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Tuberculosis in Trinidad a Small Developing Country: Will we Reach the Millennium Development Goal 8 (MDG8) as we Countdown to 2015?

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Abstract

Aims: The aim of this study was to describe the epidemiological pattern of tuberculosis in Trinidad between 1993-2012, and use this data to answer three questions: (1) where as a developing country we stand in respect to MDG 8? What factors affect the rate of progress? Is it still possible to achieve these goals in the time remaining to 2015?

Methods: We used a cohort study design in which all cases attending public facilities for diagnosis and treatment of tuberculosis were entered into a database and followed over time. Data on age and gender were recorded.

Results: Over the period 1993-1999 the number of new cases of TB ranged from 128 in 1993 to 259 in 1997, with an average of approximately 178 (SD ± 43) new cases occurring each year. However between 2000-2012 the number of new cases ranged from 161 in 2004 to 268 in 2008. The average number of new cases occurring each year for this period was 216 (SD ± 35), which translated into an average annual cumulative incidence rate of 15.2 per 100 000 population. This represented a significant increase in the occurrence of TB between 2000-2012 compared with the period 1993-1999.

Conclusion: We have not met MDG 8 and we are unlikely to meet this MDG by 2015, adequate resources to detect and treat TB are crucial to the future control and prevention of TB.

Keywords Tuberculosis; MDG; Environmental degradation

Introduction

Tuberculosis (TB) is an unconquered ancient disease that remains an important global cause of morbidity, mortality, negative socioeconomic impact, and human suffering. WHO in 2012 estimated that 8.6 million people developed TB and 1.3 million died from the disease [1]. In observing World TB day 2014 the theme, "Reach the 3 million, Find, Treat and Cure TB", emphasized the existing global challenge to the prevention and control of TB [2]. This is against a background in which most cases of TB can be treated and cured by taking a combination of several drugs for 6 to 12 months.

In September 2000 the United Nations Millennium Declaration (UNMD) was adopted by 189 states. The UNMD cemented the outcomes of decades of consensus building within the United Nations system and of UN world summits and global conferences. By adopting the UNMD, Heads of State endorsed a global strategy in which the member states commit to significantly reducing poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women by the year 2015, and spearhead key actions for development. This strategy was operationalized in a road map that defined eight specific goals and 18 targets, referred to as the Millennium Development Goals (MDGs) [3]. The strategy and goals were reaffirmed at the UN Monterrey Conference for the Financing of Development in March 2002 and the World Summit on Sustainable Development in September 2002 [4,5]. Further a set of 48 indicators has been proposed to measure progress and many international organizations and donor agencies have since refocused their programs of work towards the achievement of the MDGs. Target 8 specifically address the occurrence of TB in which it states: "Have halted by 2015 and begun to reverse the incidence" [6].

In Trinidad there is a two-tier system of health care. A public health care system in which all services are delivered by the state and are cost free to clients. A parallel private sector health care system also exists but is based on a fee for service model, which is often expensive, and beyond the capacity of low-income groups. The treatment and control of TB is a vertical program in the Ministry of Health. This service includes inpatient and outpatient clinical care, provision of effective drugs, monitoring and evaluation and laboratory support.

Consequently, three questions arise about the attainment of the Millennium Development Goals (MDGs). Where as a developing country we stand? What factors affect the rate of progress? Is it still possible to achieve these goals in the time remaining to 2015? It is therefore crucial to answer these questions to analyze the challenges and develop policies with reference to attaining these goals and targets.

Thus the aim of this study was to describe the epidemiological impact of MDG 8 on tuberculosis in Trinidad between 2000 -2012. Are we on course in meeting this goal?

