

Original Article

Epidemiological Study of Tuberculosis in Northern IranJamshid Yazdani Charati¹ Abolfazl Hosseinnataj² Mohammad Vahedi³ **Fatemeh Abdollahi^{4*}**

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Abstract

Background & Purpose: One of the most important United Nations Millennium Development Goals is to control Tuberculosis (TB). This study aimed to identify the high-risk areas of TB and other related factors of it in an epidemiological study.

Materials & Methods: In this retrospective study, the records of 1566 TB infected patients in healthcare centers of 17 cities of Mazandaran University of Medical Sciences were investigated during 2009-2013 years. Information of patients was gathered using a check list. The collected data was then analyzed using chi-square.

Results: The mean age of the patients was 46.17 ± 20.6 years. The 5-year incidence rate was 12.14 in 100,000 populations. Cities in the east of Province (Sari, Behshahr, and Neka) had highest incidence rate (about 16 cases in 100,000 population). The incidence rate was different based on gender as, 15.3 % of the men and 10.2 % of the women were infected. The median delay time in the diagnosis was 34 days.

Conclusions: The incidence rate of TB in Mazandaran was found to be almost similar to the previous reported rate in Iran. High incidence rate in east of province may be due to bordering to the Golestan Province as the immigrant province. The short delay time of TB diagnosis during this period indicated the well health services practices in this province. More attention should be paid to high risk areas for identification and giving education to those patients.

Keywords: Epidemiology; Incidence; Tuberculosis; Mazandaran

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1. Introduction

Tuberculosis has been one of the oldest diseases for centuries while threatening the life of human. One of the most important United Nation Millennium Development Goals is to control TB. About 85 % and 15 % of the TB cases are pulmonary and non-pulmonary, respectively. The untreated TB patient could, in average, transmit the disease to 10 to 15 individuals. This disease is considered the main cause of mortality and morbidity in the low income countries, and particularly in the African countries (1, 2). If the pulmonary TB patient is not treated properly, it would lead to drug resistance, hence it could not be treated with the usual antibiotics recommended for sever TB treatment, and it cannot be easily treated. In such a condition, the organism transmitted to the other individuals may create much problems, but by on time diagnosis and proper treatment, TB prevalence rate could be declined (3, 4).

TB is still an important global health problem (5) and it kills about 1.7 million people annually (6, 7). This disease is the second cause of mortality in the HIV patients and the immune deficit individuals. In 1993, the World Health Organization named it as a World Health Emergency (8). After the onset of HIV, the AIDS was suggested as the main reason of converting to the asymptomatic Tuberculosis (9). If the HIV/AIDS patients are infected with the Mycobacterium Tuberculosis, the progress of TB will speed up (10). With the development of the TB drug resistance, the significance of prevention and early diagnosis is suggested.

For 2020-2035, the World Health Organization (WHO) and United Nation (UN) have both Tuberculosis targets set to achieve End of Tuberculosis Epidemic that includes 35% reduction in TB deaths by

2035 and 20% reduction in TB incidence until 2020 as compared to the year 2015 (11).

Asia and Africa face the main burden of TB infection. About 62% of the disease occurs in the South Eastern Asian countries and West Pacific Ocean. Africa faces 25% of the world TB cases (11).

Approximately 72% of TB infected HIV patients live in Africa. In the world, 10 million people were infected by TB in 2017, of them 9% were HIV positive and 1.57 million of them died of TB (11). The TB incidence rate in Iran is 13%, and the mortality rate is 2.9%. The incidence of tuberculosis in Mazandaran Province was reported to be 8.4% (12). Sistan, Baluchistan and Golestan Provinces have been found to experience the highest incidence rate (5).

Considering the high prevalence rate of TB in Iran and the bordering Iran countries with the highest rate of TB prevalence rate, the epidemiological study on TB is very important. Moreover, due to neighboring of Mazandaran Province to Golestan Province as a high infected region, and as a result of the close relationship among the citizens of these two provinces, this study was essential to be conducted. Therefore in this study, we aimed to investigate the epidemiology of TB in Mazandaran Province and to identify the high risk areas.

