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Evaluation of Active Tuberculosis Case Finding in Shirabad Region of Zahedan

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Abstract

***Background*:** One third of world population is infected with TB germs. If untreated, each TB patient infects 15-20 people. Therefore, the rapid diagnosis of infectious TB patients is the basis to prevent from tuberculosis. Therefore, proper utilization of the methods of TB disease is very important. This study was conducted to evaluate the efficacy of active intervention in high risk areas of Shirabad of Zahedan city.

***Materials and Methods*:** In this study, two methods of house to house visit and face to face training were used to. All residents of above 6 of Shirabad, who were 55845 people, were examined for tuberculosis from mid-July to December 2008 (with emphasis on the detection of pulmonary TB). The evaluation was performed based on clinical symptoms (more than 2 weeks coughing), sputum smear and chest radiography. Data collected analyzed by the software SPSS-13.

***Results*:** Infectious TB disease had a significant increase within 2 years (320% in 2007 and 500% in 2008 (p=0.001). The incidence was significant in different nations. It had significant increase in Iranian population (p=0.001) and significant decrease in non-Iranian population (p=0.001). Reduced delay in diagnosis of non-Iranian women made smear significantly positive (p=0.014).

***Conclusion*:** The results showed that active intervention is effective in the discovery of infectious TB cases with 100% efficiency of passive TB screening. To treat patients effectively, efficient and effective DOTS strategy is the main underlying prerequisite for active intervention.

Introduction

Tuberculosis is one of the oldest infectious diseases associated with human and currently, among microbial diseases, it is the most common killer of adults (even more than AIDS and malaria). So far, a third of world population is infected with TB [3-1]. It is estimated that annually 9 million new cases of smear-positive pulmonary tuberculosis (a contagious form of tuberculosis) occur and annually 2.5-3 million people die of this disease; while all of tuberculosis caused deaths are preventable [1, 3]. More than 90% of TB cases and deaths occur in developing countries. Following the increase in the incidence of tuberculosis as a public health problem, World Health Organization in 1993 declared the disease a global emergency [1].

Many countries with abundant cases of patients have failed to achieve screening and treatment success of infectious TB disease (smear positive). This is mainly due to poverty, population growth, migration and the increase of TB cases due to epidemic HIV, inappropriate access of high risk groups to diagnostic and medical facilities, poor management and lack of support by health policy makers [1]. If untreated, the person suffering from smear positive pulmonary tuberculosis can infect 15-20 people 5-10% of which will develop tuberculosis. Thus, full diagnosis and treatment of TB patient is the basis to prevent and control TB patients in the communities [1, 3].

Cough is the most common symptoms of active tuberculosis. Patients with 2 or more than 2 weeks of cough, especially in endemic areas, should be studied by patient survey [3]. To improve and accelerate the process of tuberculosis disease, World Health Organization emphasize a symptomatic screening based on the emphasis on patients with 2 to 3 weeks of cough. Although no significant difference observed between below and over 2 weeks of cough in tuberculosis screening [5, 6].

TB disease will be diagnosed both passively and actively. Passive approach is defined as detection of active TB in symptomatic patients who refer to medical centers and is common in many countries including Iran in terms of convenience and lower cost [1, 3]. Active screening is limited to high risk populations such as dense populations (prisons, rehabilitation centers, camps, and nursing homes), patients with weak immune systems and those employees of health system who are at high or moderate risk in terms of exposure and infection of TB

[1]. The impact of active screening on the incidence rate through mathematical models suggests specific effects on reduction of TB cases. Several factors including effectiveness (considering the number of cases detected and results of treatment), demographic effects (considering reduction of the incidence and transmission of disease), required resources (personnel, instrument and equipment) and respective financial burden should be considered in assessing the value of the screening method [8, 9].

In the study conducted in 1997 in Mexico in seven poor suburbs, on patients of over 14 referred with symptoms of cough PHC centers, the value of the revealed positive pulmonary TB was equivalent to 11.1% of patients which had a direct correlation with the regional poverty [10]. In the review of Tupasi on the urban poor people in Philippine, chest radiograph and tuberculin skin test were performed through sputum smears screening method, 66% incidence of TB was obtained equivalent to 6.5% ARI (annual risk infection) which was significantly higher than the general population of the city [11].

