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## Enfermeiro do trabalho na prevenção da silicose: uma revisão integrativa

Occupational health nurse in the prevention of silicosis: an integrative review

Enfermero de trabajo en prevención de la silicosis: una revisión integradora

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### ABSTRACT

**Objective:** To investigate the spread of knowledge regarding silicosis and to identify the occupational health nurse course of action to prevent it. **Method:** It is an integrative review of the literature held in the databases: LILACS, SciELO, BDNF and PubMed. The employed keywords were “silicosis”, “occupational health nursing” and “pneumoconiosis”, published in Portuguese, Spanish and English, in the years of 2004 to 2014. Eight articles met the inclusion criteria were selected and answered the guiding questions. **Results:** The selected articles seek to deepen the knowledge on silicosis, to estimate its prevalence, to establish the patient’s profile, to describe the major symptoms, to identify the major risk factors associated with the disease and to evaluate the quality of living of those afflicted by it. **Conclusion:** Silicosis is a public health problem with high prevalence and which requires very specific strategies to its prevention and control, especially those developed in occupational health nursing.

**Descriptors:** Silicosis; Occupational Health Nursing; Pneumoconiosis.

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## RESUMO

**Objetivo:** Averiguar a divulgação do conhecimento sobre silicose e identificar ações do enfermeiro do trabalho para sua prevenção. **Métodos:** Trata-se de uma revisão integrativa da literatura realizada nas bases de dados LILACS, SciELO, BDNF e PubMed, utilizando-se os descritores “silicose”, “enfermagem do trabalho” e “pneumoconiose”, nos idiomas português, inglês e espanhol, dos anos de 2004 a 2014. Foram selecionados oito artigos que atenderam aos critérios de inclusão e responderam as questões norteadoras. **Resultados:** Os artigos selecionados abordam a silicose, estimam sua prevalência, deliniam o perfil dos portadores, descrevem os principais sintomas, identificam fatores de risco associados e avaliam a qualidade de vida dos acometidos. **Conclusão:** A silicose é um problema de saúde pública com alta prevalência, que necessita de estratégias específicas para seu controle e prevenção, especialmente aquelas desenvolvidas no âmbito da enfermagem do trabalho.

**Descritores:** Silicose; Enfermagem do Trabalho; Pneumoconiose.

## RESUMEN

**Objetivo:** Investigar la difusión del conocimiento sobre la silicosis e identificar las acciones del enfermero trabajo para su prevención. **Método:** Se trata de una revisión integradora de la literatura realizada en las bases de datos LILACS, SciELO, BDNF y PubMed utilizando las palabras clave “silicosis”, “enfermería de trabajo” y “neumoconiosis”, en Portugués, Inglés y Español. Fueron seleccionados de los años 2004 a 2014 ocho artículos que cumplieron con los criterios de inclusión y respondieron a las preguntas de orientación. **Resultados:** Los artículos seleccionados cubren silicosis, valorar su prevalencia, definir el perfil de los pacientes, describir los síntomas principales, identificar los factores de riesgo asociados y evaluar la calidad de vida de los afectados. **Conclusión:** La silicosis es un problema de salud pública con una alta prevalencia, que requiere estrategias específicas para su control y prevención, especialmente las desarrolladas en la enfermería de trabajo.

**Descritores:** Silicosis, Enfermería de Trabajo, Neumoconiosis.

## INTRODUCTION

Silicosis is a type of pneumoconiosis, characterized by the inhalation of fragments of free silica (quartz, crystallized SiO<sub>2</sub>) that are deposited in the lobes of the lungs, causing inflammation and fibrosis. Initially, it is asymptomatic and, with the aggravation of the lesions, symptoms appear like effort dyspnea and asthenia, being able to evolve into a respiratory failure and chronic bronchitis.<sup>1</sup>

Silica or silicon dioxide is a natural substance composed of two chemical elements, oxygen and silicon, which can be found in nature in amorphous and crystalline forms, which when combined with metals and oxides result in silicates such as talc, feldspar, kaolin and mica.<sup>2</sup>

The toxicity of silica in the human body is related to the contact time and the type of organic reaction of each individual. In the case of workplace exposure, the inhalation of dust is usually intense and continuous, exceeding the tolerated limit, thus triggering the pathology.<sup>3</sup>

Silicosis is considered a public health problem worldwide, with a high incidence and prevalence in both developing and developed countries.<sup>4</sup> In Brazil, this disease is the most

prevalent in the pneumoconiosis group, since workers carry out activities which expose them directly to silica, such as the extraction and processing of rocks, mining, well drilling, activities in the ceramics industry, construction materials, glass and fertilizer manufacturing, talc production, sandblasting and sandblasting operations.<sup>5</sup>