Methods

We used a cohort study design in which all cases attending public health facilities for diagnosis and treatment were eligible for entry into the study. Patients utilizing private health care facilities are logistically difficult to capture and while some patients may be referred to public health facilities for testing, not all data regarding these patients are available. Notwithstanding this represents a small group and therefore is unlikely to contribute significantly to the data set. The diagnosis of TB was based on a combination of the following criteria: (1) chronic cough, (2) other suggestive symptoms such as fever, night sweats, and weight loss, (3) a positive sputum smears and/or (4) a chest X-Ray. Data on age, and gender, were collected for each year from 1993 to 2012. A laboratory confirmed case was defined as sputum positive, while those patients who were sputum negative but diagnosed clinically and radiologically were also collected and classified as sputum negative. There was no change in the diagnostic or laboratory techniques or treatment at these facilities studied during the study period. In addition were no attempts to promote education on TB care and prevention during the study period. We used population estimates from the population census of 2010 for the TB incidence calculations. A census is conducted every 10 years in Trinidad and Tobago and is published by the Central Statistical Office, hence population data is updated and is reliable and accurate. The 1990 census and the 2000 census were examined for differences. The changes in the population were insignificant to affect calculations. Gross domestic Product (GDP) per capita is used to measure the average economic wellbeing of the Trinidad and Tobago population. Source for the GDP per capita ($US) data was obtained from the World Bank [7]. All data were stored and analyzed using SPSS vs 16.

Results

The study found a significant difference in the occurrence of TB during the period 1993-1999 i.e. the period just prior to the MDG and the period 2000-2012, the period under which the MDG were to be achieved. In the first instance the average annual number of new cases of TB during the period 2000-2012 (216 per year, SD ± 35) was significantly higher (p=0.023) than the average annual number of new cases of TB for the period 1993-1999 (178 per year, SD ± 43). In addition the average annual cumulative incidence rate for the period 2000-2012 (19.2 per 100 000 population) was also higher than the average annual cumulative incidence rate for the period 1993-1999 (13 per 100 000 population).

The trend in TB cases over the 13-year 2000-2012 demonstrated an initial decline in new cases between 2001 and 2005, thereafter was a marked increase in cases, (Figure 1). In fact TB incidence rose significantly in 2008 and 2012 (p<.01) from 2003-2004. The 13-year historical TB incidence data between 2000 and 2012 were further tested for linear, quadratic and cubic trends. Based on visual inspection and evaluation of the models, a linear model was chosen for the best fit for the data, (r^2=0.25).
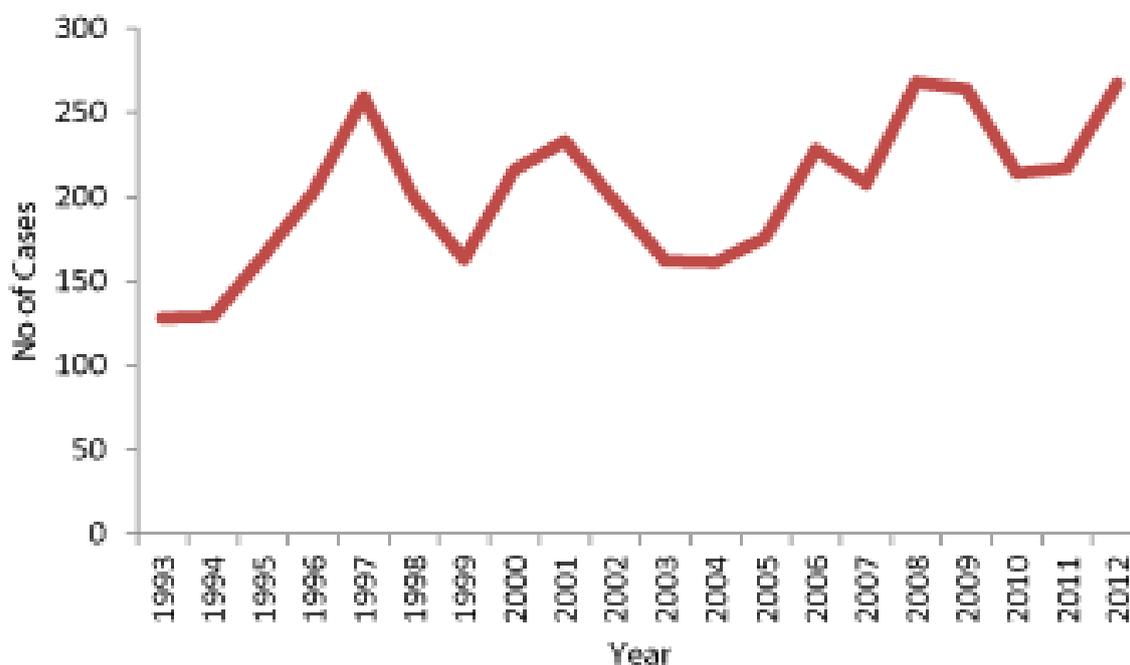

Figure 1: The trend in new cases of TB over the period 1993-2012.

