Tuberculosis Endemic in Bangladesh

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ABSTRACT

Tuberculosis (TB) has been a major public concern of Bangladesh for decades. According to the World Health Organization (WHO), Bangladesh ranks sixth among the 22 high TB-burden countries. Thus in order to improve the TB status, BRAC introduced the tuberculosis control program in 1984 in collaboration with the government. In this paper is carried out on the number of reported cases and deaths from endemic of tuberculosis. Time series analysis performed on this data reveals that tuberculosis infection has been on the rise over the years. The situation is also the same as the number of deaths. Reported cases and death cases are forecasted to carry out using appropriate and reliable method that also indicates in the two related population in this research work.

Key words: Mycobacterium tuberculosis, Epidemic, Global Infectious Diseases

INTRODUCTION

TB remains a major public health problem in Bangladesh. The country ranks sixth among 22 highest burden TB countries in the world. It was estimated that about 70,000 people die every year due to TB. In 2009, 160,735 TB cases were notified to Nation Tuberculosis Control Program (NTP). Case notification rate of all forms of TB is low at 47%. Although there is no estimate of the prevalence of childhood TB, it is believed that childhood TB is severely under-diagnosed. MDR-TB is an emerging threat to Bangladesh. According to WHO estimates, MDR-TB rate among all newly diagnosed cases is estimated at 2.2%, and among previously treated cases at 15%. The TB CARE II Bangladesh project is a field support activity funded through the USAID TB CARE II Project, which is a five years cooperative agreement awarded to the URC led consortium in September, 2010. The project, drawing on the Global Fund and the Government of Bangladesh expert resources, facilitates implementation of strategies to strengthen and expand TB DOTS, Programmatic Management of Drug-Resistant TB (PMDT) programs, and health systems. Tuberculosis (TB) is an infectious disease that has plagued humans since the Neolithic times. Physicians in ancient Greece called this illness "Phthisis" to reflect its wasting character. Tuberculosis is caused by two organisms namely Mycobacterium tuberculosis and Mycobacterium bovid. It is the characterized by incessant cough, difficulty in breathing, coughing up blood, general body weakness, loss of appetite, night sweats, fever, chills, unintentional weight loss etc. Record by WHO as cited by (Olumuyiwa and Joseph 2004) has it that during the 17th and 18th centuries, tuberculosis caused up to 25% of all deaths in Asia. This is not to say the infection is limited to one country or continent alone. However, recent research by (Mark Cichocki 2007) reveals that the infection is more pronounced in developing countries. This may be due to the standard of leaving of the people in such countries. A press release by (WHO, 2006), declares that about 80% of tuberculosis cases occur in developing nations that have fewer resources and high number of people infected with HIV. This research work is aimed at analyzing the data obtained in reported cases and corresponding deaths of this global endemic, tuberculosis in Bangladesh. The results of this analytical work will reveal the situation in Bangladesh over the years (1993 to 2014) and give an insight into the future situation through forecasting.

Tuberculosis (Wikipedia, 2010), is a disease of the lungs. However, the infection can be spread via blood from the lungs to all organs of the body. Which means that one can develop TB in the pleura (the covering of the lungs), in the bones, the urinary tract and sex organs, the intestine, and even the skin. The encyclopedia said that TB is inhaled in the form of microscopic droplets from an infected person. When coughing or sneezing, the small droplets are expelled into the air. They dry out quickly, but the bacteria itself can remain airborne for hours. According to (Friedan 2003), it is confirm that, after the TB bacteria have been inhaled, they reach the lungs and within approximately six weeks, a small infection appears that rarely gives any symptoms. This stage is generally known as primary infection.

TB includes the following symptoms:

a) Chronic or persistent cough and sputum production that contain blood at the advanced stage. b) Fatigue c) Lack of appetite d) Weight loss e) Fever f) Night sweats. If a physician suspects that there is something wrong and that it is not just cold, one may be referred to an outpatient department for people with lung's disease, or to an X-ray section. Stating

further, they said that the chest X-ray examination is the most important test. According to (Salami and Oluboyo 2003), it was revealed that TB can mimic many forms of diseases and must always be considered that if no firm diagnosis has been made. They said that the doctor cannot always hear enough to make a diagnosis by just using a stethoscope. According to (Wikipedia, 2010), bronchitis, pneumonia, smoker's lung and cancer can show practically the same symptoms as TB. It is mentioned that if TB is suspected, test will need to be done to rule out the presence of other diseases. TB frequently occurs in the course of HIV infection, often months to years before other opportunistic infection such as Pneumocystis carinii pneumonia (Mark Cichocki 2007). He states that TB may be the first indication that a person is HIV-infected, and often occurs in areas outside the lungs, particularly in the later stages of HIV. TB patients frequently have a condition that produce symptoms similar to that of TB and may not react to the standard tuberculin skin test because their immune system is suppressed. According to (Mark Cichocki 2007), WHO estimated that 4.4 million people worldwide are co-infected with TB and HIV. He said that people co-infected with TB and HIV develops active TB at a rate of about 8% each year in the United States. He concluded that diagnosing TB in HIV-infected people is often difficult.

