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MONOGRAPHIC SECTION

Communication and health education in communities experiencing asbestos risk and health impacts in Italy

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Abstract

Introduction. Numerous municipalities in Italy currently experience asbestos health impact, in particular excesses of pleural mesothelioma incidence and mortality. This paper presents an integrated analysis of epidemiological studies and communication actions in affected municipalities to highlight how communication has been implemented depending on health impact evidence and involvement of local stakeholders.

Methodology. Four case studies are identified concerning industrial and natural sources of asbestos exposure having different diseases burden. This integrated analysis benefited from multidisciplinary skills.

Discussion. Evidence of different stakeholders engagement is presented to emphasize their role in the communication process. Similarities and differences among case studies allowed us to identify lessons-learned to be transferred in other asbestos contaminated sites.

Conclusions. The adoption of communication strategies and practices, since the very early evidence of asbestos health impact, represents a relevant contribution for epidemiological and health surveillance, particularly for those communities where asbestos health impact has only been recently reported.

Key words

- asbestos
- epidemiological surveillance
- communication
- stakeholders engagement
- resilience

INTRODUCTION

Health, environmental and social impacts due to long-term asbestos use in Italy have been requiring continuing efforts both in national priority contaminated sites (NPCSs) and in areas characterized by the presence of natural sources of asbestos or asbestiform fibres [1-6]. Numerous municipalities currently experience specific, localized excesses of pleural mesothelioma incidence and mortality due to a past use of asbestos in occupational sectors and diffuse environmental exposure in the neighborhood of industrial settings. For some of these areas the increase in mesothelioma risk has only recently been identified [7, 8]. The wide use of asbestos containing products over the national territory and the long latency period of mesothelioma concur to maintaining a relatively elevated occurrence of this disease notwithstanding the asbestos ban in 1992, as forecasted [9].

Within a public health approach, health promotion and communication of epidemiological and health surveillance plans and findings to different stakeholders, including the population living in the affected areas, is considered essential [10-13]. Communication with local communities on health risks and impacts affecting their occupational and living environments plays a critical role in contributing to preventive action through informed policies [14].

Epidemiologists can build a relationship with communities by providing evidence about risk in the given context, detecting previously unknown health impacts in specific areas, and improving understanding of risk. In this perspective, a specific concern regards the no-

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tion of population risk *vs* individual risk, typical of the communication of epidemiological findings, also considering possible judicial and economic expectations of the subjects. These problems specifically apply to mesothelioma and asbestos exposure. Communication involves in particular subjects that were directly exposed, people suffering from mesothelioma and, in some cases, relatives of mesothelioma patients.

Local occupational physicians and general practitioners (GPs) play a key role in the process of communication in communities experiencing occupational, environmental, and domestic asbestos exposure. Beyond their specific health activities, they are very useful in explaining with an understandable language the meaning of mortality and morbidity statistics about asbestos related diseases, the content and the usefulness of a health surveillance program (tests, results), how to diagnose and treat asbestos-related diseases. They should be able to convey information about healthy habits adoption (i.e. smoking cessation, precautionary measures to reduce exposures), and to answer typical questions as "Is living here safe now? What about the long-term safety here?", "Is going to school dangerous for my children?", "I have been diagnosed as having asbestosis: what should I do? What should I expect?", "I am concerned about cancer". All medical communication activities should be taken on a regular, predictable basis [15-17].

Awareness and preparedness of affected communities to manage the health impact of asbestos exposure also depend on the effectiveness of communication activities capable to take into account socio-economic, institutional and cultural specificities of the local context. This requires the involvement of social researchers in the communication process playing a critical role in the relationship with institutional and social actors and the affected populations [18, 19]. Communication with asbestos exposed communities though, has not so far been systematically planned. Creating the conditions for an effective communication especially requires the aware participation of multidisciplinary research groups dedicated to increase community resilience versus asbestos health impact. This is particularly needed in areas where asbestos health impacts are still coming to light.

OBJECTIVES

This paper aims to present an integrated description and analysis of epidemiological studies and communication actions in some municipalities affected by asbestos health impact in Italy to throw light on how communication has been implemented depending on the evidence of health impact and the involvement of local institutional and social actors. The goal is to provide useful tools contributing to increased resilience of communities in areas where asbestos health impacts are currently being brought to light, in particular mesothelioma incidence and mortality.

