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Asbestos exposure and health hazards: a global emergency, Epidemiological evidence and denial theories

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ABSTRACT

On June 3rd 2013, in Turin, Italy, the Swiss industrialist Schmidheiny has been sentenced to 18 years imprisonment for intentional disaster for 3,000 asbestos-linked tumours in Italian workers at cement multinational Eternit. The indiscriminate use of asbestos, however, continues worldwide. Although many studies have shown that asbestos is associated with an increased risk of mortality and morbidity, denial theories were spread over time, showing how the logic of profit governs the production of asbestos. We examined the history of the epidemiological evidence of asbestos related risks and, second, the main sources of exposure in Italy and in the world, occupational, non-occupational, and post-disaster exposure (as occurred after L'Aquila earthquake in April 2009). The theme of inequality and social justice is ever so alarming in the fight against asbestos and its lobbies.

Key words: asbestos, environmental health, exposure risks, public health

INTRODUCTION

Asbestos is a mineral which can be found in long fibres and or thin layers of two configurations: *serpentine* and *amphibole*. The only type of asbestos derived from a *serpentine* shaped mineral, the *chrysotile* (called also white asbestos) represents 97% of asbestos used in the world. The *amphibole* mineral encompasses five species of asbestos instead: *amosite, crocidolite, tremolite, antofillite, actinolite*. Asbestos has been known since ancient times for its particular characteristics: resistant to fire, resistant to traction and rainwater, it was called *wool of the salamander*.[1]Plinius in his *Naturalis Historia*, describes the use of it when wrapping bodies such that in cremation it would leave lighter coloured ashes.[2] Following the Industrial Revolution, asbestos spread worldwide as a material resistant to heat and used in the building of the steam engine[3] for both industry as well as transportation. It was discovered new deposit and was implemented in the extraction from caves already known like the one in Balangero, in province of Turin.[4] In 1893 in Austria, the production of an indestructible mixture of asbestos-cement, patented in 1901 under the name of *Eternit* (from the Latin *aeternitas*) by Hatsheck. Eternit with its characteristic high level of resistance, became quickly used in its multi-uses, and sprang into action becoming a real worldwide business. The company Eternit was set up in Switzerland, in Niederurnen, just south of Zurich in 1903. During its expanding period Mazza acquired the licence in Italy and based a site in Casale Monferrato in 1907. The Belgian De Cartier de Marchienne in 1946 became the director of the facilities and in 1972 the Mazza family's share passed to the Schmidheinys until its closure in 1987. Casale's population was well documented on the association among occupational, domestic and environmental exposure to asbestos and the increasing risk in relation to Malignant Pleural Mesothelioma.[5] Recently, on 3 June, 2013, a Turin appeals court ordered compensation of 30.9 million euros be paid by the former owners of a disastrous cement company to the hard-hit community of Casale Monferrato. Eternit Executive Schmidheiny sentenced to 18 years on appeal, when the lower court had handed down 16 years. This has to "*make*

us reflect on the quality of industrial development in Italy and in the world. You should stop making profits on the skin of its citizens", said the prosecutor Guariniello. The Swiss Schmidheiny deemed responsible for disaster for the Eternit plants of Bagnoli and Rubiera, as well as of Casale Monferrato, Italy.

Date of knowledge of asbestos risks correlated: the history of experimental evidences.

