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Socio-demographic and Environmental Factors Affecting the Prevalence and Spread of Tuberculosis in South West Region of Cameroon

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Authors' contributions

This work was carried out in collaboration between all authors. Author IAA did the study design, wrote the protocol, ensured the follow up of standard laboratory procedure, interpreted results and wrote the manuscript. Author JFC proof read the protocol, followed up with the bacteria cultures, interpreted results and did the statistical analysis. Author JAN took part in designing the study, interpreted the results and made an input in writing the manuscript. Author ADN participated in designing the questionnaires and proof read the manuscript. Author HDM is the laboratory scientist overseeing the standard procedures in the lab and recorded results for statistical analysis. Author FRFN contributed in statistical analysis and in reading the manuscript. Author TNA participated in the study design and approved the final manuscript. Author VPKT was involved in designing the work and overseeing the study. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Aims: To carry out a household based study in the South West Region of Cameroon to evaluate the effects of selected environmental and social factors affecting the prevalence and spread of

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tuberculosis.
Study Design: This study was a cross-sectional one.
Place and Duration of Study: From May to September 2006, a team of 6 including 2 laboratory technicians and one nurse visited 309 randomly selected households in five different localities within Fako Division.
Methodology: Three major overcrowded and two major affluent quarters peculiar for high and low TB prevalence respectively were visited. We used a standard questionnaire to get demographic information. A poverty index based on type of toilet, salary scale, educational level and number of persons sleeping in a room was calculated. Sputum samples were collected from 1000 participants in 309 household and *Mycobacterium tuberculosis* identified by the standard Ziehl Nelsen staining technique.
Results: The overall prevalence of TB was 3% (30/1000). A significantly higher prevalence (1.62%) was recorded in individuals with primary level of education when compared with the prevalence rate (0.20%) for those with tertiary education (p=0.034) TB prevalence was significantly higher in people who earned between $100-200/month compared with those who earned >$200 ($p$<0.0001). A significant majority of TB positive patients (16, 53.33%) had never been vaccinated compared with those vaccinated (p<0.0001). Polygamists recorded the highest TB prevalence (12.37%) compared with monogamists (3.56%) and singles (0.93%) (p<0.0001).
Conclusion: Illiteracy and polygamy were some of the social factors significantly related to TB in our study. These findings would be used in redesigning strategies for effective control of TB in the study areas.

Keywords: Tuberculosis; prevalence; education; salary; overcrowded; affluent.

1. INTRODUCTION

Tuberculosis (TB) is a chronic, infectious disease caused by *Mycobacterium tuberculosis* (MTB) [1,2] Currently, TB is the leading cause of mortality among infectious diseases worldwide, and 95% of TB cases and 98% of deaths due to TB occur in developing countries where the lack of proper health care systems led to insufficient case detection and incomplete treatment resulting in increased drug resistance [3-6]. With 8.7 million new cases and a specific mortality of 1.4 million cases of death in 2011, tuberculosis remains a major public health problem in the world [7].

In 2012, the African region was ranked second with respect to TB cases and constitute about 27% of cases worldwide [7]. In the same year, the prevalence of TB cases and death in Cameroon was estimated at 69 thousands and 14.1 thousands respectively [8]. The fight against TB remains a worldwide challenge. It was reinvigorated in 1991, when a World Health Assembly (WHA) resolution recognized TB as a major global public health problem [9]. From that time, all actions in TB control aimed to reduce by 2015 the TB prevalence and death rates by 50% relative to 1990 [10]. Since the launch of a new international strategy for TB care and control by WHO in the mid-1990s (the DOTS strategy) and the subsequent global rollout of DOTS and its successor (the Stop TB Strategy) [11], major progress has been observed. Globally, the TB mortality rate has fallen by 45% since 1990 (with about 4.66 million lives saved). It has also been observed that the global TB incidence rate is falling in most parts of the world [12]. Despite these progresses, TB remains the second leading cause of death from an infectious disease worldwide [7]. High-risk groups for MTB infection in Cameroon, like other developing countries, may include people living with the human immunodeficiency virus (HIV)/AIDS, people with diabetes or cancer, the malnourished, those living with someone who has active TB, poor and indigent people, residents of homeless shelters, and present or former prisoners [13]. As outcome of interactions between TB and the Human Immunodeficiency Virus (HIV) [14], together with poverty and malnutrition [15], the incidence of TB is increasing dramatically in sub Saharan Africa [16]. The rapid population increase in urban areas has resulted in sprawling poor settlements where people live under desperate conditions, characterized by overcrowding, poor hygiene and lack of sanitation [17]. These factors are important determinants in disease transmission in urban poor communities [18-20] which are fertile grounds for diseases of poverty, of which tuberculosis is of paramount importance.

