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Prevalence and Risk Factors to Pulmonary Tuberculosis among Patients Attending Nyahururu District Hospital, Kenya

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Abstract:
Tuberculosis is a known pandemic worldwide with over 8.7 million new cases and 1.4 million related deaths annually. Developing countries have borne the biggest brunt with profound increase in PTB cases over the past few years. Kenya is ranked 13th among the 22 high burden countries that collectively contribute about 80% of the world's TB cases. Improved case finding has contributed to substantial increase in the notification rates in the past 2 decades. However, there is currently no reliable information on TB prevalence in some regions of Kenya. The study sought to determine the prevalence of pulmonary tuberculosis in relation to age and sex among patients attending Nyahururu District Hospital, Kenya, with a view to establishing risk factors associated with the disease. Both primary and secondary data was collected from 200 patients presenting with persistent cough between May and September 2012. Data was analyzed using SPSS descriptive statistical methods with measures of central tendency used for categorical variables and frequency listings for independent variables. Chi square was applied to test for associations among variables. The prevalence of PTB was 7% and was higher in females (57%) than males (43%). The age group 31-45 recorded highest number of cases (40%), 16-30 (26%) and 46-60 years (20%). Socio-cultural factors were significantly associated with PTB with the pastoral communities recording higher frequencies; Pokot 8(55.5%), Samburu 3(20.7%) and Maasai 3(21%) but much lower among the Kikuyu 2(13.9%) and others 2(12.9%). The study established significant differences in prevalence of PTB in relation to age and sex with risk factors being poverty, illiteracy, housing conditions, HIV co-infection and cultural practices. The study recommends continuous surveillance and awareness campaigns in rural communities on risk factors in TB transmission and th importance of prompt diagnosis treatments in order to reduce TB infections.

Keywords: *Prevalence, pulmonary tuberculosis, age, sex, risk factors*

1. Introduction

Tuberculosis (TB) is a worldwide pandemic with over 8.7 million new cases and 1.4 million related deaths recorded annually (WHO, 2011). The greatest burden is experienced in developing countries with South East Asia and Western Pacific regions accounting for (60%), India and china (40%) and Africa (24%) of the world's TB cases (WHO, 2011). Kenya is ranked 13th among the 22 high burden countries that collectively contribute about 80% of the world's TB cases. Mortality from TB in Kenya is also above the global average at 22 deaths per 100,000 (WHO, 2014). *M. tuberculosis* the causative agent of TB has developed strains that are multiple drug resistant (GitHub *et al*., 2008), a serious concern in many countries as TB is becoming the most prevalent and life threatening infectious disease (WHO, 2003). Globally the human immunodeficiency virus (HIV) has greatly influenced the burden of TB (Swaminathan and Rekha 2010) as it increases the risk of developing TB after infection while dually infected patients have a higher mortality rate (AU, 2006). Improved case finding has contributed to substantial increases in the notification rates over the past 2 decades (Mansoer, 2009). Most studies on case finding have investigated risk factors associated with delay in diagnosis of TB patients through passive case detection (Ndungu et al, 2013; Corbett et al, 2003; Mansoer, 2009). The epidemiology of tuberculosis in Kenya evolved due to economic, environmental and several other factors over years (Sitienei *et al*., 2013). Case finding in countries with high TB burdens depends primarily on detecting TB among symptomatic patients who present to health services. Diagnosis and treatment of symptomatic patients with infectious tuberculosis (TB) is now the main goal of the global TB control strategy of the World Health Organization (WHO) (2009). However, there is currently no reliable estimate of TB prevalence in all regions of Kenya. Furthermore, limited studies have addressed socio-cultural practices in communities some of which may contribute to transmission of TB. The study sought to determine the prevalence of TB in relation to age, sex and socio-cultural practices among patients attending Nyahururu District Hospital, Kenya, with a view to establishing risk factors of pulmonary tuberculosis (PTB). This may guide in TB control and prevention strategies.

2. Methodology

2.1. Site of Study

The study was carried out at Nyahururu District Hospital in Laikipia County, located on the Junction off Nyeri-Rumuruti road and the Nyeri-Nakuru highway. Nyahururu has an estimated population of 37,412 persons with about 22,459 persons living in urban areas. It lies at an altitude of 2304m above sea level, 36, 3667 East longitude and latitude 0.03^0 North latitude. Laikipia is a multi-ethnic county with diverse cultures exhibited by nomadic pastoralist communities; Samburu and Maasai with fairly similar living conditions in Manyattas and other lifestyles, the Pokot who live in temporary shelters while constantly moving in search of water and pasture and the Kikuyu who are settled and involved in agriculture and business.

2.2. Study Population

This involved all patients presenting with persistent cough exceeding three weeks presenting for treatment Nyahururu District Hospital Chest Clinic between May and September 2012. Written informed consent was obtained from all participants to whom structured questionnaires were administered to elicit demographic (age, sex) socio-economic (education level, monthly income, type of residence, occupation) and other relevant information. All participants were instructed to provide two sputum samples (spot and overnight) for microscopic examination.

