Using routine health data and intermittent community surveys to assess the impact of maternal and neonatal health interventions in low-income countries: A systematic review

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ABSTRACT

Background: There is a need to provide increased evidence on effective interventions to reduce maternal and neonatal mortality in low- and middle-income countries (LMICs). *Objectives:* To summarize the breadth of knowledge on using routine data (Routine Health Information Systems [RHIS] and Intermittent Community Surveys [ICS]) for well-designed maternal and neonatal health evaluations in LMICs. *Search strategy:* We searched reports and articles published in Embase, Medline, and Google scholar. Selection criteria Studies were considered for inclusion if they were carried out in LMICs, using RHIS or ICS data with experimental or quasi-experimental design. *Data collection and analysis:* A form was used to collect information on indicators used for interventions' impact assessment. Descriptive statistics and multiple correspondence analyses were then performed. *Main results:* Of the 1201 publications identified, 46 studies met the inclusion criteria. Most of these were using RHIS data (n = 40), mainly extracted from health facility registers (n = 34), and non-controlled before and after design (n = 30). The indicators, which were mostly reported, were related to the use of healthcare services (n = 36) and maternal/neonatal health outcomes (n = 31). Few studies used ICS data (n = 6) or indicators of severity (n = 2). *Conclusion:* RHIS and ICS data should be increasingly used for impact studies on maternal and neonatal health in LMICs.

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1. Background

Despite a significant maternal mortality decline of 45% from 1990, the fifth Millennium Development Goal (MDG) has yet to be been reached in most low- and middle income countries (LMICs) [1]. The greatest burden of maternal and neonatal mortality arises in these countries, where 99% of the maternal and neonatal deaths occur [2,3]. However, lessons learned from historical changes in high-income countries [4] and numbered studies in LMICs [3,5–9] showed evidence of a wide range of facility-based or community-based interventions that have been shown effective in improving maternal health outcomes in low-resource settings.

The implementation or scaling-up of these interventions leads to growing demands for reliable and timely data to monitor their performance and progress. But provision of data remains limited. The most important challenges faced by LMICs regarding health data information systems include lack of data availability and low awareness of quality, lack of technical expertise and/or financial resources, and limited time [10].

Routine health information systems (RHIS) and intermittent community surveys (ICS) may offer a great opportunity to address this lack of data for impact studies [11,12]. RHIS include data collected on a daily basis through facilities registers such as delivery or admission books, surgical theater or gynecology wards registers, and patient case notes. These systems are present in nearly all LMICs. ICS, such as the Demographic and Health Surveys (DHS) [13] or multiple indicator cluster survey (MICS) [14], provide nationally representative data on women of reproductive age (15–49 years). These surveys are generally carried out on an intermittent basis ranging from 2–5 years and sponsored by international organizations such as UNICEF, USAID, and WHO. Their main goal is to monitor sociodemographic characteristics, health status (maternal and neonatal health included), and the use of healthcare services among the population [9,15]. These ICS surveys have the great advantage of being generally representative of the population.

There is a need to summarize the breadth of knowledge on using RHIS or ICS data for well-designed maternal and perinatal health evaluations in LMICs. The aim of the present systematic review is to identify appropriate study design and indicators related to different types of intervention and data source. This information could be useful for donors, program managers, and researchers to design low-cost impact studies in LMICs.

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2. Materials and methods

2.1. Definition of terms

The terms of interest are defined in the glossary (Table 1).

2.2. Eligibility criteria

First, peer-reviewed publications, such as original papers and reviews, and reports investigating the impact evaluation of maternal and neonatal health interventions/programs in LMICs were considered. Secondly, we selected the following study designs: randomized and controlled trial, non-randomized before and after or interrupted time-series study (with or without a control group), and cross-sectional study with at least two groups for comparison (intervention vs control). Thirdly, the publication should contain at least RHIS or ICS data. Only the publications available in English or French and that have been published since 1995 were included.

2.3. Data sources

A systematic search of peer-reviewed publications and grey literature was conducted. All the evidence available and relevant to the impact evaluation of interventions aimed at improving maternal and neonatal health in LMICs was searched and systematically analyzed. We searched the Embase and Medline databases to locate all peer-reviewed publications. Then, the first 20 result pages in the online search engine "Google scholar" were examined to collect both grey and peer-reviewed literature. Finally, we searched references cited in systematic reviews found on the subject. All those searches were restricted to the interval from 1995 to "Current date."