Although government actions to eradicate silicosis started in 2002, it is estimated that an average of six million Brazilian workers in 2007 were exposed to silica dust in their work activities. The projections were that 264,883 of these subjects developed the disease in the following years. In Paraíba, of the 35,498 exposed, the forecast was that 3,550 would acquire this pathology.<sup>3</sup>

Clinically, silicosis is classified in three forms, being acute, subacute and chronic. Acute is associated with massive exposures of free silica, usually for a period of five years, leading to pulmonary alveolar proteinosis. The subacute occurs after five years of the beginning of exposure to silica, with radiological changes of rapid evolution, presenting initially as nodules. The chronic occurs after ten years of exposure, with the presence of nodules that may progress to large opacities with disease progression.<sup>1</sup>

Silicosis is a progressive and irreversible disease, and there is still no effective treatment, which contributes to the high mortality rates and/or limitation for work. Faced with this, it is of fundamental importance the studies that prioritize preventive actions aimed at environmental control in the workplace, as well as surveillance measures on exposed individuals.<sup>5</sup>

In this sense, the workplace nurse is an essential actor in this scenario, since, as part of the health team, he/she can carry out activities to protect and promote workers health, aimed at the prevention of occupational risks and diseases.

Such research is of importance for health professionals, especially occupational health nurses, because understanding this pathology and its implications in the life of the worker may contribute to a better care of the individuals affected by this problem.

Through the perception of silicosis as a public health problem, the research described here intends to focus the occupation health nurse on silicosis prevention through the evaluation of available evidence in the literature, based on the following objectives: to verify in the literature the dissemination of scientific knowledge regarding silicosis and to identify the actions of the occupational health nurse in the prevention of this pathology.

## METHOD

It is an integrative review of the literature. This method allows previous research to be summarized and conclusions are drawn from the critical evaluation of different methodological approaches. Its purpose is to synthesize and analyze these data to develop a more comprehensive explanation of a specific phenomenon from the synthesis or

analysis of the findings of the studies, for theoretical and/or interventionist purposes.<sup>6</sup>

The study followed a methodological rigor that goes through six phases of the integrative review: elaboration of the guiding question; search or sampling in the literature; data collect; critical analysis of included studies; discussion of the results; and the presentation of the integrative review.<sup>6</sup>

Since silicosis is the main cause of disability among occupational respiratory diseases, the following guiding questions were chosen to guide this study: what scientific knowledge is produced in the silicosis literature? What preventive actions can the nurse perform to prevent the development of silicosis?

The variables selected for the study were: first author, year of publication, article title, methodological approach, objectives, results and conclusion. The search was conducted by two independent evaluators during the month of November 2014 in the databases: Latin American and Caribbean Literature in Health Sciences (LILACS), Scientific Electronic Library (SciELO), National Library of Medicine in the area of Biosciences (PubMed) and Nursing Database (BDENF).

The descriptors used in the search were: “silicosis”; “occupational health nursing” and “pneumoconiosis”, which are part of the Descriptors in Health Sciences (DeCS). There were 276 publications, of which 215 were at PubMed, 36 were at LILACS, 25 were at SciELO and none were at BDENF. Studies found in more than one database were considered only once, being recorded in the database that presented the largest number of papers.

Included in this study were researches with humans published in the period between January 2004 and November 2014, in Portuguese, English and Spanish, available free of charge and available in full for access. Thus, the final sample consisted of eight articles, four in PubMed and four in SciELO.

The analyzes were carried out by reading, grouping and interpreting the articles, based on the elaborated instrument. The results were presented in a descriptive way and presented in synoptic tables to condense and subsidize the apprehension and discussion of the content, to be later discussed in the descriptive language.

To better operationalize the results, we chose to separate them into two areas of discussion described below: scientific knowledge produced on silicosis and preventive actions that the occupational health nurse develops to prevent the worker from becoming ill.

## RESULTS

From the analysis of the selected texts, Table 1 shows the results regarding the author’s name, title, database and methodological approach.

