

Partnership between scientists and populations resident in contaminated sites. The case study of Biancavilla, Italy

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Abstract. Partnership, from the Latin *pars-partis*, meaning part, has to do with the notion of two persons - two entities sharing a common goal, where the success of one of the two also corresponds to a benefit for the other. The beneficial effects of partnership can be observed in many domains of life. The purpose of the present contribution concerns the case study of the partnership between scientists and the population resident in the city of Biancavilla, Eastern Sicily, a town of about 20,000 inhabitants, where an excess of mortality from malignant mesothelioma had been observed in the frame of a periodic survey in the over 8,000 Italian municipalities aimed at providing estimates of the health impact of asbestos in Italy. The mesothelioma cases in Biancavilla were characterized by a low mean age at diagnosis, an even number of men and women and by the total absence of occupational asbestos exposure. The mayor and his coworkers suggested to examine a large area within the city centre where a major stone quarry was operating since several decades. There the investigators found an amphybolic fibre that contaminated the rocks extracted and used in the local building industry, that was shown to be a new mineral species named fluoro-edenite. There started a strong participatory project engaging local, regional, and national institutions. Major milestones were demonstration of carcinogenicity of fluoro-edenite fibres in rats and mice by Ramazzini Institute, and evaluation by IARC of fluoro-edenite fibres as carcinogenic to humans with sufficient evidence. Biancavilla was recognized by the Italian Government as National Priority Contaminated Site. In two decades, major environmental cleanup interventions were realized, always in the frame of precautionary and prevention approaches, and a synergy between scientists, public administrators, institutional and social actors.

Key words: fluoro-edenite, mesothelioma, lung fibrosis, research-community partnership, environmental health literacy, Biancavilla

Foreword: Partnership

The English word “partner” derives from the Latin *pars, partis*, meaning part, and more specifically indicates any of two persons, institutions or other entities that constitute a couple characterized by the pursuit of a common goal in the frame of a shared vision. Partnership can thus be defined as the integrated management of a project by two subjects that operate

as if they belonged to the same entity. Partnership can imply that one actor makes available knowledge and work procedures that are not easily accessible, thus providing a gain to the other actor, but also to himself. The partnership works out nicely in as much as it is characterised by transparency, reciprocity, ability to listen and care for the partners’ needs. These general considerations are currently agreed upon by the scientific community engaged in Environmental Health

at large, and specifically by Collegium Ramazzini and by the network underlying the initiatives of the European Journal of Oncology and Environmental Health. In this frame, the aim of the present paper is to report the collaboration process which took place since 1996 to date, and is still in progress, between the Municipality of Biancavilla, in Sicily, and the Istituto Superiore di Sanità (ISS), the Italian National Institute of Health, with a major scientific contribution from the Ramazzini Institute (IR).

Case study: Biancavilla

In the frame of a national epidemiological surveillance plan of pleural mesothelioma mortality in Italy, based on about 8,000 municipalities in the time window 1988-92, the town of Biancavilla (about 20,000 residents), located in Eastern Sicily, at the slopes of Etna Volcano, showed a statistically significant excess, based on 4 observed cases versus 0.9 expected (1). Being Biancavilla located in a rural area, in the absence of known or suspected occupational or environmental asbestos exposure, the attention of the mayor and of the investigators was focused on the Monte Calvario quarry area located at south-east of the town, from which building materials were caved since some decades. Mineralogical studies in this area lead to the identification of an amphibolic material characterized by a highly variable morphology (prismatic, acicular, fibrous) subsequently named fluoro-edenite, approved by the Commission on New Minerals and Mineral Names of the International Mineralogical Association (2). Within less than two years (1997-98), further samples of rocks and other environmental matrices were analysed, and further cases of pleural mesothelioma were detected (3). The case-series was characterised by a) low mean age at diagnosis, b) even number of cases in men and women, and c) absence of ascertained occupational or environmental asbestos exposure. In May 1998, the Deputy Director of ISS wrote to the mayor of Biancavilla, the Sicilian Regional Government and the Local Health Authorities recommending to i) terminate the quarrying activity, ii) remove the piles of debris of building materials from the roads, and iii) pave (all) white dusty roads with asphalt. For