In Bangladesh, tuberculosis is common. "A Prevalence of 9.2% has been reported in one study and a case fatality rate of 12% in another" (Olumuyiwa and Joseph 2004). They portrayed that delay in diagnosis of TB and commencement of treatment has been reported to be common in Bangladesh and other countries. These delays are attributable both to patients and doctors, and may worsen the disease; increase the risk of death and enhance TB transmission in the community. Bangladesh is one of the few countries in the world where TB control has been slow partly due to patients delay and inefficiencies in the health system. Thus the control is one of the major public health challenges facing Bangladeshi. Treatment of TB includes anti-tubercular therapy with daily oral doses of isoniazid, rifampin and pyrazinamide (and sometimes ethambutol) for at least six months. According to (Mark Cichocki 2007), it was stated that longer courses may be required for patients with AIDS or for patients who respond slowly. After 2 to 4 weeks, the disease is generally no longer infectious. The patient can resume his normal lifestyle while taking medication. He portrayed that patients with a typical mycobacterium or drug-resistant TB may require treatment with the second-line drugs such as capreomycin, steptomycin etc. Conclusively, he said that self-medication for TB should be discouraged. Professional medical advice that, must always be sought about any treatment or change in treatment plans. According to (Mark Cichocki 2007), prevention has focused on identifying infected individuals early, especially those who run the highest risk of developing active disease and treating them with drugs in a program of directly observed therapy. The National Institute of Allergy and Infectious Disease (NIAID) pointed out that in those parts of the world where the disease is common; a vaccine composed of live attenuated mycobacterium (Bacillus Chalmette Guerin [BCG]) is given to infants as part of the immunization program recommended by World Health Organization. In adults, the effectiveness of BCG has varied widely in large-scale studies. In addition, positive skin test reactions occur in people who received BCG vaccine, thus limiting of effectiveness of the skin test to identify new infections. As a result, BCG is not recommended for general use in USA. Because of its limitations, more effective vaccines are needed. Today, the Global Fund to fight AIDS, TB and malaria is disbursing additional resources to prevent and treat HIV/AIDS, TB and malaria. A press release by (WHO, 2006), said that partnership between government, civil societies, the private sector and affected communities represent a new approach to international health financing. However, if the control of tuberculosis must succeeds, causes of delay by patients and doctors should be investigated and minimized.

STATEMENT OF PROBLEM

This research work is embarked upon to analyze one of the global infectious diseases "tuberculosis". Tuberculosis poses a lot of threat to human health and life. This work is primarily targeted that at providing reliable and concrete information on the rate of occurrence of this disease and its possible outcome using a statistical tool, known as time series.

SIGNIFICANCE OF STUDY

It is expected that the information provided at the end of this research will help the readers to understand the application of statistical tools in analyzing societal issues (health problem) and other related issues of life. The research work is also hoped to serve as a source of information for future researchers, as well as health workers.

OBJECTIVES OF STUDY

This research work hoped to achieve the following criteria:

- To provide a most concise and accessible information on tuberculosis, its symptoms, and possible treatment strategies.
- To avail information on current areas of active research in the health sector.
- To unravel the outcome of the resource commitment by the government on health issues.
- To help Bangladeshi to understand their position on tuberculosis in the future though forecasting.