In Cameroon a country with about 16 million inhabitants, the prevalence of tuberculosis is estimated to be 17.5% and the incidence of TB in

2000 was estimated at >300 cases per 100,000 inhabitants [20]. In a population based epidemiological study in Ngaoundéré, Cameroon, it was shown that poverty affected health and the most common of the health problems were respiratory infections [21]. A 3-year hospital based sentinel study was previously carried out to determine the areas within Fako division in Cameroon with a high prevalence of tuberculosis [22]. As a follow up this study is aimed at identifying environmental and social factors which could influence TB prevalence in the study area.

2. MATERIALS AND METHODS

2.1 Study Site

From May to September 2006, a team of 6 including 2 laboratory technicians and one nurse visited 309 randomly selected households in five different localities within Fako Division. One thousand people participated in the study. Tiko camp, Mutengene and New Town-Limbe were chosen as areas with predicted high TB prevalence while Bonduma-Buea and Bokwango-Buea were chosen as areas with low TB prevalence [22]. The team selected every fourth house so that a wide cross section of households in each locality could be involved in the study and homes of the poor and the rich were included. The local chiefs were informed on all aspects of the study design. Positive TB cases were referred to nearby clinics for free treatment which was part of a scheme supported by the Government of Cameroon towards control.

2.2 Demographic, Physical and Environmental Data

Data were obtained from each participant on sleeping conditions, gender, age, number of members per household, salary scale, type of toilet used, level of education, BCG vaccine status and marital status.

2.3 Admission Criteria and Informed Consent

After consulting the local chiefs and heads of families to explain in the local language and in English the essence of the study, sputum samples were collected from at least 2 – 4 persons from each selected household who accepted to participate in the study. Ethical clearance was obtained from the South West Regional Delegation of Public Health, Cameroon.

2.4 Clinical Samples

A total of 1000 sputum samples were collected into sterile screw capped tubes. Slides were prepared, stained by the Ziehl Neelsen staining technique [23] and observed under a microscope at the CDC Bota Clinic and Limbe District hospital.

2.5 Data Analysis

Data was analysed using SPSS for windows version 10.0. Pearson's Chi square test was used to compare categorical or quantitative variables. A household poverty index based on 4 points namely; schooling, type of toilet, salary and the number of persons living in a room was established. If one was illiterate, used a pit toilet, earned a low salary or live in a room with >2 occupants, a zero (0) score was assigned. Statistical significance was set at $p \leq 0.05$.

3. RESULTS AND DISCUSSION

3.1 Characteristics of the Study Population

This study included 1000 persons (200 from each quarter) with ages ranging from 5 – 70 years randomly selected from 309 households. Fifty nine percent (59%) of the subjects were males and 41% were females. The subjects were grouped according to quarters as shown in Table 1. Thirty subjects (3%) were positive for TB in the entire study population. Three subjects refused to indicate the type of toilet they used, while 13 subjects did not mention their highest level of education. As shown in Table 1, the majority of those rated as rich lived in more affluent quarters such as Sandpit and Bokwango, while most of the poor people lived in the less privileged quarters namely Mutengene and Tiko. TB prevalence differed significantly between the different quarters with the poor quarters (Tiko, Mutengene and New Town-Limbe) recording the highest prevalence rates (Table 1).