METHODOLOGY

The four case studies identified include both industrial and natural sources of asbestos exposure, with different history and asbestos diseases burden:

- the municipality of Casale Monferrato in Piedmont Region, that experienced major occupational and environmental asbestos health impact due to the past asbestos-cement industrial production;
- a set of municipalities of Emilia-Romagna Region where asbestos-cement production started later than in Casale Monferrato and where a health impact on the population is currently emerging;
- the municipality of Biancavilla in Sicily Region characterized by fluoro-edenite health impact due to natural occurrence of this asbestiform fibre;
- a set of municipalities in the Mount Pollino area of the Basilicata Region characterized by the presence of naturally occurring asbestos fibres in soil.

Times and methods of developing communication processes have been analyzed regarding the scientific evidence of health impact on the affected communities on the basis of both scientific and grey literature, direct involvement of the Authors of the epidemiological studies, and retrieval of newspapers articles.

The integrated analysis of epidemiological studies and communication actions in the different settings here presented benefited from multidisciplinary skills in epidemiology, occupational medicine, social and educational sciences.

CASE STUDIES

Casale Monferrato in the Piedmont Region

The production of asbestos cement started very early in Casale Monferrato. The location of Casale Monferrato was of special interest because of the local production of high quality cement that was already one of the main economic activities of the area. The Eternit plant started operations between 1907 and 1912 and remained active until 1986. It employed a cumulative number of about 4000-4500 blue-collar workers, of which those active on January 1st, 1950 or subsequently hired have been listed and included in a cohort study. The maximum size of the workforce was around 1500 workers in the early '70s. The proportion of women was relevant: out of 3434 workers in the cohort, 777 were women. Female employment mainly occurred during the II World War. The factory covered an area of about 92 000 square metres and was located close to the urban areas of the town [20]. Given these premises, it is evident how relevant the Eternit factory was in the economy of Casale Monferrato, a town of about 40 000 inhabitants. Several books illustrated the complex social and economic relation between the Eternit factory and the town of Casale Monferrato [21-27].

The dangerous effects of exposure to the dust due to the work process started to be known early, but there is little documentation about the awareness of workers and the general population. In the early '70s workers become more conscious of the risks of asbestos exposure, and started fights for improving the workplace, later involving local institutions and citizens. In the early '80s formal judicial denunciations were registered and the institutions were urged to act.

The formal investigations on the health effects of asbestos exposure started in the '80s, with three acts. Firstly, a survey was conducted in 1982 by the Cancer Epidemiology Unit of the University of Turin and by

the Cancer Registry of Piedmont, coordinated by Prof. Benedetto Terracini and Prof. Enrico Anglesio, to investigate the frequency of deaths attributable to pleural cancer in residents of Casale Monferrato [28, 29]. Secondly, the frequency of new diagnoses of mesothelioma in the residents of Casale Monferrato was investigated by a junior pneumologist [30]. Thirdly, a court case was started by trade unions against the cancellation of economic benefits for workers affected by asbestosis [31]. The three acts came to similar conclusions. The court accepted the claim and stated that the work activity in the Eternit was dangerous. The survey documented a large increase in the number of pleural cancer deaths. The survey on mesothelioma identified a very large excess of cases, in particular it counted the enormous figure of 61 cases (34 M and 27 F) and showed the large proportion of cases (37/61) that had not worked in the Eternit factory or in other asbestos exposing occupations. These observations induced the regional administration to start an "Asbestos Cement Project" that provided resources for the epidemiological investigations as well as the town and the Local Health Administration (LHA) to start the epidemiological studies and to give a specific role to a hospital doctors team that was assisted in the scientific activity by the Cancer Epidemiology Unit of the University of Turin. The first study, published in January 1987, was the cohort study of workers of Eternit. It documented clearly the large excess of deaths from asbestos related diseases: pleural and peritoneal cancer, lung cancer and asbestosis were the most relevant [32]. The total number of deaths was much higher than expected in a population of the same characteristics but not exposed: 864 observed *vs* 710 expected. One hundred seven deaths were caused by lung neoplasm, 57 by pleural or peritoneal neoplasm, and 89 by asbestosis.

The factory had stopped activities and was declared in bankruptcy in April 1986. The debate on the possible restart of production with a new owner was hot, both in the community and within the trade unions. The final decision to refuse the proposal was influenced also by the results of the scientific research: in 1984 and 1989, two important meetings promoted by the unions were held: their motto was "No to asbestos".

