Framework for Establishment of a Comprehensive and Standardized Administration System for Prevention and Control of Tuberculosis in College Student Community in China

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Abstract

Background: College student community is the one with high risk of tuberculosis (TB). A systemic and standardized administration model for prevention and control of TB is significance in controlling TB spread in universities. Currently, the universities in China have not established the comprehensive and standardized administration system for TB prevention and control in college student community.

Methods: Firstly, the literature research and brainstorming method (n=13) were used to construct the clause and subclause pool for the administration of TB prevention and control within college student community in 2014. Secondly, a total of twenty experts in the field of TB prevention and control who are representatives of the east, west, south and north parts of China were selected and invited to participate the Delphi letter-inquiry. After two rounds of letter-inquiry, the opinions of the experts reached a consensus and the framework for the administration system was constructed.

Results: A framework for the administration system was constructed, which included 8 first class indexes, 26 second class indexes and 104 third class indexes.

Conclusion: The results are highly scientific and reliable, which can be helpful for improving the systemic and standardized levels for the administration of TB prevention and control in universities in China and perhaps in other developing counties with high TB burden as well.

Keywords: College students, Tuberculosis, Delphi method, Brainstorming method

Introduction

Tuberculosis (TB) is distributed widely in the world. As many as 9 million cases of the active TB were estimated in 2013. Among which, 1.5 million cases died of this disease (1, 2). The TB cases in 22 countries with high TB burden accounted for 82% of the total TB cases in the world. TB is still one of the most important fatal diseases that poses the serious threat to the public health and thus, has become one of the important public health issues in the world (3, 4). China is one of the 22 countries with high TB burden. There are over 500 million people infected with M. tuberculosis in China. The TB cases account for approximately 25% of the total TB cases in the world, making TB cases in China the second place in the world (5, 6). TB cases in China are still increasing in the rate of 60.76/100,000. Thus, TB epidemic in China is extremely serious (7). Among all the communities in society, the college student community has become the one with

high TB risk. In China, because during the last two decades, almost all the universities have rapidly expanded their enrollment scales and the numbers of enrolled students in campus have been dramatically increased. Almost all the students from freshmen to senior grades in universities are living in the student dormitories. They live in dormitory rooms with high residential density where they contact each other more closely and frequently. Furthermore, the mobility of student population is very high. All these features make college student community become the one with high TB risk. In abroad, the TB rates among the college students in other countries, especially in the developing countries, are also high. For instance, a more recent study reported that among 10,036 college students in Northwest Ethiopia investigated, 36 students had TB. The TB rate among college students in Ethiopia was increased from 297.6/100000 in 2009 to 404/100000 in 2011(8). Thus, great attention should be given to the global public health issue for college students as the potentially high TB risk.

Strengthening the administration system of TB prevention and control among college students is essential to reduce TB incidence in universities. In dealing with the problems existing in the administration system of TB prevention and control in universities, the investigators in both China and other countries have conducted some studies. Certain progresses have been made in the aspects of TB prevention and control (9-11), early detection of TB patients (12-14), TB detection and warning (15-17) and health promotion (18-20). However, the current studies are mainly confined to analyze or resolve the problems in certain aspects. TB prevention and control among college students in China are guided mainly by the China's Working Guidelines to the Implement of Prevention and Treatment of Tuberculosis (designated as "Guidelines" here) (21), but the Guidelines is the programmatic documents that guide the administrative work on the TB prevention and control in China in general and have a wide range of application. In term of the particular community, the "Guidelines" can only provide the frame guide but cannot take the actual difficulties in the work of TB prevention and control for college students into full consideration. For effective administration of TB prevention and control among college students in China, it is essential to construct a comprehensive and high efficient system used to standardize and guide TB prevention and control among college students in China. Therefore, this project group applied the funding for the research project "Construction of GIS-based administration system for prevention and control of tuberculosis in college students in universities in China and its application" from China's National Science Foundation, used "Guidelines" as the general guide, absorbed and referred the related experiences to construct an administrative system and achieved the standardization and informationization for the administration of TB prevention and control in college students in universities.

