

Environmental health and the multidimensional concept of development: the role of environmental epidemiology within international cooperation initiatives

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Summary. “Environmental health” and “multidimensional development process” are two concepts that have been used and discussed since the last two decades within different conceptual frameworks. The present paper presents and discusses an interpretation concerning the interconnection between these two concepts in line with the integrated approach to health of environmental epidemiology and the multidimensional development approach of socio-economic analyses. The paper aims at investigating the environmental health and the condition of environmental health deprivation affecting populations in developing countries, and proposes to consider them as central issues for integrated environmental epidemiological and socio-economic investigations. The relevance and impact of this interdisciplinary approach to investigate the different and interconnected dimensions of poverty are here discussed. Moreover, this paper points out the role of technical and scientific cooperation in environmental epidemiology presenting the experience of a bilateral scientific cooperation between the Istituto Superiore di Sanità and IFA, an Ecuadorian non-governmental organization.

Key words: environmental health, multidimensional development, environmental epidemiology, international cooperation, developing countries, Ecuador.

Riassunto (*Salute e ambiente e concetto multidimensionale dello sviluppo: il ruolo dell'epidemiologia ambientale nelle iniziative di cooperazione internazionale*). “Salute e ambiente” e “processo multidimensionale dello sviluppo” sono due concetti utilizzati e discussi da due decenni nell'ambito di distinti contesti. Il presente lavoro presenta e discute una interpretazione dell'interconnessione tra questi due concetti in linea con l'approccio integrato alla salute proprio dell'epidemiologia ambientale e con l'approccio multidimensionale dello sviluppo proprio dell'analisi socio-economica. Il lavoro si propone di indagare la relazione salute e ambiente e il nodo della deprivazione socio-economica su tale relazione per le popolazioni dei Paesi in via di sviluppo e propone di considerare questi temi come centrali per studi integrati di epidemiologia ambientale e socio-economici. Sono discussi l'impatto e la rilevanza dell'approccio inter-disciplinare nell'investigare le differenti e interconnesse dimensioni della povertà. In questo contesto, il lavoro evidenzia il ruolo della cooperazione tecnico-scientifica in epidemiologia ambientale presentando l'esperienza di cooperazione scientifica bilaterale tra Istituto Superiore di Sanità e l'IFA, una organizzazione non governativa ecuadoriana.

Parole chiave: salute e ambiente, sviluppo multidimensionale, epidemiologia ambientale, cooperazione internazionale, paesi in via di sviluppo, Ecuador.

INTRODUCTION

Since the 90's the United Nations have been adopting the multidimensional development approach and the *capability approach*, both proposed by the Nobel Price economist Amartya Sen in the framework of his analysis of human development concept. According to Sen, human development concerns the interconnections among several dimensions of the development process; in this framework, health is a constitutive dimension of human development and environmental health can be seen as a social condition historically linked to society's industrialization

and urbanization. Production and economic growth consequent to industrialization are possible means to improve the wellbeing and the quality of life for individuals and communities when they are intended to increase their *capabilities*. The *capability* concept applied to the social determinants of health is people-centred and considers the expansion of human capabilities as the ultimate goal of public policies. In the human development approach, poverty is defined by deprivation in multiple dimensions of human development: deprivations in a long and healthy life, in knowledge, in a decent standard of

living and in participation. Thus, poverty is conceptualised in relation to material and social deprivation conditions, not limited to income deprivation represented by the income poverty threshold [1].

According to those socio-economic development studies which adopt the multidimensional development approach, environmental and occupational epidemiological investigations may strengthen connections between environment and health for individuals and communities worldwide by assuming an integrated approach to health. Since 1997, the International Agency of Research on Cancer (IARC) looked at the relationship between socio-economic factors, including environmental ones, and adverse health outcomes [2]. The aim of this volume is to investigate how socio-economic factors affect population's health, linking poverty and development to environment and health [2]. Moreover, the primary goal of public health is identified in preventing disease in human populations and the socio-economic factors are of major importance in this context [3].