During 2000-2005 the majority of TB cases occurred in older age groups compared with younger age groups. In fact the majority of cases occurred among those ≥ 64 years in both males and females, compared to childhood tuberculosis (0-14 years), (Table 1). In addition the overall childhood rates were well below the notification rate of childhood TB in the Americas of 4.2 per 100,000 children [8]. Notwithstanding childhood TB is a neglected disease still accounting for at least 1 million annual cases and 100 000 deaths in children. The majority of childhood TB is preventable. The World Health Organization (WHO) estimates that TB has orphaned 9.7 million

children [9]. Generally TB was more common in males than females, with the highest male to female ratio (2.6:1) occurring in 2005. On the other hand it was the opposite with childhood tuberculosis. Apart from 2004 childhood TB was occurring more commonly in girls than boys. This suggest that adult The majority of cases (≈90%) were diagnosed as pulmonary tuberculosis and 6.7% extra-pulmonary tuberculosis. The rate of unfavorable treatment outcomes (i.e. death, failure or default) was 29% in 2010, which declined to 23%, in 2012. Mortality from TB increased from 2% in the 1990's to 2.8% by 2010. Of the 267 cases identified in 2012, 83 (33%) were tested positive for HIV. Between 2009-2012, 1698 HIV-positive people were provided with isoniazid preventative therapy (IPT) (Figure 1).

Trinidad has a petroleum-based economy and therefore enjoys a relatively high GDP per capita. This positions the country among the middle-income countries. GDP continued to grow between 2000-2005, Table 1 reflecting a strong and stable economy.

Year	2000 n (%)	2001 n (%)	2002 n (%)	2003 n (%)	2004 n (%)	2005 n (%)
Cases	216	233	197	162	161	176
Rate (100 000 mid-year pop.)	15.2	17.2	15.2	12.5	12.5	13.5
GDP per capita ($US)	8964	9641	10980	11788	12405	14039
Sputum +ev						
Male	94	126	75	77	61	82
Female	36	46	26	13	21	30
Total	130	176	101	90	82	112
Sputum –ev						
Male	40	28	54	39	39	36
Female	19	9	17	15	15	11
Total	59	37	71	54	54	47
Proportion tested	87.5	91.4	87.3	88.9	78.3	90.3
Extra pulmonary	5 (2.3)	8 (3.4)	11 (5.6)	10 (6.2)	8 (5)	13 (7.4)
Age (years)						
Male						
0-14	1.91	1.9	1.2	-	2.4	1.9
≥ 64	53.2	31.4	16.9	46	46	26.6
Female						
≤ 15	4.4	5.1	-	1.3	1.3	1.9
≥ 64	33.3	29.1	16.7	14.6	12.5	10.4

pop.=population, GDP=Gross Domestic Product, 1=age and gender specific rate per 100 000 population.

Table 1: Tuberculosis situation 2000-2005

Discussion

This is the first study to demonstrate a rising TB incidence in the context of the MDGs. In fact the African and European regions have prevalence rates above and almost equivalent to the levels in 1990, respectively and are also unlikely to meet the MDGs [10]. This finding therefore is consistent with current global epidemiologic trends of rising TB prevalence, providing evidence for the need of additional strategies to enhance current TB control and treatment efforts. In order to achieving any of the 18 target objectives derived from the MDG, effective and aggressive action on the part of governments is the essential starting point. Government is the institution which guides the policy, planning, implementation and allocation of resources under which institutions such as the Ministry of Health must operate within a society. In this regard no clear evidence exists to date that Government has as yet set out an agenda to address the prevalence of TB, although there are existing institutions for HIV/AIDS.

Several interactions between socioeconomic factors and TB prevalence in different regions of the world have been described [11,12]. TB has been associated with malnutrition, poverty and overcrowding, none of which is prevalent in Trinidad. In fact GDP per capita was relatively high for a small developing country (14-17000, $US) and continued during the first six years of the millennium. Gross domestic product (GDP) per capita is the most widely used indicator for country-level income [13] and has been used in modeling health outcomes [14], mortality trends [15,16], cause-specific mortality estimation [15], health system performance and finances [16,17].

