



Silicosis or miner's consumption in Colombia, 1910-1960

La silicosis o tisis de los mineros
en Colombia, 1910-1960

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ABSTRACT Silicosis is a disease associated with mining work, whose importance was first recognized in the medical, economic and legal fields in the 1930s. It has become an important object of historical study for both social and occupational medicine. Through the history of silicosis it has been possible to study the adoption of the concept of "occupational disease" and the birth of occupational medicine in Colombia. This process is analyzed in the article through a reading of medical publications from the first half of the twentieth century regarding silicosis in Colombian mining.

KEY WORDS Silicosis; Tuberculosis; Occupational Diseases; Industrial Hygiene; Occupational Medicine; History; Colombia.

RESUMEN La silicosis es una enfermedad asociada al trabajo minero, cuya importancia se comenzó a reconocer en los campos médico, económico y jurídico desde 1930. Se ha convertido en un importante objeto de estudio para la historia de la medicina social y del trabajo. Su historia permite estudiar la adopción del concepto de "enfermedad profesional" y el nacimiento de la medicina del trabajo en Colombia. Este artículo analiza ese proceso a través de una lectura de las publicaciones médicas de la primera mitad del siglo XX sobre la silicosis en la minería colombiana.

PALABRAS CLAVE Silicosis; Tuberculosis; Enfermedades Profesionales; Higiene Industrial; Medicina del Trabajo; Historia; Colombia.

HISTORIOGRAPHIC DISCUSSION

The issue of occupational diseases and health care access in mine workers received little attention in the historiography of the 20th century. Exceptions to this rule were George Rosen's classic work (1) on the diseases affecting mine workers, as well as the studies done by David Rosner and Gerald Markowitz in the United States (2). However, in the last two decades, historians of different origins have begun to explore the topic: in Spain, Martínez Ortíz and Tarifa Fernández (3) and Menéndez-Navarro (4); in France, Moriceau (5,6) and Rosental and Devink (7-11); in England, Bufton and Melling (12); and in Chile, Vergara (13-15).

Although not their primary focus, some Colombian historians have approached the development of "labor force medicine" through the history of labor movements, or through the organization of social security in Colombia (a). Yet, there are still no investigations providing an overall perspective on the consolidation of the concept of "occupational medicine." This historiographic oversight, common to all Latin America (15 p.727) and in large measure the rest of the world, becomes even more evident when observing the history of the occupational diseases of miners.

Likely because they lack the epidemiological and political visibility of infectious and parasitic diseases, occupational diseases have been sidelined in the historiography of medicine and health in Latin America, especially in Colombia. This lack of epidemiological and political visibility is partly explained by the indifference of Colombian doctors during the 19th and first part of the 20th centuries to work-related illnesses; the study of such illnesses may not have offered them the same opportunities to gain the scientific recognition granted by the infectious and parasitic epidemics successfully battled with hygiene, microbiology, immunization and chemotherapy. Using a discourse marked by militarist metaphors and the concept of "eradication," the battle against infectious diseases also produced a sense of triumph which was only ended by the appearance of HIV/AIDS in 1981. Furthermore, as historian

Mario Hernández points out, worker health was of importance to labor lawyers and economists, not to doctors: "the division of the field was so evident that nobody questioned it" (20 p.146).

In the particular case of a historical understanding of silicosis, the futility of transporting models of analysis which have been useful in the study of other collective diseases is evident. From an epidemiological point of view, historians Rosner and Markowitz, Bufton and Melling, Vergara, Rosental and Devink have demonstrated that pneumoconiosis, in general, and silicosis, in particular, were among the diseases of greatest medical and economic relevance around the 1930s. In fact, Rosental and Devink claim silicosis was the occupational disease of greatest importance in France during the 20th century, comparable only to the effects produced by asbestos (7 p.75). Historians Bufton and Melling, who study the case of Great Britain and Wales, gather information according to which the annual mortality due to silicosis in 1930 was greater than 300 people, while a review of the compensation for damages granted until 1946 recorded about 1,500 deaths and 16,000 cases of disability (12 p.64-65).

The history of respiratory diseases in the mining sector has often been confused with that of tuberculosis. According to Rosner and Markowitz, the boom of microbial theory coincides with a negation of the mechanical action of silica dust on the lungs. After the discovery of Koch's bacillus in 1882, miner's consumption became a synonym for tuberculosis, and the dust particles were attributed the capacity of activating the bacillus (2 p.482-487).

Doctors like Frederick Hoffman, in 1908, or A. J. Lanza, in 1914, based on meticulous statistical observations, tried to prove the relationship between dust-laden environments and miner's consumption. However, their conclusions were poorly received and, in contrary to the findings of their "epidemiological" studies, the idea that tuberculosis was the predominant disease among mine workers continued to spread, its causes being attributed to social issues such as poverty, overcrowding, malnutrition and immoral habits such as alcoholism (2 p.488).

The consequences of this view of silicosis and the weight of the fear of tuberculosis

in the world of work were reflected, up to the 1930s, in the preponderance of clinical treatments for patients and few preventive measures in the workplace (2 p.489). Moreover, the general association of tuberculosis with silicosis in the explanation of the disease resulted in the refusal to pay for damages and the lack of economic compensation for the affected miners. This was so in Chile, England, United States, France, Brazil and Colombia.

In the case of Chile, Ángela Vergara shows that silicosis emerged in the medical field as late as the 1940s, associated with tensions that arose as the causes of the disease were made visible, with the configuration of the fields of social medicine and industrial hygiene, and with the development of the concept of occupational disease within the country. The researcher remarks upon the gradual commitment assumed by the government to deal with this disease and other so-called "social diseases." The Chilean State took on responsibilities related to the health of its citizens and was consistent in recognizing the influence of health in the material progress of society (15).

