ORIGINAL RESEARCH

Children's Environmental Health Indicators for Low- and Middle-Income Countries in Asia

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Abstract

BACKGROUND Given that low- and middle-income countries (LMICs) in Asia still have high child mortality rates, improved monitoring using children's environmental health indicators (CEHI) may help reduce preventable deaths by creating healthy environments.

OBJECTIVES Thus, the aim of this study is to build a set of targeted CEHI that can be applied in LMICs in Asia through the CEHI initiative using a common conceptual framework.

METHODS A systematic review was conducted to identify the most frequently used framework for developing CEHI. Due to the limited number of eligible records, a hand search of the reference lists and an extended search of Google Scholar were also performed. Based on our findings, we designed a set of targeted CEHI to address the children's environmental health situation in LMICs in Asia. The Delphi method was then adopted to assess the relevance, appropriateness, and feasibility of the targeted CEHI.

FINDINGS The systematic review indicated that the Driving-Pressure-State-Exposure-Effect-Action framework and the Multiple-Exposures-Multiple-Effects model were the most common conceptual frameworks for developing CEHI. The Multiple-Exposures-Multiple-Effects model was adopted, given that its population of interest is children and its emphasis on the many-to-many relationship. Our review also showed that most of the previous studies covered upper-middle– or high-income countries. The Delphi results validated the targeted CEHI. The targeted CEHI were further specified by age group, gender, and place of residence (urban/rural) to enhance measurability.

CONCLUSIONS Improved monitoring systems of children's environmental health using the targeted CEHI may mitigate the data gap and enhance the quality of data in LMICs in Asia. Furthermore, critical information on the complex interaction between the environment and children's health using the CEHI will help establish a regional environmental children's health action plan, named "The Children's Environment and Health Action Plan for Asia."

KEY WORDS Asia, children's environmental health indicators, diarrheal diseases, insect-borne diseases, low- and middle-income countries, respiratory diseases.

INTRODUCTION

Despite considerable progress made in reducing child mortality worldwide, 2.4 million children under age 5 years died in low- and middle-income countries (LMICs) of Asia in 2015.[1] The Millennium Development Goal 4 (MDG 4) to reduce by two-thirds the under-5 mortality rate between 1990 and 2015 remains part of the unfinished agenda in the Sustainable Development Goals (SDGs), with the Caucasus and Central Asia, Southern Asia, Southeastern Asia, Oceania, and Eastern Asia excluding China not meeting the goal.[1] Forty-seven countries will not be able to achieve the SDG target of reducing preventable deaths of children aged under 5 years of age to 25 per 1000 live births or fewer by 2030, and almost 13% of the countries are LMICs in Asia.[1]

A number of studies have identified the leading causes of under-5 mortality in LMICs are respiratory diseases, diarrheal diseases, and insect-borne diseases including malaria and dengue.[2-5] The World Health Organization (WHO) estimated that 570,000 deaths from respiratory infections; 361,000 deaths from diarrheal diseases; and over 300,000 deaths from malaria in children aged under 5 years were linked to poor environmental conditions.[6] Each of the diseases is closely linked to poor environmental conditions. Major environmental contributors to respiratory infections include household air pollution from use of solid fuels, ambient air pollution, and environmental tobacco smoke.[6] In addition, diarrheal diseases are largely attributable to poor hygiene and sanitation, as well as water pollution.[6] Climate change and inadequate management of water bodies may cause outbreaks of insect-borne diseases.[6-9]

The international community has recognized the significance of instating environmental health monitoring systems to understand the complex relationship between environmental risks and children's health. Through the Children's Environmental Health Indicators (CEHI) Initiative, launched by the World Health Organization in 2003,[10] the WHO Regional Offices integrated the CEHI framework and its core set of indicators into regional children's environmental health monitoring systems. However, regional CEHI pilots overseen by the WHO Regional Office for South-East Asia and the WHO Regional Office for the Western Pacific were considered but not initiated.[11]

Given that LMICs in Asia often lack national monitoring systems,[12,13] have unique environmental characteristics,[14,15] and have relatively high child mortality rates,[1] establishing a regional children's environmental health monitoring system may help fill gaps in data and improve understanding of the link between the environment and children's health. Scientific evidence accumulated through the system may encourage policy makers to start developing policies. For instance, the Children's Environment and Health Action Plan for Asia (CEHAPA) was proposed to promote children's environmental health by identifying existing and emerging environmental threats to children's health and preventing children from being exposed to those environmental threats. However, a set of targeted CEHI developed on the basis of a conceptual framework for LMICs in Asia is necessary to establish the regional monitoring system.

The objective of this study was to build a set of targeted CEHI that can be applied in LMICs in Asia through the CEHI initiative using a common conceptual framework. We first conducted a systematic review to perform a qualitative analysis of the selected studies. Following the analysis, indicators from the framework were used to form a set of targeted CEHI. Indicators from several authoritative sources were also included in the set. A panel of national and international experts then validated the set of CEHI.

METHOD

Systematic Review (SR).

Literature Search. The methodological guideline upon which this study was based is the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA).[16] An iterative approach was adopted in the search and the review strategies. We conducted an electronic database search employing Pubmed, CIHANL Plus, Scopus, ProQuest Atmospheric Science Collection, ScienceDirect, Springer, Web of Science Core Collection, African Index Medicus, Latin American and Caribbean Health Sciences Literature, Index Medicus for the Eastern Mediterranean Region, Western Pacific Region Index Medicus, Index Medicus for the South-East Asian Region, and WHO Library & Information Networks for Knowledge Database. Language was restricted to English where possible, and no date restriction was imposed. The search terms were a combination of the following key words: children's environmental health indicators, children's environmental health, indicator*, child*, environment, health*, framework*, model*, and tool*. Grey literature was included due to the limited number of studies. Studies were excluded if 1) the population of concern did not include children; 2) at least one of the health