In the study of Verver conducted in 1998 in the Netherlands, screening for tuberculosis in the immigrant population, in addition to faster discovery of patients and requirement for less hospitalization by reducing symptomatic period of the disease, indicated the reduction of disease transmission period approximately by 33% [12]. The study of Den Boon conducted in South Africa on symptoms and results of treatment of TB cases which were discovered actively and passively, concluded that although actively discovered cases have less clinical symptoms, activate screening is able to identify a significant number of existing cases and reduce the risk of contagion [13]. Although the studies conducted in Iran are largely emphasized on prisoners and HIV/AIDS patients, regardless of the obtained results, shows the increasing need of TB control program for active interventions regarding TB screening [14-21].

In Iran, 50% of TB disease burden is concentrated in seven provinces among which Sistan & Balouchestan is the most important. This is because of specific geographical factors of the region (1200 km of dirt land with 2 infected countries, i.e. Pakistan and Afghanistan) along with other factors underlying the disease. Major non-Iranian population resides in the city of Zahedan (provincial capital). The city is the most populous city of the province and covers about 40% of TB patients registered in the University, approximately 20-25% of which are non-Iranians and mainly Afghans.

Shirabad is one of the marginal areas of Zahedan which contains the highest non-Iranian population (25-30% of the under coverage population) due to its proximity to Afghan border and marginal settlement problems including poverty, addiction, and low education level of the population. Hence, it has been among the high risk areas of tuberculosis. But since according to the national screening expectations, passive screening in this region was above 100% of the expected limit at least within 3 years before the study and considering the treatment improvements index above 90% during the intended years, this question was raised that in high-risk population groups (that have more than 2 or 3 TB risk factors), whether achieving the result of 100% in the passive screening fulfills the objectives of TB control program or not? Thus, considering the favorable context in Shirabad in terms of high DOTS quality and the optimal improvement rate of above 90%, this study was designed and conducted aiming to examine the effectiveness of active screening in high-risk populations living in Shirabad of Zahedan.

Materials and Methods

The study population was 55845 subjects over 6 years old who were living in Shirabad of Zahedan and receive health services from Valiasr health center and its 3 affiliated centers. This population includes 9379 households 2733 (29%) of which were non-Iranian and Afghan. Given the strong implementation of governmental policy of returning non-Iranians to their country from 2007, in 2008, this represented a certain decline in non-Iranian population residing in Shirabad which affected the plan results. The plan was conducted through screening method. The study objectives were explained to all households and those who refused cooperate along with absent households and children under 6 were excluded.

Finally, 40816 people were investigated in the form of 7961 households (73% of the population and 85% of households).The plan was implemented by eight groups of 2 consisting of a disease fighting expert and a local health volunteer from the middle of August 2008 to December 2008 as house to house visit.

Given the low literacy level of population, poverty and addiction as significant risk factors for tuberculosis in Shirabad and to enhance the effectiveness of intervention, face to face training was presented to all households through health volunteers. Tuberculosis educational leaflets were also given to literate households. Suspected people were identified according to more than 2 weeks of cough were introduced to the laboratory after completion of screening form No.1 (standardized governmental form). Patient forms used in the plan were encoded and recorded in a separate notebook in the laboratory.

Results of the sputum samples taken were daily followed up, and cases which were the result of positive sputum smear were recorded and treated through diagnosing smear-positive pulmonary TB, while obtaining free chest radiography at Seyed-al-Shohada radiology center affiliated to health system.

The cases where sputum smears results were negative, while obtaining a chest radiograph, they underwent non-specific antibiotic therapy by doctors of Valiasr health center and if symptoms continued after completion of the treatment period, sputum smear and sputum culture were performed again. Smear positive and negative pulmonary tuberculosis was considered as follows based on standardized definitions of national TB control program: Smear positive pulmonary tuberculosis: 1- At least two

AFB positive sputum smear tests 2-One AFB sputum smear positive test along with confirming chest radiographic changes 3- An AFB sputum smear positive test and an AFB sputum positive culture. Smear negative TB: 1-The disease with two series of three-sample smear negative tests along with chest radiographic changes confirms pulmonary tuberculosis which has not been improved despite 10-14 days broad-spectrum antibiotic treatment. 2-Severely ill patient with a series of sputum smear negative test (minimum 2 samples) with confirming chest radiographic changes 3-Direct AFB sputum smear negative with positive sputum culture

In terms of the time of paraclinic reviews and evaluation of education impact on the screening process, the results obtained from mid-August to March 2009 were collected and compared with the same period last year when the passive screening was performed.

The respective results were studied using χ^2 test and by software SPSS-13. Since in this study, cases of occurrence or discovery of tuberculosis in different years are used together; in other words, the numbers the incidence or discovery compared from χ^2 test are used. Student *t* test was used to compare means. Statistical significance level was considered $p<0.05$.