In the last decade, a few environmental and occupational epidemiological studies considered urgent public health issues in developing countries. These studies identify non-voluntary hazardous exposures to both man-made and natural contaminants for workers, social groups and communities frequently connected with industrialization processes involving both industry and agriculture. The results of these studies can enrich the socioeconomic development analyses, which, according to the human development approach, focus on the causes of poverty and deprivation.

In this perspective, this paper proposes the promotion of scientific cooperation activities with developing countries concerning environmental health, pointing out the role of international cooperation in environmental epidemiology. It presents a case-study of scientific cooperation focused on environmental and occupational epidemiology established between Istituto Superiore di Sanità and IFA – Corporación para el Desarrollo de la Producción y el Medio Ambiente Laboral, an Ecuadorian non governmental organization.

ENVIRONMENTAL HEALTH IN THE HUMAN DEVELOPEMNT PROCESS

In the last two decades, both environmental epidemiological studies and the socio-economical development analyses relying on the multidimensionality of human development approach have highlighted the existing link between population health and environment assuming an integrated approach to health. It is important to point out that both the definition of human development provided by United Nations and the definition of environmental health adopted by the WHO European Centre for Environment and Health rely on the integrated approach to health [4].

In the multidimensional development approach,

environmental health contributes to qualify the human development, because it concerns the living conditions of populations (individuals, social groups and communities). The improvement of environmental health conditions influences and it is influenced by the economic and social development process of each country.

According to Sen's *capability approach*, the development process of a society can be verified by the enlargement of *capability* and freedom to choose, among several combinations of *functionings* (states of being and doing), those which allow individuals, social groups and communities to lead lives they have reason to value. "Health is among the most important conditions of human life and a critically constituent of human capabilities which we have reason to value" [5]. The capability is given by society to individuals and communities through their socio-economic organizations [6].

More recently, the WHO Commission on Social Determinants of Health has emphasized that determinants of health are structural conditions of societies and that economic and social policies affect the distribution of social determinants of health, including resources for education, health, financial security and work employment policies [7].

The *capability* to control (to improve and to choose) environmental health concerns both living and working environments for individuals, social groups and communities and marks the pathway toward equity in health as a goal of the human development. In this framework, poverty and deprivation are also measured in terms of vulnerability to control living in health and in healthy environment and concern *functionings* related to environmental health for individuals, social groups and communities. Therefore, environmental health can be seen as a social condition embedded in public health, epidemiological environment and public development policies; their interconnections strongly affect the relation between individual income and capability to be healthy within a society.

Production and economic growth due to the society industrialization can represent a means to enlarge the *capabilities*, when they are addressed to enable the most socio-economically vulnerable social groups and communities to improve and control their environmental health beyond their income and their social position. At the same time, the condition of environmental health deprivation represents an important one among the diverse inequalities characterising the industrialization process and urbanization phenomena within and between societies.

The deprivation of environmental health is of particular relevance for developing countries, where unregulated industrialization, involving both industry and agriculture, and uncontrolled urbanization phenomena represent a widespread condition for environmental health deprivation of populations. Both international and domestic economic factors and relations determine the velocity and the forms char-

acterizing industrialization and urbanization of a developing country and contribute to guarantee the absence of control on public environmental health policies by local authorities, and even more by the involved social groups and communities. The WHO Commission on Social Determinants of Health has recognized the contribution that economic growth can make to the availability of resources for improving access to social determinants of health and for reducing health inequities. Indeed, it asserts that growth *per se* is not a sufficient prescription for equitable improvement in population health. Rather, actions within and between countries to mitigate and remove structural inequality are the necessary counterpart to global growth itself and the policies that aim to support it [7].

In this context, environmental and occupational epidemiology will be even more invoked in the future within social sciences to face environmental health issues at both local and global level.