In 1987, soon after the presentation of the epidemiological study on Eternit workers, Mayor Riccardo Coppo issued a historic decree prohibiting asbestos use in town and surroundings [33]. The decree was an advanced application of the precautionary principle, relevant also internationally. It was determinant to stop the opening of a new factory run by Eternit France, being added to the strong refusal expressed by the Chamber of Commerce, the environmentalist associations and a group of 110 local doctors.

The association of the families of victims of asbestos exposure was founded in 1988, with the strong support of trade unions. Its first name "AFLED" was changed in 1998 in AFeVA (Associazione Familiari e Vittime Amianto). AFeVA is the referent organization, with a leading role in the interrelation between workers, affected families, community and politics. Its role is conducted also with the communication activity connecting research and scientific world with the real world of the community affected by asbestos (www.afeva.it/). Its organized pressure for the asbestos ban in 1992 and its role has been prominent in the Eternit trial in the years 2000s and in the debate about the compensation offered to Casale municipality from the Eternit property.

In 1992, the law banning asbestos use all over Italy was issued [34]. The asbestos ban also showed the potential of the positive interaction between science and legislative efforts [35].

In the following years, scientific research continued and produced new evidence documenting the risk of mesothelioma for women with domestic exposure [36, 37] and the risk for residents, because of environmental exposure [5, 38], as well as updating studies on workers [20].

The remediation of industrial buildings and of other occurrences of asbestos presence in houses, playgrounds and other places was started in the early 90's and it is nearly completed, with a cooperation between the municipality, the local health authority and the regional agency for environmental protection, with grants from the Ministry of Environment and the Piedmont Region (www.comune.casale-monferrato.al.it/amianto).

The health assistance of patients affected by asbestos related diseases, and in particular by mesothelioma, was progressively organized and jointly carried on by the Hospitals of Casale and Alessandria, the latter being reference hospital for the area. Two units were formed: the UFIM (multifunctional team for mesothelioma) and the Unit of Simultaneus Care. A website providing information for mesothelioma patients and their families (MaiDaSoli project) is hosted by the website of the Alessandria Hospital (www.meso.ospedale.al.it/).

Communication between researchers, local administrators and the local community, including the trade unions, was frequent and intense but did not follow a well-defined plan that had not yet been devised. Communication towards local administrators had the form of reports and auditions, usually open to the press. Communication to the local community occurred also with scientific presentations, organized in cooperation between local and external scientists and local institutions, including trade unions and association of victims. Local newspapers were usually very cooperative and interested in reporting the scientific evidence to the public.

The town of Casale Monferrato later took the lead in the technical information to residents and a website was created, located in the institutional website. It informs on the results of the sampling campaigns on the concentration of asbestos fibres, which were repeated 3 times in the '90s and 2000s. It also provides practical information on the survey on asbestos in buildings of Casale Monferrato, on the correct removal of asbestos cement, and on the economical supports. A special information desk was opened in 2001 at the Town Office of Casale Monferrato to provide information on asbestos risks and appropriate procedures for removal. The general context of the activities against asbestos exposure and for the detection of asbestos related diseases were defined by the Regional legislation "Piano Regionale Amianto",

that was first issued in 2001 and renovated in 2016 (DGR 124-7279 of 1 March 2016). Moreover a Regional Board (Centro Regionale Amianto) was defined in 2008 (DGR 80-6707 of 3 August 2007, DGR 64-3574 of 19 March 2012) within the regional law on asbestos (L.R. 30 of 14 October 2008). An impulse came from the national legislation on priority areas for remediation (Law 9 December 1998 n. 426 and following laws) that provided resources for the asbestos removal. It is of extreme relevance that these procedures, including the location of a dedicated landfill for asbestos in 2001, could be conducted without oppositions or antagonistic debate. This is an empirical proof of the effectiveness of the communication process.

The education system has always been very sensitive to the issues regarding asbestos exposure and damages. The most important activity is the multimedia classroom built at the "Natale & Italo Palli Institute", promoted by AFeVA and the Network of all schools in Casale Monferrato and nearby villages. The name of the classroom is "Amiantoasbesto – the courage to know, the need to go beyond". In this special classroom we can look back at the memory, at the present still difficult, but also at the possible future of Casale Monferrato in the fields of culture, environmental innovations, work, and enhancement of the territory, as acknowledged by UNESCO. The most important reason of this Classroom has been the need to deal with the hidden presence of asbestos in the town, in the courtyards, in the attics, in the health facilities, in the gutters, in aqueduct network. It cannot be treated just with reclamation, even if it is necessary, but with the generalized awareness in every inhabitant, particularly in young people, of the danger that might derive from a wrong manipulation of asbestos materials. Multimedia Asbestos Classroom presents an innovative structure in the definition of contents and stories. It is the result of the collaboration between many subjects: volunteers, artists, technicians, journalists, experts, intellectuals, unionists, university, Ministry of Public Instruction, Foundations, Piedmont Region, with a strong global consent on the contents reported. The multimedia interactive "Ecofficina Ltd" unified the collected materials in a really effective project from the communicative point of view.