In their work, Bufton and Melling (12) analyzed the debates and tensions which gave rise to the implementation of a system of compensations for silicosis in England during the interwar period. They carried out a detailed analysis of the actors involved in the process (trade unionists, doctors, insurance agents and politicians), and analyzed the resistance from the British government, the industrial sector and the workers themselves when it came to drafting legislation regarding a disease whose causes and extent were largely unknown. Therefore, the negotiations demonstrate not only disagreements of a political and social nature, but also a lack of consensus and of sector-wide proposals that acted in detriment to a general compensation law (12 p.73).

The most recent historical studies on pneumoconiosis highlight the importance of the definition and consolidation of the concept of "occupational disease" in the attribution of responsibilities, the orientation of prevention policies, the education of workers and the defense of workers' rights. The classification of a disease as occupational determines whether or

not a patient may claim damages. According to Rosental and Devink (7 p.77), this epidemiological framework is based primarily in public health and demographic effects: morbidity, disability and mortality. However, this same framework could also eventually remove certain diseases from the category of occupational disease.

This article (b) responds to the following questions: Did Colombian miners actually suffer from silicosis during the 20th century? How did the the process of turning silicosis into an object of interest to the Colombian medical field unfold? What was the historical and social context in which this process of objectification developed? What were the prophylactic measures proposed by doctors and engineers? The aim is to understand the extent of silicosis in certain mining regions of Colombia, to analyze the disease's visibility in the medical field and to show how silicosis changed its status as a disease rarely diagnosed to a disease widely recognized. This epidemiological movement is typical of what historian Mirko Grmek has characterized as an "emerging disease" (22).

MINING AND TUBERCULOSIS OR MINER'S CONSUMPTION

From the colonial period to the 20th century, the territory of Nueva Granada, currently Colombia, was an important center of mining activity. According to the Colombian historiography on mining, the amassing wealth at the base of economic consolidation in Colombia, and especially in regions such as Antioquia, was closely related to mining. Engineer and historian Gabriel Poveda Ramos explains that at the beginning of the 19th century Nueva Granada produced nearly three million Colombian pesos in gold, while the exports of tobacco, cinchona bark and cocoa amounted to less than a million pesos (23 p.27). Furthermore, Poveda says that the loans Colombia obtained from England in 1825, after the Wars of Independence, were based on the possible findings of new gold deposits in Marmato, Zaragoza and Remedios in the west of Colombia (23 p.31).

The predominance of gold mining in Colombian exports remained high until the end of the 20th century and was the driving mechanism of the economic development of the western part of the country. According to historian María Mercedes Botero, until the 1880s, gold and silver mining were the top exports of Antioquia (24 p.15). Colombia exported £483,000 (in sterling pounds) in 1851 and £621,000 in 1881, that is, 1.75% and 3.39% of the global production (24 p.47).

During the 1920s, coffee began to lead Colombian exports and over time other sectors, such as manufacturing and livestock, became more important in the national economy.

In 1927, national gold production was estimated at 160,000 troy ounces (31 grams) with a price of \$20.67 (in US dollars) per ounce. Between 1927 and 1931, Colombia became tenth in the list of world producers with an annual average of 5.369 kg (25), not including contraband (26 p.295). In 1934, when the troy ounce reached the price of \$35 USD (price kept until 1971), gold production in Colombia was on the rise, soon to reach its peak of 656,019 ounces in 1941. Between 1935 and 1952, the annual average was 472,957 ounces. About 60% of that production came from the department of Antioquia, where several important mines such as the Frontino Gold Mines in Segovia or the Pato Gold Mines in Zaragoza (27 p.27-28), exploited by foreign investors, were located. Safford and Palacios estimated that mining and oil accounted for 3.4% of Colombia's gross domestic product (GDP) between 1945 and 1949, 1.4% between 1976 and 1980, and 4.5% between 1993 and 1998 (28 p.565).

During this period, the implementation of new exploitation technologies brought about the diversification of this sector: apart from the traditional gold mining, a growing interest in coal and new sectors such as limestone, plaster, clay and gravel developed. Starting in the 1930s, cement production also became more important (29 p.27).

For the purpose of this article, the importance of the pneumatic hammer, one of the new technologies imported into the country during the second quarter of the twentieth century, must be emphasized. In 1931, Frontino Gold Mines incorporated thirty pneumatic hammers to

open tunnels, galleries and shafts, replacing the hand hammer as the common denominator of Colombian mining. The high cost of these new tools impeded their general use within the mining industry, as their operation demanded certain spatial dimensions and characteristics within the galleries and tunnels as well as the purchase and importation of expensive air compressors (30 p.272). Nevertheless, as the drilling capacity increased, so did the concentration of silica dust, and the mine workers were therefore at greater risk of contracting respiratory diseases. This is why, although the exact relationship to worker health is unknown, the impact of new technologies on worker health cannot be dismissed.

In the history of Colombia, the reports of silicosis or miner's consumption predate the introduction of pneumatic hammers. Antioquia writer and engineer Efe Gómez recalled of his work at the company Empresa Minera El Zancudo (EMZ) at the beginning of the 20th century "the devastation caused by silicosis on weakened miners forced to breathe oxygen-depleted air at the bottom of the suffocating galleries" (31 p.379). Managers of the EMZ estimated that the devastation caused by silicosis reached "forty percent." In 1913, Dr. Gabriel Toro Villa affirmed that tuberculous meningitis was a common disease among mine workers (32). In 1917, the spread of tuberculosis among workers became one of the most pressing issues for Alejandro López, an engineer and director of the EMZ (c), especially owing to the high cost it represented. According to López, the safety measures taken could not stop the tragic consequences and workers suffering from the disease had to receive some kind of assistance, "although this does not assure that future transmission would be entirely prevented" (34 p.15).

Alejandro López's concern was not unfounded. Tuberculosis was a real threat to the miners' lives, as it isolated many of them from their work and sometimes resulted in their death. By way of example, in 1917 there were almost 1,000 workers in the mine; the company doctor treated 4,500 people that year, including miners and their families. In the population of workers there were 84 deaths, 16 of which were due to tuberculosis; this yields a proportional tuberculosis mortality of 19.04% (34 p.16). To contrast these figures, in all

of Antioquia 389 people died of tuberculosis; with a global mortality of 14,635 people, the proportional pulmonary tuberculosis mortality was 2.65% (35).