3.2 TB Status in Relation to Some Environmental Factors

Overall, no statistically significant difference was observed between TB prevalence in those using pit toilets (53.33%) and those using water system toilets (46.67%) ($p>0.05$). Similarly, there was no

statistically significant difference between positive and negative cases based on the number of individuals sleeping in the same room (Table 2). However, the majority of TB positive cases were associated with the use of the same bedroom by at least two occupants. Of the 839 people (83.90%) who reported to have taken the BCG vaccine earlier on in life, 14 (1.67%) were positive for TB, compared with 16 (9.94%) of the 161 who had never been vaccinated. The difference was statistically significant (p<0.0001).

3.3 TB Status in Relation to Some Social Factors

The majority of TB positive cases were males (23/30, 76.67%). The majority of those who had never been to school (33/34, 97.06%) were negative for TB, compared with those who had obtained at least primary education (16, 1.62%). However, the number of positive cases decreased as the level of education increased from primary through secondary to

Table 1. Frequency distribution of individuals by quarter using various parameters

Parameters		Tiko	Mutengene	Limbe	Sandpit	Bokwango
Sex	Male	127	104	114	114	131
	Female	73	96	86	86	69
Inhabitants per household	1	62	38	2	66	119
	2	91	98	184	120	79
	3-8	47	64	14	14	2
Inhabitants per room	<2	50	22	14	11	22
	2-4	62	82	132	69	123
	4-8	66	79	54	100	55
	>8	22	17	0	20	0
Toilet type	Pit	186	189	90	74	57
	Water system	14	8	110	126	142
Poverty index	Poor (0-1)	103	137	83	31	18
	Medium (2)	77	56	58	50	39
	Rich (>2)	20	7	59	119	143
TB status	Positive (%)	6 (20.0)	7 (23.3)	16 (53.3)	1 (3.3)	0 (0.0)

Table 2. Prevalence of TB positive cases based on various parameters under study

Parameters		n	TB status		
			Positive (%)	Negative (%)	
Toilet type	Pit	997	16 (1.60)	580 (58.17)	χ^2=0.535
	Water system		14 (1.40)	387 (38.82)	P= 0.465
Literacy level	Illiterate	987	1 (0.10)	33 (3.34)	χ^2=10.389 P= 0.034
	Primary school		16 (1.62)	27 (2.74)	
	Secondary school		8 (0.81)	277 (28.06)	
	High school		3 (0.30)	182 (18.44)	
	University		2 (0.20)	195 (19.76)	
Individuals per room	1	1000	6 (0.60)	281 (28.10)	χ^2=1.622 P=0.445
	2 people		18 (1.80)	554 (55.40)	
	3-8 people		6 (0.60)	135 (13.50)	
Poverty index	Poor (0-1)	1000	12 (1.20)	360 (36.00)	χ^2=0.314 P=0.855
	Average (2)		9 (0.90)	271 (27.10)	
	Rich (>2)		9 (0.90)	339 (33.90)	
Marital status	Polygamists	97	12 (12.37)	85 (87.63)	χ^2=24.142 P<0.0001
	Monogamists	281	10 (3.56)	271 (96.44)	
	Singles	536	5 (0.93)	531 (99.07)	

university level (Table 2). Income scale did not affect the TB status. The majority of TB patients (16/30, 53.33%) earned between $100-200 every month. It was observed that more polygamists were positive for TB when compared with monogamists and singles (Table 2). With reference to poverty index, the risk of having TB was not influenced by the rich or poor status of an individual (Table 2).

