

**Consultation on the Feasibility of Long Term Studies on the Environmental
Threats to the Health of Children in Developing Countries**

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Introduction

Over the last decade, evidence has been mounting about the association between the environment and children's health and the increased susceptibility of children to environmental exposures in comparison to that of adults. Furthermore, there are growing concerns that exposures to physical, chemical, and biological risk factors during critical periods of development and growth (fetal development, childhood and adolescence) may not only result in pediatric disease but also lead to long-term impact on health in adulthood, and that maternal exposures to environmental factors during pregnancy or periods of breast-feeding may also impact on children's health and development. However, our knowledge of the kinds and levels of acute and chronic exposures that children incur *in utero* and during childhood in developing countries and the scope of effects of such exposures on children's health and development is severely limited.

More research is needed to identify the long-term health and developmental consequences of children's exposures to environmental threats in developing countries. These effects should be identified and assessed both in urban and rural communities in the places where children live, learn and play and where adolescents work. Long-term cohort studies (LTCS) of environmental influences on children's health and development have the potential of identifying and assessing the harmful and helpful effects of a broad range of environmental factors on child health and development. However, successful implementation and conduct of these complex and costly studies in developing countries will require innovative approaches, including close international cooperation. This paper provides an overview of the deliberations by a group of international investigators on the rationale, potential benefits and challenges, feasibility, structure, and recommendations for LTCS in developing countries.

Rationale

There is a growing awareness that the child is more susceptible than the adult to environmental problems (or benefits), and is especially vulnerable during embryonic and fetal life as well as the first two years of life. The outcomes of environmental exposures are often subtle but may have major consequences in regard to later childhood and adult life.

Many environmental contaminants can only be identified in biological tissues that are collected contemporaneously. As a result, the only way to identify problems present in the community and the ensuing consequences is to collect data and samples from as early in pregnancy as possible, and to follow these individuals throughout childhood, adolescence and into adult life, monitoring health, development and well-being throughout. Despite their expense and complexity, LTCS studies have been implemented in a number of countries to address children's health and development and have already provided reliable research findings and critical information for evidence-based public policy decisions. As critical as such contributions have been, these studies have not addressed the emerging concerns regarding the impact of environmental factors on child health and development in a comprehensive and systematic manner in developing countries, where susceptibility to environmental

effects may be exacerbated due to more prevalent and complex exposures and disadvantageous social conditions, including poverty, inadequate nutrition, and limited access to health services. Recently, eminent investigators from around the world gathered in Bellagio, Italy reported on the leading causes of child mortality in the developing world in a series of articles in the journal *Lancet* in the July 2003, estimating that a significant proportion of morbidity and mortality resulted from unhealthy environments and the confounding factors of malnutrition and infectious agents, and provided recommendations to reduce the burden of disease and disability.

The need for LTCS in developing countries is further underscored by a number of recent recommendations on the importance of a healthy population to ensure economic growth in the developing world, and which, in turn, have led to important policy developments. One of these is the development of targets for the improvement of the health of children in developing countries and the assessment of the burden of disease among children in the region through the Millennium Development Goals that target reduction of infant mortality by two thirds by 2015. Another is the development by The World Health Organization in its General Assembly in 2003 of a Strategy for Child and Adolescent Health and Development that includes reduction in childhood deaths and disabilities through:

- Promotion of healthy environments for children as they are particularly sensitive to their physical environment
- Emphasis on the psychosocial development and mental health of children
- Emphasis on the health needs of children living in especially difficult circumstances or with special needs

The recognition of increased concerns about effects of environmental factors on child health has prompted the United States to plan a study of environmental influences on children's health and development. This study will allow the evaluation of exposure and outcome links in the context of life stages and offer a unique opportunity for cooperation. In response to a similar concern in developing countries, an International Interest Group (IIG) has been formed to address environmental issues in a more global context and to seek international collaboration and cooperation. Such international collaboration is essential to: 1) identify critical themes of concern across countries; 2) ensure a sufficiently large cohort of participants for rigorous evaluations of hypotheses; 3) capture a wide range of exposures; 4) allow for comparability of findings across countries; and 5) ensure an efficient use of limited resources in planning, developing, and implementing the research protocol.

The planning and implementation of LTCS is complex and resource consuming. A multidisciplinary effort is required to consider issues such as hypotheses and study design, ethics, development and behaviour, chemical and physical exposures, injuries, emerging technologies to measure exposures and outcomes, and community outreach/participation.

Implementation of LTCS in developing countries represents a challenge, but has the potential of offering substantial benefits, as evidenced by the experiences in Thailand, South Africa, Guatemala, the Philippines and other countries. Establishing LTCS in other developing countries could bring collateral benefits such as: strengthening health care and surveillance services, transfer of technology, improving case data

collection, and research capacity building, among others. The pursuit of this effort is justified by: 1) the need to ensure the right of every child to grow up in healthy and safe environments and reach his/her potential as a healthy and productive adult, and 2) the dependence of sustainable development of a given community on the health status of its population.

Potential Benefits

The potential benefits of LTCS examining environmental threats to children's health in developing countries are varied. Such studies will provide an increased understanding of the impact of the environment on health and development of children who may already be compromised by infections, malnutrition and other consequences of poverty. Furthermore they will provide the data to assess the relationships between multiple environmental and non-environmental exposures and multiple outcomes and also allow opportunities to explore the effects of multiple exposures, including cumulative exposures, on health and development across the life stages. Collected data will provide the basis on which to integrate the role of environmental and social factors as determinants of child health and development. On a political level, data from longitudinal studies will serve to inform communities in developing countries about their own environmental issues and will provide the bases for developing evidence-based policy decisions, including information and guidelines for environmental health education and promotion. Undertaking LTCS in developing countries is likely to result in capacity building in such countries and to the promotion of a multidisciplinary, multinational collaboration.