The classroom is interactive on three walls: one has two LIMS (interactive whiteboards) of advanced technology, another is a big colorful and bright screen, and the third represents an Eternit worker's house, with twelve symbols – objects, one for each chapter of Multimedia Classroom. The visitors enter the black box of the environmental disaster of asbestos in Casale. Through the objects, it is possible to travel from the past to the future of asbestos. The path develops through twelve specific chapters: remediation, asbestos mineral, disease, court trial, history of the factory and of awareness of citizens, initiatives that school students realize together with associations and institutions. Flexibility is an essential resource to create paths of knowledge suitable for any educational need, also by using key words. The great interactivity allows a strong involvement of visitors who actively participate in the process of acquiring and deepening knowledge, and become protagonists. The constant use of the social networks (Facebook, Instagram in particular) is essential for getting young people involved: every project, every interview, every event connected with asbestos is immediately posted and inserted among contents of the website (www.amiantoasbesto.it). Students and young people are the protagonists and their active participation is essential for the project: the students receive a specific training through lessons, then they are able to meet visitors, give lessons and apply peer education methodology. Near 200 boys and girls between 14 and 19 years old are able to animate and fill with life the multimedia Classroom experience. In fact, every time it is possible to notice emotions, positive exchanges of knowledge and humanity, as shown in the customer satisfaction questionnaires. Since November 2014 to June 2018, 3500 persons visited the Classroom: classes of students from Casale and other small towns from the area as well as from municipalities from Northern Italy, university researchers, groups of people engaged in the asbestos issue and interested in awareness raising projects, and tourists. The activity is supervised by a permanent group of teachers from all schools of Casale. A group of students carries on management and organization of activities on asbestos, as well as on environmental education.

The multimedia classroom offers the opportunity to remember the environmental disaster caused by asbestos, its victims and their suffering. At the same time, it is a new way of knowledge and environmental education. It creates network and allows all the schools of the town, the Town Council, the Region Piedmont, the Associations (Libera, Legambiente, AFeVA, ItacaMonferrato, etc.) to work together in national and international level. This Classroom inside the school keeps the consciousness of our students alive on a personal and common responsibility towards environment and people, developing real competences of active citizenship and a free and critical thinking.

The multimedia classroom is a resource also for the population of Casale Monferrato. It is a place of the memory but also a place where the status of remediation is reported and an area of debate about the status of environment and of remediation from environmental contaminants. It is a teaching area on environment and on the use of the web as well. Currently, students use it to explore and debate past events but also the possible future of the area with sustainable initiatives and economic development.

Communication has not always been an easy process, given the expectations and the extremely relevant topics [29]. In particular, an effective mesothelioma therapy is still lacking and it is difficult to explain the victims, their families and the population how complex is to find a treatment for a disease like mesothelioma. On the other hand, the need for a proper remediation is now clear for everybody. As a final balance, in Casale Monferrato a formal communication plan has not been prepared, at least not until recent years; nevertheless, the interested subjects have been able to overcome this deficiency thanks to a close cooperation among them and to the credibility that they have been able to maintain during the long period of activity.

Municipalities of Emilia-Romagna Region

The main characteristics of Emilia-Romagna Region asbestos cement production is that it started later than elsewhere (between 1952 and 1973), with a relatively higher proportion of female workforce. Women were specifically employed in producing "small" pieces, also using by-products of the main productions. Otherwise, they shared with men the same work environment.

All asbestos-cement factories, except one, utilized crocidolite in varying proportions (4-30%). One factory specialized in pipers used large amounts of amosite. Sixteen out of 20 factories operating in Emilia- Romagna were in the Reggio Emilia Province.