DATA ANALYSIS

The revised NTP adopted the DOTS strategy during the Fourth Population and Health Plan (1993-2014) under the project "Further Development of TB and Leprosy Control Services". The NTP started its field implementation in November 1993 in four Thanas (Upazilas) of 2 districts and progressively expanded to cover all Upazilas by mid-1998. In July 1998, the NTP was integrated into the Communicable Disease Control component of the Essential Services Package under the Health and Population Sector Program (HPSP). In 2003, HPSP was renamed "Health, Nutrition and Population Sector Program" (HNPSP) and NTP is recognized that as one of the priority programs in HNPSP. Tuberculosis (TB) is a major public health problem in Bangladesh since long. Estimates suggest that daily approximately 875 new TB cases and 180 TB deaths occur in the country. In 1965, tuberculosis services were mainly curative and based in TB clinics and TB hospitals. TB services were expanded to 124 Upazila health complexes (UHCs) during the Second Health and Population Plan (1980-86), and were operationally integrated with leprosy during the Third Health and Population Plan (1986-91) under the Mycobacterium Disease Control (MBDC) Directorate of the Directorate-General of Health Services (DGHS). In 2002, DOTS was expanded to Dhaka Metropolitan City and by 2003, 99% of the country's population was brought under DOTS services. The quality of NTP continues to improve. The program is maintaining high treatment success rates from the beginning and met the target of 85 % treatment success since 2003. The program has successfully treated 92% of the new smear-positive cases registered in 2006 and has detected 72% of the estimated new smear-positive cases in 2007.The Government of Bangladesh, together with its many and diverse partners from the public and private sectors and is committed to further intensify the DOTS program in order to sustain the achieved success and to reach the TB control targets linked to the Millennium Development Goals (MDGs). The data collected for this research is a reflection of the annual reported cases of Tuberculosis (TB) and deaths in Bangladesh for 20 years.

Table 1: The Original Data on Tuberculosis Infection in Bangladesh

Year	Reported Cases	Reported Deaths
1993	9233	278
1994	27566	231
1995	15175	292
1996	14341	317
1997	16064	331
1998	18570	454
1999	18737	380
2000	19368	407
2001	8570	454
2002	18737	330
2003	1368	307
2004	1101	14
2005	17855	387
2006	17627	326
2007	16259	112
2008	9368	407
2009	4558	417
2010	1042	452
2011	1484	498
2012	1160	244
2013	1855	187
2014	17628	426
TOTAL	257666	7251

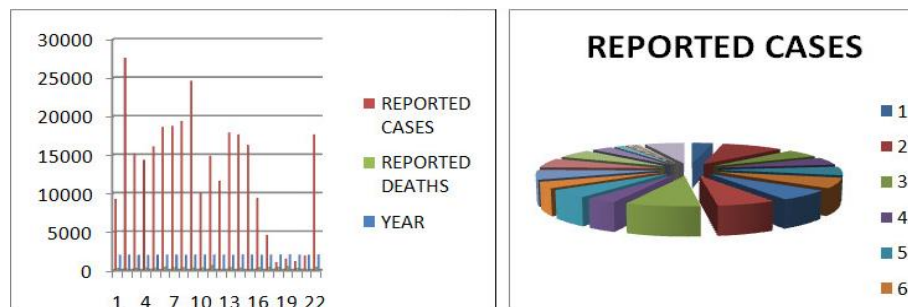Source: National Bureau of Statistics, Bangladesh

Figure 1: 5-Year Moving Average for Reported Cases of TB

The method of moving averages was used to analyze the data on reported cases of TB. Figure 1 represents the result of a 5- years moving average in reported cases of the TB. In the figure, it is observed that the actual value plots have no definite pattern of occurrence. There is fluctuation in cases of TB in Bangladesh. However, increase is noticed in 1991 and 1996, with 2003 having the highest number of reported cases. The fluctuation also result to decrease in number of cases as can be seen in 1993 and 1995, with the least number recorded in 2004. The 5-years moving average tries to smoothen the curve there by eliminating the extreme points off the trend curve. However, even with moving average curve, fluctuations are noticed, and the curve shows a growth in the population under study (number of reported TB cases) over the years. It is also observed that, as the curve is smoothen by 5-years moving average, the number of reported cases of TB is now seen to alternate (though not greatly) between the values 14,000 and 20,000. The least value is 14,079 (in 1995) and the highest value is 19,459 (in 2000). The fluctuations observed in the moving averages are characteristics of a time series which represent the time series components (specially seasonal, cyclical and irregular movements). In this research, these fluctuations (that tend to increase the population) were discovered to be due to: a) Poverty b) Increased HIV cases c) Malnutrition d) Delay by patients and doctors e) Ignorance and f) Lack of control. While the decrease in number of affected people could be attribute to a) Awareness on prevention b) Improved living standard of the people c) Quick response of suspected cases. The least square method was also used to analyze the data. As already stated previously, the least square method uses a linear equation given by $Y_t = \alpha + \beta x.$ The Minitab estimates Y_t as Y_t=15697+94.8t. Here X is replaced in the receding equation by t. Also, this is to say; $\alpha = 15697$ and $\beta = 94.8$. The fitted equation is therefore $Y_t = 15697 + 94.8t$ as given by the Minitab.
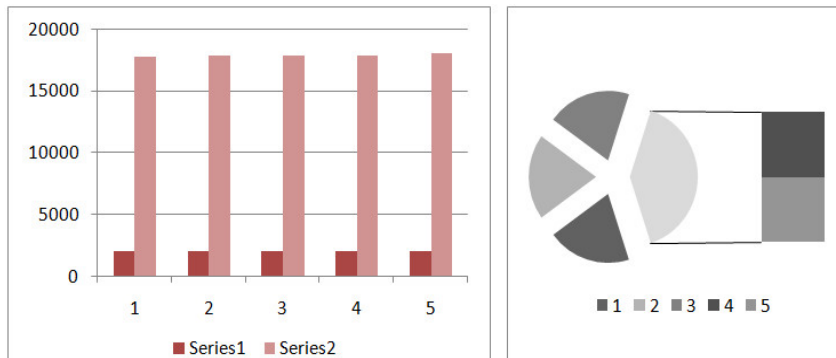
The graph of this equation (Figure 2) shows that the trend is linear rising steadily (indicating increase) from 15792 in 1988 to 17593 in 2007. The figure also possesses similar characteristics to that of moving averages in that its values lie between 14,000 and 20,000. However, it shows a difference as its values do not alternate unlike those of moving average.