2.3. Procedures

Sputum samples was collected in wide-mouthed plastic container with secure screw-cap lid and transported to the laboratory for processing within 3 days. Smears were stained for Acid Fast Bacilli (AFB) using two parallel microscopic techniques; the Ziehl-Nielsen (ZN) and Auramine phenol. The smears were scored according to guidelines of the International Union against Tuberculosis and Lung Disease (Enarson *et al.,* 2000). A smear result was considered positive if >1 acid-fast bacillus per 100 oil-immersion fields were observed. This provision included scanty smears because these are considered indicative of true positivity (van Deun *et al*., 2004). Sputum samples were liquefied and decontaminated with 4% NaOH by using standard procedures (Carroll *et al*., 2002). The smears were scored by 1 reader and confirmed by a second reader. No culture tests were performed in this study.

2.4. Data Analysis

Statistical analysis was performed by using SPSS version 12. Descriptive statistics such as mean, median and mode were used for categorical variables while frequency listings were used for numerical variables and presented tables and graphs. Prevalence of TB was calculated by dividing the number of TB cases by the number of participants who provided a sputum samples.

3. Results and Discussion

3.1. *Demographic characteristics of patients in the epidemiology of Pulmonary Tuberculosis*

40% of participants were male and 60% female while frequency of PTB was higher in males (43%) than females (57%). This was a deviation from other studies that have recorded higher prevalence in males than females. This may be attributed to difference in health-care seeking behavior among females and males. Adult men are usually too pre-occupied and seek health services when critically ill. TB prevalence has been reported to be different among different sex and age groups (Wood *et al.,* 2010).

Variable	Population N= 200 N (%)	PTB Positive cases n= 14	p value
Gender			
Male	120(60)	8(57)	0.043
Female	80(40)	6(43)	
Age			
0-15	4(2)	0	
16-30	52(26)	5 (35.7)	0.036
31-45h	80(40)	4 (28.6)	
46-60	40(20)	3 (21.4)	
61-75	20(10)	2 (14.3)	
76+	4(2)	0	
Number of rooms in residence			
Single	103(51.5)	8(57.1)	0.075
1-2 rooms	67(33.5)	4(28.6)	
>2 rooms	30(15)	2(14.3)	

Ventilation			
None	46(23)	6(42.9)	
1-2 windows	123(61.5)	6(42.9)	0.425
>2 windows	31(15.5)	2(14.3)	
Occupation			
Unemployed	17(8.5)	3(21.4)	
Livestock rearing	7 (39.5)	7(50)	0.175
Crop Farming	52(26)	2(14.2)	
Employed (Self or non-self)	52(26)	2(14.2)	
Household income per month			
< Ksh. 10,000 (100USD)	7 (37)	6(42.9)	
11,000_ 20,000 (110-200 USD)	68 (34)	4(28.6)	0.650
>20,000 (> 2000 USD)	58 (29)	4 (28.6)	
Education Level			
None	16 (8)	5 (35.7)	
Primary	78(39)	3 (21.4)	0.775
Secondary	63(31.5)	4 (28.6)	
Tertiary	43(21.5)	2 (14.3)	
HIV status			
Negative	174 (87)	3(21.4)	
Positive	26 (13)	11(78.6)	0.000
AFB smears			
PTB Positive	14 (7)	14 (100)	
PTB Negative	186 (93)	0	0.000

Table 1: Demographic Characteristics and Risk Factors to Pulmonary Tuberculosis

Reports indicate that men have higher risk of developing active TB as they are more exposed to the risk factors like alcohol, smoking and other occupational hazards than women and attend health services when they are more symptomatic compared to women (Lawson *et al.,* 2010). Some studies have cited that gender differences in response to TB infection and disease may be due to physiological development and immunity of different sexes (Thorson *et al.,* 2007). There is also evidence that sex is a key factor for modulating innate immunity, host response to infection and disease progression as well as socially constructed gender patterns (Lawson *et al.,* 2010).

The highest number of participants were aged 31-45 (40%) followed very closely by ages 16-30 (26%) and 46-60 years (20%). Among these, the highest number of TB cases were recorded among age 16-30 (36.7%) and 31-45 (28.6%) while no cases were recorded between ages 0-15 and above 75 years. These are young sexually active and productive age groups who likely to have high prevalence of HIV. Above 18 years, most youth may engage in risky behavior such as drugs abuse and alcoholism. Disease risk after primary infection with *M. tuberculosis* is greatest in very young children and youth. These differences in disease risk are accompanied by differences in the response to infection and clinical features of disease (Donald *et al,* 2010). A case-control study conducted in Hong Kong indicated that frequent travel and young age are independent predictors of MDR-TB (Law *et al.,* 2008). Similarly, age was reported to be a risk factor for MDR-TB in British Columbia where reactivated TB and pulmonary TB (PTB) were also found to be associated with MDR-TB (Moniruzzaman *et al.,* 2006).