ENVIRONMENTAL EPIDEMIOLOGY AND THE INTERDISCIPLINARY APPROACH

The development of environmental epidemiology, realised within the last decades through an increasing number of investigations, the enlargement of the research focus, and especially the advances in methodology, has promoted a better understanding of the relationships between environmental conditions and health effects. The identified criteria for setting priorities in environmental and occupational epidemiology research are based on public health indicators, such as occurrence, duration, and severity of health effects. Therefore, areas of priority research have been selected because of their relevance to public health and the investigations' results have allowed the improvement of the basis for rational decision-making [8]. In this perspective, environmental epidemiology studies focused on the integration between environment and health provide a relevant perspective, and contribute to a better understanding, to afford upcoming and irresolute health problems of contemporary social evolution.

Following the multidimensional development approach discussed in the previous section, environmental and occupational epidemiology studies represent necessary "tools" for adequately assessing the process of capability enlargement of populations in the human development process. These studies, by providing a qualified identification, characterization, quantification and assessment of the non-voluntary hazardous exposures affecting population's health in specific contexts, can contribute to understanding the environmental health deprivation impact on poverty affecting the involved communities. In particular, the *poverty-low health trap* heavily constrains the improvement of living and working conditions of specific groups of populations also where economic domestic policies as well as economic international agreements favour the economic growth of

a developing country. Environmental and occupational epidemiological studies provide elements to investigate the quality of the development process of a society. They provide tools to socio-economical analyses to point out how environmental health, as a social condition, enables individuals, social groups and communities to human development.

The lack of control on environmental health conditions by workers, social groups and communities inhibits them to assess their vulnerability and limit them in choosing the *functionings* to be in health and to live in a healthy environment. In this view, environmental and occupational epidemiological studies enable to identify conditions of health deprivation of specific populations, reconstructing at local level the uniqueness of the multi-factorial investigated phenomena [9]. This becomes even more relevant when this approach is shared with socio-economic investigators and decision-makers in order to address public health policies as a part of development policies to improve the living conditions of the most socioeconomic vulnerable groups and communities.

In this perspective, an interdisciplinary approach, linking environmental and occupational studies to socio-economic development analyses, corroborates the explanation of poverty also as a condition of environmental health deprivation and, therefore, promotes actions accounting for the peculiarity of the local context and the specific embedded problems.

Several examples allow pointing out the potential impact of an interdisciplinary approach. The first one is represented by those epidemiological studies concerning high risk groups [9, and references therein]. This because of the intrinsic condition that identifies high risk groups, characterized by particularly high levels of non-voluntary hazardous exposures and also affected by socioeconomic deprivation. Moreover, epidemiological studies on high risk groups have a peculiar dual role in identifying such groups and promoting preventive actions. Although this is known within the environmental epidemiology community, the links with socio-economical analyses and the impact for assessing deprivation conditions are not fully exploited.

A further example is represented by the use of socioeconomic deprivation indices by descriptive epidemiology and environmental epidemiology studies [10-12]. These studies use indices of deprivation in relation to health. The incorporation of a deprivation measure to account for the effects of socioeconomic factors in examining the incidence of diseases in relation to environmental factors [10] represents a widely adopted methodology. Discussing the statistical methodology is beyond the goals of the present paper. Indeed, it is of relevance that these studies use material deprivation index in order to control socioeconomic variables related to involved populations in studies. The material deprivation index summarises the identified socioeconomic confounding factors and it is taken into account as a confounding because it is associated with both the diseases and

the investigated exposures [12]. The potential confounding role of socioeconomic status in environmental epidemiological studies, especially in those studies considering small areas, has been documented, although the extent of potential confounding will depend on the type of disease (depending on the latent period before clinical diagnosis) and on the type of industrial site under consideration [10]. Socio-economic analyses can help to identify the most appropriate variables that, in different local contexts, determine socioeconomic vulnerability as well as to reconstruct the socioeconomic history of the investigated areas in order to identify the socioeconomic vulnerability in the past. It is of relevance to point out that interdisciplinary research can yield a better understanding of the link between socioeconomic conditions and environmental health and can improve the impact of epidemiological studies to society.