3.4 Discussion

This survey is one of the few to be carried out in the South West Region of Cameroon that sought to investigate the influence of socioeconomic and environmental factors on the prevalence of tuberculosis. However most reports on socio-demographic factors on diseases in this study area has been for malaria and anaemia [24]. It is estimated globally that 76% of the world's population live under poor conditions and low and average income countries account for more than 90% of TB cases and deaths [25] for which Cameroon is part. TB was originally known to be a disease of the poor, but with the onset of the HIV/AIDS pandemic the trend has become confusing. Poor living conditions and HIV/AIDS can lead to suppressed immunity creating an opportunity for reactivation of dormant TB bacilli [25]. Today risk factors have included HIV infection, increasing age, male sex, overcrowding, family structure and poor housing, some of which were given more importance during the height of TB in industrialized countries [26].

In our study we additionally found low literacy level to be significantly associated with TB, with an overall TB prevalence of 3%. The higher prevalence of TB among polygamists in our study is cause for concern as this could reflect risky sexual behaviour and a greater chance of exposure to HIV. The migration of the rural poor to urban settlements such as Limbe (the home of Cameroon's oil refinery industry) in search of a better livelihood has resulted in over crowdedness. This certainly overburdens the existing health and sanitation facilities as reported in other studies [27].

The finding that TB in adults was prevalent among those who had not been previously vaccinated calls for more intensive programmes aimed at increased public awareness on BCG vaccination of new born babies. Adolescent BCG vaccination may help prevent adult-type pulmonary tuberculosis [28].

4. CONCLUSION

The present study represents one of the few community study of non-HIV factors as risks for tuberculosis in South West Cameroon. Although not significantly associated with TB in this study, overcrowding, poverty, and toilet types are still highly important risk factors for TB, especially in this era of the HIV pandemic. Improving the living conditions, developing effective sensitization campaigns and providing free TB treatment constitute more effective strategies to reduce substantially the prevalence of tuberculosis.

CONSENT

Patients were enrolled into the study only if they gave their written informed consent for both participation in the study and for HIV testing.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the South West Delegation of Public Health.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Park JE. Preventive and social medicine. Jabalpur, India: Banarsidas Bhanot. 2001; 19:138–39.
2. Kumar PI, Cark MI. Clinical medicine. London: Bailliere Tindall. 2012;198.
3. Rajeswari R, Balasubramanian R, Muniyandi M, Geetharamani S, Thresa X, Venkatesan P. Socio-economic impact of tuberculosis on patients and family in India. Int J Tuberc Lung Dis. 1999;3:869–77.
4. Small PM. Tuberculosis research: Balancing the portfolio. JAMA. 1996; 276:1512–13.
5. Raviglione MC, Dye C, Schmidt S, Kochi A. Assessment of worldwide tuberculosis controls. Lancet. 1997;350:624–29.
6. Ahmed Y, Mwaba P, Chintu C, Grange JM, Ustianowski A, Zulma A. A study of

maternal mortality at the University Teaching Hospital, Lusaka, Zambia: The emergence of tuberculosis as a major nonobstetric cause of maternal deaths. Int J Tuberc Lung Dis. 1999;3:675-80.

7. World Health Organisation. Global tuberculosis report 2013. WHO Press, Geneva; 2013. WHO/HTM/TB/2013.11.
8. Djouma FN, Noubom M, Ngomba AV, Donfack H, Kouomboua PSM, Saah MAF. Determinants of death among tuberculosis patients in a semi urban diagnostic and treatment centre of Bafoussam, West Cameroon: A retrospective case-control study. Pan Afr Med J. 2015;22:253.
9. Resolution WHA 44.8. Tuberculosis control programme. In: Handbook of resolutions and decisions of the world health assembly and the executive board. 3rd ed. (1985-1992). Geneva, World Health Organization. 1993;3.