Regarding the methodological characteristics, it was verified that three articles are of the transversal type, two are of literature review, one qualitative, one retrospective and one with methodology of series of cases. It can be noticed that 37.5% of the studies included in this research are of the transversal type, being a useful tool for the description of population characteristics, for the identification of risk groups and for action and health planning.<sup>7</sup>

**Table 1 -** Studies included in the integrative review by authorship, title, database and methodological approach. Patos/PB, 2014

Authors	Title	Base	Methodological approach
Melo RSS, Zago MMF	The senses of silicosis attributed by workers of quarries suffering	SciELO	Qualitative study with eight workers diagnosed with the disease.
Luz FF. et al.	Silicosis in ex-miners of copper extraction	PubMed	A descriptive cross-sectional study with 100 former copper extraction miners through interviews, clinical data and radiological exams.
Yildiz T. et al.	Quality of life, depression and anxiety in young males with silicosis due to blasting denim	PubMed	A study carried out with 50 young men with silicosis, who worked in a blasting plant in Istanbul, through questionnaires.
Barbosa MSA. et al	Silicosis in quartzite workers from the region of São Thomé das Letras - Minas Gerais: initial data indicate a serious public health problem	SciELO	Case-series study, based on the review of radiographs of 185 individuals working on quartz extraction.
Brown T.	Exposure to silica, smoking, silicosis and lung cancer - complex interactions	PubMed	Literature review
Barboza CEG et al.	Tuberculosis and silicosis: epidemiology, diagnosis and chemoprophylaxis	PubMed	Literature review
Ferreira ALR et al.	Silicosis and the profile of lapidaries of semiprecious stones in Joaquim Felício, Minas Gerais, Brazil	SciELO	Cross-sectional study with 70 lapidaries of semiprecious stones, in Minas Gerais.
Carneiro APS et al.	Profile of 300 workers exposed to silica attended at an outpatient clinic	SciELO	Retrospective study, through the analysis of 300 medical records of workers exposed to silica at the outpatient clinic of the Federal University of Minas Gerais.

Regarding the year of publication, this research included an article from 2012, three from 2011, one from 2009, two from 2008 and only one from 2004. It can be observed that the studies are recent in the literature, with a greater number of publications in the last five years. Perhaps this fact demonstrates a greater concern of the researchers with this morbidity, since it is considered an irreversible occupational disease.<sup>8</sup>

Regarding the objectives, the studies aim to know the silicosis, to estimate its prevalence, to outline the profile of the patients, to describe the main symptoms, to identify the associated risk factors and to evaluate the quality of life of the subjects affected by the disease.

The results also allowed to verify the lack of knowledge on the part of the interviewees about the risk of the disease; studies showed that all diagnoses of the disease were made in men; several studies have made a correlation between silicosis and smoking for the development of lung cancer; and one study has determined that the risk of developing pulmonary tuberculosis is 2.8 to 39 times higher for patients with silicosis than for healthy controls.

With regard to the type of scientific journal, two articles were published in the Brazilian Journal of Pulmonology, one in the *Revista Texto & Contexto Enfermagem*, one in the *Revista Ciência e Saúde Coletiva*, one in the Brazilian Journal of Occupational Health, one in the Journal of Occupational Medicine and one in the Journal *Tuberkuloz vè Toraks*.

**Table 2** - Studies included in the integrative review by year of publication, objectives, results and conclusion. Patos/PB, 2014

Year	Objective	Results	Conclusion
2012	To identify the meanings attributed to silicosis among the sick workers in quarries.	The lack of knowledge about the risks is a reality among the interviewees. In addition, it has been reported difficulty in diagnosing the disease and in carrying out its treatments.	It was observed that the diagnosis, treatment and life with silicosis is permeated by suffering, by the rupture of life projects and by the loss of social identity.
2011	To describe the frequency of silicosis and verify the effects of exposure on former copper miners.	The frequency of silicosis was 35%; in addition, 11% had other pulmonary alterations such as tuberculosis, emphysema and chronic obstructive bronchopulmonary disease.	Miners exposed to silica present other lung diseases, in addition to silicosis, which may be related to the vulnerability of their professional activity.
2011	To estimate quality of life, depression, anxiety in patients with silicosis.	Silicosis was diagnosed in 50 of the 123 individuals who had worked in denim blasting. Scales used revealed correlation between depression and anxiety.	It has been suggested that silicosis can be detrimental to quality of life, with risk for depression and anxiety in patients with silicosis.
2011	To delineate the occupational and radiological profile of 185 quartzite workers from São Thomé das Letras - Minas Gerais and region.	The 185 workers were male, with an average age of 41.3 years and a average exposure time of 6.1 years. The radiographs showed images compatible with silicosis in 46 (24.9%) of them.	The high frequency of silicosis found in the group suggests that measures to prevent exposure to silica are precarious. Surveillance and prevention actions should be prioritized.
2009	To present an overview of the literature on the relationship of silica to the development of lung cancer.	Several studies correlate silicosis and smoking as assumptions for the development of lung cancer.	Smoking and silicosis are potential causes of lung cancer among workers exposed to silica dust, however further studies are needed to explain these effects.
2008	To focus the association between silicosis and the development of tuberculosis.	The risk of developing pulmonary tuberculosis is 2.8 to 39 times higher for patients with silicosis than for healthy controls.	Patients with silicosis, as well as those with periods of exposure to silica for more than 10 years, even without the disease, should undergo the tuberculin test.
2008	To outline the epidemiological and operational profile of the lapidaries of Joaquim Felício, and to estimate the prevalence of silicosis in this population.	The prevalence of silicosis was 7.1%. All were male, with a average age of 21.5 years and average exposure time to silica of 7.1 years.	Silicosis in lapidary is a serious public health problem that requires efforts to minimize the risk of illness, through the actions of multidisciplinary teams.
2004	To describe the profile of workers assisted at the Outpatient Clinic of the Hospital das Clínicas of the Federal University of Minas Gerais.	The average age of the exposed patients was 51 years, with an average of 15.6 years of exposure. As to gender, 98% were male and only 2% female. 126 (42%) cases of silicosis were diagnosed.	Silicosis is a disease of great relevance, with high prevalence and personal and social impact.