Figure 2: Under trend for TB i=Infection

FORECAST 1

For a study of situations such as Tuberculosis occurrence and outcome. It is necessary to estimate or make an assumption of what the future possibly holds. For the purpose of this research, the least square method is adopted by the research to give a forecast for a period of four (4) years. The forecast values are given below:

In the year, 2008 forecasted value is 17687.3, 2009 forecasted value is 17782.0, 2010 forecasted value is 17782.8, 2011 forecasted value is 17971.6. This is estimated that approximately 17687 people were infected with TB in 2008, 17782 were infected in 2009, 17783 were infected in 2010, where as in 2011, 17972 were infected. An analysis was also carried out on the outcome of the infectious disease (TB). It discovered that TB has claimed a lot of lives during the period of this research. The original date plots on deaths cases shows that there have been fluctuations in the number of death cases by TB.
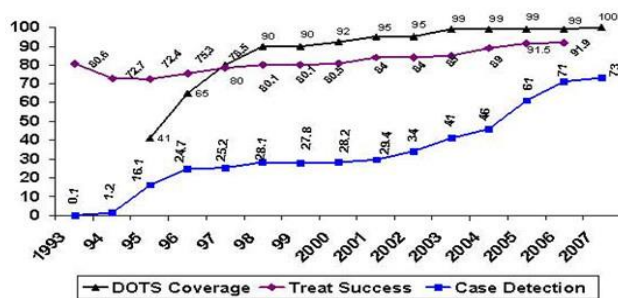

Figure 3: 5- Year Moving Average for Deaths By TB

Figure (3) shows that there was an increase in death cases in 1991 with a heavy drop in 1992 with approximately the same figure in 1993. An increase was also noticed in 1994 while 2002 had the highest number of deaths. A 5 year moving average performed on this date approximately smoothen the curved. However, fluctuating in death cases is still noticed with the moving average curve. In figure the curve appears to grow over the years. This implies that there has been increase in death cases resulting from TB within the time covered by this work. The least square method of estimating growth was also being employed. The Minitab estimated the linear trend equation to be: $Y_t = 274.8 + 3.94t$ which implies α=274.8 and β=3.94. The fitted linear curve also shows growth that implies there has been increasing the number of deaths by TB within the period under study. The linear curve, however, reveals that the number of death cases resulting from this infectious disease (TB) lies between 260 and 400, even though, the curve rises linearly steady.

FORECAST 2

The death cases caused by this infectious enemy of health (TB) needs to be forecast in order to ascertain the situation in the nearest future. Their searcher uses least square method from the fitted equation to make a forecast of four (4) years. The forecast values are given below:

2008 forecast value is 357.495   2009 forecast value is 361.432
2010 forecast value is 365.370   2011 forecast value is 369.308
2012 forecast value is 367.308   2013 forecast value is 379.308
2014 forecast value is 389.23
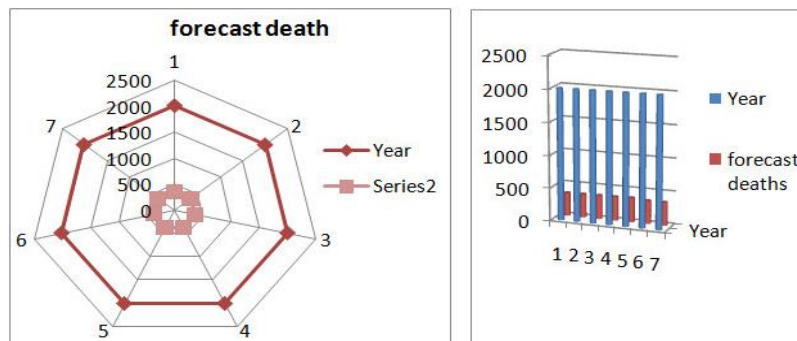
Which implies approximately 357 people will die of TB by 2008, 361 will die by 2009; 365 will die by 2010 and up to 369 people will die of TB bye 2011.

