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ORIGINAL ARTICLE

Prevalence of smear positive tuberculosis among outpatient attendees, the case of the Tamale Teaching Hospital

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There is paucity of data on the prevalence of pulmonary tuberculosis (PTB) among out-patient attendees from individual Institutions and Health Care Facilities performing sputum smear microscopy in Ghana. This retrospective study analyzed sputum smear microscopy results among pulmonary TB suspected patients presenting to the Tamale Teaching Hospital in the Northern Region of Ghana. Sputum smear microscopy for Acid Fast Bacilli (AFB) results of new suspected pulmonary TB (Diagnosis) patients and their demographic data comprising age and sex recorded from January 2004 to December 2010 were retrieved from the TB Laboratory Register (TB04) of the Bacteriology unit and analyzed. Out of a total of 5,720 registered cases, 4,762 (83.3%) were new patients with suspected pulmonary TB (diagnostic cases). This comprised of 2,766 (58.1%) males and 1,996 (41.9%) females giving a female to male ratio of 1:1.4. Assessment of recorded data for newly suspected pulmonary TB patients rose from a minimum of 165 (9.9%) in 2004 to a maximum of 948 (19.9%) in 2009. Out of a total of the 4,762 recorded new cases, 620 were sputum smear positive yielding positivity rate of 13.0%. The positivity rate on a year-on-year basis was 15.7% (2004), 15.8% (2005), 13.4% (2006), 12.7% (2007), 20.6% (2008), 10.0% (2009) and 6.3% (2010). The median age for recorded smear positive cases was 42 years. Generally the percentage proportion of smear positives in the recorded cases stratified by age showed a steady rise from 0.3% in the <5 year olds and peaked at 16.3% in the 30-35 years age group. A gradual decline in smear positive cases was observed within the 36 – 41 years age group from 10.0% to 4.8% in the 54 – 59 years age group from where a gradual rise was observed up to the >72 years age group. There has been a remarkable improvement in diagnostic requests for suspected TB patients. The decline in positivity rates might have been impacted upon greatly by the national strategy to stop TB which emphasized on active case finding and prompt reporting at the community level, improving diagnostic processes and strengthening the health systems. The rapid urbanization and changes in the social fibre of inhabitants cannot be underestimated in the overall TB control efforts.

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INTRODUCTION

Tuberculosis (TB) is one of the major infectious diseases worldwide and an opportunistic infection in Africa due to the relatively high rates of human immunodeficiency virus (HIV) co infection (Fairlie *et al.*, 2010). It is estimated that about one-third of the world's population are infected with the bacterium and new infections occur at a rate of about one per second. Most infections in humans are asymptomatic or latent infections, however 5-10% of the infected persons develop active respiratory disease (infectious) at some time in their life (Nitesh and Kiran, 2012). Sputum smear positive patients with active respiratory disease transmit the bacilli to other persons via droplets (WHO, 2003). Left undetected and untreated, each person with active TB disease will infect on average between 10 and 15 people every year (WHO, 2010). Early detection and treatment in other to reduce the transmission

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within communities are therefore essential for an effective control of the disease (Borgdorff *et al.*, 2002).

Passive detection where self-referred out-patient attendees at health facilities are evaluated on signs and symptoms suggestive of TB and referred to the laboratory for sputum smear microscopy for Acid Fast Bacilli (AFB) remains the major diagnostic tool of TB diagnosis and management in developing countries (WHO, 1997; Steingart *et al.*, 2006; Addo *et al.*, 2010). Passive detection is and continues to be the main strategy for TB case finding in Ghana. Although Ghana is not ranked among the world's high-burden TB countries, the disease still remains a major cause of morbidity and mortality in the country (WHO, 2009). One of the major challenges facing the National Tuberculosis Control Program (NTP) in Ghana is the reported low case detection due partly to under reporting from health facilities (Addo *et al.*, 2010). In spite of the over 46,000 new TB cases reported annually (WHO, 2006a), which is estimated to rank between 19% and 31% (1990-2009) detection rates, this still falls short of the expected average of 50% in Africa and a Global target of 70% (WHO, 2008). Data from NTP presented at national level are collated from the peripheral health facilities through the Regional Health Directorates; however, there is indication that less than a third of the estimated number of TB cases detected within these health facilities are officially reported each year (Addo *et al.*, 2010).

Moreover there is limited independent data from institutions and health care facilities enumerating TB case detection performance of such institutions to support the data from the NTP. This study was therefore aimed at assessing the prevalence of new smear-positive pulmonary tuberculosis diagnosed among suspected persons presenting at the Tamale Teaching Hospital from January 2004 to December 2010.