2. Methods

In this retrospective descriptive study, all of the TB patients' registered in the healthcare centers of Mazandaran University of Medical Sciences were investigated. Patients whose records were not registered were excluded from the study. Names of the patients were omitted for the ethical point of view. Overall, 1647 infected

patients have been found with various types of TB in 17 townships of Mazandaran Province during 2009 to 2013. For data analysis, only the patients with new onset of TB infection were included in this study. Data related to the variables of age, sex, type of disease, history of contact with the infected patients, HIV (Human Immunodeficiency Virus) condition, nationality, duration of disease, and patient's residency were all collected using a check list. All analyses were done using SPSS Software V.16, and the descriptive data was presented and then analyzed using chi-square test. The study was approved in Ethics Committees of Mazandaran University of Medical Sciences.

3. Results

A total of 1647 TB infected patients were recorded during the study period, of whom 1566 patients were newly identified cases. The mean age of the infected male and female was 45.2 ± 19.7 and 47.3 ± 21.5 years, respectively. A small number of patients were Afghani (2.7%). Most of the patients were in the age range of 15-44 years (50.7%), and about 61% of them came from urban areas and more than half of them were male (60%). The demographic characteristics of the patients are shown in Table 1.

Table 1. Incidence Rate of TB Infection based on Demographic Characteristics of Patients in Northern Iran, 2009-2013 Years.

Variables	Level	Number (%)	Incidence *	p-value
Gender	Male	991(60)	15.3	<0.001
	Female	656(40)	10.2	
Residency	Urban	1001 (61)	14.1	<0.001
	Rural	646 (39)	11.2	
Age	0-4	12 (.8)	1.1	<0.001
	5-14	23 (1.5)	1.4	
	15-44	795 (50.7)	11.3	
	45-64	371 (23.7)	14.8	
	>64	365 (23.3)	43.1	
Nationality	Iranian	1602 (97.3)	10	<0.001
	Afghani	45 (2.7)	79	

*Incidence Rate in 100,000 population

Incidence= the number of new cases within 5 years / (the size of the population*5)

Table 2 illustrates the clinical characteristics of TB infected patients in the sample under study. Majority of TB infection was pulmonary (73.4%). A small number of patients were HIV positive (11%). About half of them were also

reported to have a contact with TB infected person (42%). A large number of patients were hospitalized due to TB infection (52.3%), and 17% of the cases passed away because of TB infection. The non-pulmonary TB infections included

lymphatic node 26%, pleural 23%, and bone 15%. All variables in Table 2 were tested using chi-square test, and all results were found to be at significant level. In

analyzing the data, the participants whose test results were at uncertain status were not considered for analysis.

Table 2. Clinical Characteristics of TB Infected Patients in North of Iran, 2009-2013 Years.

Variable		Number	Percent	p-value
Type of disease	Pulmonary	1209	73.4	<0.001
	Non Pulmonary	438	26.6	
HIV condition	Positive	178	11	<0.001
	Negative	19	1	
	Unknown	1450	88	
Contact with the infected patients	Yes	687	42	<0.001
	No	218	13	
	Unknown	742	45	
History of hospitalization due to disease	Yes	763	46.3	.01
	No	861	52.3	
	Unknown	23	1.4	
Prison	Yes	151	9	<0.001
	No	1496	91	
Cause of death*	TB	17	17	<0.001
	Others	63	62	
	Unknown	21	21	

*Total number of death, 101 (6.1%)

In the 5-year study period, Sari Township had the highest rate of pulmonary TB incidence, while Galougah and Juybar had the lowest incidence rate. Table 3 shows the incidence rate of the infection based on the residency and gender of patients. As

the table shows, the highest rate of TB infection was found in males from urban areas of Sari (22.5%), and among females living in the urban areas of Neka (22.2%), as well as the rural males of Fereydunkenar (21.7%).

Table 3. Distribution of the Incidence Rate of TB based on the living place and gender (in 100,000 population).

