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Original Article

Evaluation of occupational tuberculosis prevention in a brazilian hospital

Avaliação da prevenção de tuberculose ocupacional em um hospital brasileiro

Evaluación de la prevención de la tuberculosis ocupacional en un hospital brasileño

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Objective: to assess the institutional processes for preventing occupational tuberculosis. **Methods:** this is a quasi-experimental research in a pre and post-intervention model (3 phases), conducted in a Brazilian hospital. Specific quality indicators were used for assessment structure (physical and educational resources) and process (52 direct observations of compliance to the use of N95 mask at each stage). **Results:** the compliance rates were 33.0% and 94.2% in the pre-intervention phase; and 44% and 100% in the post-intervention phase, respectively, for structure and process. The interventions designed based on initial results of indicators (pre-intervention phase) were structural and educational. **Conclusion:** there was an improvement of the indicators in the post-intervention phase due to the interventions performed, which contributed to improved quality of service.
Descriptors: Tuberculosis; Occupational Risks; Health Care Evaluation Mechanisms.

Objetivo: avaliar o processo institucional de prevenção da tuberculose ocupacional. **Métodos**: pesquisa quasi-experimental em um modelo de pré e pós-intervenção (3 fases), realizado em um hospital brasileiro. Utilizaram-se indicadores de qualidade específicos para avaliação de estrutura (recursos físicos e educacionais) e processo (52 observações diretas da adesão ao uso de máscara N95 em cada fase). **Resultados:** os índices de conformidade foram de 33,0% e 94,2%, na fase pré-intervenção; e 44% e 100% na fase pós-intervenção, respectivamente para estrutura e processo. As intervenções elaboradas a partir do resultado inicial dos indicadores (fase pré-intervenção) foram estruturais e educativas. **Conclusão:** houve melhora dos indicadores na fase pós-intervenção a partir das intervenções realizadas, contribuindo para melhoria da qualidade do serviço.
Descritores: Tuberculose; Riscos Ocupacionais; Mecanismos de Avaliação da Assistência a Saúde.

Objetivo: evaluar el proceso institucional para prevención de la tuberculosis ocupacional. **Métodos**: investigación cuasi-experimental en un modelo de pre y post-intervención (3 fases) en un hospital brasileño. Se utilizaron indicadores de calidad específicos para el marco de evaluación (recursos físicos y educativos) y proceso (52 observaciones directas de adhesión a la utilización de mascarilla N95 en cada etapa). Resultados: Las tasas de cumplimiento fueron 33,0% y 94,2% en la fase previa a la intervención; y 44% y 100% fase posterior a la intervención, respectivamente, para estructura y proceso. Las intervenciones diseñadas a partir de los primeros resultados de los indicadores (en fase de pre-intervención) eran estructural y educativo. **Conclusión**: hubo mejoría de los indicadores en la fase posterior a partir de las intervenciones realizadas, lo que contribuye a mejorar la calidad del servicio.
Descriptores: Tuberculosis; Riesgos Laborales; Mecanismos de Evaluación de la Atención de Salud.

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Introduction

Tuberculosis is a disease of global repercussion and has higher incidence in developing countries, that come to concentrate 80% of cases worldwide[1-3]. In addition to the poor socio economic conditions and insufficient public health policies, these countries face the association of tuberculosis with human immune deficiency virus and the emergence of multidrug-resistant strains that make it difficult to treat the disease and its containment[1,4].

The transmission person-to-person occurs in laryngeal and lung forms, more common in adults, accounting for 80% of cases[1-2]. It is estimated that every person with pulmonary tuberculosis can infect about 10 to 15 people each year and of these 5 to 10% patients become sick throughout life[2-4].

In this context, health professionals are exposed to disease and strains with microbial resistance, mainly in intra-hospital environment that receives most of these patients, usually in the transmissible phase of the disease. Thus, occupational tuberculosis, or that acquired by health professionals, becomes a concern in our daily lives because of the risk of a professional to acquire tuberculosis is high and can be twenty times higher than other individuals[3,5-8]. Therefore, measures to prevent and control the disease are extremely necessary.

