The process of implementating child mortality reviews in low and middle income countries: narrative systematic review

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Abstract

Objectives: This review aims to describe the processes that have been used to implement child mortality reviews in LMICs and to identify the facilitators and barriers to their implementation and impact. This will help to inform health care professionals and managers planning to implement a child mortality review in their setting.

Methods: MEDLINE and EMBASE databases were searched for papers published between January 1996 and April 2019. Studies reporting the implementation of a child mortality review process in LMICs were considered eligible. A narrative approach was used to describe the stages in the audit process outlined in the WHO "Operational guide for facility-based audit and review of paediatric mortality" which were completed, and to synthesise the barriers and facilitators to implementation and impact of the child mortality review process.

Results: From 776 potentially relevant articles, seven studies were included. In six studies problems contributing to child deaths and possible solutions were identified, in four these solutions were implemented and in one this implementation was monitored. Key factors influencing implementation and impact were: attendance at meetings, use of a blame-free approach, allocating adequate human and financial resources to make changes, and level of engagement from leadership.

Conclusions: Despite the common use of mortality reviews in paediatric departments, there are few studies published on this topic. The transition from identifying problems and solutions to implementing and monitoring action plans appears to be the most difficult aspect of the process, which requires commitment of adequate resources and strong leadership.

Keywords: child mortality review, LMIC, implementation, systematic review

Introduction

An estimated 6.3 million children and adolescents died in 2017, representing a global under 5 mortality rate of 39 per 1000 live births.[1] Many of these deaths are due to preventable causes, some of which are amenable to health care.[1] Across all age groups, of the 8.6 million people who die in low- and middle-income countries (LMICs) each year from causes amenable to health care, 5 million will have used the health system but received poor quality care.[2] Improving facility-based quality of care is therefore an important part of the effort to continue reductions in all-age mortality, including for children, in LMICs.

There is a large variety of methods available for improving facility-based quality of care, including technology-based strategies, providing printed information, training, supervision, and group problem solving.[3] Many of the interventions used to improve child survival through health service strengthening have been standardised packages, such as the Integrated Management of Childhood Illness (IMCI) programme. As we move towards the Sustainable Development Goal (SDG) target of an under-5 mortality rate of below 25 per 1000 live births, there will be a decreasing number of problems that can be addressed with generic programmes.[4] Robust, decentralised processes which empower local actors to identify problems and implement solutions will be essential to achieving the SDG targets for health.

In 2018, WHO released the "Operational guide for facility-based audit and review of paediatric mortality".[5] In this guide WHO outlines a six-step process for reviewing child deaths (Figure 1) from identification of deaths within the facility, to identifying causes of death and modifiable factors, to recommending and implementing solutions or actions. WHO suggests that this process will lead to improved quality of care and corresponding improvements in outcomes for children admitted to health facilities by identifying locally relevant problems and solutions.

This review aims to understand the processes that have been implemented in previous studies of child mortality reviews by comparing them to the process outlined in the WHO operational guide, and identify facilitators and barriers to implementation and impact. This will help to inform health care professionals and managers planning to implement a child mortality review in their setting.[3]

Methods

Eligibility criteria

Studies reporting the implementation of a child death review process in a LMIC were considered eligible. Studies which reported deaths of children of any age range within the boundaries of 28 days (or younger if being cared for outside of a neonatal unit) and 18 years were included. Studies considering only perinatal or neonatal deaths were not eligible but those that included these alongside child deaths were included. One-off cross-sectional studies of child mortality were not considered eligible if they did not establish an ongoing mortality review process. Grey literature was not considered eligible. Only studies from countries considered to be low or middle income by World Bank classification in July 2018 were included.

Search strategy

The Medline and Embase databases were searched for papers published between January 1996 and April 2019 using the concepts of paediatric, mortality, audit, and LMIC. Synonyms and subject headings were used to create search strings for these four concepts which were then combined with AND operators. Aside from tailoring subject headings, the searches performed in each database were identical. The full search terms used are included in Appendix 1. After initial title and abstract screening, potentially relevant studies were used to conduct snowballing using reference lists and citation tracking using Google Scholar to identify further studies for full text screening. This was conducted by a single reviewer.