However, the proportion of people suffering from tuberculosis within the EMZ may be analyzed as evidence of a situation in which the risks of silica dust were just starting to be perceived. This is why in 1919, four years after Dr. A. J. Lanza's research studies on silicosis in US miners were published, engineer Alejandro López focused more on the features of silicosis than on the diagnosis of tuberculosis:

Apparently this disease is triggered by an attachment in the lungs of the rock dust that abounds in the air within the dry inner parts of the mine, leading easily to tuberculosis. (36 p.19)

Indeed, the debates and difficulties surrounding the differentiation of an infectious disease like tuberculosis from an occupational disease like pneumoconiosis held an important role in Colombian medical literature until mid-20th century. It is a fact that, to a certain extent, the usual association of tuberculosis with workers, including miners, interfered with the knowledge of occupational diseases, which helps explain why respiratory diseases related to mining work remained concealed under the diagnosis of tuberculosis until well into the 20th century.

MEDICINE AND INFECTIOUS, PARASITIC AND OCCUPATIONAL DISEASES

In 1905, the Congress of the Republic of Colombia passed the first law regulating the exercise of medical professions (Act 12 of 1905) and during that same decade came the first calls to unionize certified doctors. The scientific organizations that were founded at the end of 19th century and the regulation of degree-granting by the principal medical schools (Universidad Nacional de Colombia, Universidad de Antioquia and Universidad de Cartagena) finally gave rise to a consolidated body of medical doctors around this same period.

As scientists, as hygienists holding public office, and as liberal professionals, Colombian doctors during the first half of the 20th century were aware of their complex professional identity. It was with this identity that they promoted the medicalization of society as well as allopathic, private and public medicine as agents of "civilization" and "progress." In this context, they demonstrated great sensitivity to the difficult living conditions of the workers, the poverty of the majority of the population and other social problems such as collective emerging diseases.

After intense civil wars, in 1902 Colombia's export-based economy as well as its internal trade began firm processes of recovery. The country was in total reconstruction and urban development was on the agenda, although it remained a mostly rural society. At the same time, Colombia was undergoing remarkable demographic growth and industrialization, with growing development in communications media and transportation systems (railways, roads, telegraphs, electricity). Different processes of medicalization of society were underway, first led by doctors enjoying a privileged position within the government elite and later propelled by the upper echelons of the government through the sanitary reform started in 1913 and 1914, under the pressure of the international sanitary conventions Colombia had signed (d). The period of 1914-1929 was the starting point of the medicalization of rural areas where, except in mining areas, during the 19th century neither private nor public medical services had been provided (38).

Dr. Miguel María Calle, in his capacity as doctor in the EMZ, and thanks to his experience with tunnel workers and his interest in preventing and treating miner's anemia, led an international campaign in Colombia to fight "hookworm disease" in the mines, as had been initiated in some European countries at the end of 19th century (39). His knowledge of the international debate on the etiology of parasitic diseases led him to make the following declarations on ancylostomiasis in 1910: "After all, a worker's infection with hookworm disease cannot be considered an occupational accident!" (40 p.83).

This statement of Dr. Calle's is significant because it differs from the "facts" commonly admitted by the Colombian doctors of the time. Considering ancylostomiasis an "occupational accident" or an "occupational disease" implied that industrial companies and owners had to assume responsibility for the workers' health.

Engineer Alfonso Mejía made similar statements in 1918. Having studied at the Escuela Nacional de Minas and later worked for the EMZ with Alejandro López, Mejía considered himself in a position to assign a role to engineers and businessmen regarding the health of mine workers:

...ancylostomiasis or hookworm disease [is] easily caught by workers like ours, who work barefoot and do not wash their hands before having meals or their feet before going to bed. This disease, its treatment and prophylaxis, should be an object of study for engineers and especially for the heads of agricultural and mining companies in which, considering its etiology, the disease is easily caught. (41 p.455).

Mejía stressed the lack of hygienic measures resulting from the businessmen's ignorance and underlined their lack of commitment in fighting against workers' diseases:

...It is the government's role to solve this matter by passing appropriate labor legislation, as it is not right that industrial work damage an individual only for private or public charity to make amends for that situation later. (41)

In Colombia, Calle and Mejía's views on employer responsibility were exceptional. On the one hand, the historiography reveals very few examples during the first two decades of the 20th century of actions performed by employers in favor of worker health. The Sanitary Department of the Antioquia Railway (16) and the Sanitary Department of the EMZ stand out in this regard (18).

On the other hand, the doctors committed to public health campaigns and the Colombian government itself, although immersed

in a period of intense institutional weakness, were deeply concerned with fighting against diseases of social and public relevance, at least during the first three decades of the 20th century. An example of this trend was the campaign carried out by the Rockefeller Foundation against ancylostomiasis in Colombia. With this approach, ancylostomiasis became visible not as an "occupational disease" suffered by the miners, as occurred in some European countries (39), but rather as a parasitic disease affecting, among many other rural residents, agricultural workers bearing the weight of an agro-export economy. This meant it was approached as a public health rather than as an occupational health issue.

When in the 1930s the discussion of occupational diseases began in the medical and legal fields, ancylostomiasis was considered to be almost completely under control. The ephemeral debate on the occupational character of this parasitic disease lost significance when it seemed clear that uncinariasis was among a wider group of diseases that, although avoidable, were of public and social relevance, such as "alcoholism," leprosy, tuberculosis, malaria, yellow fever, typhoid fever and dysentery.

In the 1930s, the international medical field made distinctions among these diseases from an etiological point of view, differentiating parasitic diseases, microbe-caused diseases and occupational diseases. The latter were attributed to "a causal factor, acting repeatedly and frequently present, always in relation to certain activities" (42 p.32). This meant they were considered microtrauma that in isolation did not alter the general physical condition in the short term.