Township	Living place				Total (%)
	Urban		Rural		
	Male (%)	Female (%)	Male (%)	Female (%)	
Abbas Abad	17.8	10.7	11.4	8	11.9
Amol	14.2	11.6	11.4	8.5	11.7
Babolsar	7.8	3.8	8.9	0.6	5.3
Behshahr	19.3	13.8	19	9.9	16
Chaluos	17	11	17.2	10.8	14.2
Fereydunkenar	9.8	2.2	21.7	3.7	8.6
Galugah	14.1	10.3	4.2	6.2	8.7
Qaemshahr	8.9	8.8	11.8	7.3	9.1
Juybar	12.7	5.2	4.7	6.6	7.1
Mahmoud Abad	18.8	7.5	18.9	11.1	14.4
Neka	18.1	22.2	11.2	11.6	15.4
Noshahr	19.1	12.7	14	6.3	12.3
Noor	9	7.4	7.3	7.2	7.7
Ramsar	11.7	7.8	0	9.4	8.5
Sari	22.5	15	16.3	9.4	16.2
Savadkooh	11.1	7.4	15.4	5.3	9.9
Tonekabon	17.8	10.7	11.4	8	11.9

The trend of incidence rates of TB [cases in 100,000 populations] by studied years is demonstrates in Figure 1. As is seen in the

Figure, the incidence rate was raised from 10% in 2009 to 12.6% in the year 2013.

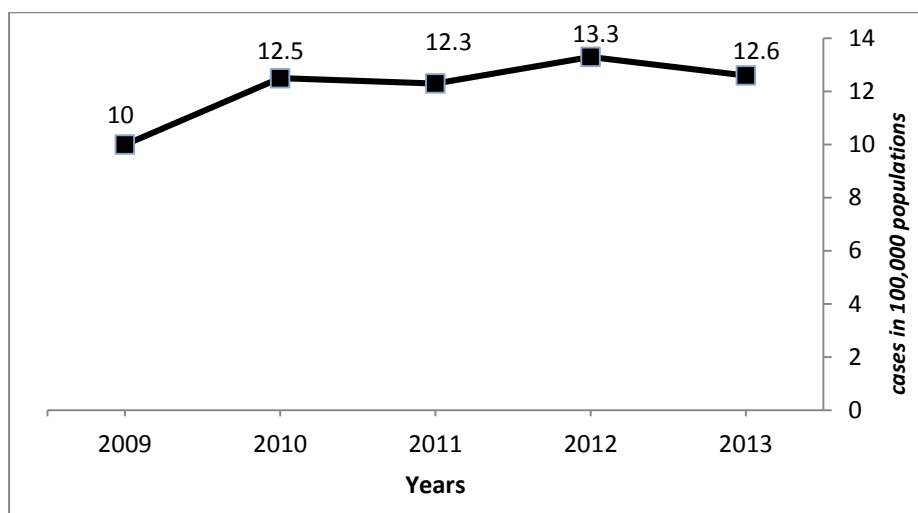


Figure 1. Trend of TB Incidence Rate (cases in 100,000 population) by studied years

Figure 2 illustrates the incidence rate of TB by differentiating the age and sex of patients. As the figure shows, the TB

incidence rate in the males of all age groups is higher than the female groups.

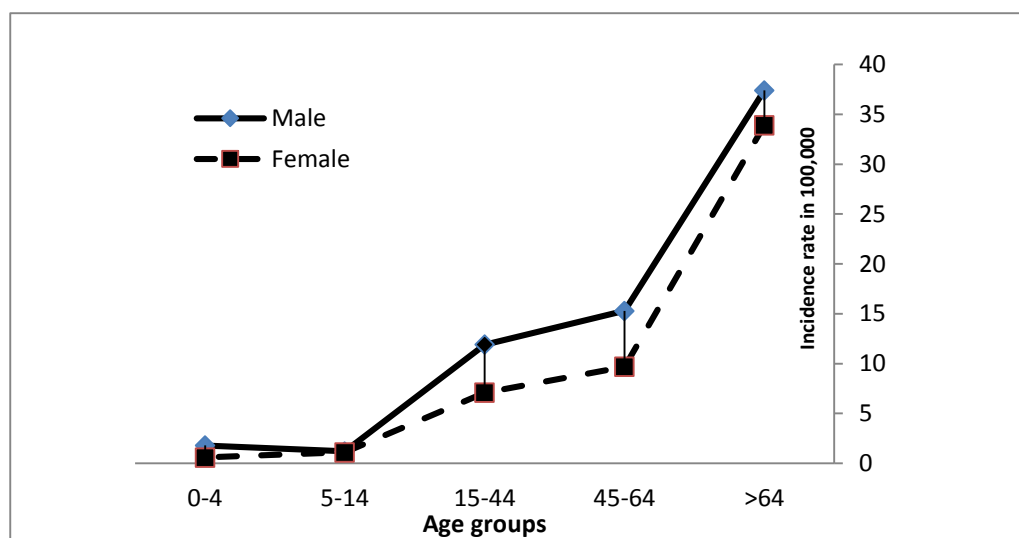


Figure 2. The TB Incidence Rate (cases in 100,000 population) by Patients' Age and Gender

During the study period, 617(37.5%) of the patients were recovered. The mean delay time in the diagnosis of the disease was 66 ± 65.96 , and the median was 34 days during the study period. The median delay times in the diagnosis of the TB in each year from 2009 to 2013 were 59, 37.5, 32, 32.5, and 30 days, respectively.