Selection process

Title and abstract screening were conducted for all studies returned by the initial search based upon the above eligibility criteria. Full text versions of studies deemed potentially relevant were used to make final decisions regarding eligibility. Where multiple publications referred to the same study, these were considered as one study with all articles being retained for data extraction. This was conducted by a single reviewer.

Quality appraisal

Quality appraisal was performed using the Public Health Agency of Canada Critical Appraisal Toolkit for descriptive research.[6] The descriptive study appraisal tool was used to assign ratings of weak, moderate, or strong for five areas of study design: study participants' representativeness, data collection sources and methods, data collection instruments, ethics, and statistics. An overall rating of high, medium, or low quality was then assigned based on these areas of design. Of note, as this review is assessing the process of implementation of child mortality review processes across different settings, potential bias in the estimates produced by the included studies has a limited impact on this review's results.

Data collection process

A piloted form was used to extract data from the text of published articles regarding study characteristics, study setting, details of the audit process, barriers and facilitators for implementation and impact of the audit process, and details of the authors' stated theory of change, if included. This was done by a single reviewer.

Synthesis

A narrative approach was used to synthesise the different approaches to establishing child mortality reviews, to appraise the stages in the audit process which were completed as per the WHO Child Mortality Review framework, and to synthesise the barriers and facilitators to implementation and impact reported

by study authors.

Results

Study selection

A total of 776 articles were found through the database search, which was reduced to 641 after deduplication. Of these, 629 studies were excluded at title and abstract screening for not appearing to be relevant, resulting in 12 studies being considered for inclusion at full-text screening. Handsearching using snowballing and citation tracking based on these 12 studies identified a further two studies for full-text screening. At full-text screening six studies were excluded as they represented one-off cross-sectional mortality audits, rather than ongoing child mortality review processes. Two articles were combined as they reported data from the same study. This resulted in a total of seven studies included in this review. Further details of this process are provided in the PRISMA diagram in Figure 2.

Study characteristics

All studies included in this review were performed in LMICs. Three were performed in South Africa[7–10] with one other in sub-Saharan Africa[11], two in the Pacific islands[12,13], and one in India[14]. They were performed across a mixture of settings, from tertiary paediatric hospitals to being entirely community-based. Three studies were performed in one facility[12–14], three were performed across multiple facilities (4 to 51) in one country[7–10], and one was performed within the community in five districts across two countries[11]. Reported in-hospital mortality rates ranged from 5.6% to 7.8%. Data collection for studies was conducted between 1998 and 2017 with data collection periods ranging from six months to three years. Full details of study characteristics are shown in Table 1.

Quality appraisal

One study was assessed to be of low quality, five were of medium quality, and one was of high quality. Full details of the domains contributing to these ratings are included in Table 2. All studies described the implementation of mortality audits in the author's own department or in a purposefully selected setting. Most studies had well-described methods for collecting data regarding deaths and used a standardised process for collecting these data. All studies had ethical approval. Two studies used formal statistical methods whereas the remaining five provided measures of frequency and central tendency.

Mortality meeting process

All studies involved the conduct of regular meetings to discuss deaths which had occurred in the facility or community. The meetings were mostly held weekly to monthly, with some facilities in one study holding daily meetings. Where information was given on who chaired meetings, this was most commonly

performed by a paediatrician or other senior doctor for both facility-based and community-based studies. Attendees in facility-based studies were clinical staff, nursing staff, health managers, and administrative staff. The community-based study also involved community representatives.

The facility-based studies did not outline the process for identification of deaths to discuss at meetings, but this might be considered by authors to be self-evident in a clinical setting. The community-based study identified deaths through community informants, who would also collect data through medical records and interviews with families and health care workers. Data were collected about deaths for facility-based mortality reviews using audit proformas, running from one to two pages in length. Causes of death were classified either using ICD-10 or a system adapted from ICD-10. The simplified death classification system developed for the Child Healthcare Problem Identification Programme was used for the studies in South Africa and was also utilised by studies in other settings. Provision was made for allocation of primary and secondary or contributory causes of death in all studies.