## DISCUSSION

The term silicosis, first used by Visconti in 1870, is the name given to pulmonary fibrosis caused by the inhalation of dust containing crystalline silica, the most frequent being pneumoconiosis. Silicosis is an occupational disease that remains a public health problem, especially in underdeveloped countries. It is considered the oldest and most serious occupational disease that exists, besides being progressive and irreversible.<sup>9</sup>

To prevent silicosis, the use of personal protective equipment (PPE) is a necessary resource; however, PPE can be considered as the last barrier between the dangerous condition and the worker. According to regulation number 06 (NR-6), PPE is any device or product used individually by the worker whose job is to protect him/her from risks that could threaten his/her safety and health. Therefore, it is important the presence of professionals specialized in worker health, as well as risk assessment programs in companies. The choice and accuracy of the EPI specifications are essential, having to comply with Brazilian legislation and protect the user. In this way, personal protective equipment in the prevention of silicosis, associated with other preventive measures, is indispensable to the maintenance of the health of the worker.

To better visualize the findings in this study, two areas of discussion were chosen.

### Scientific knowledge produced regarding silicosis

When analyzing the articles, it was verified that four studies were carried out in the state of Minas Gerais, one in Rio Grande do Sul, one in São Paulo, one in Turkey and one in the United Kingdom. Thus, it can be seen that the state of Minas Gerais presented the highest percentage, with 50% of the studies analyzed. This fact may be related to the increase of small and medium-size companies in the state, many of them informal, without technical knowledge about the occurrence of silicosis and without the capacity for technological investment that allows for improvements in working conditions.<sup>10</sup>

It was noticed that there is a consensus of the studies referring to the high prevalence of silicosis and its correlation to the time of exposure; that is, the greater the exposure, the greater the health impairment. On average, silicosis appears around 10 to 18 years, but if the exposure is severe, the disease may appear in less than five years. Thus, this data demonstrates that this pathology is a serious public health problem, because the ideal should be the absence of illness caused by the conditions of the work environment.<sup>8</sup>

Regarding the profile of silicosis carriers, there was also consensus among the studies. In general, they are male workers, with incomplete elementary education and who develop their activities in the informal sector. The predominance of man is compatible with labor activities that expose them to silica; however, these individuals, for cultural

reasons, end up not taking care of themselves, which makes them more vulnerable to the risks, resulting in their illness.<sup>11</sup>

As for the symptoms, the studies make explicit the slowness and aggressiveness of the disease. Initially, the silicosis patient has a habitual cough and chest pain. Over time, the condition worsens, with mucopurulent and hemoptytic expectoration, dyspnea, marked asthenia, weight loss and chronic respiratory failure. A survey of quarry workers diagnosed with pathology shows the report of two individuals describing the progression of the disease: “[...] *this is too serious! Now I cannot even walk on the street. I cannot do anything else today. It’s just that I start coughing [...]*”; “[...] *the disease is serious, because it will corrode people a little, it will take oxygenation, it will weaken...*”<sup>8,12</sup>

Silicosis was also observed as a risk factor for the development of tuberculosis and lung cancer. One study reports that the subject with silicosis is 40 times more likely to develop tuberculosis than non-carriers; however, even those people who do not have the disease but who are exposed to silica for a period of more than 10 years should undergo the tuberculin test.<sup>13-14</sup>

Regarding quality of life, one study mentions the patient’s strong predisposition to develop anxiety and, as a consequence, depression. This fact can be explained by the fact that the literature states that fibrous pneumoconiosis, due to inhalation of silica, has no cure, only palliative treatments.<sup>15-16</sup>