Company records were available for 10 factories, 8 of which in the Province of Reggio Emilia. A cohort study was thus set up, including 2712 men and 632 women, followed-up through 30/6/1987 [39], detecting five pleural malignant neoplasms and one of peritoneum. The extension to 1998 [40] detected 18 pleural and 4 peritoneal malignant neoplasms. Finally, the extension to 2012 showed 63 pleural neoplasms (49 men and 18 women) and 8 peritoneal (7 men and 1 woman).

The first communication interventions took place in the '70s and mainly concerned occupational exposures to asbestos and to other hazards. Subsequently to the 1992 ban of asbestos use in Italy, initiatives of general population information have taken place in case of demolition, cleanup and restore of industrial building.

Public health interventions have been focused, in more recent years, on removal and management of asbestos-containing materials, especially if friable, in a wide variety of settings.

Victims' Associations have been playing a major role in this context. In particular, the collaboration between AFeVA and Schools (teachers and students) allowed to developed initiatives to increase awareness of asbestos risk among the young people. In this collaborative frame, students from Bologna High School "Liceo Artistico Arcangeli" have set up an exhibit on asbestos and wrote a book [41].

The currently adopted Emilia-Romagna Regional Asbestos Plan includes a communication strategy aimed at promoting safe behaviors with asbestos in place, training professionals, informing stakeholders and in more general terms fostering networking between public institutions and general population A major aspect of this plan is the establishment of outpatient wards for ex-exposed subjects, free of charge, and of a therapeutic plan for mesothelioma patients. Communication activities targeted to ex-exposed subjects and mesothelioma patients are foreseen [42].

Biancavilla in Sicily

Biancavilla, a town with 24 000 inhabitants in Sicily, experienced a localized excess of mesothelioma [43, 44]. The town inhabitants diagnosed with pleural mesothelioma had no relevant exposure to asbestos during their professional lives. No consistent occupational exposure to asbestos was detected and the main activity was devoted to the production of prickly pears, citrus fruits and vegetables. The incoherent building materials extracted in a local quarry and used in building industry and road paving were investigated and a new-identified amphibole (fluoro-edenite) was found and approved by Commission on New Minerals and Mineral Names of the International Mineralogical Association in 2001 [45].

High concentration of the amphibole fibre in out-door environment was found, namely in the unpaved roads because of passing cars and lorries. Out-door workers personal samplers showed the highest concentration when jobs were performed near to unpaved roads and crossing.

In 1998, the quarry activity was terminated. In 2002, Biancavilla was recognized as a site of national interest for environmental cleanup. Remediation activities started by covering the quarry area with spritz bitumen, and paving with asphalt all the roads that were considered the main sources of population exposure. Since 2009 the Regional Environmental Protection Agency has been performing regular monitoring of airborne fibres weekly. Bruni *et al.* documented the significant decrease of airborne levels of fluoro-edenite fibres [46].

Since 1988 different reports and studies clearly showed that mesothelioma occurrence in Biancavilla was steadily high: 62 cases were reported between 1988 and 2011. The collection of the cases became systematic since 1998 because of the work of the Sicilian Region Mesothelioma Register. The overall SIR was 576 (95% CI 376-844) respectively, 369 (95% CI 197-632) in men and 1308 (95% CI 697-2200) in women in 1998-2011, based on 26 cases. The highest overall SIR was found for peritoneal cases (SIR 792, 95% CI 96-2000), based on two observed cases. With regard to pleural mesothelioma, when SIR estimates were stratified by age, extremely high figures were shown in the younger age groups: the overall SIR in subjects less than 50 years old was 2134 (95% CI 693-5000). The results in the less than 40 years age group were impressive (overall SIR 6288, 95% CI 1300-18 000, based on 3 cases) [47]. Analysis of mortality and hospitalization from pleural mesothelioma confirmed excesses for both mortality (men SMR 379, women SMR 1128) and hospital discharges (men SHR 261, women SHR 780) [48].

In 2014, the International Agency for Research on Cancer (IARC) assessed the carcinogenicity of fluoro-edenite concluding that there is sufficient evidence in humans that exposure to fluoro-edenite fibrous amphibole causes mesothelioma, and sufficient evidence of carcinogenicity in experimental animals. Fluoro-edenite was included in Group 1 (the agent is carcinogenic to humans) [49].