The relevance of the interdisciplinary research involving social and environmental epidemiology has been discussed by different authors [13-16] and recognized by the International Society for Environmental Epidemiology (ISEE). In particular, Soskolne *et al.* (2007) affirm that "Multi and interdisciplinary approaches, including collaboration by epidemiologists with ecologists, social and behavioural scientists, and human rights and law experts, are needed to recognize, prevent, and mitigate the effects of socio-ecological changes that have implications for the health and well-being of communities worldwide" [16]. Nevertheless, socio-ecological changes are strictly interconnected with industrialization processes and economic growth within countries and regions in the world.

Steenland and Savitz (1997) [17] point out that environmental epidemiology studies focused on epidemics and endemics in less developed countries often involve control of known hazards. Moreover, looking at the uncontrolled industrialization and urbanization processes of developing countries, occupational and environmental epidemiological studies focused on contextualised issues of health have been insufficiently implemented. Because the results of environmental and occupational epidemiological studies highlight specific and local conditions of environmental health deprivation embedded in poverty, they are of particular relevance for developing countries and the interdisciplinary approach might clarify causes and indicate appropriate solutions for priorities of intervention on the most vulnerable social groups and communities in these countries.

THE ROLE OF INTERNATIONAL COOPERATION IN ENVIRONMENTAL EPIDEMIOLOGY

The seventh and eighth futures of the Millennium Development Goals (MDGs) [19], "Ensure an environmental sustainability" and "Develop a global partnership for development", represent the global scenario for international cooperation on environ-

mental epidemiology. Within this global scenario, the recent paper by O'Neil *et al.* (2007) [20] points out several emerging directions for environmental epidemiology in the context of the increasing interest in global health and emphasises "how the interactions between environmental epidemiology exposures and poverty may affect public health and the role of environmental epidemiology in research and actions in response to these impacts". To these goals the ISEE has recently planned to promote the examination of the intersection of poverty and health fostering North-South collaborations and the application of research results to actions in order to play a central and cooperative role with those outside disciplines which are working toward the same goals [20]. Participating to the Council of Science Editors 2007 international initiative on the Global Theme Issue "Poverty and Human Development", *Annali dell'Istituto Superiore di Sanità*, the official journal of the Italian National Institute of Health, has published papers focused on environmental and health risks associated with poverty and human development [18].

In line with this view, two working strategies characterizing scientific cooperation with developing countries in environmental epidemiology can be envisaged.

The first one concerns the interdisciplinary approach, which links the socio-economic analyses of the development process to the core of environmental epidemiology research, as discussed in previous sections. This approach, assumed by each partner of the cooperation, should characterize cooperation activities, research and field studies. International scientific cooperation represents an appropriate framework in which the interdisciplinary approach can be implemented. In this context, it is recommended that cooperation activities in environmental epidemiology are developed with a deep knowledge of the local socio-economic problems and with the participation of the local partners entitled of deciding the forms of intervention. The interdisciplinary approach pushes environmental and occupational epidemiological investigations to take into account how the historical and socio-economical framework of a developing country may influence the environmental health of populations involved in the studies. This might provide original and innovative tools for implementing environmental and occupational studies emphasizing the social feature of epidemiology in order to promote actions for improving health and living conditions of populations in developing countries. In this perspective, environmental epidemiology investigations on a specific context of a developing country should not solely represent the opportunity to access to original unexplored data; rather, they should represent an opportunity to jointly elaborate relevant contributions of knowledge for both the involved communities and decision-makers. This concerns the mission of epidemiology and the supposed distinction between "scientific" and

“action-oriented” epidemiology or, in other words, between “theory” and “praxis” of epidemiology [21-23]. For what concerns Latin America, the cited papers propose common perspectives on environmental epidemiology with this work, which will be described in the following section.