Modifiable factors were generally defined similarly to one study's definition of "events, actions or omissions contributing to the death or contributing to substandard care in a child who died, and which can be modified by means of locally achievable interventions".[7] All studies made attempts to group modifiable factors, making a distinction between community level and facility level factors. These were further subdivided in some studies as administrative factors, health-care personnel factors, family / caregiver factors, primary preventive, primary curative, hospital level routine care, and hospital level emergency care.

All studies used some form of consensus from the mortality meeting to allocate causes of death and modifiable factors. The details of what was considered consensus, how this was reached, and how conflicting opinions were dealt with was not provided by any study. This may have been considered self-evident by authors as part of how to run a meeting.

In the four studies that conducted action-planning to address the modifiable factors identified during the mortality review meeting, this appears to have been fairly informal, with potential interventions discussed or the "audit meeting" being responsible for identifying action plans. One study provided an appendix with an action plan summary form which lists findings to be improved, the corresponding action to be taken with a deadline and responsible person, including space for review at subsequent meetings.

Audit steps completed

As shown in Table 3, all studies were able to complete the first three steps of the child mortality review process as outlined by WHO: identifying cases, collecting information, and identifying causes of death and modifiable factors.[5] One study went no further.[14] Six studies continued to identifying and recommending solutions.[9,13] Four reported implementing action plans made at mortality review meetings.[7,8,10–12] Only one study continued to monitor and evaluate processes and outcomes of the action plans which had been implemented.[10]

Barriers and facilitators to audit implementation and impact

The theory of change stated by study authors for the mortality review process leading to reductions in child mortality were through helping to set priorities for change, allowing the monitoring of the impact of interventions, highlighting the need for quality improvement to staff, and through the direct educational effect of the meeting for attendees.[7,10–13]

As shown in Table 4, reported barriers to implementation of the audit process were: poor attendance by staff, either due to shortages or clinical duties; poor attendance from community services; delays between cases and meetings; and poor record keeping in clinical notes.[7–10,13] Barriers to the meetings implementing effective action plans were: limited resources (human or financial) to implement action plans; lack of support from health managers; limited communication of findings beyond meeting attendees; lack of skills in quality improvement methodology; no dedicated staff for implementing action plans; and frequent repetition of the same problems.[9,11–13]

Facilitators to implementation of the audit were: having support from relevant clinical personnel and hospital management; conducting the meetings with confidentiality and having a blame free approach; ascertaining cases using existing networks and resources; and using a standardised process and toolkits.[7,8,10,11,13,14] Facilitators to the mortality meetings implementing effective action plans were: judgements on quality of care and action plans being made by local health care workers; looking for common patterns rather than individuals to blame; encouraging good attendance at meetings; and community based ascertainment and investigation.[10,11,13]

Discussion

This review identified seven studies outlining the implementation of a child mortality review process. Of the published studies, it appears that more departments are able to identify problems and potential solutions than are able to progress to implementing and monitoring action plans. The key factors influencing the successful implementation of solutions include the choice and training of staff who are responsible for the process, whether they are given time to conduct the role adequately, and if they are given financial and managerial support to implement and monitor action plans.

Process

Four of the seven studies in this review reached a stage of implementing an action plan, while only one continually monitored and evaluated the process and outcomes of these action plans. Child mortality review meetings are likely to have an intrinsic effect on quality of care through the educational components of the meeting. However, their key proposed impact is through the implementation and monitoring of action plans intended to solve identified problems. The early stages of the child mortality review process are reasonably straightforward to achieve: gathering data, discussing medical cases, and

identifying problems. Following on from this work, recommending possible solutions to the identified problems, feasible or otherwise, is not particularly complicated. Difficulty comes, as demonstrated by the studies included in this review, in identifying locally feasible solutions and following through on their implementation.

The process for forming consensus at child mortality review meetings has not been outlined in the studies in this review. A representative and transparent process for reaching consensus is critical to the child mortality review process. Depending on the seniority and cadres of staff who attend the meeting, hierarchies and dominating personalities may result in the "consensus" from these meetings only representing the opinions or ideas of one or a small number of attendees. The WHO operational guide suggests that ground rules should be set, including a guarantee of confidentiality and openness, that all views will be heard, that there will be a culture of no blame, that wide participation should be welcomed and encouraged, and that responsibility for reaching consensus is with the chair.[5] If these ground rules are followed, the chance of identifying the most relevant problems and most effective solutions should be improved, and solutions will have broad support across staff cadres and levels of seniority, increasing their chance of success.