Education level of most participants varied from primary (39%), secondary (31.5%) and tertiary level (21.5%) while no education rated 8%. Illiteracy may lead to language barrier between the community and health workers and may contribute to misdiagnosis of disease. This was indicated by high numbers among Maasai and Samburu. Targeting this population with relevant messages may have some impact in reducing the risk of MDR-TB (Carolyn et *al.,* 2009). Education level has been found to be significantly associated with prevalent TB in a study done in Western Kenya (van't Hoog et al., 2011).

There was an increase in PTB cases among HIV positive cases (78.6%) than HIV negative cases (21.4%). HIV infection has been reported to cause an upsurge of TB infection (Sitienei et al., 2013). Low CD4 cell count and advanced HIV disease were risk factors for MDR-TB in a study conducted among HIV infected patients in Mozambique (Nunes *et al.,* 2005). Similar findings have been reported in several sub-Saharan African settings (Hill et al, 20067, Lawson et al., 2010, Mansour et al., 2009).

Distribution of participants showed that majority lived in single roomed houses (51.5%) with limited ventilation of 1-2 windows (61.5%) or none at all (23%). A high number of TB cases were recorded among persons from poorly ventilated rooms. The nature of housing inhabited by most of the pastoralists communities (Pokot, Maasai and Samburu) are temporary mud walled manyattas characterized by poor ventilation and likely overcrowding. The risk of exposure is known to increase with limited air circulation. Some studies in Pakistan (Alvi et al., 1998, England (Corbett et al., 2007) and Gambia (Hill et al, 2006) have shown that crowding is associated with rising incidences of TB and that living quarters with less space facilitate the spread of infection.

`Poverty was noted to significantly influence in spread of tuberculosis. TB is described as "a disease of poverty." It is widely seen that the poorer the community, the greater the likelihood of being infected with *Mucobaterium tuberculosis* and developing clinical disease. This is a well-known fact among the pastoralists communities in Kenya (Samburu, Maasai, Pokot and Turkana who lose their livestock to wild animals, harsh weather conditions and diseases leaving them hopelessly poor. The prevalence of PTB in the study population was 7%. This was lower than previous studies in Kenya which established higher prevalence in Western Kenya (van't Hoog et al, 2011), Nairobi, Rift Valley and Nyanza (Sitienei eta al., 2013).

3.2. Socio-Cultural Factors and TB

An evaluation of the influence of ethnic background, revealed that the highest number of PTB cases were recorded among the Pokot 8(55.5%) followed by Samburu 3(20.7%) and closely by Maasai 3(21%) and much lower among the Kikuyu 2(13.9%) while other communities rated 2(12.9%). The nomadic communities have no permanent aboard and usually reside in temporary structures which are usually crowded and predispose to transmission of TB. Similarly, these communities may not easily access treatment and as a result cases may have high default rates which are also likely to promote antibiotic resistance. Living in close proximity to a health facility has been associated with greater access to care and adherence to treatment (Lawson et al., 2010; Corbett et al., 2007). The main occupation, livestock rearing (39.5%) is a preserve of the Pokot, Maasai and Samburu, followed by crop farming among Kikuyu (26%) and self / formal employment (26%) which is common to all. 50% of PTB cases were from the nomadic pastoralists with lower rates among Kikuyu other ethnic groups.

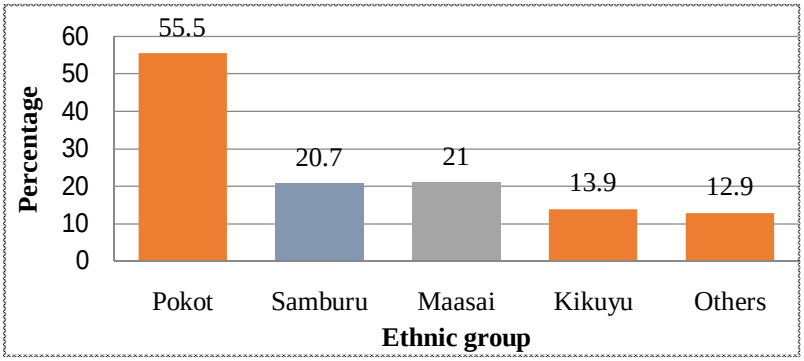

Figure 1: Prevalence of PTB in relation to Ethnic group

4. Conclusion and Recommendations

There is a significant influence of age, sex and socio-economic and cultural factors on prevalence of PTB. There is a need for continuous surveillance and awareness campaigns in rural communities on risk factors for TB transmission and the importance of prompt diagnosis treatments in order to reduce the incidence of the disease.

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