   (WHA44/1991/REC/1):116.
10. World Health Organization: The stop TB strategy: Building on and enhancing DOTS to meet the TB-related millennium development goals. WHO Press, Geneva; 2006. WHO/HTM/TB/2006.368.
11. Raviglione M, Uplekar M. WHO's new stop TB strategy. Lancet. 2006;367(9514): 952-5.
12. Glaziou P, Floyd K, Korenromp E, Sismanidis C, Bierrenbach A, Williams B, Atun R, Raviglione M. Lives saved by tuberculosis control and prospects for achieving the 2015 global target for reducing tuberculosis mortality. Bull World Health Organ. 2011;89(8):573-82.
13. Braun MM, Truman BI, Maguire B, et al. Increasing incidence of tuberculosis in a prison inmate population. JAMA. 1989; 261:393–97.
14. Kuaban C, Ndoumou A, Koualla-shios S, Afaneze E, Ghipponi PM, Pignon D. Seroprevalence of HIV infection among patients with pulmonary tuberculosis in Yaounde- Cameroon. West African Journal of Medicine. 1995;14(2):112-115.
15. Tupasi TE, Mangubar NV, Sunico ME. Malnutrition and acute respiratory tract infections in Filipino children. Review of Infectious Disease. 1990;12(8):1047-1054.
16. Raviglion MC, Snider Jr DE, Kochi A. Global epidemiology of tuberculosis, morbidity and mortality of a worldwide epidemic. JAMA. 1995;273:220-226.
17. Menzies D. The urban factor in tuberculosis. Tubercle Lung Disease. 1996;77:16.
18. Tupasi TE, Velmonte MA, Sanvictores ME. Determinants of morbidity and mortality due to acute respiratory infection; implication for intervention. J Infection. 1996;157:615-623.
19. Tupasi TE, De Leon IE, Lupisan S. Patterns of acute respiratory tracks in children: A longitudinal study in a depressed community in Metro Manila. Review of Infectious Disease. 1990b; 12(8):940-949.
20. WHO. Global tuberculosis control: Surveillance, planning and financing. W.H.O/CDS/TB/2002. No 295. World Health Organisation, Geneva, Switzerland; 2002.
21. Knut H, Hurum H. Cross-sectional study, morbidity, morbidity-association factors and cost of treatment in Ngaoundre, Cameroon, with implication for health policy in developing countries and development assistance policy. BMC International Health and Human Rights. 2002;2(2):1472-698.
22. Ane-Anyangwe IN, Nkuo-Akenji T, Mbacham WF, Penlap VN, Titanji VPK. Seasonal variation and prevalence of tuberculosis among health seekers in the South Western Cameroon. East African Medical Journal. 2006;83(11):360-368.
23. De Kantor N, Kim I, Fluelmo SJ, Rieder HP-Y, Valenzuela P, Weyer K. Laboratory services in tuberculosis control part II: Microscopy WHO/BB/89. 1998;258. saHo Associatis.a.s.-Biella- Italy.
24. Ndamukong-Nyanga J, Kimbi HK, Ngole S, Irene U, Emmaculate L, Nweboh MN, Nana Y, Ndamukong KJN. Socio-demographic and environmental factors influencing asymptomatic malaria and anaemia incidence among school children in Fako division, South West Cameroon. British Journal of Medicine & Medical Research. 2014;4(20):3814.
25. WHO report. Epidemiology-tuberculosis and HIV- some questions and answers. World Health Organisation, Geneva, Switzerland; 2002.

26. Gustafson P, Gomes VF, Vieira PR, Seng R, Johansson P, Setndröm A, Norberg R, Lisse I, Samb B, Aaby P. Tuberculosis in Bissau: Incidence and risk factors in an unrban community in Sub-Saharan Africa. International Journal of Epidemiology. 2004;33:163-172.
27. Tupasi TE, Radhakrishna S, Quelapio MID, Villa MLA, Pascual MLG, Rivera AB, Sarmiento A, Co VM, Sarol JN, Beltran G, Legaspi DJ, Mangubat NV, Reyes AC, Salon M, Salon FS, Burton L, Mantala M. Tuberculosis in the urban poor settlements in Philippines. International Journal of Tuberculosis and Lung Diseases. 2000; 4(1):4-11.
28. Donald PR. Children and tuberculosis: Protecting the next generation?" Lancet. 1999;353:1001-1002.

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