MATERIALS AND METHODS

Study design and site

This hospital-based retrospective study was conducted at the Tamale Teaching Hospital (TTH) and comprised of review of available data from January 2004 to December 2010. TTH is a 340 bed complement hospital situated in the Northern Region of Ghana. In addition to offering clinical care to inhabitants of the Tamale metropolis and its surrounding districts, it also serves as a referral hospital to the two Upper Regions (Upper East and Upper West) of Ghana. The hospital runs six clinical departments including the Chest clinic/ward which attends to patients with complicated respiratory tract infections including TB cases visiting the hospital from the metropolis, surrounding districts and catchment areas beyond the region.

Data extraction

Data comprising age, sex and results for Ziehl-Neelsen stained sputum smear microscopy for Acid Fast Bacilli (AFB) of all recorded cases from January 2004 to December 2010 were retrieved from the TB Laboratory Register (TB04) of the Tamale Teaching Hospital Bacteriology Laboratory. From the recorded data information about patients for whom diagnosis has been requested for the first time were retrieved and theses were classified as new suspected TB. Repeat cases and patients requesting follow-up test were excluded from the analysis.

Case definition

A case of pulmonary TB was classified as positive (confirmed case of PTB) if at least one out of the two/three smears from the two/three sputum specimen received was AFB positive and quantified as being scanty, 1+, 2+ and 3+ AFB present. New patients for the purposes of this study were defined as patients who were not on TB treatment .

Data analysis

Data retrieved were entered into Microsoft Excel and analyzed using GraphPad Prism® Version 5.0 for Windows (GraphPad Software, San Diego, CA, USA). Normality of data was tested using Kolmogorov-Smirnov normality test ($\alpha > 0.05$). Descriptive statistics was employed to explain the general distribution of data. Categorical variables were compared using Chi-square test where appropriate. For all statistical comparisons a p-value of <0.05

was considered statistically significant. This study was approved by the Planning and Research unit of the Tamale Teaching Hospital.

RESULTS

A total of 5,720 cases were registered during the period under study in the TB 04 register at the laboratory, out which a total of 4,762 new patients with suspected pulmonary TB (diagnostic) were screened for AFB. More males reported with symptoms of pulmonary TB compared to females for the periods under review. Males comprised 2,766 (58.1%) and females 1,996 (41.9%) giving a female to male ratio of 1:1.4. (Table 1).

Table 2 represents the yearly age variables among the patients from 2004 to 2010. The median ages for newly suspected cases ranged from a least of 40 years in 2006 and 2007 respectively to a maximum of 44.5 in 2010. The study recorded a minimum age of one (1) year and a maximum age of 102 years in the years under review with inter-quartile (IQR) age spanning from 27 years to 70 years.

In total, 620 of the 4,762 suspected cases examined were Acid Fast Bacilli positive representing cumulative positivity rate of 13.0%. When stratified into the respective years, the positivity rates were as follows: 15.7% (74/471) in 2004, 15.8% (66/416) in 2005, 13.4% (66/494) in 2006, 12.7% (78/616) in 2007, 20.6% (183/890) in 2008, 10.0% (95/948) in 2009 and 6.3% (58/927) in 2010. The proportion of suspected cases to smear positives was 7:1, implying that for every seven new suspected pulmonary TB patients screened, there was one smear positive for the period under review. The general trend showed a gradual decline in the proportions of smear positives from 2004 (15.7%) to 2010 (6.3%), with the exception of 2008 which showed a sharp rise in smear positive cases (20.6%) (Figure 1).

For the years under review, dominance in male smear positivity was observed over that of females. Out of the 620 smear positives, 383 (61.8%) were males giving a male to female ratio of 1.0:0.6. A marked rise in the proportions of smear positives in females (46.4%) was observed in 2008(Figure 2).

Table 1: General overview of TB cases examined within the years under review

		New Suspected Cases		
Year	Total Registered Cases	**Male**	**Female**	**Total**
2004	594	306(65.0)	165(35.0)	471
2005	534	277(66.6)	139(33.4)	416
2006	611	310(62.8)	184(37.2)	494
2007	770	348(56.5)	268(43.5)	616
2008	1114	496(55.7)	394(44.3)	890
2009	1117	543(57.3)	405(42.7)	948
2010	1012	486(52.4)	441(47.6)	927
Total	**5720**	**2766**	**1996**	**4762**

Table 2: Age stratification for reviewed cases in suspected TB patients

	Years Under Review						
Age	2004	2005	2006	2007	2008	2009	2010
Minimum year	1	5	2	6	1	1	1
Median year	42	44	40	40	42	44.5	41
Maximum year	100	90	95	92	95	90	102
IQR year	27 – 60	32 – 60	30 – 56	27 – 60	29 – 65	29 – 70	27 – 65

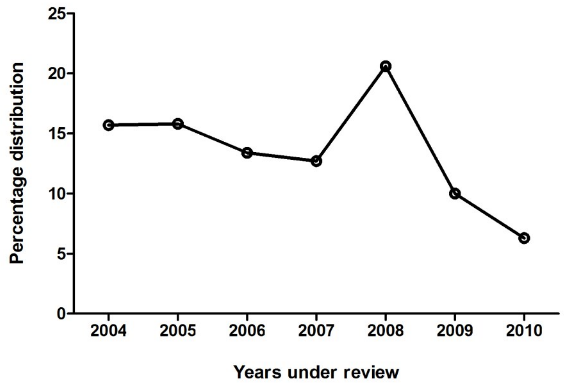

Figure 1: Pulmonary TB sputum smear positive cases over the study period

Figure 3 shows the distribution of cumulative smear positive cases by age groups over the review period.