The researchers' professional practice brought the perception of the difficulties in the management, treatment and adoption of appropriate prevention and control measures in times when the quality of health has been discussed, and led to reflection on the possibilities of contributing to the improvement of these conditions. Therefore, the development of a research that provides tools to identify weaknesses and propose effective actions was the path chosen to intervene in a situation that is both real and present in most health services.

The possibility of using specific indicators for evaluation of occupational tuberculosis prevention measures led us to the hypothesis that it would be possible to design selected interventions using objective criteria, aiming to improving the institutional process.

Thus, this study aimed to evaluate the institutional process of prevention and control of occupational tuberculosis and the impact of a set of interventions to improve compliance of preventive actions.

Method

This is a descriptive study with quasi-experimental design of pre and post-intervention model with a quantitative approach to evaluate prevention and control of occupational tuberculosis in the hospital.

This research was carried out in a medium-sized hospital in the city of São Paulo, during the year 2013. The choice of the institution was based on the fact that it has high frequency of patient care for suspected or confirmed cases of tuberculosis, mainly in its bacillary forms.

Specific structure and process indicators for occupational tuberculosis were used as evaluation tools. They were previously developed and validated by experts[9].

The indicators used are described bellow: structure indicator: evaluation indicator of technical and operational resource for occupational tuberculosis control. The available resources for occupational tuberculosis prevention and control, regarding to structural and material aspects, norms and educational measures, are evaluated[9-11]. Process indicator: evaluation indicator of workers' compliance to occupational tuberculosis control and prevention measures. It evaluates compliance of health workers to occupational tuberculosis control and risk prevention measures.

Figure 1 shows the characteristics of the indicators used.

Characteristics	Evaluation indicator of technical and operational resources for occupational tuberculosis control	Evaluation indicator of workers' compliance to occupational tuberculosis control and prevention measures
Type	Structure	Process
Evaluation	Evaluates elements of physical structure, physical resources and education, among others.	Evaluates compliance of health professionals to respiratory protection to use of N95 mask.
Formula	[Number of structural components in conformity of the occupational tuberculosis prevention program/ number of components of occupational tuberculosis prevention program evaluated] x 100.	[Number of opportunities in conformity with respiratory protection/number of opportunities to the use of respiratory protection in accordance with the guidelines of the institution] x 100.
Ideal value	100.0%	100.0%
Information sources	Interview and document analysis in the units involved in the process: hospital infection control services, safety and occupational health.	Direct observation.
Analysis Components	- Performance of annual testing of respiratory symptoms; - Performance of tuberculin testing at the annual periodic evaluation; - Presence of flow to refer professionals with suspected tuberculosis for reference units; - Presence of routines to adopt respiratory precautions for aerosols - Presence of rooms with ventilation system, special air filtration and negative pressure; - Evidence of guidance on the prevention of occupational tuberculosis; - Provision of personal protective equipment.	Proper use of respiratory protection (N95 mask), considering the adequacy of the face adjustment and the use according to the recommendations.
Evaluation criteria	Compliance or not to the criteria.	Compliance or not to the criteria.

Source: Adapted[10-11]

Figure 1 - Summary of characteristics of indicators of structure and process for evaluating the program of prevention and control of occupational biological risk for tuberculosis used in this study

Data collection occurred in three distinct phases, as following: Phase 1 - Pre-intervention: the structure and process indicators were applied to assess measures of prevention and control of occupational tuberculosis at the institution. For the indicator of structure, it was applied a specific assessment of the institution by checking the indicator components as shown in Figure 1, through observation, inspection of documents and interviews.