They cannot cause damage, except when their frequency and frequent repetition prevent the body from counteracting their effects and thus recover its biological balance. (42 p.32)

In one of the articles written by Mexican doctor José Torres Torija and published in the *Revista de Medicina y Cirugía* of Barranquilla (Colombia), the doctor pondered whether it was possible for paludism to match the "etiopathogenic" features specific to occupational diseases. Torres finally rejected this possibility, as the disease could affect any inhabitant of a

particular area, regardless of the activity they performed. Unlike occupational diseases, paludism was not the result of microtrauma, but of a specific action taking place in a short period of time (42 p. 35). This reasoning is similar to that used by a Colombian doctor regarding tuberculosis, as will be seen below later.

Among the several concerns of sanitarian doctors and legislators were to limit the responsibilities of the State regarding the health of the population and to understand the level of employer's responsibility as well as the extent of the workers' involvement in their physical deterioration or in the emergence of occupational diseases. Moreover, they also were attempting to limit the number of diseases eligible for compensation within the incipient labor legislation. Although State paternalism and public charity were not totally surmounted, a new atmosphere of rights, employer responsibility and social policy was beginning to be felt.

According to historian Mario Hernández, between 1930 and 1950 the working masses began to be incorporated into a framework of social policy (20). This process implied greater State intervention "after an era of arbitrary capitalism" (43 p.5-6). At the same time, this social policy was reflected in the creation of institutions which safeguarded the workers' welfare and health. An example of this was the creation in 1938 of the Ministry of Labor, Hygiene and Social Security. This ministry took over many of the functions of previous institutions dealing with public health and hygiene such as the National Office of Hygiene (1920-1922), the National Office of Hygiene and Social Security (1923-1929), the National Office of Hygiene (1930), the National Department of Hygiene and Social Security (1931-1934) and the National Department of Hygiene (1935-1937) (44).

These institutional modifications indicate changes in the understanding of the relationship between health-disease and work, however, at this stage of the study conclusions cannot yet be drawn regarding the extent to which these changes played a pivotal role in worker health (e). One historiographical hypothesis upholds that the scientific organization of work, Taylorism and Fordism, popularized by Colombian engineers starting at the beginning of the 20th century,

played an essential role in persuading industrial companies of the advantages of prevention using the logic of cost-benefit analysis (45).

Various sources indicate that the first steps were taken in Colombia during this period that would permit silicosis to emerge (f) as an occupational disease associated with mining work. On the one hand, that meant questioning the connection between an infectious disease such as tuberculosis and a mechanical disease like pneumoconiosis; on the other hand, it meant a process of incorporating and legitimizing the etiology and nosology of silicosis; and finally, it implied establishing a social framework for the disease to complement its epidemiological framework (2). These simultaneous events were reflected, within the medical practices of Colombia, in an increase in the number of diagnoses of silicosis.

SILICOSIS IN MINERS

Between 1932 and 1954, eight medical texts on silicosis (including articles and theses) were published in Colombia (g). As the researchers focused on the causes of silicosis and their association with the working environment, the illness was gradually being understood as an occupational disease, and a new field of medical knowledge was slowly emerging: occupational medicine. Although the emergence of this specialization within the medical practice of Colombia has not yet been fully researched, it may be assumed that the process was similar to that described by Anna Beatriz Sá de Almeida (46) regarding Brazil. According to Almeida, the process of development of occupational medicine involved the legitimation of a scientific field and the consolidation of a habitus. To this effect, many institutions, journals and university courses were created. This academic movement coincided with a political environment favorable to the protection of worker health.

The process by which silicosis became an occupational disease did not automatically result in the overall implementation of occupational medicine, as this required a wider movement that could reach all the industrial

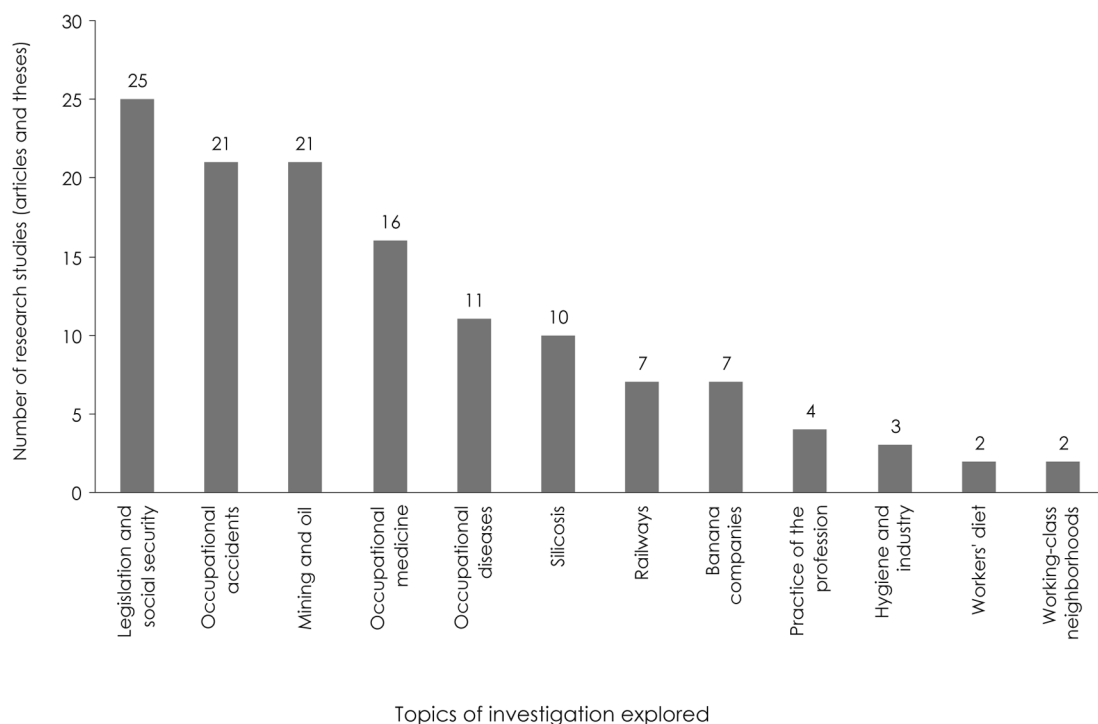
sectors. However, when looking at the university production associated with worker health in the two main universities of Colombia (Universidad de Antioquia and Universidad Nacional de Colombia), it can be seen that silicosis and occupational diseases (many of them related to mining work) held an important role between 1920 and 1960 (Figure 1).

