

Asbestos-related Diseases in the Philippines: The Lung Center of the Philippines Asbestos Screening Program

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ABSTRACT

Adverse health effects from asbestos are well known and are due to the inhalation of fibers in concentrations that overwhelm the normal pulmonary defense and clearance mechanisms. Asbestos-related diseases include an interstitial lung disease termed asbestosis, pleural-based abnormalities, such as diffuse pleural thickening, pleural plaques, pleural effusions, and malignant mesothelioma. Asbestos exposure also significantly increases the risk of developing lung carcinoma. Despite the hazards borne from exposure to this mineral, asbestos is still commonly used in the developing world, putting workers at risk of developing these diseases.

The Lung Center of the Philippines' Asbestos Screening Program (1992 to 1996) examined former workers from the Subic Naval Base in Zambales for the presence of asbestos-related disease. Out of the 1,542 screened, 58.75 % demonstrated asbestos-related interstitial lung or pleural disease.

There is a need to recognize the health risks from asbestos exposure in the past which continue up to the present. Until a total asbestos ban is in place, efforts should be directed towards the elimination of asbestos-related diseases through prevention of exposures, raising awareness on health effects, establishing registries, early diagnosis, treatment and rehabilitation of those affected, and more stringent monitoring and control of asbestos use.

Key Words: asbestos-related diseases, asbestos, screening, Philippines

Case History¹

An actual case from the files of the Lung Center of the Philippines (LCP) Asbestos Screening Program is that of B.C., a 57 year old mechanic, who worked for 23 years in the boiler rooms and fire rooms at the Ship Repair Facility inside the Subic Naval Base. He complained of shortness of breath on exertion of 3 years duration. He had episodes of cough with minimal whitish sputum. Work history revealed that he had been an electrician for 7 years prior to his job at the Base. He had a 25 pack-year history of cigarette smoking but quit at the age of 53. He had no previous illnesses or

hospitalizations. Pertinent physical examination findings showed an elevated blood pressure, bibasilar fine end-inspiratory crackles more prominent over the left lower lung field on auscultation of the chest, and digital clubbing. His lung function test showed a restrictive ventilatory pattern with reduced diffusing capacity.

Chest x-ray (Figure 1) demonstrated abnormal interstitial opacities on both mid and lower lung fields. Based on the adequate work exposure, appropriate latency, radiographic and pulmonary function test findings, B.C. was diagnosed as a case of interstitial lung disease consistent with asbestosis.



Figure 1. Chest x-ray of B.C., 57 yr old mechanic with asbestosis.

Introduction

The word *asbestos*, derived from a Greek term for 'inextinguishable' or 'unquenchable', refers to a group of minerals which are crystalline-hydrated silicates that exist in a fibrous form.² It is the fiber-like structure, in addition to the chemical composition of the mineral, that is the basis for its extensive commercial use. Asbestos occurs in one of two forms: serpentine and amphibole. Chrysotile is the only serpentine form of asbestos, whereas there are several forms of the amphiboles.²

At the present time, it appears that all adverse effects on health from asbestos exposure are due to the inhalation of fibers in concentrations that overwhelm the normal pulmonary defense and clearance mechanisms.² Asbestos

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fibers carried to the deep lung induce an alveolitis that results in fibrosis. Asbestos fibers are transported to the pleural surface along lymphatic channels by macrophages and/or by direct penetration. The degree of fibrosis in asbestosis is dose dependent and tissue fiber burdens are generally related to cumulative exposure.³ Chrysotile fibers are less harmful than the amphiboles, in part because these fibers are cleared more efficiently than amphibole asbestos fibers, which may be retained indefinitely.³

Asbestos-related diseases include an interstitial lung disease, termed asbestosis, and pleural-based abnormalities, such as diffuse pleural thickening, benign plaques, benign pleural effusions, and malignant mesothelioma. Asbestos exposure also significantly increases the risk of developing lung carcinoma. Lung cancer can occur in nonsmokers exposed to asbestos; however, the risk is magnified several-fold by smoking.⁴ Most asbestos-related diseases have lengthy latent periods, the shortest would be benign effusions while the longest would be mesothelioma.