For the process indicator 52 direct observations were conducted to verify compliance to the use of N95 mask, distributed in the four service shifts (morning, afternoon and evening and night) in the sectors that take care of patients with suspected or confirmed pulmonary or laryngeal tuberculosis and that have facilities airborne isolation infection, which are the emergency room, the adult Intensive Care Unit and the clinical ward. The definition of the sample regarding

the number of opportunities to be observed met the recommended by researchers who developed the indicators[9].

Phase 2 - Intervention: in this phase a set of intervening actions was implemented. This actions have not been previously establishe considering that they should be prepared based on the needs identified in phase 1. Phase 3 - Post-intervention: the same indicators of phase 01 were reapplied. Then, there was a comparison between the results of phases 01 and 03 in order to measure the effectiveness of interventions implemented.

Data collection was performed by one of the researchers (E.H.S.) from June 05 to December 15, 2013, using a standardized form to record the structure indicator components and the results of observations of the process indicator.

Data were tabulated in Microsoft Excel® spreadsheet. Data analysis was performed using descriptive statistics, by identifying the percentage of improvement of indicators and comparing them between the pre- and post-intervention phases. Conformity index were calculated according to the formulas shown in Table 1.

The project was approved by the Research Ethics Committee was developed under the number 06/13.

Results

Phase 1 - Pre-intervention: it lasted 40 days. The conformity index rate was 33% for the structure indicator and 94% for the process indicator.

Among the nine items evaluated in the structure indicator, the compliance was not achieved in four, as follows: 1) absence of annual testing of respiratory symptoms by surveying signs and symptoms; 2) absence of tuberculin testing in employees non-reactive at the annual periodic evaluation; 3) absence of guidelines and referencing flow of professionals with suspected tuberculosis to reference units; and 4) partial adequacy of rooms with negative pressure system, special ventilation system and HEPA® (High Efficiency Particulate Air) filters in ventilation, exhaust ducts or mobile units in the four rooms dedicated to this purpose in the institution, since only two of them had the proper system. Consequently, this item was considered in non-compliance.

Regarding the process indicator, from the total of observations, 22 (42.3%) occurred in the adult intensive care unit, 17 (32.7%) in the emergency room and 13 (25%) in clinical ward. As for the professional category, the largest contingent was the nursing technicians and the smallest was physical therapists. The non-compliances identified were regarding failures in the use of N95 mask in three of 52 opportunities observed during the care of patients with tuberculosis and measures to control airborne infection.

An important finding was that despite the N95 mask be provided by the institution, it was only available in two specific points (occupational security service and pharmacy), which would eventually hinder the access to it and hence adherence to its use.

Phase 2 - Intervention: it lasted 04 months, comprising the steps of preparation, submission, approval and implementation of interventions. Interventions aimed to improve the prevention and control of occupational tuberculosis transmission in the institution and were based on the results of structure and process indicators. The interventions were classified into educational and structural, according to their characteristics.

Structural interventions covered the production, development and implementation of investigation and monitoring of respiratory symptoms and establishment of routines for the annual testing of respiratory symptoms by surveying signs and symptoms; the establishment of guidelines and clinical research flow and referring of professionals with suspected tuberculosis for reference units. It was implemented adjustments in the questionnaire used during routine visits and periodic examinations by adding questions to identify respiratory symptoms. Printouts descri-

bing flows for monitoring and standard operating procedure for the management of professionals with respiratory symptoms were prepared.

In the educational intervention, researchers chose to use direct and individual approach of professionals in their work station. At this moment, it was intended to stimulate reflection on conducts in their daily lives and then discuss and answer questions on the subject. Based on the problem-solving method, seven cases were prepared with daily working situations, which were developed based on local observations made in the previous phase. In each unit and period two of these situations were delivered to professionals and they were asked to immediately read them, identifying problems and proposing possible solutions. The success rate of problem-solving situations was 11% (29 right answers of 266 evaluations).