Methods

The literature search method, the brainstorming method and the Delphi method were used in this study. The whole technical flow chart is shown in Fig.1.

Literature Search and Brainstorming Meeting

Through searching the relevant papers in the literature about TB prevention and control in university campus in both China and other countries and comprehensively incorporating the relevant national policies and guidelines for TB prevention and control and the current situation of the administration departments for TB prevention and control at all levels and the university's hospitals, we preliminarily formulated a clause and sub-clause pool for the administration system for TB prevention and control in university campus. The data for TB status among general population and college students in China were mainly derived from the Database (22).
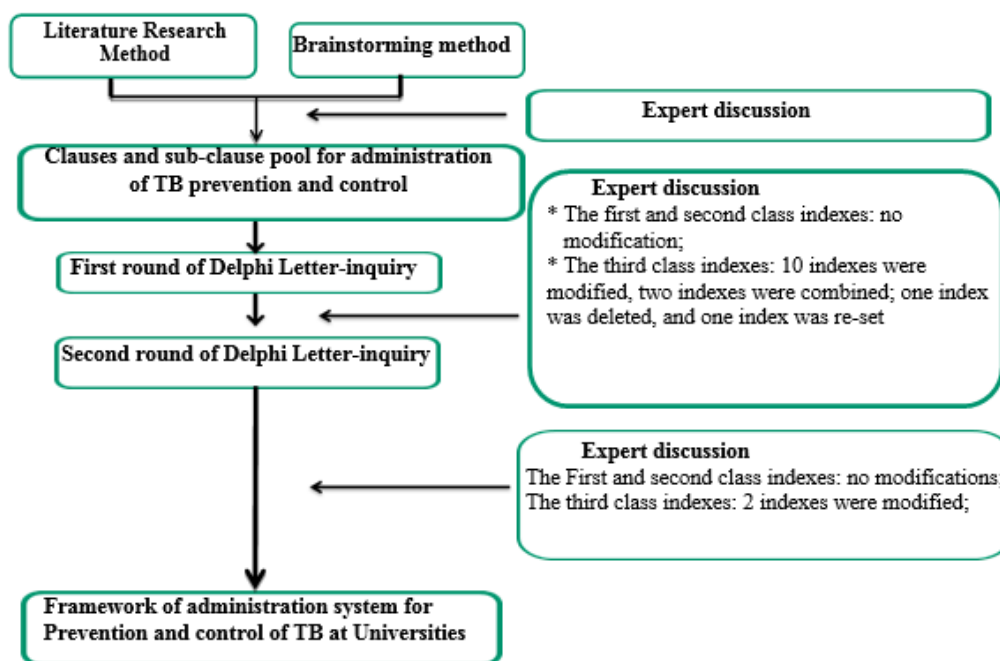
Fig. 1: Technical flow chart

The brainstorming meeting was used to find a conclusion for administration of TB prevention and control among college students. Thirteen experts were selected from Shaanxi Province for brainstorming meeting. Among them, seven members were the personnel from the administration departments for TB prevention and control at the provincial, prefecture city, and county levels. Four members were the personnel in charge of TB prevention and control at university hospitals. One member was the expert of clinical TB diagnosis and one member was the research expert in administration system of TB prevention and control in university campus. In Jun 2014, a brainstorming meeting with focus on "*construction of clause and sub-clause pool for the administration system for TB prevention and control in university campus*" was held in Xi'an City, Shaanxi Province. In this meeting, an initial clause and sub-clause pool for the administration system for TB prevention and control in university campus was formulated.

The initial clause and sub-clause pool formulated by using literature research method and brainstorming methods, respectively, were combined together to construct a preliminary framework pool for the administration system for TB prevention and control. Finally, five expert members, including 4 from the TB prevention and control at the provincial and prefecture levels and one research expert in TB prevention and control in university campus, were selected and formed an expert group. This group discussed the formation of preliminarily framework pool for TB prevention and control and the framework of the clause and sub-clause pool consisting of 8 first class indexes, 26 second class indexes and 107 third class indexes for the administration system of TB prevention and control in university campus was constructed.