Within the appropriate common working field and shared approach by the partners of the cooperation, the second working strategy concerns the exchange of scientific knowledge [24] relying on a broad access to qualified scientific information and expertise associated with environmental and toxicological problems affecting population health. In this framework, the development of research activities which take into account a methodology to collect and archive data, documents and results as well as to access and disseminate information and knowledge in developing countries assumes a particular relevance. The adoption of high scientific standards for environmental epidemiology investigations as well as the declared adoption of robust scientific methodologies allows substantial progresses for both the cooperating partners. Moreover, the possibility to reach and share an advanced level of knowledge can promote actions aimed to strengthen the local capacity building process. “Capacity building and technology-transfer need to be explicitly addressed in research involving developing countries” (Soskolne, 2007) [16]. This represents a guarantee for the long-term sustainability of the outcomes of international cooperation activities. Valuable scientific cooperation activities can also support the partners in developing countries in their request to local authorities to develop or implement research infrastructures.

Moreover, the development of field studies and of the investigations within cooperation activities also depends on the dedicated financial resources available for the cooperating partners. In this sense, the cooperation can favour the independence of local investigators working on “trouble” cases. The cooperation framework can “protect” local investigators from interferences by local power and encourage focused epidemiological studies on the prevalence of exposures [21].

THE CASE-STUDY OF ISS-IFA TECHNICAL AND SCIENTIFIC COOPERATION IN ENVIRONMENTAL EPIDEMIOLOGY

In order to illustrate a case-study for the possible application of the scientific cooperation strategies discussed in the previous sections, an experience of technical and scientific cooperation on health and environmental epidemiology between the Istituto Superiore di Sanità (ISS) and the IFA (Cooperación para el Desarrollo de la Producción y el Medio Ambiente Laboral), an Ecuadorian non-governmental organization (NGO), is presented. The collaboration agreement benefits of the expertise of a public research institution (ISS), which is officially involved in public health issues concerning environ-

ment, and of an Ecuadorian NGO (IFA) with an established skill in occupational and environmental epidemiology. This represents a key feature to develop a successful scientific and technical cooperation.

In the framework of the cooperation activities, ISS has also promoted collaborations with several universities (Universities of Bologna and Pavia for occupational medicine studies and University of Rome “Sapienza” for socio-economic analyses on human development). The IFA NGO, established in Quito in 1992, works at international and national level in environmental and occupational epidemiology and collaborates with local institutions and social organizations (the local authorities of the Quito Distrito Federal (DF), the Confederación Nacional de los Barrios de Ecuador – CONBADE, the Andean University of Quito for socio-environmental researches, trade-unions and private companies) in order to face a large spectrum of occupational and environmental health problems. Therefore, another qualifying feature of this scientific cooperation is the available multidisciplinary know-how, which guarantees the implementation of the interdisciplinary approach proposed in this paper. This emerges also by the different topics faced in the scientific works that have been performed in the framework of this cooperation agreement [25-28].

Following the cooperation strategies discussed in the previous section, the scientific collaboration activities on environmental and occupational epidemiology have been addressed to the mutual exchange of scientific knowledge as well as of the local experiences matured by each partner. This has allowed the identification of specific problems of the Ecuadorian context related to occupational and environmental health issues and has addressed the research activities in Ecuador. Studies on known risks affecting environmental health of particular population groups have been performed in Ecuador, some of which concern non-voluntary hazardous exposures of high risk groups characterized by both epidemiological vulnerability and socio-economic deprivation conditions. For example, the effects of pesticides exposures for children in a school near a flower plantation [30] as well as of the synergy of social and environmental factors as determinants of silicotuberculosis affecting a community living close to a mining industry [31] have been investigated. These studies exemplify how, in a developing country, environmental and socio-economic factors related to diseases are interconnected and corroborate the need to investigate *in situ* well-known questions in order to get solutions appropriate to the local context.

The relevance of the mutual transfer of knowledge on scientific issues currently discussed in the international epidemiology community, peculiar of the cooperation strategies proposed in this paper, emerges from studies on unknown non-voluntary exposures of large sectors of the population. For example, a recent field study has concerned the possible impact

on health of non-ionizing radiation due to different sources existing in the neighbourhoods of Quito DF [32]. These studies are of relevance for both the cooperating partners because they might contribute to a better understanding of environmental exposures whose adverse affects are still debated.