TB incidence (the partial standardized incidence for every hundred thousand inhabitants in Mazandaran University of Medical Sciences) was equal to 4.7×10^{-3} . The 95% confidence interval for the 5-year incidence was equal to (10, 14.25). As a result, the incidence rate in Sari (16.2%), Behshahr (16%), Neka (15.4%), and Mahmoud Abad (14.4%) were out of the 95% confidence interval.

incidence rate in the males of all age groups is higher than the female groups.

4. Discussion

In the current study, the incidence of tuberculosis and its relationship with some patients' characteristics in Mazandaran Province was assessed during 2009 to 2013. Moreover, the incidence of tuberculosis for each of the cities of Mazandaran Province was reported, and the high risk cities were satisfied.

The incidence rate in 100,000 population in the present study (12.14%) was almost similar to the reported incidence rate in Iran (5), but lower than the reported rate in Golestan (13) and Guilan Provinces (14).

After Sistan and Baluchestan Province, Golestan has the highest TB incidence rate in Iran (15). The high prevalence rate of TB in Sari, Behshahr, and Neka could be due to the bordering to Golestan Province. Therefore, in these townships as the high risk areas, more attention should be paid to the identification and education of those suffering patients.

Regarding the race of patients in the present study, the TB incidence rate in every hundred thousand Iranian and Afghani was 10 and 79, respectively, which is a warrant to the Mazandaran society and administrators.

From the epidemiologic point of view, such as gender, 60% of the patients were male. The previous study in Mazandaran showed that 54% of the TB infected patients were male (12). These results showed that the incidence rate in male in comparison to female has been increased in the recent years, which may be due to the fact that fewer female patients have been referring to physician for diagnosis and treatment. Another reason that could justify this difference was the socio-economical differences between males and females, which emphasized the epidemiologic and social aspects (16).

Regarding the residency of the patients, the results showed that the incidence rate of TB in urban areas (14.1%) was more than rural areas (11.2%), which agrees with the previous studies reports in Ardebil (17) and Mazandaran (18), while it disagrees with the report given from Birjand (13). This variation in incidence rates could be due to climatic condition in similar areas, and the quality of healthcare services, as well as the observation of the DOTs program for the patients in these Provinces.

The non-pulmonary TB cases in the present study was 26.6%, which was lower than the prevalence reported rate in Kurdistan (37%) (19), and higher than the reported rate in Semnan Province (11.49%) (20). This variation may be related to different geographic areas under study and also the sensitivity of diagnostic tests which were used in each laboratory. As such, livestock farming is a common job in Kurdistan Province. The reasons of infection by non-pulmonary TB could be attributed to the: inefficient diagnosis of pulmonary TB, false negative test for non-pulmonary cases, and increases of HIV/AIDS infected patients (21, 22).

As was reported before, in this study, 197 of the diagnosed TB patients were suffering HIV, of whom 19 (10%) were HIV positive. In a study conducted among 293 patients in Kermanshah Province, 19 (6.45%) were HIV positive. Another study in Mazandaran Province in 2008 on 26 TB patients, revealed 3 (12%) HIV positive (18). One third of the forty million HIV patients in the world are infected with TB; as a result, such patients are susceptible to TB 50 times more (19).

TB is the main cause of death in the HIV patients. In many developing African and Asian countries, due to the wide spread of

HIV /AIDS in a 10-year period study, the number of TB affected patients increased 2 to 3 times more (13, 21).