After healthcare workers answered the problem-solving questions, researchers initiated clarification of doubts and guidance on occupational tuberculosis. As feedback strategy, there was later delivery of the same situations with the correct answers, aimed at learning retention. Immediately after this step, it was given an explanatory brochure on occupational tuberculosis, also developed by the researchers. It contained information on the definitions, transmission, diagnostic investigation, prevention, and indication of appropriate personal protective equipment (N95 mask) according to the potential risk situations, where to obtain it and its conservation.

Phase 3 - Post-intervention: This phase lasted 15 days. The indicators have been reapplied in the same way as in the pre-intervention phase. Compliance rates were 44% and 100% for structure and process, respectively. There was no observation in the adult intensive care unit in this period because there were no patients in aerosol precaution. Among the health care professionals observed, the highest percentage was for nursing assistants of clinical ward. Table 1 shows the compliance rates in each professional category observed in pre- and post-intervention.

Table 1 – Number of non-compliance, number of opportunities observed and conformity index on the use of N95 mask according to professional category in pre- and post-intervention

Professional category	Pre-intervention		Post-intervention	
	Non-compliance/ Observed opportunities*	CI(%)	Non-compliance/ Observed opportunities*	CI(%)
Nursing assistant	1/10	90.0	0/33	100.0
Nurse	0/4	100.0	0/4	100.0
Physical therapists	0/2	100.0	0/1	100.0
Doctor	1/3	100.0	0/0	0.0
Nursing technicians	1/32	96.8	0/12	100.0
Others (cleaning assistant)	0/1	100.0	0/2	100.0
Total	3/52	94.2	0/52	100.0

*In situations of aerosol precautions for tuberculosis; CI= Conformity index

On the pre-intervention phase, it was noticed there was no adherence to the use of N95 mask in three opportunities (5.8%). In one of the opportunities the professional did not use any respiratory protection. In two occasions, there was use of surgical masks under the N95 mask, which is considered inappropriate and thus characterized as non-compliance. As for the N95 mask, it was available; however, the current system do not facilitate its obtainment by workers. The conformity index for the adherence to the use of N95 masks by sector is presented in Table 2.

Table 2 - Conformity index for adherence to the use of N95 mask on assistance opportunities to patients in aerosol precautions for tuberculosis, according to the service sector. Number of observations: 52 for each phase

Sector	Conformity index (%)	
	Phase 1 Pre-intervention	Phase 2 Post-intervention
Clinical ward	25.0	69.2
Emergency	32.7	30.8
Adult intensive care	42.3	0 *
Total	100.0	100.0

*There were no patients in aerosol precautions for tuberculosis in this period

There was a difference of 25 days in the execution of the project between the time spent in Phase 1 (40 days) and Phase 3 (15 days) due to the time required to reach the number of 52 observations of opportunities.

Discussion

Tuberculosis in health professionals is related to specific factors of their role as direct care to individuals in bacillus stage as well as to structural characteristics of health services and investigation of the health status of patients[3,7-9]. Therefore, preventive measures should not only be restricted to use of personal protective equipment. The Ministry of Health recommends that health services should develop policies for the prevention of occupational tuberculosis and provide conditions to develop, implement and evaluate compliance to these practices[2-3]. However, many institutions have never been evaluated regarding to this issue.

This study showed that occupational tuberculosis indicators can be used as tools for identifying, targeting, and measurement of the effectiveness of preventive actions. It showed, in addition, that it is possible to obtain improvements through simple interventions, based on these indicators. The comparison between the pre and post-intervention phases identified an increase in compliance of the items assessed, after the implementation of the previously mentioned interventions.

As for structure indicators, interventions contributed to the development of an active surveillance program for respiratory symptoms as well as investigation and monitoring of professionals and aligned institutional actions with the program recommended by the Ministry of Health[3].

In the post-intervention phase, the increase in the compliance of the indicator reflected the interventions performed. However, the percentage obtained even after the improvements showed that many actions are still needed to achieve full compliance in this indicator.