Numerous are the historical and scientific evidences which document the awareness of the risks tied with the use of asbestos in a former period from the one chosen by the lobbies to deny their own civil and criminal responsibilities. In 1898, Murray of *Charing Cross Hospital* of London, noticed pulmonary alterations of sclerotic type in the autopsy of a carder in an asbestos factory.[6] In 1918, in the USA Hoffman of *Prudential Insurance Company*, convinced of the dangers of asbestos suggested not stipulating it in the life insurance contracts of asbestos workers.[7] A number of scientific studies followed: in one study of tubercolosis, Scarpa, in 1908, out of 30 cases of asbestos workers he observed a good 29 of them showed galloping progress of the tubercular pathology, he hypothesized that asbestos played a role in the workers' exposure.[8] In 1924 the term *asbestosis* was coined from a case report in a young woman death after working twenty years in the textile field in which a large amount of asbestos was used.[9] In 1926 there were noted cases of deaths from pleural tumour of asbestos workers occurring in the years between 1890 and 1895 by the French Workers Inspectors.[10] In 1930 Merewether produced in Great Britain the first report of the effects of asbestos dust in the lungs as well as a policy to bring the dust level down at the work place.[11] In 1935 a research was conducted by Lanza in the inside of factories where asbestos was used. Evidences that 2/3 of the 126 chest x-rays that were made resulted in pathologies.[12] In later studies, the reports were published of high levels of asbestosis and in a report for the industrialists, Vigliani recommended the reduction to the exposure in work areas with possible suction tools and the possibility of training the workers on preventive behaviours.[13] Afterward, there was a confirmation from scientific community as for links between asbestos and lung cancer. Weiss's was the case report on asbestosis and malignant pathology;[14] in 1955 Doll noticed the causal relationship between asbestosis and lung cancer;[15] Van der Schoot in 1958 described deaths of asbestos workers of whom two were from Pleural.[16] In 1960 Wagner established a possible association between the Mesothelioma and the exposure to *crocidolite*.[17]

After the 1964 conference of the *New York Academy of Sciences* the scientific international Community recognized the asbestos carcinogenic effects of asbestos. Still in 1964 Selikoff also affirmed the relationship between asbestos exposure and *neoplasia*. [18] Castelman will testify in court "*Since the 1950s and onwards there have been over eighty publications on relative works about possible development of tumours from inhaling asbestos dust*".[19] The *cartel of asbestos*, nevertheless, commissioned the creation of an alternative scientific truth, according to which asbestos was not harmful and did not have any correlation with the pathogenesis of Mesothelioma, having to do with denying, concealing and manipulating scientific information.

Business and continuous exposure to asbestos

Within the century between 1900 and 2000, there has been produced 173 million tons of asbestos in the world. After World War II until its banning in 1992 in Italy, it has been calculated that there might have been three million tons of asbestos.[20] First in Europe, Iceland had banned asbestos in 1983, followed by Norway a year later. In 1996 France banned it, and in 2000 Switzerland and Belgium followed. The leading asbestos producing countries in 2000 remain, with 2-4 millions tons of asbestos extracted every year, Russia, Kazakistan, China, Brazil, Canada and Zimbabwe. Canada's embarrassing position that exports almost its total amount of asbestos production exclusively to developing countries and fast growing ones, and in the area of Quebec there is the so called city of *Asbestos*.[1]

The epidemiologist found difficulties in establishing the dimensions of the work and environmental exposure in the main producing asbestos countries have been keenly noted; such as Brazil.[21] Given the reduced publications found, it can be concluded that the study of the epidemiology of the asbestos-

related pathologies is wilfully underestimated and neglected. If the global use of asbestos would stop today the decrease of pathological cases associated with asbestos would have only been seen only over the next twenty years, considering the latent period of the pathology.[22] Before the worldwide banning of asbestos and the fruition of its exposure, the outbreak of asbestos cancer would reach up to ten million lives.[23]