Since the beginning of the epidemiological investigation, a main point of concern was how to provide clear information to the population. Early, pragmatic indications were provided by the Mayor with the support of Istituto Superiore di Sanità (ISS) [50]. A meeting organized by the Mayor in 2002 with local authorities, researchers, experts, and other stakeholders represented an important mutual knowledge-exchanging event. More recently, in 2015, the scientific collaboration between ISS and the Sicilian Regional Health Authority allowed to implement communication paths in a Biancavilla prevention model. Different groups of stakeholders were involved in the communication path:

physicians and other health workers, local authorities, teachers and local media [51]. Communication initiatives and seminars dedicated to health workers with the participation of family doctors, health personnel and professionals in the Prevention Department of Local Health Unit were aimed to update professional skills and information on fluoro-edenite related-diseases, and contributed to improve mutual understanding among doctors, patients and attendants. Adequate diagnostic and therapeutic pathways have been implemented to help families and patients with fluoro-edenite related diseases.

Communication with local authorities aimed to provide tailored information for defining rules and modality of building activities and minimizing dispersion of fluoro-edenite fibres in the environment as well as to prevent workers and population exposure. Training has still to be performed for workers of external companies involved in construction and other dust-creating activities.

The health education at the different levels of schooling was considered the most important formative path, making it possible to avoid risky behaviours for schoolchildren. Teachers have a pivotal role for the active involvement of students according to their level of literacy, because of their continuous and qualified presence. In this perspective, initiatives have been undertaken in the High Schools involving students in learning about fluoro-edenite fibres characteristics and exposure modality. Students from the Biancavilla Technological High School – Istituto Tecnico Tecnologico "M. Rapisardi" – illustrated their schoolwork on fluoro-edenite and related-mesothelioma in Biancavilla during a town event on 19th February, 2015.

The Sicilian Government has recently approved a plan of health interventions in Biancavilla favouring cooperation between national, regional and local health institutions with the common goal of improving the quality and appropriateness of diagnostic and therapeutic procedures offered to the community by the health services.

Municipalities in the Mount Pollino area in Basilicata Region

The area of Pollino National Park in Basilicata region (Southern Italy) represents another case study of natural sources of asbestos fibres exposure, including natural outcrops of tremolite-containing rocks, for their health-related impact. The study area includes twelve municipalities, seven of which (Castelluccio Superiore, Castelluccio Inferiore, Episcopia, Lauria, Latronico, San Severino Lucano, Viggianello) are characterized by the presence of asbestos outcrops close to areas where people live or work [52]. Awareness of public health risk raised since the early 2000s when the Regional Centre of the National Mesothelioma Registry (Registro Nazionale Mesoteliomi, ReNaM) identified three cases of mesothelioma mortality occurred in the Lauria and Castelluccio Superiore municipalities [53]. In 2005, joint efforts of national, regional and local health and environmental Authorities allowed the organization of a Consensus Conference on health surveillance of resident population exposed to tremolite in that area [54]. The Consensus Conference delivered guidelines for epidemiologic and health surveillance of the residents in the area of Lauria and Castelluccio Superiore municipalities as well as a communication initiative providing information on asbestos risk and promoting personal and collective behaviours for reducing asbestos exposure [54]. The Consensus Conference guidelines were adopted in the Regional Regulation [55]. Several media and newspapers articles informed the public about the Consensus Conference and the surveillance system guidelines [56, 57]. Local health Authorities, in charge for the epidemiological and health surveillance of the resident population, disseminated information material on asbestos risk for human health in lay language, as well as on the health services provided including a toll-free-number for the resident population. They also collaborated with the local church representatives in realizing tailored initiatives for increasing asbestos literacy of the affected communities [58].

In 2012, studies aimed to assessing asbestos exposure in both occupational and environmental settings highlighted a relevant tremolite exposure both in construction workers [59] and in farmers employed in those areas compared with a group of residents engaged in activities that did not require contact with the soil [60]. The analysis of personal samples showed the presence of tremolite fibres in concentrations higher than these found in natural ground in 100% of the construction workers as well as in two out three cases of farmers, with a peak of 26 ff/l over the background value of 2ff/l. These studies increased the awareness of local Authorities on both safety measures to be implemented and communication initiatives to be undertaken with the resident population.