Asbestos has been used in many worksites throughout the world and, although exposures may be more limited at this time due to restrictions in its use, many people continue to come in contact with asbestos fibers through their jobs. Current published literature states that about 125 million people are exposed to asbestos at the workplace.⁵ Asbestos is still commonly used in the developing world and many more workers remain at risk to develop asbestosis and asbestos-related disease.⁶ Global estimates report that at least 90,000 people die each year from asbestos-related lung cancer, mesothelioma, and asbestos resulting from occupational exposures.^{7,8}

Asbestos has been used in numerous applications, including automotive brakes, electrical products, in boiler rooms and furnaces, in shipbuilding, in spray paints, in building construction and in asbestos cement products.⁶ Workers may be exposed in the production, manufacturing, transport and removal of asbestos products.^{6,9}

Asbestos use in the Philippines

No accurate records of the beginnings of asbestos in the Philippines are available. In a country report presented during the Asbestos Symposium for Asian Countries at University of Environmental and Occupational Health, Kitakyushu held in Japan in September, 2002, Villanueva, et.al. reported that much of the data that could be obtained are from reports on file from the Department of Environmental and Natural Resources (DENR).¹⁰ Those documents showed that reconstruction projects conducted after the Second World War utilized asbestos materials in water pipelines buried underground throughout Manila. Moreover, it was mentioned that there may still be asbestos-insulated water pipes in existence today, numbers of which could no longer be determined.¹⁰ In the late 1980's, attention was raised about the possible leaching of asbestos into the drinking water from deteriorating water pipes in Metro Manila. No evidence could reportedly be obtained that

such has occurred, however, despite a few investigations conducted by the government-run National Waterworks and Sewerage Authority (NAWASA).¹⁰ Government-funded housing projects also reportedly used asbestos-containing roofing materials.

Despite inclusion of asbestos (both chrysotile and crocidolite) as one of the mineral deposits present in mines in Mindanao, there are no sufficient viable asbestos mineral deposits present in the Philippines.¹¹ In addition, the quality of local chrysotile asbestos has not been deemed fit for commercial use. Therefore, asbestos used in the Philippines is imported mostly from Canada, Eastern Europe and China.¹⁰ The Philippines ranks number 10 among asbestos importers in Asia next to Taiwan followed by Australia with an approximate value of US \$ 2 million.¹² As of 2001, there were 14 manufacturing companies registered with the DENR importing chrysotile asbestos.¹⁰ The importation of crocidolite and other amphiboles has been strictly prohibited since two decades ago.

The Philippine Council of International Federation of Building and Wood Workers in its preliminary study found out that chrysotile asbestos has been used for the manufacture of construction materials, friction materials and gaskets.¹³ In addition, according to the Association of Asbestos Industries, up to 77 companies in the Philippines are using asbestos in its finished products.¹⁴ An estimated 5,000 workers may be currently exposed to asbestos during its use in manufacturing and an additional 30,000 through their direct handling of asbestos-containing materials in the construction industry, transport, storage and trade industries.¹⁴

Workplace Exposure Assessments for Asbestos

Workplace exposure assessments were conducted in a few asbestos-using establishments by the Occupational Safety and Health Center in 1990 and reports revealed fiber concentration levels way below the occupational exposure limits of 2 fibers/mm³ prescribed by the Philippine Occupational Safety and Health Standards.^{15,16}

Surveys on Asbestos-related Diseases

There is a paucity of prevalence data on asbestos-related diseases in the Philippines. A survey was conducted in 1992 by the Occupational Safety and Health Center on four manufacturing companies that used asbestos as the main material for their products, mostly for roofing, textiles and packing. Out of the total 86 workers who were examined and underwent chest x-ray, only 12 or 13.95 % were reported to have x-ray changes suggestive of asbestosis. There were no other clinical data or lung function tests performed, however, and no follow-up work-ups were done.¹⁰