The presence of silicosis and other occupational diseases in the Colombian medical publications coincided with the peak of information in medical literature worldwide regarding silicosis, after the International Labour Organization (ILO) held a conference in November 1930 in Johannesburg that highlighted the need to develop information on the disease and later included it the list of occupational diseases of the ILO in 1934 (h). Moreover, in

Colombia, the publications dates also coincide with the introduction of pneumatic hammers. Neither the epidemiological importance nor insignificance of silicosis in the country can be deduced from this information; the effects of the new technologies were yet to be revealed, for the technical change was recent. Therefore, the research studies carried out in other countries did not reflect the initial situation in Colombia. It is possible that during the 1940s the increased risks made silicosis more visible, however the epidemiological framework within which silicosis prevalence is evaluated has been and remains a challenge to ascertain in specific terms (47 p.9-12).

These aspects indicate the difficulty of classifying nosologically, socially and politically a new disease such as silicosis, whose explanation

Figure 1. Number of research studies (articles and theses) related to occupational medicine, by topic. Universidad de Antioquia and Universidad Nacional de Colombia, 1910-1960.



Source: Own elaboration based on data from the collections of the Medical Library and Hall of Medical History of the Universidad de Antioquia (Medellín) and from the Newspaper and Periodicals Library and Collection of Theses of the Universidad Nacional de Colombia (Bogotá).

and acceptance are closely tied to economic factors; this affirmation in turn supports the hypothesis that the social and political framework provided the disease by the emerging field of occupational medicine is what granted silicosis the necessary importance to become an occupational disease. Indeed, throughout this period an increasing interest in work-related diseases can be noted in Colombia, as from the 1930s on worker health held a central place in the agenda of doctors, engineers and legislators (45).

In 1938, the official inspector for the central region (i) and engineer Pablo Forero reported to the director of the National Department of Hygiene on the operation of the coal mines in San Vicente (municipality of Suesca, departament of Cundinamarca) (48 p.5). In his report, Forero explained that there were shafts in which the coal could only be transported by a miner lying on his back, and that children aged 12 and 13 were employed to do this type of work. Even though children were working in these and other positions in violation of legislation that forbade child labor (j), there was not a single mention of this situation in the 21 recommendations Forero made to the company at the end of the report. Forero's omission takes place during the height of eugenic doctrines in Colombian medicine, which makes it especially paradoxical that in his report worker health would appear as a priority, even before concerns regarding childhood, women, and maternity (k).

Additionally, the report by engineer Pablo Forero demonstrates the increasing attention doctors and businessmen paid the relationship between working conditions and worker health. This concern is clearly reflected in reports by the National Department of Hygiene regarding mining areas. In one of these documents, engineer Próspero Ruiz, official inspector for the eastern region, described the situation of an alluvial gold mine in the mining district of Zaragoza and of a gold vein mine in Segovia, department of Antioquia. According to Ruiz, malaria prevailed in Zaragoza whereas in Segovia occupational accidents, poor ventilation, parasitic diseases and "innumerable cases of tuberculosis" were the norm. In his view, dry drilling in some work sites produced large

quantities of dust and although the "silica stones" were not "poisonous," they favored the onset of pneumoconiosis and silicosis, the "precursor to true tuberculosis" (51).

In 1939, Dr. Agustín Arango was consulted regarding the possibility of declaring tuberculosis an occupational disease. In his answer, he attempted to put an end to the discussion and, although he did not elaborate upon silicosis, his argument questioned any possible relationship between this occupational illness and tuberculosis. According to Arango, firstly, an occupational disease is associated exclusively to the carrying out of an occupation. Tuberculosis may affect any individual. Secondly, there is no occupation linked to tuberculosis, while saturnism is undeniably associated to a sole occupation. Thirdly, occupational diseases develop slowly as a result of a repetitive series of poisonings, while "tuberculosis can have an abrupt onset" (52 p. 149) (l).

The conclusions drawn by Agustín Arango were in contradiction with the views of other Colombian doctors accustomed to associating silicosis with tuberculosis. The medical publications from the 1930s and 1940s were in agreement that tuberculosis was not an occupational disease, but that silicosis was indeed one. Furthermore, they agreed that the latter was a predisposing factor for tuberculosis: "70% of silicotic patients later fall victim to that disease [tuberculosis]" (54 p.16). According to Dr. Ciro Jáuregui, the relationship between silicosis and tuberculosis was the result of loss in lung tissue resistance together with an overall weakening of the body due to the poor sanitary conditions in which workers lived (55 p.45-46). The tendency of silicosis to produce tuberculosis must have increased the doctors and the authorities' interest in controlling this disease. In Jáuregui's view, silicosis was a disease "much more widely spread than is usually believed" (55 p.81).