Finally, a particular attention is given to activities aimed at disseminating information in Ecuador, which make available the outcomes of the performed studies and researches to the society (trade-unions, local communities, private companies, etc.). Basic information and dissemination on environmental health issues are provided to the involved social subjects and local authorities following a methodological plan. To this goal, the scientific publications and reports have been published both in Spanish and Italian in order to disseminate knowledge and awareness on the investigated topics to cooperation operators in both countries and, at the same time, to facilitate the access to qualified information for the Ecuadorian society.

Despite the promising and satisfactory results of this initial scientific cooperation experience, several critical issues have to be pointed out. The first issue concerns the multidisciplinary approach, which should be widened in this cooperation program. This will promote innovative and more complex forms of cooperation which may increase the impact of research to society. The second important critical issue concerns the visibility and the relevance that the cooperation activities need to reach in order to strengthen IFA NGO as a technical and scientific reference subject for the Ecuadorian civil society and local authorities. The present cooperation should develop a participatory program, in which the active participation of informed social subject will support technical and scientific operators to identify sustainable solutions. This is of particular relevance for developing countries characterized by a structural institutional weakness that, together with a heavy bureaucracy, limits the short- and long-term planning of development policies addressed to the improvement of the environmental health. Finally, the third critical issue concerns the necessary development of scientific infrastructures in developing countries. A bilateral scientific cooperation program based on a mutual collaborative approach would require also appropriate economic resources for the implementation of local research infrastructures (instrument and laboratories). This might guarantee the scientific independence of collaborating NGOs in the long-term sustainability of the cooperation outcomes.

CONCLUDING REMARKS

In the framework of human development approach and multidimensionality of development process, environmental health has been discussed in this paper as a social dimension representing the living conditions of populations, social groups and communities. In this context, deprivation of environmental health

has been considered as one of the conditions characterizing poverty caused by the uncontrolled industrialization and urbanization processes particularly affecting developing countries.

It is suggested to consider environmental and occupational epidemiology studies, adopting an integrated approach to health, as necessary "tools" contributing to adequately assess the process of capability enlargement of populations in the human development. In particular, the identification of the health impact of non-voluntary hazardous exposures as well as the identification of high risk groups in a developing country point out the link between environmental health deprivation and human development, contributing to spread knowledge on the causes of poverty. The results of these studies can provide unexplored "tools" to tackle the *poverty-low health trap*. This highlights the role and the relevance of the interdisciplinary approach connecting environmental and occupational epidemiology studies to socio-economic development analyses focused on the causes of poverty as a multidimensional deprivation condition.

A discussion of the impact of international scientific cooperation on environment epidemiology leads to envisage two working cooperation strategies. First, international cooperation activities focused on environmental and occupational epidemiology require the interdisciplinary approach which represents an innovative framework to promote researches and field studies connected to the real local problems and specific needs of the local context, especially in a developing country. Second, scientific cooperation activities call for a common working and shared approach by cooperating partners concerning mutual exchange of scientific knowledge, the adoption of high scientific standards for the investigations as well as of robust scientific methodologies. This will promote transfer of technology as well as strengthen capacity building processes for the long-term sustainability of the cooperation outcomes.

An experience of bilateral scientific cooperation in environmental epidemiology between an Italian public health research institute (ISS) and an Ecuadorian NGO (IFA) has offered the opportunity to develop collaborative scientific activities adopting the integrated approach to health. The supporting and the critical issues motivating and characterising this bilateral cooperation may represent a case-study in order to provide theoretical and practical tools to cooperating operators which can improve the impact of research to society.

Acknowledgement

I wish to thank Pietro Comba for encouraging me in doing this work. I also thank Pietro Comba, Roberta Pirastu, Elisabetta Basile and Raúl Harari for the helpful discussions and for a preliminary review of the draft.

Received on 23 April 2008.

Accepted on 4 November 2008.

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