ABSTRACT

This paper introduces a framework for conducting and disseminating mixed methods research on positive outlier countries that successfully improved their health outcomes and systems. We provide guidance on identifying exemplary countries, assembling multidisciplinary teams, collecting and synthesising pre-existing evidence, undertaking qualitative and quantitative analyses, and preparing dissemination products for various target audiences. Through a range of ongoing research studies, we illustrate application of each step of the framework while highlighting key considerations and lessons learnt. We hope uptake of this comprehensive framework by diverse stakeholders will increase the availability and utilisation of rigorous and comparable insights from global health success stories.

INTRODUCTION

Starting in the early 2000s, the Millennium Development Goals (MDGs) aligned countries towards achieving measurable targets for health and survival (box 1). By the end of the MDG period, several health success stories had emerged. These exemplars provided an opportunity to understand ‘what works’ for attaining the Sustainable Development Goals (SDGs) (box 1).

Many groups, such as the Countdown to 2030 collaborative and WHO success stories initiative, have highlighted policy successes to facilitate adoption of lessons in other contexts. Building on such efforts using standardised, rigorous and holistic mixed methods approaches can further evidence base and ensure comparability across contexts. The Exemplars in Global Health (EGH) Partnership (established in 2017) aims to do precisely this (box 2). EGH conducts systematic and comprehensive mixed methods studies in priority health and development areas to generate evidence of impact at scale. We hope that lessons from ‘exemplar’ countries, which have achieved success in given areas (eg, child survival and nutrition), will support evidence-based decision-making among donors, governments and the global community.
Box 1 The Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)

In the early 2000s, the world adopted eight MDGs to achieve by 2015 and aligned on 21 targets to track progress. Several of these targets are relevant to health, either directly or indirectly. Three of these health-relevant targets — reduced incidence of malaria, reduced incidence of tuberculosis, and improved access to safe drinking water — were achieved at a global level; yet, several targets were missed, including reduction in child mortality (Goal 4), improvements to maternal health (Goal 5), reduction in the spread of HIV/AIDS (Goal 6) and sustainable access to sanitation (Goal 7). Targets to halve the proportion of individuals suffering from hunger were also not met. However, several regions and countries have achieved individual success in one or many of these indicators.

To build on and scale up momentum from the MDGs, in 2015, the United Nations General Assembly set 17 Sustainable Development Goals (SDGs) to achieve by 2030. These goals resulted from consensus derived from extensive multisector and multi-stakeholder consultations. Several of the SDGs are either directly or indirectly related to human health, including the following:

- **SDG 2. Zero hunger:** End hunger, achieve food security and improved nutrition and promote sustainable agriculture (indicators include stunting, wasting, and overweight)
- **SDG 3. Good health and well-being:** Ensure healthy lives and promote well-being for all at all ages (indicators include maternal mortality ratio, under-five mortality rate, vaccine coverage, and health worker density)
- **SDG 6. Clean water and sanitation:** Ensure availability and sustainable management of water and sanitation for all (indicators include proportion of population using safely managed drinking water and sanitation services)

Box 2 What is Exemplars in Global Health?

Exemplars in Global Health (EGH) is a partnership between academic researchers, implementers, policymakers, and donors that seeks to capture lessons from positive outlier countries that have achieved success in either solving health challenges in low-resource contexts or implementing programs at scale. To date, several EGH projects are ongoing based on an initial selection of diverse priorities spanning health, nutrition and key interventions within health systems: Stunting, Under-5 Mortality, Community Health Workers, Mass Drug Administration, and Vaccine Delivery.

Each area has seen tremendous improvement in the past two decades. A core set of principles drives EGH work and gave rise to the framework that we draw upon across our research. We aim to understand national and subnational successes and positive deviant examples through analysis that is: (a) methodologically rigorous; (b) objective; (c) comparable across countries; and (d) conducted in close partnership with in-country experts. EGH case studies attempt to capture not only the “what,” but also the “how” behind successful strategies and interventions (e.g., decision making, strategies and tactics, adaptation of programs over time). In sharing these lessons, we aim to enable policy makers, funders, global stakeholders, and implementing organizations to identify relevant lessons learned, and to adapt and emulate successes.

The EGH approach is rooted in the recognition that data and research from isolated methods are useful, yet incomplete in revealing the full picture. Hence, EGH applies comprehensive mixed methodologies while ensuring triangulation and corroboration of inferences across research activities and with input from technical and national experts. We believe this holistic process reveals novel and nuanced insights, while humbly acknowledging methodological and data limitations.

This paper presents our mixed methods research approach for studying positive outlier countries (figure 1). We discuss the process of identifying exemplar countries, selecting and engaging topic experts, collating and summarising available evidence, undertaking qualitative and quantitative analyses, and preparing dissemination products for diverse audiences. Of note, ours is far from the first framework developed to collect and analyse health data for use by policy makers. In fact, there is a rich tradition of similar methods used across social science disciplines. We have, however, formalised a mixed methods approach and applied it consistently across case studies of different topics and countries. To demonstrate, we share illustrative examples from ongoing EGH research. In describing the EGH framework, we encourage its uptake by diverse stakeholders when narrating the stories of positive outliers.

**FRAMEWORK COMPONENTS**

EGH employs a framework to identify exemplar countries for a given topic, and then to assemble, generate, analyse and synthesise evidence for disseminating their stories (figure 1). Before identifying exemplar countries, a global health topic area —either a health outcome or an evidence-based health programme— is selected via consultations between subject matter experts and funding partners while considering relevance and evidence of impact in low-resource settings. The topics selected to date are detailed in box 3. Below, we provide a step-by-step overview of how we execute a common EGH research approach. Methods details for the various EGH topics are included in online supplemental file 1.