Barriers and facilitators

The two key elements leading to success or failure of child mortality review processes identified by the studies in this review can be summarised as people and resources. Firstly, considering people, the type of attendees at child mortality review meetings were considered vital. The absolute number of attendees is less important than having representation from the right groups: not just clinicians but nursing staff, health managers, administrative staff, and sometimes key community members. For those unable to attend, disseminating the learning points and action points was also identified as important. Having the right representation at meetings will allow to identify problems and solutions that one group alone would not be able to see, and allows ideas for solutions that involve different groups and settings to be sought. Staff groups that propose their own solutions are also much more likely to engage with their implementation than if they are imposed by another group. Applying a small amount of resources to allow training of staff and for them to be able to dedicate time to the process was identified as an enabler to implementing action plans, as was support and involvement of clinical leaders and managerial staff.

Many of the modifiable factors identified in the included studies were community-based. Without community involvement in the identification and implementation of solutions to these factors, the work put in to identifying them is wasted. For example, the one community-based study was able to implement solutions to community issues influencing treatment seeking behaviour. If facility-based studies can bring in community representatives, they may be able to do the same.

Strengths and limitations

This study is the first review of the process of child mortality reviews that we are aware of. The study design has allowed the collation of experiences of implementation of child mortality reviews from a diversity of settings which has provided new insights into the common themes which emerge across different contexts. The review has been performed shortly after the publication of the first edition of the WHO operational guide to child mortality review and is therefore well timed to inform those intending to implement the WHO child mortality review process.

There are also limitations to this review. Only seven studies were included, representing limited research into such a common and important process. It is likely that the majority of departments that implement child mortality reviews do not publish their findings and therefore this review does not reflect the extent of experience implementing child mortality reviews. This may be due to concern about opening the department or hospital to potential criticism, because the process and results of child mortality reviews are not seen as suitable for publication, because journals are reluctant to publish audits, or simply because clinicians are busy with little time to write. Methodological limitations were that the use of one reviewer for study selection and data extraction may have introduced bias and that not including grey literature in this review's search strategy may have led to relevant abstracts or conference presentations not having contributed to this review's results.

The process for child death review which is used as a framework to assess the steps completed by the studies in this review was published after these studies had been completed. However, this review was not an audit of guideline compliance, but an exploration of whether authors describing these programmes had used similar processes to those which are now recommended. The steps outlined in the WHO operational guide are similar to previously published guidelines for mortality reviews such as those published for maternal mortality in 2004.[15]

Conclusions

Despite the common use of child mortality reviews around the world, there are few published studies of the implementation and impact of this intervention in LMICs. In the studies published to date, it appears that selecting appropriate staff and providing them with training, allowing them sufficient time and financial support to conduct the role adequately, and ensuring engagement from management and leadership are key elements of a successful child mortality review process. Increased publication of existing and new experiences of implementing child mortality reviews would allow for more learning to be shared and would likely improve the quality of child mortality reviews that are implemented.

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Figure 1. The six step child mortality review process from the WHO "Operational guide for facility-based audit and review of paediatric mortality".

