB treatment.

Introduction

World Health Organization (WHO) reported that 33.3% of the global population was tobacco smokers(1). Comparing the WHO regions, African region is the less affected by tobacco use. It was estimated at 18.5% in 2000 in African Region, it decreased at 13.5% in 2015, and it is expected to decrease at 12.3% in 2020 and at 11.2% in 2025(1). The highest prevalence of tobacco smoking was reported in the South-

East Asia region, where this prevalence was 46.6% in 2015, it is expected be 27.9% in 2020 and 25.1% in 2025(1). There is a kind of tobacco smoking culture in many countries(2). The prevalence of tobacco smoking varies according to countries and demographic characteristics, such as gender, age, race and other(2). The culture component of tobacco smoking was reported in Nigeria, where in marriage ceremony, when one is giving a daughter, tobacco is among the requirements to provide to the family of the daughter(3). A systematic review revealed that the number of tobacco smoking-related deaths increased in African countries(4). However, other studies showed that tobacco smoking-related deaths increased from around 150,000 in 1990 to over 215,000 deaths in 2016(4). In 2016, a research reported that among people over 15 years living in 32 high TB-burden countries, the proportion of TB incidence attributable to tobacco smoking was 19.6%, varying from a country to another(5). The country-specific TB disease attributable to tobacco was 4.7% in Nigeria while it was 31.6% in Russia(5). It was reported that tobacco smoking-related death was observed in all African regions, with the highest number of deaths in Eastern Africa(4). According to a cross-sectional study conducted in Ethiopia and Kenya, the prevalence of tobacco smoking among Ethiopian men increased significantly from 8.5% in 2005 to 11.7% in 2014 (p-value < 0.001), while in Kenya, it significantly decreased from 22.9% in 2003 to 17.0% in 2014(p-value < 0.001)(6). In Rwanda the Demographic Health Survey conducted in 2015 showed that the prevalence of any kind of tobacco smoking was lower compared to any prevalence mentioned in other African countries. This prevalence in Rwanda was much higher among men (14%) compared to women (3%)(7).

When there is an association between tobacco smoking and pulmonary TB, the situation worsens for pulmonary safety. Sometimes, tobacco smoking can jeopardize TB treatment outcomes. In a case control study conducted in Iran, Alavi-Nain et al. demonstrated a strong association between tobacco smoking and pulmonary TB (p-value < 0.001)(8). A study conducted in Georgia showed that there was a poor outcome of TB treatment among people who were tobacco smokers(9). Also, a current or past history of tobacco smoking was positively associated with TB treatment failure and death in an Indian cohort study(10). Moreover, tobacco smoking during breastfeeding was significantly associated to TB transmission to the child compared to non-exposed children(11). This study published that the tuberculin skin test was more positive in exposed children than unexposed children(11).

Factors associated with tobacco smoking among pulmonary TB patients were identified in a number of studies. In Spain, males patients, alcohol users, patients using illicit injecting drugs and poverty were associated with a high odds of tobacco smoking(12). In African countries the identified factors were age, gender, level of education and marital status and employment status(13)(14)(15),

In this study we aimed to assess the factors associated with tobacco smoking among pulmonary TB patients.

Methods

Study design

A retrospective case-control study, carried out by the Rwanda Biomedical Centre-TB&ORD division through its Centres for Diagnosis and Treatment (CDTs) in Rwanda. This study is a secondary data analysis using a data base abstracted a data base of a study carried out from June to December 2017 among participants aged 15 or over.

Study population and inclusion criteria

Cases were defined as patients aged 15 or over who had a positive TB test (confirmation of diagnosis was done through a sputum microscopy test or a GeneXpert test in the past six months). Controls were defined as any person aged 15 or over who attended the same clinics as the case during the same period who was presumptive TB patient (with clinical signs) with no TB diagnosis made by a clinician. The study team located cases from TB registers, contacted them via phone calls, invited and appointed them for interview. A take all approach has been used for the recruitment of cases. In case of refusal to participate, the case was documented and replaced by another eligible participant. For the control group, a random selection was applied to replace any participant who would refuse to participate. The patients with impaired decision-making capacity due to mental health conditions, children under 15 years of age and prisoners were not considered for this study. A Structured questionnaire translated from English to Kinyarwanda was used for interview. For both cases and controls, face-to-face interviews were conducted by trained healthcare providers.