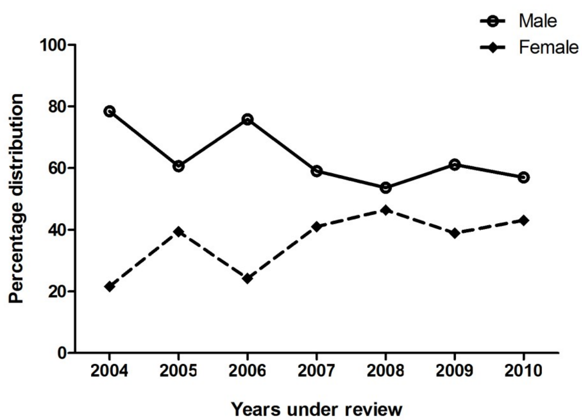

Figure 2: Sex distribution of Pulmonary TB sputum smear positive cases over the study period.

Generally, the percentage proportion of smear positives rose steadily from 0.3% in the <5 year olds and peaked to 16.3% in the 30 – 35 years age group. There was a gradual decline smear positive cases from 10.0% in the 36 – 41 years age group to 4.8% in the 54 – 59 years age group from where a gradual rise was observed up to the >72 years age group.

DISCUSSION

The number of individuals with active TB disease

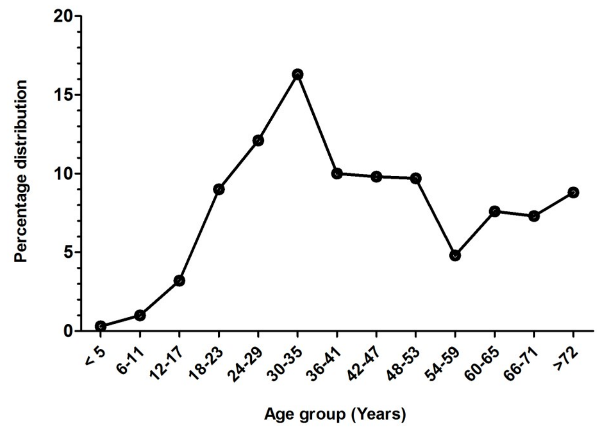

Figure 3: Age group distribution for recorded pulmonary TB sputum smear positive cases over the study period (2004 – 2010).

and proximity with these persons are important risk factors for TB infection. Thus, the Stop TB Strategy adopted by the NTP aims to control TB mainly by cutting the transmission chain which should be achieved through early detection and effective treatment of all people with active TB disease (WHO, 2006b; Lonnroth *et al.*, 2009). This study aimed at reviewing the prevalence of new smear positive TB cases among out patient department (OPD) attendees reporting to the Tamale Teaching Hospital. The study observed improvement in reported case activity among suspected individual patients in a year-on-year basis with steady declines in positivity rates with an exception in case activity for 2008 which recorded a high positivity rate. This sudden spike could be due to the national action plan from NTP in 2008 tasking all health facilities to be actively involved in case finding and this mandated that patients who are high suspects or with cough were sent to the laboratory for sputum smear microscopy. Cases for which sputum smear turns out positive, the case is traced back to the exact home address and all members of the household are encouraged to take sputum smear tests hence the increase in registered cases and new smear positives for that particular year. This notwithstanding, the observation of declines in positivity rates could be suggestive of one of the following: an overall impact with the initiated treatment plan accompanying the Stop TB Strategy adopted by NTP; a decline in TB prevalence among patients within the catchment area of the hospital or the fact that those who are really burdened with TB disease are either not reporting promptly to the hospital to seek treatment or are missed due to institutional challenges affecting case detection activities within the hospital.

The impact of initiated treatment plans and support packages afforded to patients burdened with TB could have led to the effective management of cases and improvements in living and social conditions of the people thereby leading to a reduction in prevalence rates and declines in risk of transmission from infected individuals. Over time, the social and living conditions of indigenes have improved tremendously with improvement in diet and environmental hygiene. The resultant decrease in overcrowding in homes as a result of social development could have impacted greatly on the degree of exposure, reduction in the risk of transmission and susceptibility to infection in exposed persons as related in the studies of Vynnyvk and Fine (1999) and Lonnroth *et al.,* (2009). In order to improve case detection, other studies have advocated for active case search through community and household visits which will not only improve smear positivity rates but as well address the social and gender inequities associated with accessibility of health care services by TB patients (Horie *et al.*, 2007; Yimer *et al.*, 2009; Tadesse *et al.*, 2011).