In evaluating the process indicator, it became clear that adherence to the use of N95 mask is not very well established among health professionals, although the number of failures in compliance had been small. The quality of the N95 mask, discomfort and neglect its importance are factors for the non-adherence to its use[12]. The discussion about the possibility of expanding the points where the N95 masks should be available has also become an item to be improved because it was not yet done in a way to facilitate its access and consequent adherence to its use.

As for the time used for the application of this indicator, it was found difference between phases 1 and 3, in the time required to achieve the number of observations, which may vary according to the number of patients and the type of care provided. In addition, the researcher in charge for data collection could identify from her own experience in the first phase of the project which were the periods that facilitated the observation of a greater number of opportunities.

As for interventions performed, the educational strategies emphasized the use of the problem-solving learning method[13], leading professionals to reflect on steps taken with everyday situations. The low rate of correct answers in the expected responses in problem-solving situations showed a gap in the knowledge of professionals on preventive actions for tuberculosis and their self-protection. Ignorance about the disease, its impact and low perceived risk of acquiring and transmitting tuberculosis are factors that lead professionals not to value and not to take precautionary actions against disease transmission, despite the increased risk of transmission in areas with high prevalence of infected patients[4-6].

The delivery of the folder and discussion of problem-solving situations aimed at providing a relatively simple and easy to use resource to promote in-service education on the prevention and allowing space for answering questions. The percentage improvement in this indicator in the post-intervention

phase showed that professionals were sensitive to this strategy.

This perception is reinforced by demonstrating that health professionals have difficulty in making decisions for the prevention of tuberculosis in their practice[14-18]. The lack of knowledge of health professionals about tuberculosis is evident in all professional categories[13-16]. The gaps range from knowledge about disease transmission to conducts for its prevention.

African, Asian and European research[13-17] show poor adherence to prevention and absence of tuberculosis transmission control policies in health care settings, which increases the existing gaps and consequently the risk of acquiring the disease.

The roles of the permanent and continuing education, besides establishing routines for conducts, are also essential for improving prevention[15-17] and actions related to structure and process are more effective when used together[15-16]. There is evidence that guidelines on the proper use of the mask are also needed[17].

The population observed consisted mostly by nursing team professionals, which is common in studies of this aspect [5,14,15,17-18] mainly because nursing has the largest number of healthcare professionals and consequently the higher rate of occupational exposure[3,15,17].

In this way, it is highlighted the importance of nursing staff in the prevention and control of occupational tuberculosis transmission as a key group so that actions taken can be effective. It is also identified the important role of nursing professionals in Infection Control Committees and in the education process of health professionals, since this study was developed under the Nursing actions in Infection Control.

As a limitation, the greater difficulty in the study was related to establishment of interventions for structural improvements, since this type of intervention has additional costs as implications and therefore requires more time to be implemented.

Also among the limitations of the research, we recognize that observation for adherence to the use of N95 mask in the post-intervention phase could have been influenced by the presence of the researcher, since she also held the educational interventions. It is also possible that different values in compliance rates would be identified if measured in the long term after the educational interventions. However, we consider that this is a minor limitation since the indicators for quality evaluation are tools that must be used continuously, in subsequent improvement cycles.

Conclusion

The present study demonstrated that the use of indicators for quality assessment of occupational tuberculosis prevention programs was helpful to drive intervention actions, with positive results in a hospital. The continued use of these tools should provide the advancement in the program qualification, promoting effective interventions to prevent the occurrence of occupational tuberculosis. It also becomes very important that nursing professionals working in infection prevention and control should be aware of opportunities for improvement to reduce occupational biological risk for tuberculosis.

Collaborations

Silva EH and Padoveze MC contributed to the design, data collection, analysis, interpretation of data and preparation of the article. Tanaka AT, Higa RCM and Américo LGC contributed to data interpretation, writing of the article, relevant critical review of content and final approval of the version to be published.

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