Asbestos Screening Program of the Lung Center

The largest population of workers examined for the presence of asbestos-related disease consisted of former employees at the Subic Naval Base in Zambales.¹⁷

Background on Subic Naval Base

In the 1960s, during the Vietnam War, Subic took on the task of maintaining ships and providing supplies (such as food, fuel, and ammunition) to sustain the fleet in the Western Pacific region.¹⁸ Even in the 1990s, Subic played a role in military operations in the Desert Shield and Desert Storm operations. However, in June of 1991, Mt. Pinatubo erupted and Subic Bay was buried under 18 inches of ash fall.¹⁸ Later, on September 13, 1991, the Philippine Senate rejected the 10-year Bases Treaty of Friendship, Peace and Cooperation and the following year, the Subic Bay Freeport was created under Republic Act 7227.¹⁹

Objectives

The objective of the screening program was to determine the prevalence of asbestos-related lung and pleural disease among those who were exposed to asbestos during the course of their employment at the Base. The data gathered was also intended to support the subjects' petition for disability compensation.

Screening Methodology

From November, 1992 up to the middle of 1996, the Asbestos Screening Program was conducted at the Lung Center of the Philippines (LCP). The findings of this screening program were retrieved and reviewed. The screened population comprised former Subic Naval Base Filipino workers employed at the Ship Repair Facility and at the Public Works Center. Since those workers officially ended their employment by 1992, they were contacted via mail, through local broadcast radio and word of mouth through the efforts of a US-based law firm who was interested in assisting them in filing disability claims.

A basic requirement to qualify for the screening program was the availability of complete service records containing specific job description and duration of employment of the target group.

All subjects who consented to undergo screening had a chest x-ray taken at the LCP. A postero-anterior view was required in all subjects, and lateral and oblique views were performed in selected individuals to verify the presence or absence of pleural abnormalities. The technique used in the chest radiography was based on those specified by the American College of Radiology "Technique for Chest Radiographs for Pneumoconiosis" prepared for the National Institute for Occupational Safety and Health.²⁰ This was intended to produce optimum technical quality of films that would meet requirements for a valid interpretation. The chest x-ray films were subsequently sent to the USA for quality assessment and interpretation by a certified "B" reader who utilized the scoring system of the Standard 1980 International Labour Office (ILO) Classification of Radiographs of Pneumoconiosis. This scoring system has been recently revised.²¹ Asbestosis characteristically presents on plain chest radiographs as small irregular

(reticular opacities) in contrast to silicosis or coal workers' pneumoconiosis which present as rounded (nodular) opacities. In asbestos-exposed subjects, the presence of pleural plaques, although not invariably detectable, tends to support a radiographic diagnosis of asbestosis. Other findings, such as diffuse pleural thickening and calcification, are non-specific. In general, pleural abnormalities signal asbestos exposure but not necessarily asbestosis.

Those subjects whose chest films showed radiographic abnormalities were called back for additional examinations which consisted of face-to-face interviews to obtain a thorough clinical and occupational history and a physical examination with emphasis on the respiratory system. The presence of dyspnea, chest pain, cough and history of other respiratory diseases was noted. The interviews detailed information about the individual's prior employment, smoking history, and personal and family health histories. Subjects were asked to quantify their tobacco use behavior according to method of smoking (cigarette, cigar, or pipe), packs per day, pack-years and their ages of initiation and cessation of smoking. Smoking status was reported as: never smoked, ever smokers, current smokers, and former smokers. Subjects were asked to narrate every job since finishing school (name of company, job title, and tasks performed). They were also asked about the year of first exposure to asbestos, and whether they ever worked in trades or at locations known to be associated with asbestos exposure. Personal health history questions included a listing of all medications and hospitalizations, including date of confinement and diagnoses.