The observed smear positivity rate from adolescence, into young adulthood could partly be attributed to the propensity of such age class being actively involved in social events where overcrowding is rife and as such being in the relatively high risk group as related in the studies of Lonnroth *et al.,* (2009) and Bekker and Wood (2012). The study further observed a low prevalence of TB in children (<5 years) which finding corroborates other studies that reported low smear positive pulmonary TB cases in children, supporting the fact that children rarely produce bacteriologically positive sputum (Starke, 1993; Osborne, 1995; Raqib *et al.*, 2009). Bacteriological diagnosis of TB in young children has remained a major challenge particularly in resource-limited areas due to diagnostic constraints (Osborne, 1995). In countries, where TB is not endemic, most childhood TB cases are detected through close contact with an infectious index patient, a positive tuberculin skin test (TST) result, and presence of suggestive abnormalities on a chest radiograph. With the exception of contact with an infectious index patient, the aforementioned diagnostic tools are virtually non-existent in resource-limited countries where childhood TB is closely associated with poverty, overcrowding and malnutrition.

Furthermore, active case detection and contact tracing activities are not routinely done primarily because of deficiencies in home address allocation and as such diagnosis, is solely based on suggestive signs or symptoms and chest radiograph abnormalities (Cruz and Starke, 2007). The positivity rate of sputum smear microscopy and culture in children has been reported to be less than 15% and between 30%–40% respectively (Marais and Pai, 2007). The challenge lies in the acquisition of adequate quality specimens, particularly from smaller children. Even though diagnostic algorithms have been recommended through consensus and expert opinion, these algorithms prolong the child's evaluation over a period of time. The resultant delayed diagnosis might be an important cause of increased TB mortality in children particularly situated in resource-limited countries (Eamranond and Jaramillo, 2001).

The steady rise of positivity rates in the elderly from the 60-65 years age group as observed in the current study agrees well with other studies (Davies, 2007; Schaaf *et al.*, 2010). These studies have shown that the elderly because of age related decline in immunity and risk factors such as poverty, malnutrition and smoking especially in resource-limited areas are most often affected with other chronic diseases either with subtle or atypical clinical manifestations thereby making early diagnosis more difficult and going unrecognized. The diseases are therefore mostly detected in the advanced state (Zevallos and Justman, 2003; Davies, 2007; WHO, 2007; Schaaf *et al.*, 2010) and as such a high index of suspicion is of the essence in order to make an early diagnosis; and timely initiation of treatment are important in both the very young and the elderly.

In consent with other reports (Murray *et al.*, 1990; Connolly and Nunn, 1996; Hudelson, 1996; WHO, 2004), this study observed high proportion of sputum smear positivity among males than in females. This observed trend agrees well with global picture of tuberculosis cases notified (WHO, 2004). According to the WHO report, more smear-positive males than females infected with tuberculosis are diagnosed every year and notified. Several reasons including biological, epidemiological, social and cultural barriers have been cited for this observed gender-based difference (Jianming *et al.*, 2008; Neyrolles and Quintana-Murci, 2009). Health care accessibility and health seeking behaviours with regards to stigmatization and its social consequences have been noted to be more pronounced in the females than in males and therefore affect their health care seeking behaviours hence the overall seemingly low female-related cases (Diwan *et al.*, 1998; Uplekar *et al.*, 1999; Borgdorff *et al.*, 2000).

Other studies have indicated that men are more likely to be associated with factors and behaviours such as, frequent use of alcohol and illicit drugs that may increase their exposure and influence the rate at which the infection progresses into active disease (Hudelson, 1996). The quality of sputum specimen produced by suspected individuals has also been cited. Indications of poor-quality sputum specimens usually submitted by women has been noted to account for lower smear positivity in women than in men (Khan *et al.*, 2007). This review has provided the baseline information for further studies into the sociological and behavioural factors mediating the gender and age differentials associated with TB infections within the catchment area. Furthermore, research into the transmission dynamics of the disease would also provide insight into whether the high rates of infection among males and the young adults are due to reactivation of latent infection or recent transmission.

CONCLUSIONS

There is an indication of remarkable improvement in the case detection efforts in the hospital which could possibly have resulted in the steady decline of positivity rates. Such gains made can further be enhanced by creating effective help-seeking environments within the communities and the hospital, improving diagnostic and health systems efficiency. Furthermore, to minimize delays in initiating effective chemotherapy, intensified case-finding activities should be directed towards high-risk communities and age-specific groups so as to increase awareness of typical symptoms of TB disease.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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