In 1954, doctor Gonzalo Bermúdez Montaña (56 p.19), with the help of other doctors, one of whom was Ciro Jáuregui, carried out an x-ray study of 650 miners from the region of Suesca. The results of the study demonstrated the reality of miners in the country. Bermúdez found that 19% of miners were suffering from different degrees of silicosis (10%, first degree

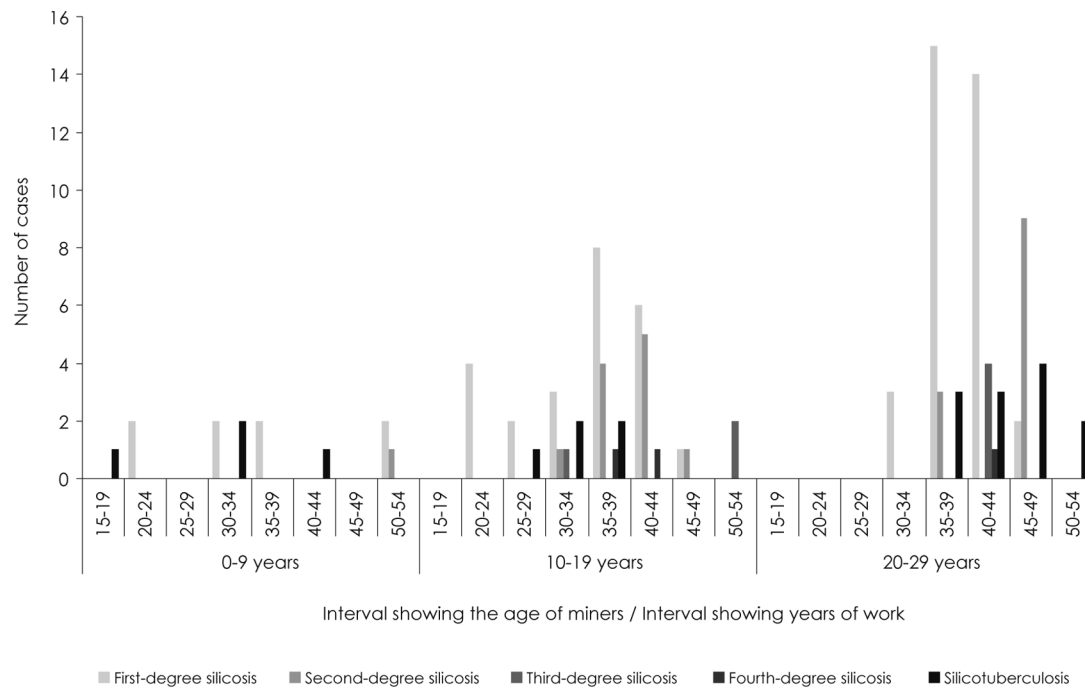
silicosis; 3.7%, second degree; 1.23% third degree; 0.61% fourth degree; and 3.23%, "silicotuberculosis"). On average, symptoms appeared at the age of 45 or after 19 years of mining work. Additionally, 6.6% of miners had a clinical diagnosis of chronic bronchitis, which usually indicated the beginning of silica impregnation. According to Bermúdez the miners' condition worsened due to the lack of professional medical assistance. Doctors were replaced by "the terrible and daring empiricism of healers and quacks who offer their services in the mines" (56 p.37) (Figure 2).

It is necessary to point out that the speed at which silicosis affects the body has apparently changed over time. In 1914, American doctor A. J. Lanza estimated that the first symptoms of silicosis appeared after 9.6 years (2). During the 1940s, research studies carried out on African miners estimated a 14-year

period of mining work before the start of the first symptoms (57), and specifically in Colombia, doctors such as Guillermo Soto spoke of at least 10 years of mining work before the first symptoms and about 20 before the definitive deterioration or the onset of silicotuberculosis (54). In 1954, according to data collected by Dr. Bermúdez Montaña, one could estimate 17.8 years before the onset of first-degree silicosis and 21 years before silicotuberculosis (56). Although silicosis depends on the exposure time or the concentration of silica dust, currently the estimated exposure time is over 20 years (58).

Whatever the impact of silicosis epidemiologically, doctors and engineers had to find new ways to combat the disease. In order to avoid the eventual and irreparable chain of pathological events with no known treatment or therapy, the only option was prevention. Hence Jáuregui's conclusion that governments needed

Figure 2. Relation between the number of silicosis cases and the degree of advancement, age and years of work in miners from Suesca. Department of Cundinamarca, Colombia, 1953.



Source: Own elaboration based on data from Gonzalo Bermúdez Montaña (56 p.24-25).

to pass "prophylactic and public safety laws that safeguard the future of these permanently disabled victims" (55 p.82).

PROPHYLAXIS, HYGIENE AND SAFETY IN MINING WORK

It would not be an exaggeration to state that until as late as the 1930s, within Colombia's academic and university medicine there was certain indifference to the diseases affecting miners. However, such indifference was not limited to the academic field. According to Dr. Martiniano Echeverri, the Ordinance 49 issued by the department of Antioquia in 1935 was the first to officially mention the problem of silicosis. In this ordinance, issued upon the recommendation and intervention of Dr. Antonio J. Ospina, a doctor working for Frontino Gold Mines, the first and second sections read as follows:

Section 1. All mining companies employing personnel required to work in shafts, tunnels, galleries, etc., and who as a result of the tasks performed must inhale particles of any mineral produced by drills and gunpowder smoke, are obligated to supply their employees with safety masks and corresponding safety equipment [...] Section 2. It is prohibited for said companies to impose workdays exceeding eight (8) hours on personnel working under the aforementioned conditions (59 p.535)

In these early laws for the prevention of silicosis, prophylaxis remained at the employer's discretion and subject to some timid general measures stipulated by labor legislation.

Because the medical distinction between silicosis and tuberculosis remained unclear, isolation and burning of the affected workers' homes were at first considered the most effective ways of controlling the spread of "tuberculosis" among mine workers. On the activities in the EMZ at the beginning of the 20th century, Antioquia writer Efe Gómez recalled: "People are cured, or alleviated. The affected houses are set fire. For the healthy, new houses are constructed" (31 p.379).

The acknowledgement both within medical and university circles of the difference between tuberculosis and silicosis had a great impact on the mining sector. From that point on, the efforts to reduce the effects of dust in mines were focused on care of the mining personnel and towards minimizing the pressures the working environment placed on the body. To that effect, in 1941 Dr. Martiniano Echeverri suggested the following: a physical examination before entering the company; periodic medical examinations; removal of affected employees from their work activities; dust concentrations kept within accepted limits; adequate ventilation; encouraging the use of respirators, filters and masks; regular cleaning of the premises; and monitoring compliance with prophylactic measures (59 p.548).