The recent epidemiological study by Caputo *et al.* [52] concerning the Pollino sub-area in which asbestos fibres are close to dwelling and settlement observed: i) a significant excess of mesothelioma incidence (SIR: 208; CI 95% 111-355; 13 observed); ii) a non-significant excess of hospitalization for malignant pleural neoplasm (SHR 176; CI 95% 93-355; 9 observed); iii) a significant excess for mortality and hospitalization for pneumoconiosis (SMR: 534; CI 95% 345-824; 20 observed – SHR: 245; CI 95% 149-405; 15 observed); iv) a significant excess for hospitalization for asbestosis (SHR: 852; CI 95% 290-2506; 3 observed). This study clarified that in 7 out of 12 municipalities characterized by the presence of naturally occurring outcrops of minerals containing among else tremolite and chrysotile, health risks were ascertained as the outcrops were close to areas with dwellings, quarries, cultivated areas and pastures. Areas where anthropic activities were apt to determine mechanical solicitations to outcrops resulting in fibres release and diffusion, with respect to evidence available in 2003-2005, appeared to be much wider than previously suspected [52].

This study provides recommendations for both fostering environmental monitoring and safety measures concerning those situations considered at high asbestos risk and implementing epidemiological surveillance as a permanent activity by periodically updating mortal-

ity and hospitalization analyses for all asbestos-related diseases and incidence of mesothelioma. In this frame, the Authors recommended starting a communication plan with the relevant stakeholders: local administrators, general practitioners, health and environmental professionals, schools, media, local associations and the resident population, in order to implement epidemiological surveillance and contribute to asbestos-related disease prevention [52].

DISCUSSION

The analysis of the communication experiences in the case studies presented in this paper allows the identification of similarities and differences useful to shed light on a few relevant lessons learned.

In all case studies the communication process started with dissemination of basic information concerning the results of the first epidemiological studies. This information was provided to both the workers of the industrial settings and the resident populations (associations, trade unions, local administrators) and concerned the preliminary evidence of health risks of exposure to asbestos and/or asbestiform fibres. The subsequent epidemiological investigations, while providing further scientific evidence of the health impact of exposure to asbestos and /or asbestiform fibres, allowed the establishment and/or strengthened the relationships between the researchers and the affected communities. In particular, they contributed to the development of different types of communication and forms of engagement of social and institutional stakeholders.

According to this common kickoff of the communication activities in the four case studies, we list in the following some evidence of the engagement of different stakeholders, emphasizing their role in the whole communication process:

- trade unions in cases of industrial activities focused on information on asbestos risk and reclaimed better safety conditions for the workers. They promoted the establishment of associations of former exposed workers and family members of asbestos victims in the affected communities. The associations of former exposed workers and family members of asbestos victims, as well as other territorial subjects (the local church representatives in the case of Pollino area), developed local communication networks that really increased knowledge and awareness on asbestos risk and impacts. Local media often contributed to raising the level of attention on asbestos risk and impacts in the affected communities;
- regional and local administrators, because of the scientific evidence of the asbestos health impact in their communities, played a role according to their responsibilities for planning the most urgent prevention interventions and in responding to the requests and needs of their communities;
- local operators of health prevention and environmental remediation progressively increased relationships with researchers involved in the studies and acquired a better knowledge for undertaking proper actions;
- researchers involved in the studies acquired greater awareness of their role in the development of communication processes starting from the relationships with the trade union representatives, the association of former exposed workers and victims as well as with local health and environmental operators, thus contributing to strengthen the resilience of the affected communities;
- the involvement of the School has been more recently developed in all the selected case studies. School action has been characterized by the adoption of learning methodologies "train to trainers" and "peer to peer education", and the undertaking of interactive and multimedia communication. The adoption of these methods has favoured the preservation of the histories and memory of the communities related to asbestos and promoted awareness on the asbestos health related-impact in the communities. The students are involved in the network of relationships of their community and play an active role in increasing the collective reaction of the communities.

Similarities and differences characterizing the four case studies selected in this paper allowed us to identify criticalities and extract the lessons-learned to be transferred through shared communication strategies in other asbestos contaminated sites. *Figure 1* illustrates through a synoptic sketch the key actions/processes and the stakeholders engagement to foster awareness and increase resilience.

CONCLUSIONS

The integrated analysis proposed in the present paper focusing on the four selected case studies allows us emphasizing key points for improving communication processes and building effective relationships between the researchers involved in the investigations and the affected communities. In particular, epidemiological surveillance of asbestos affected populations has been playing a critical role in the perspective of public health. Epidemiologists, occupational physicians and social researchers involved in the studies of asbestos impact on the affected communities should participate in the process of relationships among the others involved stakeholders (the case of Casale Monferrato is an example of good practice). This process of social relationships characterizes the communication practices among relevant stakeholders and strengthens resilience of communities *(Figure 1)*. A strong relationship between the professional figures, epidemiologists and occupational physicians is useful to transfer concepts such as risk at population level versus individual risk by using lay language, without ignoring the complexity and socio-emotional implications of the messages. The communication practices, designed in shared communication plans, certainly benefit by joining multidisciplinary skills and strong relationships within community networks. In this frame, the involvement of the School in participative communication paths is essential to create awareness of the youngest population in order to promote their active role to increase the preparedness of communities.