Those subjects with asbestos exposure history but with equivocal, atypical, or near-normal chest radiographs were requested to undergo further imaging studies, specifically a high-resolution chest CT (HRCT) scan which were performed in another center. All scans were sent to the USA for further interpretation by a certified "B" reader. On HRCT, asbestosis is characterized by several signs which include septal lines, intralobular lines, subpleural curvilinear lines, and honeycombing. The first three are not definitive of pulmonary fibrosis seen in asbestosis and may be seen in a variety of other conditions. Honeycombing is a specific indicator of pulmonary fibrosis but not specifically of asbestosis. A 'ground-glass' opacification of the lung parenchyma is less common in asbestosis. Other findings are: parenchymal band and rounded atelectasis, both of which are not specific for asbestos exposure. There are no standard set of CT films comparable to those of the ILO system.

Pulmonary function testing was performed in all those found to have chest x-ray findings that may be consistent with asbestos-related disease. The tests consisted of spirometry, pre-and post-bronchodilator, lung volumes and diffusing capacity measurements. These tests were conducted and their results interpreted in conformity with published standards.^{22,23}

The criteria used for the diagnosis of asbestosis and

asbestos-related pleural disease was based on clinical, physiological, and radiologic features, namely: an adequate exposure history, chronic symptoms of breathlessness, characteristic linear, irregular radiographic opacities (1/0 or greater) and/or diffuse pleural thickening or pleural plaques on chest x-ray or HRCT, and pulmonary function abnormalities showing restriction or a combination of restriction and airflow obstruction with reduced diffusing capacity. A chest film showing the characteristic signs of asbestosis in the presence of a compatible history of exposure is considered adequate for the diagnosis of the disease and further imaging procedures are not required.²⁴

Screening Results

A total of 1,542 ex-workers volunteered to be screened. Their ages ranged from 43 to 84 years with a mean age of 62.18 years. Smoking history was positive in 92.74% (ever smokers) and 48.89% were current smokers at the time of the examination. The mean number of years of smoking was 15.17 years.

Out of these 1,542 subjects, 593 who were shown to have abnormalities on chest x-ray returned for interview, physical examination and pulmonary function tests. Only 587 of the 593 subjects had evaluable results.

There were 208 subjects (35.4%) out of the 587 who underwent further high-resolution chest CT scanning.

Figure 2 depicts the percentage distribution by occupation. It showed that over 30% were machinery mechanics, 22.83% were metal molders, 13.28% were pipefitters with smaller percentages for the other occupations. In about 50% of the screened population, the duration of asbestos exposure based on their jobs ranged from 21 to 30 years with a mean of 24.01 years as shown in Figure 3. It was noted that majority commenced work at the Base in the early 1950s and 60s and stayed on until the Base's closure in 1992.

Chest radiographs in 302 out of the 587 or 51.44% demonstrated a profusion of interstitial opacities of ILO 1/0 or higher and lesions were predominantly linear or reticulo-nodular infiltrates distributed over both lung fields. Pulmonary function test results revealed that 363 subjects or 61.84% had a reduced diffusing capacity for carbon monoxide (DLCO) and 143 or 24.36% showed a decreased total lung capacity consistent with a restrictive ventilatory impairment. A good number of subjects, 321 (54.68%),

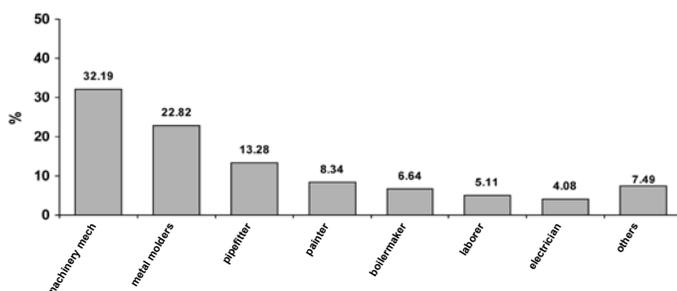


Figure 2. Percentage Distribution of workers by Occupation.