Study site

The study enrolled participants from CDTs/Health Centres in Rwanda. Thirty-nine CDTs in Health centres were included in the study. Referral Hospitals and prisons were not included in the study because they don't serve a homogenous population.

Sample size calculation

The minimum sample size was calculated basing on simulation approach and controls (free of TB), we considered a matching of controls with cases for sex and age group. We used a simulation approach to identify the adequate sample size with appropriate power (the probability of finding an effect if it is real). The probability of finding an effect if it is real ($1-\beta$) was set to 80%; we set a series of 1.2 to 2.5 to detect the Odds Ratio. Each case was given 3 controls (Design 1:3) and we set a series of proportion from 0.01 to 0.9 to calculate the proportion of exposed in the control group (λ). The minimum sample size required from the above estimates was 503 cases. From this sample size, we added 20% for non-response rate; therefore, the sample size of TB cases was 629 cases. We then recruited 3 matched controls for each case recruited totalizing 1887 controls and making a total of 2516 participants.

In order to get at least the power of 80%, we assumed Odds Ratio of 1.5 and proportion of exposed in the control group (λ) to be 0.5. The sample distribution per province and HF was calculated basing on the probability proportional to size (PPS) sampling. A two stages calculation of the weight was applied. In the first stage, the weights has been chosen to compensate for the effect that health facilities do not have

the same size where is the sampling probability of each cluster, while for the second stage, weights have been used to compensate for the effect that target groups of participants do not have the same number of individuals.

Data collection method

Study team members received training on data collection tool, ethics and protection of human subjects. Data collectors were also trained to ascertain and document participant eligibility, provide eligible patients with study information, obtain signed informed consents, conduct participant interviews, and provide collected data to the data manager for back up. Prior to the interviews, data collectors obtained signed consent forms from cases and control groups. Interviews were conducted in a secured private place. A structured questionnaire was completed matching one case to three controls. Once all expected cases responded to the questionnaires and matched controls interviewed at the selected sites, the sampling process was ended.

Data management and analysis

For quality assurance purposes, Access programme-based questionnaires have been used. Every participant had a unique study identification code. Signed informed consents were obtained from participants and stored in a lock and key protected location in RBC under supervision of the Principle Investigator (PI) of the study. A dedicated data manager was responsible for data entry and cleaning processes. Data analysis was performed in MS Excel and Stata version 13.1 (Stata Statistical Software: Release 13. College Station, TX: StataCorp LP). For descriptive statistics, variables were tabulated and subsequent proportions analysed by age, sex, frequencies, percentage, medians and inter-quartile ranges (IQR). In multivariable logistic regression, the dependent variable was tobacco smoking. Socio-demographic and other variables were dependent variables. Differences were considered statistically significant with $p < 0.05$.

Ethical considerations

The informed consent process was completed prior to conducting the interviews. The information sheet was provided and read to participant and signed consent form obtained following voluntarily agreement of participant. Participants were free to withdraw from the study at any moment without any prejudice. All interviews were conducted in private locations to ensure confidentiality. Data collectors were trained on data collection tools, ethical considerations, privacy and confidentiality. The approval of the study and study instruments were obtained from the National Health Research Committee and the Rwanda National Ethics Committee.

Results

The total number of tobacco smokers in the current study was 680.

Table 1 displays the description of the study population by socio-demographic characteristics. Among all the registered tobacco smokers in the study, 223(32.8%) were recruited from pulmonary TB patients and 88.3% of them were males. Similarly, 88.0% of the tobacco smokers were males in the control group. More than 93.0% of the tobacco smokers were aged 25 or over in both the pulmonary TB cases and control groups. The cases had more underweight tobacco smokers (29.1%) than the control group (23.4%). Furthermore, pulmonary TB cases were found to have higher records of history of imprisonment than the control group with 43.2% and 35.8%, respectively. Considering HIV status, 27.9% of TB cases and 14.0% of control group were HIV positive.