Types of exposure

Asbestos has been ubiquitous in its use in the work world. The risk associated in its exposure has been proved in the real world of industry in Italy and abroad. In Italy is outstanding the case of *Broni*, in the province of Pavia, Northern Italy, where in the proximity of an asbestos-cement producing establishment called *Fibronit*, was found a significant increase of death of malignant neoplasy of pleura.[4,24] In the area of Monfalcone-Trieste, in the North-East, work exposure was matched to naval yards with a large amount of asbestos from the large use of asbestos in the non-conductivity of the ships. In a 1997 study 421 cases of Mesothelioma were diagnosed in the area of Monfalcone.[25] Several epidemiologic investigations in the last few years have looked into the cohort of workers from the *Ansaldo-Breda* of Pistoia factory with previous exposure to asbestos identifying a number of diagnostic Mesothelioma higher than normal values.[26] The tumours from asbestos exposure in the work place include also the ones of Italians who have worked abroad, like the workers in the *crocidolite* mine of Wittenoom, Australia, and of the cement-asbestos factory in Niederurnen in Switzerland. Among the latter there has been fifteen cases identified of Pleural Mesothelioma or Peritoneal. Nevertheless the asbestos' workers family members who indirectly had been exposed to it, have shown to be at risk to develop Mesothelioma in many studies of cohort, like the one conducted on one out of 1780 workers' wives employed at *Eternit* in the period between from 1988 to 2003, in which the mortality rate for Pleural Mesothelioma for women has increased.[27] The 8% of the deaths (40 cases) of women who lived in Wittenoom until the end of 2004 has been for Malignant Mesothelioma. Therefore the mortality rate shown in this cohort until 2030 will be 66-87 cases, showing how high the risk of developing Mesothelioma is still a public health problem today in cohorts for the exposed subjects, as in this case of domestic exposure to asbestos.[28] The main sources of exposure to *environmental exposure* to asbestos or to fibres shaped like asbestos derived from industrial establishment, or it is the case of *asbestos in place*, that is asbestos used like construction material; in the end, the environmental exposure happens for the ground and rocks contaminated, above all from *amphiboles*.[29,30] In Turkey, a study done on a sample of inhabitants of small villages in the centre of the country exposed to *tremolite* and *chrysolite* present in the ground, has located an average annual cases of *Mesothelioma* of 88 times and 7999 times (with male/female rate) higher respect to the world average in the same period.[31] Numerous studies affirm that even 50% of all the deaths in small villages in another area of Turkey, the Cappadocia, is caused by environmental exposure Mesothelioma of *erionite*, shaped like asbestos *zeolite.*[32] Studies made in the North West of Greece, in the Metsovo area, have shown high level of endemic pulmonary calcification in 47% inhabitants of villages made with a material, called *lute*, which has high presence of long fibres of *tremolite*,[33] with an increase of risk for Malignant Mesothelioma of 300 times.[34] The presence of stones containing serpentine, also called *NOA, Naturally Occuring Asbestos*,[35] in Sierra Nevada, California, is attributed as the cause of the increased risk of developing Mesothelioma. In the United States the city of Libby, Montana, is the epicentre of one of the biggest environmental disaster in the world regarding asbestos exposure.[36] In Biancavilla, a small city in the province of Catania in eastern Sicily, Italy, which stands in the proximity of a cave for building material[37] containing a great quantity of *amphibole* fibers of the serie of the *fluorine adenitis*, it presently represents a significant number of deaths for Mesothelioma. A controlled case study in which is investigated the association between Malignant Mesothelioma and environmental and domestic exposure in Casale Monferrato, suggests nevertheless that asbestos environmental exposure could provoke a higher risk of developing Mesothelioma with respect to domestic exposure.[4]

Asbestos environmental exposure issue following natural disasters or linked to human activity is of notable impact to public health: *earthquakes* (Sichuan, China; Japan, 2011; Christchurch, New

Zealand, 2011; and lastly in Italy, L'Aquila, 2009 and Emilia-Romagna, 2012), *hurricanes* and *destruction* episodes like the Twin Towers crash on September 11th, can expose the population to a massive quantitative of asbestos. On September 11th, 2001, in New York City the *World Trade Center* crash caused a large dispersion of *amosite*, material used in the *Twin Towers.*[38]