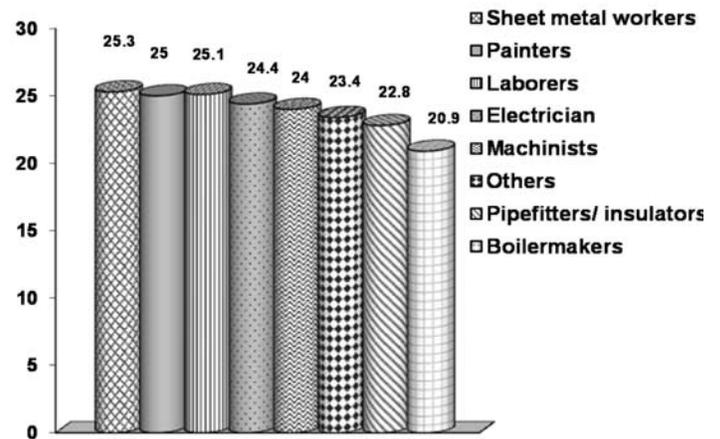


Figure 3. Mean Duration of Employment in Years.

however, showed combined obstructive and restrictive ventilatory pattern. There were 366 out of the 587 (62.35%) subjects evaluated who had features of asbestosis based on the above mentioned diagnostic criteria. A total of 132 (22.48%) only had pleural abnormalities consistent with previous asbestos exposure. Only in 1 was the combination of parenchymal and pleural disease noted. Overall, for those with complete work-ups, 387 out of the 587 or 65.93% showed asbestosis and up to 519 out of the 587 or 88.41% showed either parenchymal or pleural disease consistent with previous asbestos exposure. Out of the total population (n=1,542) screened, 58.75% had asbestos-related parenchymal or pleural disease.

In 35 individuals included in the screened population, the presence of concomitant malignancy was suggested by chest radiographic findings of either a discrete pulmonary nodule or mass density. Unfortunately, from 1996 to 1998, only a handful of these subjects returned for follow-up and none of those consented for further work-up.

From 2001 to the present, at least four individuals positive for asbestosis among the original screened population were diagnosed with lung cancer; two by post-mortem lung biopsy and two from surgical biopsies. No mesothelioma cases were seen.

From 1997 up to the 2007, there were 16 individuals out of the screened population who submitted disability claims to the Social Security System stating asbestosis as the nature of their illness; two with asbestos-related pleural disease and one was a death claim.²⁵ No accurate records on long-term survival could be obtained.

Discussion

There are numerous published data on the prevalence of asbestos-related disease in different countries. The Institut National de Santé Publique Quebec in the Report on The Epidemiology of Asbestos-related Diseases in Quebec mentioned that 378 out of 691 (54.70%) workers with files obtained from 1988 to 1997 and recognized with asbestos-related diseases suffered from asbestosis.²⁶ Job distribution

in that report showed that 35 % of the workers came from mines while 42 % from maintenance, repair and construction work.²⁶ This is in contrast to the LCP Asbestos Screening Program population who were all involved in the latter industries and who had considerably higher percentage (65.93 %) positive for asbestosis.

In more recently published data relating prevalence of asbestos-related disease among 18,211 sheet metal workers examined between 1986 and 2004 in the USA with a mean duration of 32.9 years in the trade, only 9.6 % had findings consistent with asbestosis while 21 % had pleural scarring.²⁷ It was noted that the strongest predictor of both parenchymal and pleural disease on chest x-ray was the year in which the worker began sheet metal work, and that work in a shipyard was an important risk. The authors suggested that reduced asbestos exposure in the 1980s may have accounted for the lower disease prevalence. On the other hand, work in the Subic Base shipyards and employment in the early 50s and 60s may be the very reasons for the contrasting high prevalence of radiographic abnormalities consistent with asbestos-related disease in the LCP Asbestos Screening population.

The prevalence of asbestosis among asbestos workers increases with the length of employment. An analysis of chest films of 1,117 New York and New Jersey asbestos insulation workers, taken during an eleven year period 1981 to 1991, found asbestosis in 10% of workers who had been employed for 10 to 19 years, 73% among those employed for 20 to 29 years, and in 92% of those employed for 40 or more years.²⁸ A similar exposure-response relationship was found among asbestos cement workers.²⁹ In the LCP Asbestos Screening population, the mean exposure duration of 24 years was consistent with the high percentage of positive radiographic findings.