CONTRIBUTION

It is necessary to apply the theoretical aspect of the course to real life situations, so as to affirm the functionality of existing statistical tools.
In this research Work, the application of time series has been critically shown by the researcher in analyzing a health problem facing the country (Bangladesh).
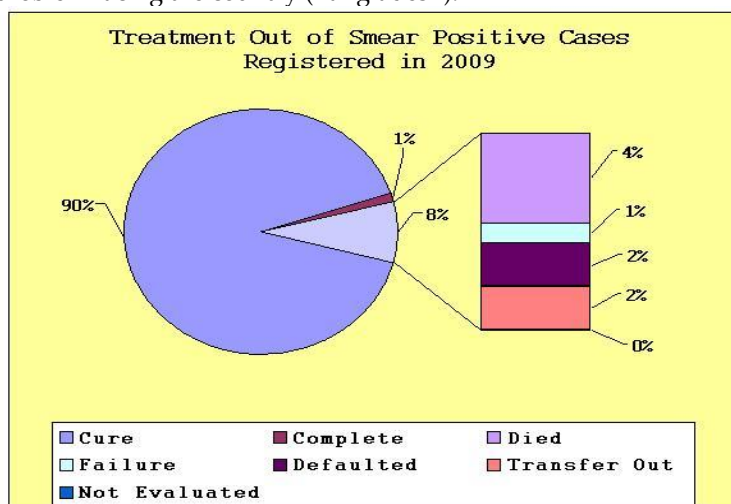
SUGGESTIONS

The revised NTP adopted the DOTS strategy during the Fourth Population and Health Plan (1992-98) under the project "Further Development of TB and Leprosy Control Services". The NTP started its field implementation in November 1993 in four Thanas (Upazilas) of 2 districts and progressively expanded to cover all Upazilas by mid-1998. In July 1998, the NTP was integrated into the Communicable Disease Control component of the Essential Services Package under the Health and Population Sector Program (HPSP). In 2003, HPSP was renamed "Health, Nutrition and Population Sector Program" (HNPSP) and NTP is recognized as one of the priority programs in HNPSP. Tuberculosis (TB) is a major public health problem in Bangladesh since long. Estimates suggest that daily approximately 875 new TB cases and 180 TB deaths occur in the country. With reference to the agenda of the National Institute of Allergy and Infectious Diseases (NIAID), the following suggestions were made for possible improvement:

- There should be new ways to educate health Workers and the public about TB prevention in Bangladesh.
- There should be a way of improving the general way of living of Bangladeshi.
- Foreign-born people coming to Bangladesh from countries where TB is common should be properly checked and considered for preventive therapy.
- Infants should be immunized with BCG to prevent TB.
- Causes of delay by patients and doctors should be investigated and minimized.
- Measures should be taken against any symptoms of TB to avoid advancement of the TB bacteria.

CONCLUSION

National Tuberculosis Control Program (NTP) aims to strengthen the effort of TB Control through effective partnership, mobilizing resources and ensuring quality diagnostic and treatment services under defined Directly Observed Treatment Short Course (DOTS) strategy. The service should be equally available to all people of Bangladesh irrespective of age, sex, religion, ethnicity, social status and race. The overall goal of TB control is to reduce morbidity, mortality and transmission of TB until it is no longer a public health problem. The objectives of NTP are to reach and after that sustain the global targets of achieving at least 70% case detection and 85% treatment success among smear-positive TB cases under DOTS. Reach the interim target of halving the TB death rate and TB prevalence by 2010 towards achieving a reduction in an incidence of TB, as stated under the MDGs (2015). The data collected on reported cases and deaths of TB in Bangladesh from 1993 to 2014 have been critically examined and analyzed using time series. The analysis shows that there has been an increase in the number of reported cases TB in Bangladesh, the analysis of deaths also revealed that there has been increasing the number of deaths resulting from this infectious disease (TB) within the time under study. Forecasts for both cases of TB were also made to show that the situation of TB in Bangladesh will be high in 2015.

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