Potential Challenges

The planning and implementation of LTCS of environmental threats to the health of children in developing countries face a number of challenges. These can be grouped into: coordination of efforts, data gathering, addressing ethical guidelines, and ensuring long-term support.

Possibly the most complex challenge will be the development of a framework for multi-disciplinary and multi-national teams to work under a common protocol and to ensure the implementation and maintenance of standardized methods, data collection instruments, and datasets across countries. Such studies will need to bring together the different agendas of various organizations to work in unison to achieve the millennium objectives regarding children's health and development. An additional challenge will be to ensure that the research adheres to accepted ethical guidelines/considerations across different countries.

Significant long term funding will need to be procured for timelines that may transcend the duration of individual governments. Such commitments will require an overall societal recognition of the value of longitudinal cohort studies, and integration of relevant government sectors (not only MOPH, but also Ministry of Agriculture, Ministry of Environmental Safety, Ministry of Education, etc.) in a proactive way through greater participation, commitment, and ownership. Such support will bring these important players as partners of LTCS and share in the use of the data for policy decisions.

Once LTCS are launched, mechanisms will need to be established for data quality assurance, control, and harmonization (e.g., a data coordinating centre) as well as for collection and banking of biological samples. Procedures will need to be developed to promote data sharing across countries including facilitating access to datasets for secondary analysis based on well-documented datasets and procedures. Finally, once data are analyzed, there will be a need for timely dissemination of findings, to promote evidence-based policy and program development and evaluation.

Feasibility

A number of detailed longitudinal studies have taken place successfully in developing countries, looking in particular at growth, weaning patterns and infectious diseases, as well as other factors. Examples of such studies are listed in Table 1. These studies underscore the feasibility of LTCS studies in developing countries. In addition, there is a growing interest in the implementation of additional long-term studies of environmental threats to the health children in other countries/regions of the world.

Table 1. Examples of longitudinal studies in developing countries

Country	Objectives/Outcomes
Thailand	Biological, psychosocial, and moral development in Thai children, from the perinatal period to adulthood
Cuba	Injuries and respiratory morbidity in children
Guatemala	Growth and development in children and cardiovascular risk factors and economic productivity in adults in relation to prenatal and childhood nutrition
Dominican Republic	Cooking with charcoal indoors and respiratory illnesses infants and young children
Chile	Ambient air pollution and respiratory disorders in children
Brazil	Social inequities and health outcomes in children
China	Folic acid supplements before an early in pregnancy and risk of neural tube defects
South Africa	Health and development of children born in a 7 week period in 1990 in the Greater City of Johannesburg
Peru, India, Ethiopia, Viet Nam	Causes and consequences of childhood poverty
Multinational	Growth and nutrition

Structure

New LTCS in developing countries are likely to be successful in areas with one or more of the following conditions: 1) a coherent process for collecting accurate health records; 2) little outward migration from the study region/community; 3) a public education system which will cooperate with assessing and recording pupils' competence and behaviour; 4) a relatively literate population would be an asset; and 5) the political will exists within the region to support LTCS.

Given the challenges of capacity building and acquisition and efficient use of resources for a LTCS, it would be prudent to plan and conduct LTCS based on a multidisciplinary, multinational approach with an agreed upon core of data collection, standard methods for the collection and storage of biological samples, and the storage of copies of the core data and assay results centrally as well as in each individual country. Each centre could add on to the core as required, and may analyse and publish individually. Comparative data analysis could however be carried out in association with the coordinated centre.

One potential drawback of an LTCS based on a multidisciplinary, multinational effort is that such an effort requires some degree of organization that delineates roles and responsibilities for coordination of planning and implementation efforts, input and support from national and international organizations, academic institution, and/or non-governmental organizations, and communication. However, there are examples that such level of organization is not only feasible but can be of great benefit to a complex undertaking requiring various types of input or perspectives.

Recommendations and Next Steps

To facilitate the development of LTCS in developing countries, the IIG recommends that existing LTCS in such regions should be expanded to include environmental factors, and that potential sites for establishing new studies focusing in environmental factors be identified. The IIG also recommends that interested investigators work toward the development of a core protocol that will link new and ongoing LTCS, and target participant recruitment to start early in pregnancy, and aim for long term follow-up

LTCS require long-term commitments from governments and significant financial contributions. In order to obtain such support, the IIG recommends: 1) development of a strong network of parties interested in children and the environment; 2) raising the awareness of policy and decision makers as well as NGO and CSO about the importance and potential benefits of such studies; and 3) development and dissemination of information and advocacy materials on LTCS, including brochures and videos in the languages of countries to be involved.

Finally in order to realize the development of a network of longitudinal studies in developing countries, the IIG proposes the following preliminary steps: 1) establishment of a core interest group to organize and coordinate the initial planning process; 2) identification of potential donors; 3) convening a meeting of the core interest group to draft/review a position paper; 4) prepare materials for seeking support from potential donors; 5) develop a draft core protocol, including provisions for public access to data after a defined embargo period; and 6) identify basic environmental components to be built into existing LTCS.

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