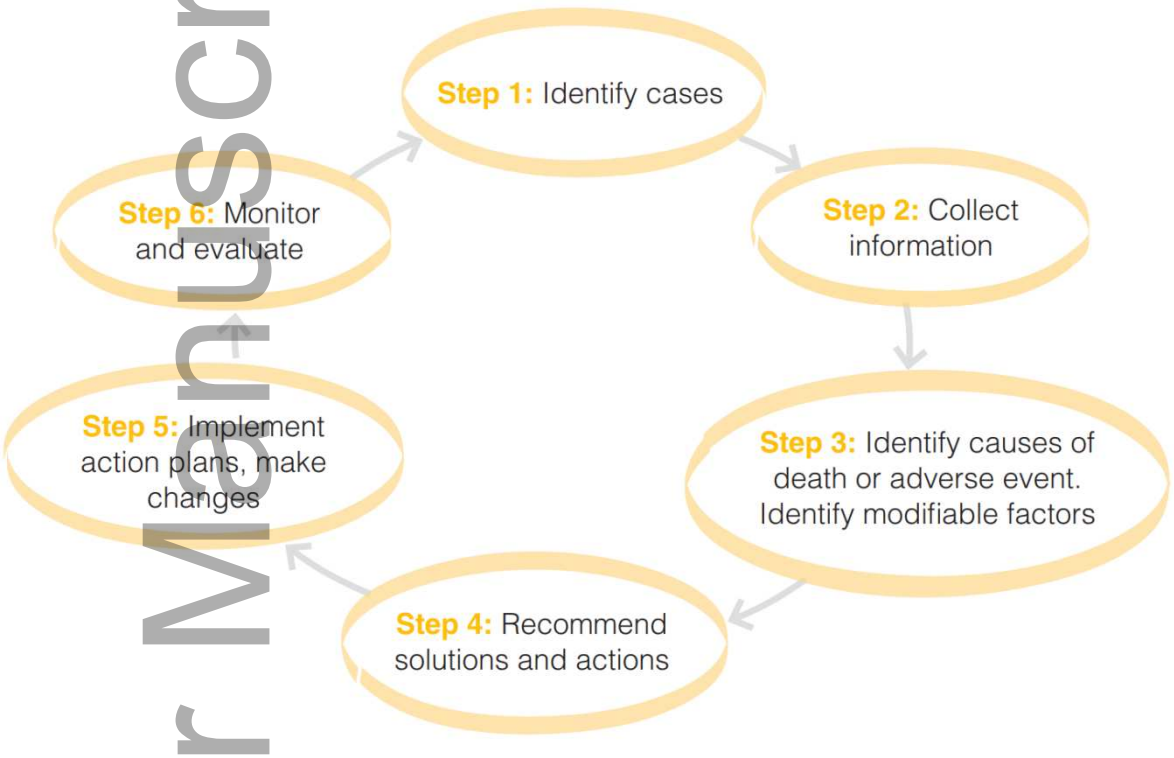

Figure 2. PRISMA diagram demonstrating the results of the review search strategy

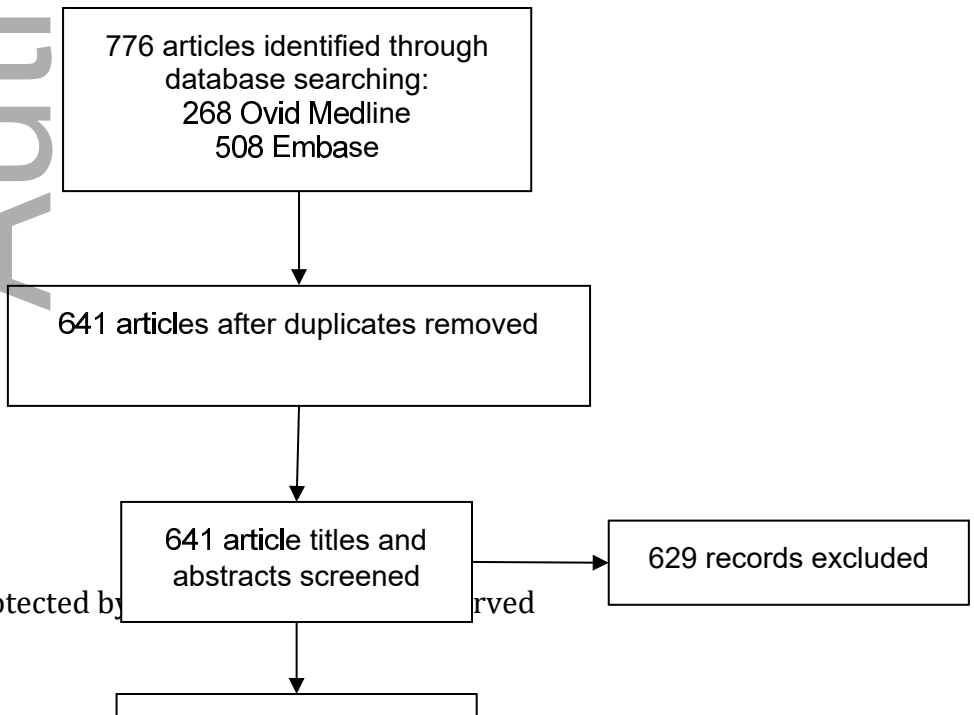

Table 1. Study characteristics and details of child mortality review processes implemented for included studies. CMR = Crude Mortality Rate