The prevention systems were focused on monitoring both the working environment and the individual worker. The aim of the working environment prevention system was to keep the levels of dust concentration low through humidification, ventilation or fumigation with calcium carbonate and magnesium. The system applied to the individual worker intended to prevent the lungs from becoming silicotic. For that purpose, the use of dust-filter masks was encouraged. A further suggestion was to not permit workers to spend more than six years working in the tunnels or eight years working with rock outdoors. Dr. Jáuregui claimed this was the only prevention method applicable in Colombia (55 p.57).

In these proposals for silicosis prevention, a large part of the responsibility fell upon the industrial employers, who were obligated to provide all the necessary safety equipment. However, it was the miner's duty to report any past activity which could have led to silicosis, and to observe all the safety and sanitary recommendations in effect.

Nonetheless, mining work frequently implied a risk to miners' lives. Hence, technical recommendations were made to improve the working conditions: ventilation drums had to have a height greater than 1.40 meters; galleries longer than 40 meters had to have an opening at each end; electric alarms had to be installed (Act 15 of 1925, section 27); miners could not be obligated to work in places where lighting a

match or a kerosene lamp was impossible due to lack of ventilation; the use of wires without the suitable insulation was to be avoided; miners needed to be provided with electric lighting and the tools necessary to do their work. In addition, all of the following needed to be made available: suitable rooms or dwellings for the workers; a medical office, supplies and a first-aid station; a hired district hospitalisation service or a hospital built for the exclusive use of the company; drinking water; and latrines with concrete seats (48 p.12). It is a widely known fact that industrial companies usually ignored the suggestions engineers made or limited themselves to the hygiene and safety legislation regarding mining camps. Negligence on the companies' part even included the dismissal of sick employees without any kind of compensation (m).

However, all the elements putting miners at risk of falling ill or affecting negatively their health cannot be attributed to the employers' negligence. Miners also played a part in the acceptance or refusal of the safety measures and in the control of occupational risks. It can be affirmed that miners rejected every single measure that seemed to them inconvenient. According to Alain Corbin, "the worker's body is still the place where he can exert power over himself" (60 p.246).

In fact, at the beginning of the 20th century, engineers working for the EMZ denounced the "disobedience" of workers in following the recommendation to not smoke inside the mine. In 1949, Dr. Ciro Jáuregui claimed miners grew tired of or frequently lost their masks (55 p.57). During the mid-20th century, engineer Próspero Ruiz expressed his concern over how frequently occupational accidents occurred as a consequence of carelessness, or were even intentional. Regarding this situation he stated:

A worker who hurts himself intentionally in order to receive compensation is either mentally ill or is undergoing an alarming economic situation because he does not earn enough. (51 p.37)

A recent research study showed that among a group of 310 miners, 93% did not use the safety equipment (61 p.58).

According to engineers, honesty and compliance with the rules were lacking among miners, and workers were therefore blamed for accidents. This strategy could be referred to as risk transference. Suspicion underlay the employer/employee relationship. For instance, Dr. Benjamín Bernal suggested that doctors avoid mentioning compensations or pay for the sake of the patient's recovery (62 p.35). Dr. Guillermo Soto shared a similar view, stating that miners usually suffered from "tisiophobia" and "mythomania," first trying to conceal the disease and then exaggerating it in order to receive the compensation corresponding to occupational diseases (54).

CONCLUSIONS

The route to medical research on silicosis was marked by the difficulty describing a condition new to clinical medicine, hygiene, and occupational medicine. In order to determine its etiology and classify this illness nosologically, clinical observation needed to be distanced from microbiological medicine, utilizing different types of diagnosis underdeveloped or inexistent in Colombian mining areas during the first half of the 20th century, such as X-rays.

Overcoming the ambiguities in the diagnosis of tuberculosis and silicosis had consequences on the doctor-patient relationship and on the evolution of medical knowledge. Nevertheless, the main repercussions were primarily social and occupational, through the identification of appropriate preventive measures and the establishment of the legal scope of compensation: tuberculosis in itself was not a reason for compensation.

Until the second quarter of the 20th century, most Colombian doctors were indifferent to the social issue of occupational diseases. Hence, silicosis was cloaked under a diagnosis of tuberculosis. This concealment in turn hindered the prevention of a disease whose cause had nothing to do with Koch's bacillus. Once the difference was recognized in the medical field, sophisticated techniques were developed for the prevention of silicosis, which

enabled a gradual reduction of the effects of silica dust and a decrease in the rate of biological deterioration.

One of the most relevant aspects in Colombian research on silicosis was the indirect questioning of the traditional models of medical-sanitary intervention. A prophylaxis focused on the working environment and on workers' bodies brought about important changes in the hygienic practices carried out by miners, employers and doctors as well as in medical intervention techniques; this is precisely the setting in which we can pinpoint the birth of occupational medicine in Colombia.

Finally, it is important to underline that within the relationships between miners and employers two parallel movements can be

identified: on the one hand, the transference of risk or strategies on the industrial employer's part to fracture working relations; on the other hand, on a set of negotiations and transactions of rights on the workers' part (13). Regarding the transfer of risks, employers blame workers for accidents and disease, either because of their behavior outside the company or for their individual predispositions or carelessness within the company. Concerning the second movement, a set of negotiations or transactions is carried out (13) in which the miner, without fatalisms and aware of the inevitability of the disease, negotiates the compensation instead of claiming access to his rights. However, this matter should be the subject of future research.

ACKNOWLEDGEMENTS

This article is one of the results of the research study entitled "*Emergencia de la medicina rural en Antioquia en el siglo XX*" ("Emergence of rural medicine in Antioquia in the 20th century"), by the research team Producción, Circulación y Apropriación de Saberes (PROCIRCAS), financially supported by Colciencias (code 111845221370) and the Dirección de Investigaciones of the Universidad Nacional de Colombia (DIME), in Medellín.