The analysis of the four case studies selected in this paper indicates that the different local contexts require tailored communication processes able to take into ac-

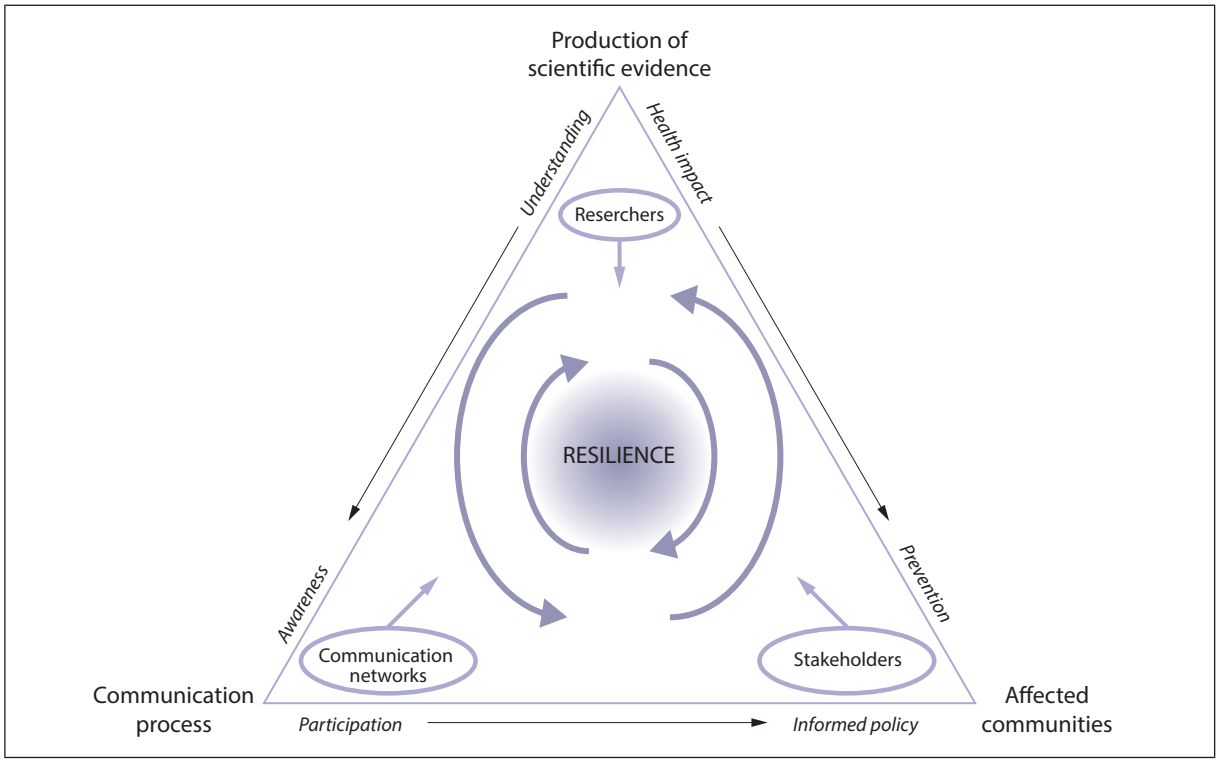

Figure 1
Key actions to foster awareness and increase resilience through communication processes involving relevant stakeholders of the affected communities.

count diverse levels of literacy on asbestos of the involved institutional and social stakeholders and communities.

Although regional asbestos plans recently adopted in Italy envisage communication activities, no experiences of structured communication plans have been implemented to date. The lessons learned from the case studies indicate that the definition of communication strategies and the adoption of communication practices since the very early evidence of local asbestos health impact can represent a relevant contribution for epidemiological and health surveillance of the affected populations. This is especially for those communities in which the health impact has only recently been reported.

The communication process is an effective way to manage the relationships among researchers, local authorities and society at large. The adoption of participated communication practices can foster aware policy-making, health prevention and environmental remediation actions, which in turn represent an effective way to increase the resilience of affected communities.

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias the conduct and findings of this study.

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