In the present study, the low incidence rate of TB was found among the adolescents (less than 15 years old groups). It may be due to benefiting of people from the BCG vaccination program in recent years (23). The highest incidence rate was found among the 15-64 year-age group. One reason for this finding could be that the young individuals may refer to doctor for diagnosis and treatment, which is a hypothesis that needs to be investigated. From the other side, TB infection could affect the economy status of the affected persons (24, 25), because the TB could affect the productive years of adult patients (26). In the elderly, TB is considered as an epidemiological and clinical challenge. This could be due to the recurrent infection in the line of their immune compromised system and the age condition (27). TB in the developed countries is still considered as a public health problem (28). Also, in the developed countries, about 80% of the affected individuals are in the age groups of 50-year and above (19, 25). In developing countries, on the other hand, TB has a high incidence and mortality (more than 95%) (26). For the low-income countries, the required fund for controlling TB was estimated to be around US\$ 22 billion (26). The results of the current study showed that the reported incidence rate differentiating the years has nearly a progressive process, indicating the improvement of healthcare, increasing the level of patients' education, more care of the physician on TB, and having more equipped facilities in hospitals.

The median delay time in diagnosing TB in our study was 34 days approximately equal to the delay time of diagnosis in Rasht city

(31 days) (14). This similarity may be due to the same healthcare system in two near provinces of Gilan and Mazandaran.

The high incidence rate of TB and its increased rate during the study period indicated that the administrators of the Mazandaran University of Medical Sciences should pay more attention to TB diagnosis, prevention, and treatment. Improving the life standard, giving education to the TB patients in order to prevent the spread of the disease, tuberculosis screening in patients with HIV (for example by cough ≥ 2 weeks, fever, night sweats, unintentional weight loss, chest pain and/or breathlessness) (29), and using mass media to educate the whole society members could help to prevalent the disease.

Limitations

This study was limited using retrospective data, as the data about TB infection and relevant factors were obtained retrospectively from the available records, which were susceptible to some bias.

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Conflict of Interest

The authors declare that there are no conflicts of interests.

References

1. Abegunde DO, Mathers CD, Adam T, Ortegon M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet*. 2007;370(9603):1929-38. [Doi:10.1016/S0140-6736(07)61696-1]
2. Choi H, Lee M, Chen RY, Kim Y, Yoon S, Joh JS, et al. Predictors of pulmonary tuberculosis treatment outcomes in South Korea: a prospective cohort study, 2005-2012. *BMC Infectious Diseases*.