### Preventive actions that the occupational health nurse develops to prevent the worker from becoming ill

The occupational health nurse attends to workers promoting and looking after their health, focusing on the prevention of occupational diseases and accidents at work, aiming at the physical and mental well-being of the subjects. By having direct contact with clients, he can offer precise guidelines for not only health, but also the hygiene and safety of those he watches.<sup>17</sup>

In this investigation, it was observed that all selected studies recognize the use of personal protective equipment as essential for the prevention of silicosis. However, there was no evidence of research that would better discuss preventive actions that lead health teams to take actions that minimize the damage caused by inhalation of silica. Given this fact, manuals of the Ministry of Health were analyzed to know some important measures for the prevention of silicosis.

The activities of prevention and control of occupational pneumoconioses are based on principles such as: industrial hygiene actions, which try to change the occupational environment, making it healthier, such as simple humidification of the environment and constantly washing of the floor, avoiding secondary lifting of dust, in addition to educational actions and medical control of the exposed working population.<sup>1</sup>

Educational actions are basic points in the primary and secondary prevention of pneumoconiosis. Risk exposure in

work environments with dust exposure is common. Thus, taking information about these risks to both employers and employees should be a priority.<sup>1</sup>

Individual respiratory protection should be used when collective respiratory protective measures are unable to control harmful agents. For dust protection, the mask or respirator indicated must have a mechanical filter capable of holding the respirable fraction of the particulate material. There are two basic types of dust respirators: air-purifying respirator, which covers the mouth and nose, with a filter with porosity of various sizes, and an air-supplied respirator that covers the entire head and is recommended for situations of low oxygen atmosphere and/or high environmental pollution, as in underground mines.<sup>2</sup>

The respirator is intended to prevent the inhalation of undesirable substances and to provide a source of breathable air in environments with low oxygen concentrations. Its use must be appropriate to the type of aerosol generated, it must be of good quality, efficient, have good adaptation to the worker's face, have periodic maintenance, cleaning and replacement of filters when necessary.<sup>1-2</sup>

According to the Ministry of Health's work-related disease handbook, when the disease is related to work or suspected, it should be reported to the worker; examine the exhibits in order to identify other cases; notify the case to health information systems; provide the issuance of the CAT (Occupational Accident Report) and guide the employer to adopt adequate technical and managerial resources to eliminate or control risk factors.<sup>10</sup>

The occupational health nurse is of fundamental importance for the control of silicosis in vulnerable workers, since, together with the team of the Specialized Service in Safety Engineering and Occupational Medicine (SESMT), it can promote and execute educational programs aimed at the promotion and protection against this disease, as well as to carry out training and capacitation that stimulate the acquisition of preventive habits.<sup>18</sup>

## CONCLUSION

The objective of this study was to identify the available evidence in the scientific literature about the impact of silicosis on occupational health and the preventive actions that nurses can perform to prevent the development of silicosis. Among these, it is possible to mention:

- The articles showed that there is a consensus of the studies regarding the high prevalence of silicosis and its correlation to the time of exposure, that is, the greater the exposure, the greater the health damage;
- Regarding the profile of silicosis patients, there was a consensus among the studies that are usually male workers with incomplete elementary education and who develop their activities in the informal sector;
- Regarding the symptoms, the studies make explicit the slowness and aggressiveness of the disease;

- In view of what was observed and researched, it was found through this research that there is no curative treatment for silicosis, however, it is of great importance that the prevention measures be implemented, making employees exposed to free silica aware of using the personal protective equipment, according to NR 22 which refers to protection against mineral dust.
- It was also verified in the articles studied the lack of an effective treatment, requiring a different look on the part of the managers, businessmen and health professionals to develop measures that aim at the prevention of this pathology and, thus, provide safety to the subjects in their place of work.

Through the above, it can be considered that silicosis is a public health problem with high prevalence, which requires specific strategies for its control and prevention. Considered an old work-related disease, it remains a challenge for both developed and developing countries, as it is the leading cause of disability among occupational respiratory diseases.

Thus, it is believed that the occupational health nurse plays an important role in the control of this pathology because, through health promotion actions, this professional can minimize the occupational risks caused by silica, creating a safer environment in order to avoid the emergence of the disease and ensure the well-being of workers.

Therefore, occupational health nursing must be able to promote continuous education with its workers, avoiding future damages. Emphasizing their importance, these actions surely require a multidisciplinary work with intense involvement of the SESMT to obtain operational success. Noting that occupational diseases are directly related to cause and effect among risk factors in the workplace, companies should be aware of the risks to which their workers are exposed.

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