Another indicator of the economy is the unemployment rate, which has been estimated at approximately 10% [18-20]. However Sookram reported that 27.3% of the population was living below the poverty line [21]. There was a positive correlation between the economy and the incidence of TB. In other words as the economy continued to grow the incidence of TB increased. During the American Great Depression TB incidence and mortality continued to decline [22,23] under the prevailing economy, emphasizing that in some contexts the economy may have varying influences on the incidence of TB. The distinction in this case may be due to the high prevalence of HIV in the Caribbean being second only to sub-Saharan Africa. In fact in 2010 Trinidad ranked first among the top 10 countries in the Pan American Health Organization (PAHO) with an estimated prevalence of HIV of 30% among incident TB cases [8]. HIV coinfection increases the likelihood of progression to active TB after primary infection and reactivation of latent TB infection [24-26]. The immunocompromised state increases the mycobacterial burden of disease and enhances the evolution of drug resistant TB [27,28]. TB diagnosis in Trinidad is in general still made by tuberculin skin testing, sputum smear microscopy, and evaluation of clinical symptoms. The sensitivity of such tests is very poor, especially for patients with HIV or extra pulmonary infection. [29,30]. Further in most high-burden countries, sputum smear microscopy remains the principal tool for diagnosing active disease; however, operationally, its sensitivity for pulmonary tuberculosis can be as low as 20% [31,32]. The global control of the tuberculosis epidemic is a public health priority [33,34]. The targets for reduction in tuberculosis prevalence and mortality linked to the Millennium Development Goals and enshrined in the STOP TB Global Plan 2006-2015 will not be achieved with current interventions [3,35]. In this regard there is an urgent need for improved tuberculosis diagnostics as one critical component of the public health response to the tuberculosis epidemic. It has been hypothesized that a test more sensitive than sputum microscopy for tuberculosis would be the

diagnostic intervention that would alleviate the greatest burden of infectious disease in developing countries [36]. More specifically, one mathematical model of the global tuberculosis epidemic suggested that a new rapid diagnostic test with 100% sensitivity, 100% specificity, and 100% access could prevent 625 000 deaths annually (equivalent to 36% of all tuberculosis-related deaths) [37]. Other models have derived fairly consistent estimates of mortality reductions of 17%-23% from a more sensitive rapid tuberculosis diagnostic test, [38-40]. In one model, the estimated benefit in terms of mortality from a new diagnostic test was equivalent in magnitude to that expected from a novel vaccine or an optimized 2-month treatment regimen for active disease [41].

Another critical component to achieve reductions in TB prevalence is the need for the development of newer and cheaper drugs for treatment. Antituberculosis drug resistance underscores the major deficiencies in current diagnostic technologies both for pathogen detection and for diagnosis of drug resistance [42]. Sputum culture and drug susceptibility testing are available in certain settings, but their impact is limited by the long duration and complexity of the laboratory processes [43]. Additional challenges are faced in developing diagnostics for extrapulmonary tuberculosis, pediatric tuberculosis, and latent tuberculosis infection [44-46].

A limitation of this study is that our study population may not be representative of socioeconomic groups in Trinidad as there is no data on household incomes. All cases in this study accessed public health care facilities therefore it is likely that patients who accessed private health care will not form part of this data set. In addition there is no data on ethnicity hence ethnic differences could not be ascertained.

Conclusion

In conclusion Trinidad will not be able to achieve the 2015 target of prevalence rates that are half that at the start of the MDGs. Further tuberculosis remains a not only a major global health problem but an important contributor to the group of communicable disease that still need to be controlled in Trinidad. In fact 20 years after the WHO declaration of TB as a global public health emergency, and several months ahead of the deadline of the MDGs, the country has not met this MDG and is unlikely to meet this MDG by 2015. The study advocates for better governance to improve resources to detect and treat TB. Although the MDGs are a step in the right direction, several key actions are needed as we move ahead which includes detection, the right treatment and a supportive health care system.

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