- 2014;14(1):360. [Doi:10.1186/1471-2334-14-360]
3. CHang KC, YEW WW. Management of difficult multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis: update 2012. *Respirology*. 2013;18(1):8-21. [Doi:10.1111/j.1440-1843.2012.02257.x.]
 4. Hatami H, Razavi S, Eftekhari H, Majlesi F. Comprehensive book of public health. Tehran: Arjemand Publications. 2007:45-7.
 5. Organization WH. Global tuberculosis report 2013: World Health Organization; 2013. Book
 6. Soria J, Metcalf T, Mori N, Newby RE, Montano SM, Huaroto L, et al. Mortality in hospitalized patients with tuberculous meningitis. *BMC Infectious Diseases*. 2019;19(1):9. [Doi:10.1186/s12879-018-3633-4]
 7. Hassan Zadeh J, Nasehi M, Rezaianzadeh A, Tabatabaee H, Rajaeifard A, Ghaderi E. Pattern of reported tuberculosis cases in Iran 2009-2010. *Iranian journal of public health*. 2013;42(1):72-8. [PMC3595631]
 8. Organization WH. Global tuberculosis control: epidemiology, strategy, financing: WHO report 2009: World Health Organization; 2009. Book
 9. Selwyn PA, Hartel D, Lewis VA, Schoenbaum EE, Vermund SH, Klein RS, et al. A prospective study of the risk of tuberculosis among intravenous drug users with human immunodeficiency virus infection. *The New England journal of medicine*. 1989; 320(9):545-50. [Doi:10.1056/nejm198903023200901]
 10. Shamu S, Kuwanda L, Farirai T, Guloba G, Slabbert J, Nkhwashu N. Study on knowledge about associated factors of Tuberculosis (TB) and TB/HIV co-infection among young adults in two districts of South Africa. *PloS one*. 2019;14(6):e0217836. [Doi:10.1371/journal.pone.0217836] [PMC6553726]
 11. MacNeil A, Glaziou P, Sismanidis C, Maloney S, Floyd K. Global Epidemiology of Tuberculosis and Progress Toward Achieving Global Targets - 2017. *MMWR Morb Mortal Wkly Rep*. 2019;68(11):263-6. [Doi:10.15585/mmwr.mm6811a3]
 12. Yazdani-Charati J, Mrdانشah F, Etemadi-Nejad S, Rezaei M-S, Ghadami M, Ahmadi-Baseri E. Application of empirical Bayes smoothed incidence rates of tuberculosis during the year 2005-2011 to prepare geographical map of tuberculosis incidence. *Journal of Mazandaran University of Medical Sciences*. 2014;23(110):45-56.
 13. Ebrahimzadeh A, Sharifzadeh GR, Eshaghi S. The epidemiology of Tuberculosis in Birjand (1996-2006). *Journal of Birjand University of Medical Sciences*. 2009;16(1):31-8.
 14. Najafzadeh H, Ghorbani K. Epidemiology of tuberculosis in a health center in Rasht city in 86 years. 5th National Congress of Tuberculosis 2009.
 15. Organization WH. Global Tuberculosis Report. Geneva: World Health Organization; 2014. 2016.
 16. Martinez AN, Rhee JT, Small PM, Behr MA. Sex differences in the epidemiology of tuberculosis in San Francisco. *International Journal of Tuberculosis and Lung Disease*. 2000;4(1):26-31. [PMID: 10654640]
 17. Amani F, Bashiri J, Sabzevari A, Gharoosi B, Nahanmoghaddam N. Epidemiology of Tuberculosis in Ardabil, 2001-2005. *Journal of Ardabil University of Medical Sciences*. 2007;7(3):236-341.
 18. Yazdani Charati J, Kazemnejad A, Mosazadeh M. An epidemiological study on the reported cases of tuberculosis in Mazandaran (1999-2008) using spatial design. *Journal of Mazandaran University of Medical Sciences*. 2010;19(74):9-16.
 19. Nili S, Karimi M, Banafshi O. Epidemiologic study of extrapulmonary TB in Kurdistan 2007-2009. 19th Iranian congress on infectious diseases and tropical medicine 2010; Iran 2010. p. 138.
 20. Mohamadi Azni S, Mansourian AA, Nokandeh Z. Epidemiological study of tuberculosis in Damghan city (Iran) during 2003-2007. *koomesh*. 2008;9(4):315-20.
 21. Abbasi A, Arabi M. Efficiency of Dots strategy in Recovery or reverse of tuberculosis Patient. *Journal of Gorgan Medical Science university*. 2004;6(13):78-84.
 22. Najafzadeh H, Ghorbani K, Sedighi A, Asadi S, Rezaee A. Epidemiologic study of tuberculosis in a health center in Rasht city in 2007. 19th National Congress of tuberculosis; Zanjan, Iran 2008. p. 20.
 23. Tavakoli A. Incidence and Prevalence of Tuberculosis in Iran and Neighboring Countries. *Zahedan Journal of Research in*

- Medical Sciences 2017;19(7):e9238. [Doi:10.5812/zjrms.9238]
24. Rajeswari R, Balasubramanian R, Muniyandi M, Geetharamani S, Thresa X, Venkatesan P. Socio-economic impact of tuberculosis on patients and family in India. *The international journal of tuberculosis and lung disease*. 1999;3(10):869-77.
25. Hazrati S, Khaligh N, Moeini A, Amani F, Barak M, Rahimi G, et al. Epidemiology of Tuberculosis in Ardabil City from 2005 to 2010. *Journal of Health*. 2013;4(2):103-9.
26. WHO. World Health organization global tuberculosis: Tuberculosis 2018 [Available from: <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>]
27. Rajagopalan S, Yoshikawa TT. Tuberculosis in the elderly. *Zeitschrift fur Gerontologie und Geriatrie*. 2000;33(5):374-80. [PMID: 11130191]
28. Caylà JA, Orcau A. Control of tuberculosis in large cities in developed countries: an organizational problem. *BMC Medicine*. 2011;9(1):127. [Doi:10.1186/1741-7015-9-127]
29. Owiti P, Onyango D, Momanyi R, Harries AD. Screening and testing for tuberculosis among the HIV-infected: outcomes from a large HIV programme in western Kenya. *BMC Public Health*. 2019;19(1):29-. [Doi:10.1186/s12889-018-6334-4]