Results

In this project, 205 suspected cases were recorded in 163 of which were fully reviewed [15]. TB patients were found among which 8 cases were new smear positive, a case was relapsed, 5 cases were smear negative and one case was extra-pulmonary. Among them, 10 cases were Iranians (5 new smear positive, 3 smear-negative, 1 case of extra-pulmonary and 1 recurrence) and 5 non-Iranian cases (3 new smear positive and 2 smear negative).

Since intervention was conducted in two forms of screening and training and completed studies were completed until the end of 2009. The impact of the performed intervention was determined through comparing 2007 and 2008 from mid-August to the end of the year.

From mid-August 2007 to March 2008, 38 TB patients (Table 1) and in the same period in 2008-2009, 45 patients were recorded which are represented in table 1 separately by TB type, gender and nationality. In other groups, data collection error is likely. The results showed that gender ratio of patients was at 2 similar years and included 66% women and 34% male. National ratio of patients in 2007 (29% Iranians and 71% non- Iranians) was significant ($p=0.001$), but it was not significant in 2008 (41% Iranians and 59% non-Iranians) ($p=0.072$) which was due to reduction of non-Iranians which was a result of implementation of the project to return non-Iranians to their country.

The mean age of men and women in 2007-2008 (men 55.5 and women 44.9 in the year) was not significant. But this difference in 2008-2009 (men 64.5% and women 44% in the year) was significant ($p=0.044$). Also, the mean age of non-Iranian men and women in 2008 (men 65.4% and women 44/4% in the year) was significant ($p=0.044$). In both cases, it was due to the discovery of TB in younger women (Table 2).

Smear-positive pulmonary TB screening and all forms in the total population ($p=0.001$) was significant separately by Iranian nationality ($p=0.001$) and non-Iranian nationality ($p=0.001$) (Table 3).

Regarding occurrence changes, it should be noted that although 12 per one hundred thousand of increase obtained in the incidence of tuberculosis smear positive (39 per one hundred thousand in 2007 and 51 per hundred thousand in 2008) without consideration of nationality, was not statistically significant within 2 years.

However, incidence variations, in smear positive pulmonary tuberculosis, smear negative pulmonary tuberculosis and all forms of TB; was significantly increased in Iranian population and was significantly decreased in the non-Iranian population mainly due to reduction of non- Iranian population residing in this region (Table 4).

It is noteworthy that incidence difference of smear positive pulmonary tuberculosis in Shirabad (32.7 per hundred thousand) and the city of Zahedan (27.2% per hundred thousand) was not significant in the entire 2007-2008, but in 2008-2009, this difference (Shirabad 47.3% per hundred thousand and Zahedan 25.2% per hundred thousand) was significant ($p=0.001$).

Smear-positive pulmonary tuberculosis screening in 2008-2009 is about 5 times as much as 2007-2008 and 6 times as much as the state expected limit. Screening all forms of TB was also 2.5 times as much as 2007-2008 (screening all forms of TB disease has no state expected limit).This indicates the significant increase of screening and the discovery of contagious TB cases in this study.

Smear positive pulmonary tuberculosis and all forms in the total population ($p=0.001$) separately by Iranian nationality ($p=0.001$) and non-Iranian nationality ($p=0.001$) were significant. The incidence of smear-positive pulmonary TB, smear negative and all forms of tuberculosis has increased, but in all cases it has significantly increased in Iranian population and has significantly decreased in non-Iranian population which is mainly due to reduction of non- Iranian population Shirabad due to returning non- Iranian population to their country. In the cases mentioned above, the occurrence is not significant regardless of nationality. Delayed diagnosis of tuberculosis separately by tuberculosis type, gender and nationality within 2 years did not decrease in other groups except in non-Iranian women with positive smears. In this group, due to restrictions on access to health services and reduction of significant delay, it indicates the impact of active intervention. Data collection error in the other groups is likely.

Discussion

The result of house –to- house survey with enhanced case finding in our intervention showed the effectiveness of intervention both in the discovery of smear positive TB and all forms of TB. This effect in Iranian population was increased it was significantly decreased in non-Iranian population.