Delphi method
Delphi method is a systematic analysis method applied in the field of opinion and value judgment (23). With this method, the opinions of experts are collected by several rounds of letter-inquiry or interviews. The consensus is finally reached and the judgment is made. We used the modified Delphi method, including two rounds of letter-inquiry during the period from Jul 2014 to Sep 2014.

Selection of Experts

While for the modified Delphi method, there is no the uniform requirement for the number of experts for participating letter-inquiry, it could be appropriate to have 15-50 experts for Delphi letter-inquiry (24, 25). Thus, 20 experts were selected to participate in the Delphi process by letter-inquiry. The results of letter-inquiry have a national coverage, which can be applied nationally. The experts were selected from the east, west, south and north parts of China. All the experts selected were engaged in the administration in the agencies for TB prevention and control at national, provincial or municipal levels for at least 5 yr. During the process of selecting experts, we firstly communicated with the expert candidates and gave them the detailed explanation of the research contents and purposes. We decided to select those candidates interested and willing to participate as the experts of letter-inquiry. The basic information about consultant experts is shown in Table 1. The authority coefficient of these experts was 0.88.

Table 1: The basic information about consultant experts

Educational level	Number (%)	Title	Number (%)	Years of work	Number (%)
Above undergraduate	7 (35)	Physician in-chief	14 (70)	<10	9 (45)
Undergraduate	11 (55)	Associate physician in-chief	3 (15)	10-20	6 (30)
Below undergraduate	2 (10)	Investigator	3 (15)	>20	5 (250)

Design of questionnaires for Delphi investigation

We used the framework of clause and sub-clause pool obtained by applying the literature search, brainstorming meeting and Delphi methods to prepare and design the questionnaires for letter-inquiry and then invited the experts in TB prevention and control to evaluate these questionnaires and to give their corresponding opinions, rationality and clarity. The questionnaires were modified according to the opinions and suggestions provided by these experts, and then, the modified Delphi questionnaires were used as the survey tool for expert letter-inquiry.

The questionnaires for letter-inquiry included four parts: 1) the general information about the experts; 2) explanation of Delphi consultation method with letter-inquiry, introduction into the research contents, research field and instruction for how to complete the investigation questionnaires; 3) The expert's authority; and 4) the judgment of experts on the importance of each clause and sub-clauses, the degree of familiarity with the of the clause and sub-clauses and the basis of their judgment. A column for remarks was set following each clause and sub-clause so that they were convenient for experts to provide their opinions for revision and modification.

The experts were requested to evaluate the importance of each index. The importance was divided into three classes according to their priority: important, relatively important and not important. The degree of familiarity of experts with these indexes was divided into three classes according to priority: familiar with, relatively familiar, and not familiar. The basis for expert's judgment on these indexes was routinely divided into four aspects as follows: theoretical analysis, practical experience, literature in Chinese and other languages, and the instinctive judgment. The experts made their judgments based on their own situations.

The questionnaires for second round of letter-inquiry included the feedbacks of the results of the first round of letter-inquiry and the clause and sub-clauses after screening and requested the experts to make their judgment again on the importance on the clause and sub-clauses until the all experts reached the consensus.

Implement of Delphi method

The questionnaires were sent to experts and retrieved from them via email. The duration of letter-inquiry was two wk. Before the closing date, the investigators reminded the experts via email. The screening and revision of the clauses and sub-clauses for questionnaires were conducted by using the bounding method. The opinions of experts and the actual work situation were taken into comprehensive consideration. At the end of the first round of the letter-inquiry, statistical analysis was conducted. The questionnaires for the second round of letter-inquiry were designed after discussion. The modified questionnaires were sent to the experts timely. The experts scored again. After statistical analysis and comprehensive analysis on the opinions provided by the experts, clauses and sub-clauses were revised. When the opinions of experts reached a consensus, the letter-inquiry was closed.