2.4. Literature search

A series of keywords was selected to best represent the general terms "maternal mortality," "neonatal mortality," "program or intervention," "evaluation," and "impact or effect." Of note, we decided not to include the keyword "LMIC" to collect the maximum number of relevant publications. Indeed, the keyword "LMIC" could have excluded some publications because it is uncommon to see it in the abstracts and/or titles of publications.

2.5. Article selection process

We developed a study protocol following the PRISMA checklist for systematic reviews [16]. The review was performed using a three-stage screening approach. First, publications that included keywords

Table 1
Glossary of terms.

Terms of interest in review	Definition
Maternal mortality	The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[a]
Neonatal mortality	Death of a newborn before the age of 28 completed days following live birth.[a]
Program/intervention	Any type of action or initiative taken to improve maternal and/or neonatal health. The intervention or program can be multifaceted.
Impact or effect	Considered as the outcomes of a program/intervention on maternal or neonatal health.
Evaluation	Assessment of the nature, quality, or ability of a program/intervention to improve maternal and/or neonatal health.

[a] World Health Organization. International Statistical Classification of Diseases and Related Health Problems, 10th Revision. Geneva: WHO; 2016.

related to the terms of interest in either the title, abstract, article, or subject heading were selected. Duplicates of publications were carefully deleted. Second, one author (NID) screened each abstract for suitability based on the explicit examination of the methods and results sections. Thirdly, two authors (NID and AD) reviewed the methods section of each full-text paper to validate its eligibility. In the case of disagreement, points of view were discussed until a decision was reached.

A publication was included in the review if: (1) the primary goal was to assess the impact of a program/intervention; and (2) the program/intervention aimed at reducing maternal and/or neonatal mortality or improving maternal and/or neonatal health; and (3) the methods of evaluation consisted of a randomized controlled trial, a before and after, an interrupted time-series, or a observational study with a comparison group (intervention versus control); and (4) using RHIS or ICS data; and (5) carried out in an LMIC. Any publication that did not meet all five criteria was excluded from the review.

2.6. Bibliometric analysis

From each publication selected, a bibliometric analysis was performed on the following characteristics: country; year of publication; type of intervention (community-based, facility-based intervention, or mixed); study design (randomized controlled trial, before and after, interrupted time series, or observational study); type of data used (RHIS or ICS); source of information (household surveys, patient records, health facility registers, project reports); and the category of indicators computed along with their definition when provided. The indicators of interest included the level of availability and accessibility of healthcare facilities, the use and quality of healthcare services, and maternal or neonatal health outcomes. No outcome was prioritized.

2.7. Data synthesis

Descriptive statistics were used to illustrate the general characteristics of the publications. A series of multiple correspondence analyses (MCA) was performed to explore the nature and the strength of the associations existing between the different characteristics cited above. MCA is a nonlinear multivariate factorial analysis method that integrates multidimensional scaling [17]. It is a graphical technique that can reveal any pattern in complex datasets by a "cloud" of points or clusters plotted in a multidimensional Euclidean space [18]. Each factor (axis) is listed according to the amount of variance explained in the model [17]. The first factor explains more variance than the second factor, and so on. The clustering analysis on the MCA is based on the scores methods. The shorter the distance between two points (categories in the publication's characteristics), the stronger their association [19]. Validity of MCA is verified by the measure of scale reliability (Cronbach α index) and the variance accounted for each factor (eigenvalue and %).

Results were defined as statistically significant at $P \leq 0.05$. Analyses were performed using JMP 10.0.2 software (SAS Institute Inc., Cary, NC, USA) and SPSS version 22 (IBM, Armonk, NY, USA).

3. Results

3.1. Screening stage

Fig. 1 shows the flow chart for literature selection. We retrieved a total of 1531 publications (databases: 1410, other sources: 121) based on the keywords. Of these, 209 were deleted as duplicates (databases: 209, other sources: 0). In the 1322 remaining papers, abstracts were screened for eligibility and a total of 254 were selected (databases: 133, other sources: 121). As the abstract does not always provide sufficient data to rule out eligibility criteria, the remaining 254 publications were fully read and re-examined. Finally, a total of 46 publications were selected (databases: 31, other sources: 15) [9,15,20–29,32–38,43–69].