a detailed reconstruction of these activities, the reader is referred to Paoletti et al. (4). Despite the available evidence still being remarkably uncertain, these first mitigation actions were (rightfully) undertaken adopting a well-justified precautionary approach. As shown by Bruni et al. (5), the distribution of airborne fibres in the urban area of Biancavilla decreased between 2000 through 2013. In the meanwhile, the Italian Ministry of Environment recognized Biancavilla as National Priority Contaminated Site. As extensively discussed in a recent WHO Document (6), the core issue of the adopted approach was the assumption that fluoro-edenitic fibres should be dealt with as if they were regulated asbestos fibres. Primary sources of exposure scenarios (the quarry area and a series of naturally occurring outcrops) and secondary sources associated with various anthropic activities (e.g., car traffic, waste management, road cleaning and recreational activities) required ad hoc protocols for interventions. The latter ranged from spritz-beton treatment of soils to removal and capping of contaminated materials, including plasters. Former quarry workers, mostly informal workforce, were involved in the environmental clean-up efforts, thus avoiding or reducing unemployment. Two events, in this frame, played a major role in further fostering the notion of environmental remediation. In the decade 2004-2014, Soffritti et al. and Belpoggi et al. published the results of a set of experiments showing that intrapleural and intraperitoneal injections of fluoro-edenitic fibres cause mesothelioma in rats (7, 8). These findings, which can be considered decisive if only for their ability to explain the mechanistic and carcinogenic evidence part, have also swept away the last doubts about the causal role of fluoro-edenite in inducing mesothelioma that some denier “experts” tried to raise in order to save the quarry’s business in Biancavilla (thanks for this to Drs. Soffritti and Belpoggi). In 2014, the International Agency for Research on Cancer (IARC) evaluated the carcinogenicity of fluoro-edenite. The conclusions were the following: there is sufficient evidence in humans for the carcinogenicity of fluoro-edenite fibrous amphibole; fluoro-edenite fibrous amphibole causes mesothelioma. Moreover, there is sufficient evidence in experimental animals for the carcinogenicity of fluoro-edenite fibrous amphibole. Thus, according

to IARC evaluation procedure fluoro-edenite fibrous amphibole is carcinogenic to humans (Group 1) (9). A recent study published by the Annals of Istituto Superiore di Sanità threw new light on the health impact of fluoro-edenite (10), based on the well assessed elevated mortality and hospitalizations due to respiratory disease in Biancavilla residents, performed an epidemiological work investigating the medical records and diagnostic imaging of the patients hospitalized for asbestosis (2006-2013). The authors observed that 10 out of 25 for which imaging data were available showed asbestosis-like features, in the absence of occupational asbestos exposure. This study corroborates the occurrence of a cluster of cases of fluoro-edenite-induced environmental fibrosis among Biancavilla residents, that requires appropriate contrast measures and further research. The key point is to estimate past and current levels of indoor and outdoor exposure to fluoro-edenitic fibres, and age at first exposure in view of the early mean age of mesothelioma occurrence in Biancavilla (11). It is noteworthy to consider that public institutions cannot enforce any action in the indoor home environment, but only give advice.

Perspectives of the research-community partnership

Since 1996, the collaboration process between the Municipality of Biancavilla and the Istituto Superiore di Sanità on the environmental and health issues related to fluoro-edenite risks and impacts has evolved from dissemination of available information to a bi-directional communication along with a strengthened partnership. Since the beginning of the epidemiological investigation, a main point of concern was how to provide clear information to the population. Firstly, the mayor with the support of ISS provided pragmatic indications: risk communication was focused on presenting the epidemiological findings and the subsequent decision-making initiatives, in the framework of environmental clean-up. The central issue in communicating with health authorities was the evaluation of the causal link between available knowledge and consequent mitigation actions. Press releases broadcasted by various means, such as local radio stations,

were dedicated to informing the community. The recommended interventions were of preventive nature, for instance covering in asphalt roads that were previously paved with the local quarry's byproducts (12). A meeting organized by the mayor in 2002 with local authorities, researchers, experts, and other stakeholders represented an important event for mutual exchanging available information and knowledge. The collaboration between the ISS and the Regional Health Authorities was dedicated to increase the understanding and awareness on environmental contamination and the related health risks of the Biancavilla community. This motivated the ISS publication "Preventing fluoro-edenite related disease: the Biancavilla model. Research, public health and health promotion interventions" (available online) (13). The monograph aimed at providing evidence-based information in lay language to the Biancavilla community on the risks associated with fluoro-edenite in their environment, and on the environmental remediation process. Primary prevention and health promotion interventions were translated in tailored messages to local public health professionals, administrators, teachers and students, and the media (13). Several public events were held in Biancavilla to share information about the environmental risks, provide updated data on health-related impacts, and inform on the appropriate individual behaviours to be adopted in daily life to minimize the risks and encourage citizens to comply with the recommendations made by the national-regional health authorities. This contributed to promote prevention initiatives and behavioural changes. A key indicator demonstrating the successful communication and the effective increase of environmental health literacy (EHL) of local actors was the use of evidence-based information in decision-making with the inclusion of the shared prevention actions in the Sicilian Regional Plan of Health Interventions in the contaminated site of Biancavilla (13). Indeed, the actions included:

1. the strengthening of existing epidemiological surveillance through information tools (such as the mortality regional register, the hospital admission database, the mesothelioma regional register and the regional database of cancer registers), and the periodic reporting to use for communication initiatives;

2. the activation of an *ad hoc* health surveillance system for subjects exposed to fluoro-edenite covering the whole territory of Catania province in order to estimate the prevalence of pneumoconiosis and pulmonary fibrosis and improving diagnostic protocols by the Biancavilla hospital and the general practitioners;
3. the strengthening of health promotion interventions to tackle the modifiable risk factor for chronic respiratory diseases (namely smoking), and communicate suitable information to the residents, in particular the most exposed groups including work categories (building industry and farming);
4. the improvement of the quality of the diagnostic-assistance provided to chronic patients with respiratory diseases with the activation of a dedicated health service and the implementation of integrated diagnostic-therapeutic pathways.

Communication initiatives and seminars dedicated to public health professionals in the Prevention Department of the Local Health Unit, with the participation of general practitioners, were aimed at strengthening professional skills and providing information on fluoro-edenite-related diseases, focusing initially on mesothelioma and subsequently on lung fibrosis. This contributed to improve the mutual understanding among doctors, patients, and attendants (14). Moreover, the health education at the different levels of schooling was considered an important formative path, contributing to avoid risky behaviours for school-children and students at high schools who were trained about characteristics of fluoro-edenitic fibres and exposure modality (14). The most recent results provided by the national-regional-local multidisciplinary study group on the emergent risk of environmental fibrosis and pneumoconiosis in Biancavilla (10) highlighted the need of further developing environmental health literacy in the community (15) to comprehend, evaluate, and use the new information on latest evidence-based knowledge. This is due to the higher number of residents potentially affected by these diseases compared to mesothelioma, a rare and well-known disease previously found in Biancavilla. The aforementioned respiratory diseases are not fatal, but strongly

influence the daily lives of citizens and require a heavy commitment from the local health services to manage the new health impact and the population's reaction to the newly discovered risk. The communication process in this current stage of the epidemiological studies must be structured and tailored in order to prioritize the needs and to manage the knowledge gaps of the community. These communication initiatives on contextualized environmental health issues are essential to further increase the collective resilience. Partnership between the Istituto Superiore di Sanità and the Biancavilla community in environmental and public health requires promoting inclusiveness and engagement of the local actors as key elements of a participative process, empowering them in minimizing potential risks and new impacts recently raised to the public attention from the study results. This can also be promoted by a structured communication plan, to be jointly implemented through the engagement of all local institutional and social actors (15, 16), which is still not developed. The past study findings and the prioritized actions for environmental remediation in Biancavilla to reduce airborne fibre level in the environment and therefore the mesothelioma risk have been communicated to the local institutions and citizenry, although without a structured communication plan. The dissemination and sharing of information on the new emerging risk of environmental fibrosis and pneumoconiosis to the population, which should be now undertaken in the framework of the already existing relationships based on trust, requires the adoption of a structured communication plan in which appropriate strategies are tailored and prioritized for the different local stakeholders (i.e., local health services, general practitioners, agricultural and construction workers, and the residents).

Concluding remarks

As witnessed by a growing body of scientific literature in the domains of both biomedical research and the social sciences, the interaction between researchers and communities' objects/subjects of the studies has evolved over time. As stated by anthropologist Scheper-Hugues, quoted by Agata Mazzeo (17) "In

the act of writing culture, what emerges is always a highly subjective, partial and fragmentary but also deeply personal record of human lives, based on eye-witness accounts and testimony. If “observation” links anthropology to the natural sciences, “witnessing” links anthropology to moral philosophy”. The community of Biancavilla has experienced, and is still experiencing, the disastrous health impact of an improper model of development. The partnership of Biancavilla residents with the scientific community, supported by local, regional, and national authorities, has contributed and is still contributing to decreasing environmental and domestic exposure to fluoro-edenitic fibres. The benefits of these public health interventions, previously based on a precautionary approach and in the following years on the increasing evidence-based knowledge, will be observable over time, and epidemiological surveillance will be the tool to monitor the desirable reduction of occurrence of fluoro-edenite-related diseases for the next generation.

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