Statistical Analysis

The statistical software SPSS 18.0 (Chicago, IL, USA) was used to conduct statistical analysis on the results obtained from the first and the second-rounds of Delphi investigation.

We mainly used the bound value method to screen and evaluate these indexes. The percentage of full marks, arithmetic mean and analysis of variance were calculated according to the importance score for each index. The method used for calculating bound values of the percentage of full marks and the arithmetic mean was: bound value=mean value –standard deviation. The indexes with scores higher than bound value were selected. The calculation method for bound value of analysis of variance was: bound value=mean value + SD. The indexes with scores lower than bound value were selected. In order to avoid the elimination of the important indexes, only those indexes that did not meet the requirement for the levels of three measurements mentioned above were deleted. For those indexes that did not meet the requirement of the levels of one or two measurements, they were either selected or deleted according to the actual situation after discussion.

Results

For the Delphi method, the degree of consensus of expert's opinions was expressed as the mean assignment value for the importance of clause and sub-clauses. The mean scores for the importance of the first, the second and the third class indexes given by experts in the first round were 2.66±0.48, 2.58±0.45 and 2.46±0.57, respectively. The mean scores for the importance of the first, the second and the third class indexes given by experts in the second round were 2.73±0.43, 2.67±0.47 and 2.65±0.49, respectively. During the two rounds of letter-inquiry for expert consultation, analysis of variance was conducted on the concordance coefficient of expert's opinions on the importance of the first, the second and the third class indexes. The P values corresponding to χ^2 were all <0.05, indicating that the concordance of the expert's opinions is quite good. The concordance coefficient of expert's opinions and significant test are listed in Table 2.

Table 2: The concordance coefficient of expert's opinions and significant test

Round	The level of index	Number of indexes	Kandill's coefficient (W)	Chi-squareχ^2	Degree of freedom (DF)	P value (<)
First	First Class	8	0.200	27.992	7	0.05
	Second class	26	0.200	150.479	25	0.05
	Third class	107	0.302	438.683	106	0.05
Second	First Class	8	0.207	26.288	7	0.05
	Second class	26	0.221	81.487	25	0.05
	Third class	107	0.192	286.2	103	0.05

After closing the Delphi letter-inquiry, we organized a discussion meeting for the experts in the field of TB prevention and control to determine finally the framework for the system. A total of eight participating experts included five personnel for prevention and control of TB at provincial, prefecture-level city and county (district) levels, one expert in clinical TB diagnosis, two research experts on TB prevention and control in universities. After discussion, all the experts agreed with the research results obtained with Delphi letter-inquiry and they finally confirmed framework for the system consisting of a total of 8 first class indexes, 26 second class indexes and 104 third class indexes. Because the detailed indexes table is very bulky and large, the 8 first class indexes and the 26 second class indexes were presented in appendix Table 1.

Discussion

The framework was constructed based on the "Guidelines" by taking the particularity of college student community and the status of the real work into consideration. This framework is an improvement of the existing administrative measures.

In this study, we selected 20 experts with expertise in TB prevention and control representative for different parts of China to participate in the letter-inquiry and authority coefficient of these experts was 0.88. A related study indicated that the authority coefficient of these experts of 0.7 or higher was acceptable and when this coefficient was higher than 0.8, the experts had relatively high certainty on the selection of the contents (26). Therefore, the experts selected to participate Delphi letter-inquiry are suitable and the results obtained are reliable. Moreover, other studies reported that the basic requirement for Delphi letter-inquiry is that returning rate of the questionnaires should be at least the 50% and that 60% of returning rate was better and 70% of returning rate was very good (27, 28). In this study, the returning rates of questionnaires for both the first and the second-rounds of letter-inquiry were 100%. 60% and 45% of experts provided their

constructive opinions in the first and the second-rounds of letter-inquiry, respectively, indicating that the consultant experts have a relatively strong support and high activeness toward the establishment of the administrative system for TB prevention and control in universities. The results obtained from application of Delphi method were based on the opinions of a number of experts. Thus, the degree of the concordance of their opinions among different experts is extremely important for the study results. After two rounds of letter-inquiry, the significant tests for the concordance coefficients for various indexes revealed that the mean P values for the corresponding indexes were all less than 0.05, indicating that the opinions of these experts tend to be of consistency and that the concordance is quite good. Thus, the results obtained from this study can be recommended.