Table 1. Gender and nationality distribution of TB patients registered from mid-August to March 2007 in shirabad of Zahedan

Type of tuberculosis	Iranian				Non Iranian				Total	
	Female		Male		Female		Male			
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
New smear positive pulmonary tuberculosis	1	6	2	3	6	6	7	5	16	20
New smear negative pulmonary tuberculosis	1	4	0	2	8	4	0	2	9	12
New extra pulmonary	3	4	1	0	3	1	1	2	8	7
Relapse	2	0	0	0	1	3	0	0	3	3
Others	0	0	1	0	0	2	1	1	2	3
Total forms	7	14	4	5	18	16	9	10	38	45

Table 2. The mean age of TB patients registered from mid-August to Mar (the end of hejri shamsi year) in 2007 and 2008 in Shirabad

Year	Iranian			Non Iranian			Total		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
2007-2008	43.7	85.5	49	45.4	54.2	48.3	44.9	55.5	48.5
2008-2009	43.4	62.4	48.7	44.4	65.4	52.6	44	64.5	51

Table 3. TB Case finding index in 2007-2008 in Shirabad of Zahedan

Case Finding	Iranian			Non Iranian			Total		
	2007	2008	*p*-Value	2007	2008	*p*-Value	2007	2008	*p*-Value
New smear positive pulmonary tuberculosis	86%	400%	0.001	1300%	956%	0.001	354%	500%	0.001
Total forms	148%	365/7%	0.001	1326%	1032%	0.001	402%	519%	0.001

Table 4. Incidence variations of smear positive pulmonary tuberculosis in 2007 and 2008 in Shirabad

Incidence	Iranian			Non Iranian			Total		
	2008	2009	*p*-Value	2009	2008	*p*-Value	2009	2008	*p*-Value
New smear positive pulmonary tuberculosis	9.3	38.6	0.001	146.9	95.6	0.001	39	51	0.206
New smear negative pulmonary tuberculosis	1.8	15	0.002	85.7	48.8	0.001	21.9	30.4	0.267
New extra pulmonary	10.9	9.4	0.655	32.9	41.8	0.299	19.5	17.7	0.746
Total forms	34	80.4	0.001	305	227	0.001	92.5	114	0.144

The similar study conducted by Dr. Ghane in 2001 on Afghan immigrants in Kavar of Shiraz, showed no significant difference in terms of active and passive screening methods which can indicate that similar social groups have no similar incidence and risk factors in different conditions [15]. A large number of performed interventions have been successful depending on the desired goal; goals such as discovery of new unknown cases, prevalence estimation, targeted resources, and short-term incidence decrease, more rapid detection of patients and assessment of the success of existing systems in the detection of TB cases [9].

In a survey conducted by the author in 2004 on clients of Imam Khomeini Relief Committee in Zahedan, who had referred to obtain annual coupon, 13 cases of TB patients were discovered that was about 10 times as much as the incidence rate of smear positive pulmonary tuberculosis in the population residing in Zahedan. In the conditions where these clients' visit had no medical aspect and was only to receive support services, the results indicate the high turnover of microbes in high-risk populations in areas with high incidence.

Obviously, with 14-day intervention performed, the infection of about 200 people and affliction of at least 10 others were prevented. Study of Murray et al. showed that the strategy of active screening along with DOTS in countries with high prevalence of tuberculosis will have many benefits, and can stop millions of new cases and death [22].

In the study of Verver in the Netherlands and den Boon in South Africa, active intervention of screening along with faster discovery of patients and shortness of symptomatic period decreases contagion period to 33%. However in our study, the time of onset of symptoms till the time of discovery of smear positive pulmonary TB was significant, except in the female population (this reduction was significant in non-Iranian women p=0.014). In other groups, not only it did not decrease, but it increased, which can be for two reasons of short distance of comparison as well as human errors in description taking [12, 13].

Study of Ward in Canada showed that in ages below 19, the screening method becomes significant, but it had no effect at older ages. However, regardless of age group under 19 (which is not available in this study), this study shows the difference of efficacy of screening method in old age, in areas with different incidence [23]. Although active screening is often costly, but 44-year review of Golub et al. on methods and techniques used in active interventions in 1966 has shown that despite high expense of active screening, in areas with high burden of tuberculosis, active screening along with desirable and strong DOTS, has the potential to reduce the incidence in these areas [9].

According to the nature of the underlying causes of disease and speed of its spread, and several studies conducted on the effectiveness of active interventions, it seems that regardless of required costs and resources, active interventions of screening will be a practical efficient action to reduce tuberculosis spread reservoirs. Obviously, the initial prerequisite for performing such interventions will be strong DOTS to provide appropriate full treatment to the discovered patients in line with the successful removal of spread centers.

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Authors' Contributions

All authors had not equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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