Study	Setting and duration	Meeting frequency, chair, and attendees	Method for identifying deaths, collecting data	Method of classifying and assigning causes of death and modifiable factors
Duke et al 2002 Papua New Guinea [12]	1 district hospital, CMR 6.6%. 24 months.	Weekly meeting attended by consultant paediatrician, paediatric resident, and nurses.	Collected data with single page data sheet.	Deaths classified using ICD-10. Modifiable factors classified by: Community, primary preventive, primary curative, referral hospital. Assigned by consensus from meeting attendees.
Krug et al 2004 South Africa [7,8]	4 public district hospitals, CMR 5.7%. 12 months.	Once or twice a month conducted by regional paediatrician attended by nurses, doctors, and health managers.	Collected data with single page data sheet.	Deaths classified using modified ICD-10. Modifiable factors classified by: administrative, medical personnel related (primary, hospital emergency, hospital routine). Assigned by consensus during meeting.
Krug et al 2006 South Africa [9]	8 public district hospitals, CMR 7.8%. 12 months.	Daily, weekly, or monthly attended by doctors and nurses.	Collected data with single page data sheet.	Deaths classified using modified ICD-10. Modifiable factors classified by: family, administrative, medical personnel related. Assigned by group discussion and consensus.
Stephen et al 2009 South Africa [10]	51 public hospitals from district to referral level, CMR 5.6%. 3 years.	Weekly or monthly attended by doctors, nurses, allied health workers and administrators.	All deaths reviewed and summarised within 24 hours followed by preparatory meeting where cases compiled.	Deaths classified using modified ICD-10. Modifiable factors classified by: caregiver, administrative, healthcare personnel. Assigned by consensus during meeting.
Mahajan et al 2014 India [14]	1 referral hospital, CMR 8.4%. 12 months.	Twice a month attended by consulting paediatricians, resident doctors, and nursing staff.	Collected data with death audit pro forma.	Deaths classified using ICD-10. Modifiable factors classified by: family /caregiver, medical personnel, administrative. Assigned by consensus at meeting.
Sandakabatu et	1 referral hospital, CMR	Weekly. Conducted by	Registrar (paediatric doctor)	Deaths classified using modified ICD-10. Modifiable

al 2018 Solomon Islands [13]	6.8%. 6 months.	consultant paediatrician and attended by all medical, nursing and administrative staff.	collected data and summarised cases from notes.	factors classified by: Assigned by consensus at audit meeting.
Willcox et al 2018 Mali and Uganda [11]	Community based in 5 districts (2 in Mali, 3 in Uganda). Under 5 mortality rate for study population Uganda: 33, Mali: 126. 3 years.	Once a month, conducted by local paediatrician or other senior doctor and attended by local doctors, nurses, health-care assistants, and usually at least one community representative.	Identified deaths through volunteer informants who collected data from interviews with families and health care workers, and medical records.	Unclear method for classifying deaths. Modifiable factors classified by: missed opportunities for prevention and problems in the treatment-seeking pathway. Assigned by panel discussion.

Table 2: Study quality appraisal from the Public Health Agency of Canada Critical Appraisal Toolkit for descriptive research

Author (Year) Country	Study participants representative of target population	Data collection sources and methods	Data collection instruments	Ethics	Statistics	Overall study quality	Comments
Duke et al 2002 Papua New Guinea	Moderate	Moderate	Moderate	Strong	Strong	Medium	Participants from researcher's own department. Identified more deaths than official system. Analysed all deaths. Avoidable factors identified at weekly mortality audit process by consensus process with clinical team. Appropriate descriptive and inferential statistics.