END NOTES

a. It is necessary to highlight the pioneering work of Libia Restrepo (16) regarding medical practice in the Sanitary Department of the Antioquia Railway. The period covered by the historian ends in 1930, just when industrial hygiene, social struggles and widespread concern for social issues favored the creation of "occupational medicine." This line of study has been followed by very few other works. Among them are found the work of Luna-García (17) on models of worker health care at Tropical Oil Company, an oil processing plant; and the study by Gallo (18) on models of worker health care at El Zancudo, a mining company in Antioquia. For further reference, see Mauricio Archila (19), Mario Hernández (20) and Alberto Mayor Mora (21).

b. This article was elaborated on the basis of a presentation given in the IV Seminario de História das doenças, Museo da Vida (Fiocruz), Rio de Janeiro, held from September 1 to 3, 2010.

c. Among the most important mines in the country, the Empresa Minera El Zancudo (EMZ) was highlighted as "one of greatest economic and business phenomena in the history of Colombia" (33 p. 635). As its operation spans an entire century (1848-1948), the company allows for a better understanding of significant transformations in the labor history of Colombia.

d. The Washington Convention of 1905, signed by Colombia under Act 17 of 1908; the Paris Convention of 1912, signed under Act 109 of 1912. See (37).

e. A project regarding the history of occupational medicine in Colombia and Brazil has been proposed by the doctorate program in History of the Universidad Federal de Santa Catarina (Brazil) in order to begin to fill this void in the historiography.

f. According to historian Mirko Grmek, a disease can be described as emerging if it meets one of the following conditions: it existed before its first description but as it could not be conceptualized

nosologically, it escaped the attention of doctors; it existed previously, but its existence was only recognized after a qualitative or quantitative change in the disease's manifestations; it did not exist in a certain region of the world but was introduced from another region; it did not exist in humans but affected animals; it is absolutely new, as the causal germ or the necessary environmental conditions did not exist before the disease's first clinical manifestations (22 p.120-121).

g. Article by Gabriel Toro Villa from 1932; thesis by Luis Alberto Torres from 1934, based on his observations of coal miners in Cundinamarca; article published in 1940 in the *Revista de la Asociación Colombiana de Mineros*, by engineer Juan de la Cruz Posada; thesis by doctor Guillermo Soto written in 1941, based on his observations of Compañía Minera Frontino Gold Mines; presentation by Dr. Martiniano Echeverri Duque from 1941, delivered before the other members of the Academia de Medicina de Medellín; a letter written in 1941 to the Academia de Medicina de Medellín by doctors Emilio Robledo, Eduardo Vasco and Lázaro Uribe, in their capacity as commissioners to assess the effects of the company Cemento Argos; the thesis written in 1948 by Ciro Alfonso Jáuregui on the association between silicosis and tuberculosis; and, finally, the thesis on pulmonary tuberculosis written by Miguel A. Zapata in Segovia in 1954.

h. We could only uncover the following works associated to miners' health within Colombian medical literature before 1920: *Trastornos medulares de origen complejo (Medullary Disorders of Complex Origin)* (1892), *Régimen alimenticio de los jornaleros de la Sabana de Bogotá (Diet of Day Laborers in the Bogotá Savannah)* (1893), *Habitaciones de la clase obrera (Dwelling Places of the Working Class)* (1893), *Quemaduras por gas grisú (Burns Caused by Firedamp Gas)* (1907), *Alimentación de la clase obrera y su relación con el alcoholismo (Working-Class Diet and its relation with Alcoholism)* (1914), *Higiene de los barrios obreros (Hygiene in Working-Class Neighborhoods)* (1914), *Los accidentes de trabajo en sus relaciones con la medicina legal (Occupational accidents related to Legal Medicine)* (1911) and *Fábricas insalubres y*

peligrosas (Unhealthy and Dangerous Factories) (1916).

i. The country was divided into four regions for sanitation monitoring: the central region led by engineer Forero, the western region led by Roberto Franco Arango, the northern region led by Hernando Sánchez, and the eastern region led by Próspero Ruiz Restrepo.

j. Act 48 of 1924, in addition to mandating the establishment of nurseries to care for workers' children, banned child labor in children under 14 in all types of mines, as well as other places (49). Nevertheless, this law was not fully enforced; no real intention was placed in stopping child labor or turning the use of child labor into a crime.

k. A further sign of this change are the legislative priorities established by the Ministry of Labor, Hygiene and Social Security. In 1938 the minister declared that according to the directors of the departments of hygiene, a law should be formulated requiring all agricultural, industrial or mining companies with more than five employees to provide their employees with healthcare services (50).

l. It is impossible to analyze this discussion thoroughly. During the 8th Latin American Conference on Tuberculosis, according to Dr. Miguel Zapata, the conclusion was that tuberculosis was not an occupational disease, however, work activity involved a direct risk of developing tuberculosis; the epidemiological characteristics and the sociocultural factors within the region in which the work was performed could worsen the situation, and working conditions were an indirect risk since they favored the development of tuberculosis. From that point of view, Zapata took into consideration the continuous exposure due to mining work and would thus make reference to "occupational tuberculosis" (53 p.20).

m. This practice of firing sick workers was commonplace in Spain; the pragmatism of English companies in charge of lead mining in Jaén meant dismissing sick miners and evicting the families of those who had died (3). In Colombia, the EMZ sometimes used this same method of dismissing sick workers (18 p.149).

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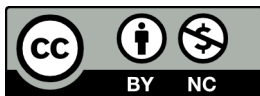
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CITATION

Gallo O, Márquez Valderrama J. Silicosis or miner's consumption in Colombia, 1910-1960. *Salud Colectiva*. 2011;7(1):35-51.

Received: 19 November 2010 | Revised: 1 February 2011 | Accepted: 20 February 2011



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This article was translated as a part of an interdepartmental collaboration between the Bachelor's Program in Sworn Translation of English Language and the Institute of Collective Health within the Universidad Nacional de Lanús. The article was translated by Nadia Couselo, reviewed by María Victoria Illas, and modified for publication by Vanessa Di Cecco.