Table 1
Description of tobacco smokers by socio-demographic characteristics

	Control		Cases		Total	
Socio-demographic characteristics	N	%	N	%	N	%
Total	457		223		680	
Sex						
Male	402	88.0	197	88.3	599	88.1
Female	55	12.0	26	11.7	81	11.9
Age group						
15–24	28	6.1	11	4.9	39	5.7
≥ 25	429	93.9	212	95.1	641	94.3
Marital status						
Currently living in union (Married + Cohabiting)	310	68.1	128	57.4	438	64.6
Not currently living in union (Single + Separated + Widowed + Divorced)	145	31.9	95	42.6	240	35.4
Education level						
None/Primary	383	83.8	194	87.0	577	84.9
Above primary	74	16.2	29	13.0	103	15.1
Occupation						
Student	5	1.1	0	0	5	0.7
Unemployed	30	6.6	18	8.1	48	7.1
Employed	8	1.8	2	0.9	10	1.5
Farming	262	57.3	116	52.0	378	55.6
Services and Sales workers	9	2	13	5.8	22	3.2
Unskilled manual workers	31	6.8	20	9.0	51	7.5
Skilled manual workers*	20	4.4	10	4.5	30	4.4
Others**	92	20.1	44	19.7	136	20

*Skilled manual workers: were defined as all workers with formal training working as professionals

**Others: was defined as all workers - non-professionals

***Ubudehe: means social-economic categories in Rwanda

	Control		Cases		Total	
Ubudehe categories						
Ubudehe Category 1	98	21.5	36	16.1	134	19.7
Ubudehe Category 2	161	35.3	91	40.8	252	37.1
Ubudehe Category 3	157	34.4	51	22.9	208	30.6
Unknown	40	8.8	45	20.2	85	12.5
Alcohol drinking						
Never	13	2.9	7	3.2	20	3.0
Ever	440	97.1	212	96.8	652	97.0
BMI						
< 18.5 (Underweight)	107	23.4	65	29.1	172	25.3
18.5–24.9 (Normal)	314	68.7	150	67.3	464	68.2
25–29.9 (Overweight)	34	7.4	8	3.6	42	6.2
>=30 (Obese)	2	0.4	0	0	2	0.3
HIV status						
Negative	392	86.0	160	72.1	552	81.4
Positive	64	14.0	62	27.9	126	18.6
Illicit drugs						
Yes	139	30.6	78	35.0	217	32.1
No	315	69.4	145	65.0	460	67.9
Homeless						
Yes	116	25.5	58	26.0	174	25.7
No	339	74.5	165	74.0	504	74.3
Diabetes						
Yes	2	0.4	4	1.8	6	0.9
No	455	99.6	219	98.2	674	99.1
*Skilled manual workers: were defined as all workers with formal training working as professionals						
**Others: was defined as all workers - non-professionals						
***Ubudehe: means social-economic categories in Rwanda						

	Control		Cases		Total	
HTA						
Yes	17	3.7	3	1.3	20	2.9
No	440	96.3	220	98.7	660	97.1
Asthma						
yes	2	0.4	0	0	2	0.3
No	455	99.6	223	100	678	99.7
History of imprisonment						
yes	163	35.8	96	43.2	259	38.3
no	292	64.2	126	56.8	418	61.7
Living in a ventilated House						
Yes	317	69.5	133	61.0	450	66.8
No	139	30.5	85	39.0	224	33.2
*Skilled manual workers: were defined as all workers with formal training working as professionals						
**Others: was defined as all workers - non-professionals						
***Ubudehe: means social-economic categories in Rwanda						

Globally, 88.1% tobacco smokers were males, 94.3% tobacco smokers had at least 25 years old and 64.6% were living in union. By education, 84.9% tobacco smokers were illiterate or attained primary school education level. The majority of tobacco smokers were farmers (55.6%) and 33.2% of the tobacco smokers were living in non-ventilated house. Almost all tobacco smokers (97.0%) ever drunk alcohol while 67.9% used illicit drugs and 25.3% had low BMI (≤ 18.5). A proportion of 38.3% of tobacco smokers had history of imprisonment (Table 1).

Table 2 shows factors associated with tobacco smoking among patients attending HF with sign and symptoms of TB. In bivariate logistic regression data analysis, respondents belonging to male gender, having 25 years old or above, having none or primary education level, belonging to Ubudehe (socio-economic) category one or two, alcohol drinker, using illicit drug, homeless, experienced a history of imprisonment and living in a non-ventilated house were associated with high odds of tobacco smoking among TB patients (p-value < 0.05).