Case study in L'Aquila, Abruzzo, Italy

In the days following the earthquake of April 6, 2009, between the critical emerged the management of waste rubble, as an element to quantify and analyze its components. The identification and removal of hazardous materials is of paramount importance to achieve, by the process of demolition, non-contaminated materials that can be easily sent for recycling. Among the elements most hazardous to health is asbestos present in the building materials in use until the 80s. We tried to quantify the amount of debris produced in the process of demolition / reconstruction of the city of L'Aquila and examine in particular the risk of asbestos related. We assessed the presence of asbestos in the debris storage sites, sampling and analysis of airborne fibers and shredded material. Through preventive inspections in crumbling buildings has been verified the presence of asbestos and the possibility of selective demolition. The amount of rubble is estimated amounted to 3,760,000 tons, of which more than 70% only in the Municipality of L'Aquila, where there are currently 89 cubic meters of asbestos disposed of 87,018 m3 of rubble treated (0.1% of the total), about 200 kg per day. More than 40,000 m2 are the products containing asbestos (asbestos-cement slabs covering, chimneys and tanks, etc.)[39] In buildings affected by the earthquake collapsed or yet to be demolished. The results derived the finding of the hazards of contamination and the resulting estimate of the risk to the health of workers and the public exposed, necessitate the activation of an integrated program of public health, to put in place adequate prevention strategies. It is also a need for greater public awareness about the risks linked to asbestos from the rubble caused by earthquakes, in reference to their recurrence as has happened recently in Emilia Romagna earthquake, 2012.

Science and conflicts of interests

The so called *controlled use of asbestos* is the proposed alternative towards the Third World Countries from the asbestos producers. The strong points of this strategy are represented by the import of products containing asbestos *chrysotile* only from the authorized producers; the check supplies; the final test of the chain in use. The more serious fact is the apparent lacking of real possibility of supervising and checking of the strategy in the developing countries, where there is a lack of rules and regulations in the area of production and work safety.

In order to reinforce the safeness of *chrysotile* is commonly used the hypothesis formulated by Stanton,[40] according to which the longer and thinner fibres are much more carcinogenic than those shorter and thicker. Due to the fibres' dimension, with respect to any other characteristic, and having more influence on pathogenicity among the different types of asbestos. Studies of *biopersistency* have indicated that the *chrysotile* of Canada and California is quickly eliminated from the lungs once it is inhaled. These results support the evidence presented by McDonald in 1997 for whom the *chrysotile* fibres are quickly eliminated from the lungs, to the contrary for the amphibole which remain trapped.[41] Bernstein in his research has found that longer fibres are eliminated via dissolution and breaking up in shorter ones, in turn quickly eliminated from the lungs .[42]

These theories sustain the *controlled use of chrysotile*, in contrast to the world anti-asbestos campaign. The *Global Asbestos Network* is an international network whose aim is to ban the production and the use of asbestos in the world, from the north to the south, from the super powers to developing countries.[43,44] Scientists from all over the world are the first ones to sign on to the document in which says "*Scientists, doctors, and people in power of the consenting countries using asbestos should not have any illusion that "the controlled use" of chrysotile asbestos could be an efficient alternative with respects to the absolute banning and use of asbestos. An international banning of extracting and using asbestos seems urgent, because the risks of exposure to it cannot be controlled by technology or regulated by the work use procedures*." Also the Collegium Ramazzini called

for an international asbestos ban (Collegium Ramazzini, 2011) and, more recently, the *Joint Policy Committee* (JPC) *of the Societies of Epidemiology* (SE), a consortium of national and international epidemiologic societies and organizations, released a statement calling for the global ban of asbestos use.[44,45, 46]

CONCLUSIONS

Casale Monferrato, Turin, Italy, represents a great example for the scientific community and the world public opinion. Nevertheless the difficulties of the hardship of investigating the risks, it seems a priority to identify the possible sources of exposure so as to prepare the strategies of primary prevention and overseeing health programs for workers previously and currently exposed. The research represents a continuing challenge: several are the Italian research groups who have studied new therapies for Mesothelioma, in order to improve the patients quality and lifespan. In the end the greatest tragedy of asbestos deaths is that they are foreseeable and above all such tragedy strikes unrelentingly the poorest in the world. The theme of inequality and social justice is ever so alarming in the fight against asbestos and its lobbies.

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