As with other interstitial lung diseases, the classic finding in pulmonary function observed in asbestosis is a restrictive impairment, characterized by reduction in lung volumes along with reduced diffusing capacity for carbon monoxide.³⁰ Restrictive impairment may also be observed with pleural disease.³¹ Mixed restrictive and obstructive ventilatory pattern is frequently seen. These obstructive findings have been thought to be due to asbestos-induced small airway disease. As such, mixed restrictive and obstructive abnormalities do not rule out asbestosis and this was observed as such in over half of this screened population. Moreover, the presence of chronic obstructive airway disease that is not due to asbestos but rather secondary to smoking may complicate the lung function measurements in those with asbestosis. Total lung capacity may be normal rather than decreased when both disorders are present due to the restrictive process offsetting the air trapping.³² It is notable that a great majority of this screened population had a significant smoking history.

No written records could be obtained that indicated the type of asbestos fiber used or handled by these subjects. A gross description of the work areas on board ships were

narrated by many of the workers who mentioned the presence of visible clouds of dust and fibers during repair activities (e.g. removal, installation of insulation) at the Ship Repair Facility and during construction operations at the Public Works Center. No standard personal protective devices were reportedly available to the workers until the mid to late 70s.

Conclusion

The results of the Lung Center Asbestos Screening Program demonstrated that, in this population of former Subic Naval Base workers, 58.75 % suffered from asbestos-related disease.

Current Status of Asbestos Control

Overall, there has been a downward trend for asbestos consumption in Asia from the 1900s to 2000. This is consistent with the decline in worldwide consumption. In keeping with this observation, the Philippines is among the list of countries in this region that appear to be maintaining low levels of asbestos manufacturing capability.¹²

By 1995, due to the increase in worldwide awareness of the adverse health effects of asbestos exposure, the DENR listed asbestos as one of its priority chemicals for regulation. This laid the groundwork for the enactment of a law, the Chemical Control Order for Asbestos, DENR Administrative Order No. 02 which was passed in 2000.³³ This law was formulated through a series of consultative meetings participated in by multi-sectoral groups including, among others, representatives from the government, the scientific community, and the asbestos industry. The law sought to raise awareness on asbestos exposure and its effects.³³

The Occupational Safety and Health Center on October 12, 2000, held a "Forum on Asbestos" at the Occupational Safety and Health Center in Quezon City as part of its awareness campaign on the hazards of asbestos. Subsequently, a National Conference on Asbestos was held in April 26, 2001 wherein the International Federation of Building and Wood Workers and its Philippine Affiliates Council reported that "an estimated more than half of the 1.4 million wage and salary workers under construction are considered already and potentially exposed to asbestos-containing products."¹³

Recently, there has been a call for a total ban on the importation and commercial and industrial usage of asbestos, primarily chrysotile. The movement for this ban was initiated by a loose coalition of concerned individuals and organizations who called themselves the Philippine Ban Asbestos Network.³⁴ The same coalition also intends to push for raising public concern on asbestos and its risks to human health.³⁴ Such a strategy may be consistent with the World Health Organization (WHO) recommendations highlighted during the 13th Session of the Joint ILO/WHO Committee on Occupational Health in 2003 that special attention be paid to the prevention of asbestos-related diseases.³⁵ And that the most efficient way to eliminate asbestos-related

diseases is to stop using all types of asbestos.³⁶

There is a need to recognize the importance of health risks posed by asbestos exposure in the past which continue up to the present.³⁷⁻⁴⁰ Until a total asbestos ban is in place, a national plan of action for elimination of asbestos-related diseases should be implemented through efforts directed, on one hand, towards protection of at-risk workers' health by prevention of exposures to asbestos, raising awareness on health effects, establishing registries, early diagnosis, treatment and rehabilitation of those affected, and on the other, more stringent monitoring and control of asbestos use.

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