Table 2
Factors associated with tobacco smoking in pulmonary TB patients in Rwanda

	Bivariate			Multivariable		
Socio-demographic characteristics	P-value	cOR	95%CI	P-value	aOR	95%CI
Sex						
Male	0.000	4.56	[2.5–8.31]	0.001	3.49	[1.76–6.94]
Female		1			1	
Age group						
15–24		1			1	
≥ 25	0.003	3.98	[1.67–9.49]	0.068	2.75	[0.93–8.16]
Marital status						
Currently living in union (Married + Cohabiting)		1				
Not currently living in union (Separated + Widowed + Divorced)	0.513	0.88	[0.6–1.29]			
Education level						
None/Primary	0.000	3.46	[2.04–5.87]	0.002	2.53	[1.45–4.41]
Above primary		1			1	
Ubudehe categories						
Ubudehe Category 1	0.009	2.12	[1.16–3.86]	0.079	1.89	[0.93–3.84]
Ubudehe Category 2	0.010	1.82	[1.17–2.85]	0.059	1.48	[0.99–2.22]
Ubudehe Category 3		1				
Unknown	0.005	2.89	[1.42–5.88]	0.136	1.78	[0.83–3.83]
Alcohol drinking						
Never		1			1	
Ever	0.000	15.90	[6.76–37.39]	0.000	6.39	[2.67–15.31]
BMI						

	Bivariate			Multivariable		
< 18.5 (Underweight)	0.706	0.91	[0.56–1.49]			
18.5–24.9 (Normal)		1				
25–29.9 (Overweight)	0.964	0.98	[0.45–2.15]			
>=30 (Obese)		1				
Ever used modern contraception						
Yes		1				
No	0.145	2.13	[0.76–5.95]			
HIV status						
Negative		1				
Positive	0.128	1.51	[0.88–2.56]			
Illicit drugs						
Yes	0.000	15.56	[6.59–36.72]	0.000	9.89	[3.87–25.25]
No		1			1	
Homeless						
Yes	0.000	3.24	[1.92–5.46]	0.778	1.12	[0.49–2.56]
No		1			1	
Diabetes						
Yes	0.187	0.45	[0.13–1.51]			
No		1				
History of imprisonment						
yes	0.007	2.90	[1.36–6.2]	0.551	1.21	[0.63–2.32]
no		1			1	
House ventilated						
Yes		1			1	

	Bivariate			Multivariable		
No	0.002	2.65	[1.47–4.76]	0.056	1.91	[0.98–3.71]

In multivariable logistic regression data analysis, after adjusting variables, males compared to females (aOR = 3.49[95%CI:1.76–6.94]), illiterate people or those who attained only the primary school education level compared to people having primary school level and above (aOR = 2.53 [95%CI: [1.45–4.41]), ever drunk alcohol compared to never drank alcohol (aOR = 6.39[95%CI:2.67–15.31]); and ever used illicit drugs compared to never used illicit drugs (aOR = 9.89[95%CI:3.87–25.25]) were associated with high odds of tobacco smoking.

Discussion

The high proportion of tobacco smokers was found among males, alcohol drinkers and illicit drug users. People with no formal education and those who attained only the primary school education level were more likely tobacco smoking than people with education above primary school education level.

Our study found that males were more tobacco smoking than the females (aOR = 3.49[95%CI:1.76–6.94]). According to WHO report, the prevalence of tobacco smoking was decreasing from 50.0% in 2000 to 37.5% in 2020; and it is expected to decrease at 35.1% in 2025 among males(1). The same report estimated that the prevalence of tobacco use among females was quite low. It was estimated at 16.7% in 2000, then expected to decrease at 8.0% in 2020 and 6.7% in 2025(1). A multi-disciplinary study conducted in 2000 in many countries, showed that the prevalence of tobacco smoking varied from 17–64% among men, while it varied from 1–42% among women(2). For instance, in China, there was a predominance of tobacco smoking among men compared to women, with a tobacco smoking prevalence of 63% among men, while it was 4% among women(2). Higher tobacco smoking in females was related to the Western culture and life style as reported by different authors(2, 16). A systematic review study conducted in sub-Sahara African countries showed that tobacco use is most frequently found in males; and the study showed that in females, the tobacco smoking behaviour was linked with high income countries(4). Findings from a study conducted in China among TB patients indicated that tobacco smoking behaviour was more related to males than to females(17). A similar study conducted in Spain found that males were highly associated with tobacco smoking than females (aOR = 2.26[95%CI:1.97–2.60])(12). In South Africa, male gender was found to be associated with tobacco smoking among TB patients(18). Wessels et al, in another study reported that in a tuberculosis specialized hospital in South-Africa, among tuberculosis patients, men were significantly tobacco smoking than women(19). The difference of tobacco smoking behaviour by gender was reported in a study conducted in the United State of America(20). A recent study conducted in Rwanda in 2019 reported that males were more likely to tobacco smoke than females(15,(21). In the traditional Rwanda, tobacco smoking was a social value and associated with culture norms where males were allowed to smoke even in public events. By education level, our study revealed that illiterate people or primary school education level were likely to smoke more