Advantages and limitations of this study
In this study, the framework for the administration system for TB prevention and control among college students by referring the "Guidelines" is constructed, played important roles in standardization and guide of the work in TB prevention and control in general population. Additionally, during the study process, we applied literature research, brainstorming and Delphi methods and took the measures for strict quantitative control. After two rounds of letter-inquiry, the opinions of experts reached consensus. Thus, the established administration system for TB prevention and control in universities are scientific and reasonable. In spite of this advantage, there are still some limitations. The obvious one is that this administration system has not been systematically applied in real work yet. Thus, this system needs to be re-evaluated and improved according to the actual results after being implemented.

Conclusion

This work is the further exploration for improving the administration of TB prevention and control in university and is helpful for the standardization of administration of TB prevention and

control in universities in China and in turn, to improve the administrative levels of TB prevention and control. The established framework of the administration system still needs to be systematically verified in actual work. However, with the rapid development of informatization, the administration of the informatization for TB in universities also needs to be continuously updated and the warning and monitoring system needs to be further improved, so that the TB can be controlled effectively.

In the subsequent study, we will conduct in-depth study in this aspect and make this system perfect. While this study is conducted mainly for college students in China, the established framework for the administration system for prevention and control of TB in college students may also provide the reference for the administration of prevention and control of TB in college students in other countries, especially in the developing countries with high TB burden.

Appendix

The framework for the administration system for prevention and control of TB in college students and the degree of consensus of opinions and coefficient of variation for the second-round of letter inquiry

Index	Mean	standard deviation	Coefficient of variation
A1 Service system	2.9	0.3	0.11
B1 Organizational guarantee	2.8	0.4	0.16
B2 Personnel Guarantee	2.9	0.3	0.11
B3 Facility/Equipment Guarantee	2.4	0.5	0.21
B4 Funding Guarantee	2.9	0.3	0.11
A2 Health promotion	2.9	0.4	0.13
B5 Strategies and planning	2.6	0.5	0.19
B6 Health Education	3.0	0.2	0.08
B7 Environmental Support	2.5	0.5	0.21
A3 Finding the students with TB	2.9	0.3	0.11
B8 Daily monitoring	2.9	0.3	0.11
B9 Report and referral	2.9	0.4	0.13
B10 Screening the persons who have close contact with TB patients	2.8	0.4	0.15
B11 Admission of TB patient and diagnosis	2.6	0.7	0.27
B12 Verification and follow up	2.8	0.4	0.16
A4 Management of therapeutic treatment	2.8	0.4	0.15
B13 therapeutic treatment at the university location	2.6	0.6	0.23
B14 Therapeutic treatment in student's home location	2.5	0.6	0.24
B15 Taking care of the Student TB patients	2.5	0.5	0.21
A5 Response to emergency and the unexpected events	2.9	0.3	0.11
B16 Report of epidemic surveillance	2.9	0.5	0.17
B17 Field investigation and handling	2.9	0.3	0.11
A6 Personnel Training	2.8	0.4	0.16
B18 Planning	2.4	0.5	0.21
B19 Implement	2.9	0.4	0.13
B20 Evaluation	2.5	0.5	0.21
A7 Supervision and Urge	2.4	0.6	0.25
B21 Preparation before supervision	2.3	0.6	0.28
B22 Supervision in site	2.7	0.6	0.21
B23 Summing up supervision	2.3	0.7	0.29
A8 Information administration	2.6	0.6	0.23
B24 Information input;	2.7	0.6	0.22
B25 Analysis and utilization	2.8	0.6	0.20
B26 Safety Administration	2.4	0.6	0.25

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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