Krug et al 2004 South Africa	Strong	Moderate	Strong	Strong	Weak	Medium	Participants from 4 non-randomly selected departments. 5% deaths not analysed due to missing files. Process for allocating modifiable factors validated as part of study. Measures of frequency provided.
Krug et al 2006 South Africa	Strong	Moderate	Strong	Strong	Weak	Medium	Participants from 8 non-randomly selected departments. 18% cases unable to assess modifiable factors due to insufficient or missing notes. Modifiable factors allocated by consensus at mortality meetings in 5 hospitals, in 3 hospitals only file reviews. Analysed together. Measures of frequency provided.
Stephen et al 2009 South Africa	Strong	Moderate	Strong	Strong	Weak	Medium	Participants from 51 non-randomly selected departments. Modifiable factors allocated by consensus at mortality meetings using a validated process. Measures of frequency and central tendency provided.
Mahajan et al 2014 India	Weak	Moderate	Weak	Strong	Weak	Low	Participants from researcher's own department. 1% cases excluded for missing notes. Modifiable factors analysed in 22% of deaths. Modifiable factors allocated at fortnightly mortality review meeting using unvalidated process. Measures of frequency and central tendency provided.
Sandakabatu et al 2018 Solomon	Moderate	Strong	Moderate	Strong	Weak	Medium	Participants from researcher's own department. All deaths analysed. Modifiable factors allocated by consensus using data from patient notes. Process for

Islands							allocating modifiable factors not validated. Measures of frequency provided.
Willcox et al 2018 Mali and Uganda	Strong	Strong	Strong	Strong	Strong	High	Participants from purposefully selected communities. Missing data dealt with appropriately. Data collected through process adapted from a validated measure. Avoidable factors allocated through non-standardised multi-disciplinary community meeting. Appropriate descriptive statistics.

Table 3. Steps in the audit and review cycle from the WHO operational guide for audit and review of paediatric mortality completed by included studies.

	Audit step completed					
	1. Identify cases	2. Collect information	3. Identify causes of death and modifiable factors	4. Identify and recommend solutions	5. Implement an action plan and make changes	6. Monitor and evaluate the process and outcomes
Duke et al 2002 Papua New Guinea	Yes	Yes	Yes	Yes	Yes	No
Krug et al 2004 South Africa	Yes	Yes	Yes	Yes	Yes	No
Krug et al 2006 South Africa	Yes	Yes	Yes	Yes	No	No
Stephen et al 2009 South Africa	Yes	Yes	Yes	Yes	Yes	Yes

Mahajan et al 2014 India	Yes	Yes	Yes	No	No	No
Sandakabatu et al 2018 Solomon Islands	Yes	Yes	Yes	Yes	No	No
Willcox et al 2018 Mali and Uganda	Yes	Yes	Yes	Yes	Yes	No

Table 4. Barriers and facilitators to implementation and impact of child mortality reviews identified by study authors.

Barriers to implementation	
Poor attendance (due to staff shortages, clinical need).	Krug 2004, Krug 2006, Sandakabatu 2018
Facilities needing improvement most have least capacity to implement improvements.	Krug 2004, Krug 2006
Poor attendance from community services.	Krug 2004
Delay between case and meeting resulting in loss of relevant information.	Krug 2006, Sandakabatu 2018
Poor record keeping in clinical notes.	Krug 2004, Krug 2006, Stephen 2009, Sandakabatu 2018
Barriers to positive impact	
Limited resources to implement action plans.	Duke 2002
Lack of support from health managers.	Krug 2006
Limited communication of findings beyond meeting attendees.	Sandakabatu 2018
Limited skills in quality improvement methodology.	Sandakabatu 2018
No dedicated staff for implementing action plans.	Sandakabatu 2018
Frequent repetition of the same problems.	Willcox 2018
Facilitators for implementation	
Allocation of case finding and presentation to regular health workers within the department.	Krug 2004, Mahajan 2014
Provision of training to staff using the audit system.	Krug 2004, Willcox 2018
Support from relevant clinical personnel and hospital management.	Krug 2006, Mahajan 2014
Confidential, blame free case discussion.	Sandakabatu 2018, Willcox 2018
Case ascertainment through existing networks.	Willcox 2018
Standardised, off the shelf process limiting work to set up.	Stephen 2009
Facilitators for positive impact	
Judgements on quality of care and remedial action made by local providers.	Stephen 2009, Willcox 2018
Looking for common patterns rather than individuals to blame.	Sandakabatu 2018
Good meeting attendance.	Sandakabatu 2018
Community based ascertainment and investigation.	Willcox 2018