(aOR = 2.53 [95%CI: [1.45–4.41]) compared to people with more than primary school education level. The same, a study conducted in South Africa found that people who completed high education were likely to smoke less (18); another study mentioned above conducted in a tuberculosis specialized hospital above, authors reported that tuberculosis was associated with lower education level(19); and a similar study found that good academic performance was associated with non-tobacco smoking(16). This is complemented by findings from China where people with high education were tobacco smoking less compared to people with non-formal education(22). Likewise, results from a study conducted in rural settings in Uganda found similarly found that people with any education level were less tobacco smoking than people without any form of education level (14). In contrast, results from a study conducted in Kenya, people who attained high school education level and above were likely to smoke more than people with lower education level(23). Tobacco smoking by education level differs from a region to another but it decrease globally with the level of education. The difference between tobacco use in different countries shows that tobacco smoking could be related to socio-cultural norms. Even in Rwanda, tobacco smoking was among cultural values, where men could smoke in cultural ceremonies. Our study showed that alcohol drinking was associated with high odds of tobacco smoking (aOR = 6.39[95%CI:2.67–15.31]). The association of illicit drug use with high odds of tobacco smoking among TB patients was observed in our study (aOR = 9.89[95%CI:3.87–25.25]). This study corroborates the findings from a study conducted in Malaysia which reported that alcohol drinking was associated with high odds of tobacco smoking(17).

The current research is however subject to several limitations. The analysis was solely based on secondary data analysis. This study has not explicitly categorized different types of tobacco smoking and therefore it combines all type of tobacco smoking including cigarette, water pipe, pipe and so on) as one variable of tobacco smoking. Passive tobacco smokers were not captured in this study. Daily consumption of tobacco and the type of tobacco used were not quantified. For this very reason, we did not intend to capture all factors associated with tobacco smoking. The information provided by the study participants was a self-report with possibility of response bias when collecting self-reported data in healthcare settings. There was no way to verify the veracity of the information. This study shows an epidemiological view of association between tobacco smoking and above-mentioned factors but cannot show causality, however it is informative to decision makers and health providers.

Conclusion And Recommendations

Generally, tobacco smoking is still a common behaviour in the general population and particularly in pulmonary TB patients. Tobacco smoking is among the leading factors of lung diseases and negatively impacts the outcomes of TB treatment. Our study found that males were more likely to engage in tobacco smoking compared to females. Lower education level in some countries and higher education level in other countries were associated with tobacco smoking. High odds of tobacco smoking were associated with being alcohol drinkers and illicit drug users.

The community education and awareness campaigns on tobacco cessation should be conducted in the general population starting by people on TB treatment. Tobacco smoking cessation should particularly emphasize on males.

Abbreviations

aOR

Adjusted odds ratio CDT:Centres of Diagnosis and Treatment

IQR

inter-quartile ranges

HF

Health Facility WHO:World Health Organization

HIV

Human Immunodeficiency Virus

OR

Odds ratio

RBC

Rwanda Biomedical Center

TB

Tuberculosis

TB&ORD

Tuberculosis and Other Respiratory Diseases

Declarations

Conflict of interest declarations

Authors declare that they have not conflict of interest to publish this manuscript

Ethical approval and consent to participate

The approval of the study and study instruments were obtained from the National Health Research Committee and the Rwanda National Ethics Committee.

A written signed consent form was provided by participants, they are available in the National Institute of Statistics of Rwanda.

Availability of data

The data set of this study is available either in Rwanda Biomedical Center or in the National Institute of Statistics of Rwanda

Authors' contribution

Patrick Migambi, Augustin Dushime, Murego Felix and Mwumvaneza Mutagoma designed the study, conducted data collection, data analysis and manuscript writing.

Prosper Karame, Muhammed Semakula and Leopold Bitunguhari worked on manuscript writing and review.

Francine Birungi participated in study design and manuscript writing.

Ndishimye Pacifique and Nshimiyimana Ladislas contributed in data analysis and manuscript writing

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