**Technical Advisory Group selection and activities**

For each topic, we convene Technical Advisory Groups (TAGs) of global experts to provide support throughout the research process. The role of a TAG is to ensure rigour, offer new ideas and avenues for exploration, and facilitate connections with in-country research partners and dissemination partners. In practice, similar to other groups that have used TAGs, EGH selects advisers who are renowned content and methods experts and represent a diverse group of stakeholders. TAG members are identified by project teams through self-nomination or through snowball sampling approaches, whereby experts are recommended by others in the field. The TAG is continuously engaged through all aspects of the project, including methods and inferences, strengths/limitations, prior knowledge, discourse on dissemination and partnerships.
Exemplar country selection

EGH selects exemplar countries based on their exceptional performance relative to secular or global trends. Historically, economic development has been a primary driver of improvements in health, but a close look at the data reveals that health outcomes vary considerably between countries with similar economic conditions and trajectories. The EGH approach aims to identify true positive deviants by selecting countries that outperform expectations from economic gains alone. Therefore, we select exemplar countries by assessing performance conditional on changes in the most relevant economic measures: gross domestic product (GDP) or gross national income per capita, programme-specific expenditures or other proxies for a country’s capacity to achieve improvement. The selected topics are studied across the past two decades, when data is of reliable quality and when significant improvements in the outcome are observed.

For some topics, we use a range of country-level time series estimates from multiple institutions. As shown in figure 2, an initial critical step is to generate visuals (e.g., scatter plots) of average annual rate of change (AARC) in the outcome of interest as a function of the AARC in an economic indicator (e.g., GDP per capita). This comparison enables identification of countries’ actual change relative to their expected change in the outcome given economic improvement only. Inspection of these quantitative measures is combined with qualitative considerations regarding feasibility of conducting research in-country, the generalisability of findings from a country given its size, diversity of government type, policy relevance and, when appropriate, representation across geographic regions. The shortlist of countries is shared with the TAG, which subsequently ranks contenders for the final list of exemplar countries. In the case of our under-five mortality research, this process resulted in the selection of seven exemplar countries, shown in figure 2.

Evidence collection and collation

Understanding the complex chain of context, policies, programmes and interventions that drive large-scale national change is challenging. And although establishing

Box 3 Exemplar Types

Exemplar topics fall into two broad categories: outcomes and programs. Outcome topics investigate countries’ efforts in addressing a specific health outcome (e.g., stunting, under-5 mortality). Program topics look at which countries were most successful in implementing specific evidence-based programs, interventions, policies or practices (e.g., vaccine delivery, community health worker programs). For program topics, we focus less on causal evaluation of program impact and more on lessons in implementation.

Ongoing EGH Projects by Type

Health Outcomes:
- Stunting
- Under-5 mortality
- Neonatal and maternal mortality

Programs:
- Community health workers
- Mass drug administration
- Vaccine delivery

Figure 2 Exemplar country selection process: under-five mortality example. GDP, gross domestic product.
causality with retrospective studies is aspirational, triangulating evidence across a broad range of data sources and methods brings us closer to the truth (see figure 3 for an example of under-five mortality data triangulation in Rwanda). The EGH approach to evidence collection is to first systematically and comprehensively review existing evidence to identify knowledge gaps that could be filled with empirical analysis. Subsequently, we triangulate analyses from qualitative, quantitative and policy data to uncover a holistic narrative of what contributed to a given country's success. In addition to critical insights from the TAG, an appropriate in-country partner is identified for each exemplar country; this partner plays a key role in collecting, generating and synthesising evidence across analyses. To illustrate, each of the evidence collection steps is discussed through EGH research examples below.

Literature review

The EGH approach involves conducting one or more literature reviews for the topic of interest. The type of literature review conducted is dependent on several factors, including (1) the existing breadth of information available; (2) the need to assess evidence systematically versus more broadly; (3) the intended final output (e.g., a meta-analysis or descriptive summary); and (4) the available time and financial resources. The main objective of the literature review is to assemble the latest evidence on the topic of interest that can be cited and from which insights can be extracted and gaps identified. Detail on the literature review features of EGH projects is provided in box 4.

Qualitative analysis

EGH research involves conducting consultations with key informants. These consultations can be in-depth interviews and/or focus group discussions as required for the study question and target population. Potential informants include international experts, donors, researchers, representatives of multilateral or bilateral institutions, current and former Ministry of Health members, programme implementers such as national and international non-governmental organisations, frontline workers, and community members or direct beneficiaries of programmes implemented at scale at the local level. Snowball sampling was used across projects to identify additional key informants. Once data were retrieved, qualitative data analysis of the appropriate level of rigour was carried out according to an evidence-based conceptual framework.

The Community Health Worker (CHW) Project, which incorporates research visits to each exemplar country, illustrates how the EGH project collaborates with local partners. Prior to a research visit, the research team works closely with the local partner to identify stakeholders. These trips include site visits to observe programmes and in-person, semi-structured interviews with key stakeholders.

Quantitative analysis

Data sources

Although data quality is a substantial concern in many low-income countries, rich data sources for measures of health outcomes, health systems and contextual factors, including education, income distribution and population density, are plentiful. Household surveys are readily accessible and provide representative snapshots of changes in health and intervention coverage over time. Along with primary data sources, there are numerous sources that provide estimates of disease burden and intervention coverage which incorporate data into models that produce full time-series for every country. In addition, estimates summarising the state of a country's economy, education system and infrastructure offer helpful context for describing the combination of factors that contributed to changes in outcomes. Critically, care must be taken when incorporating modelled estimates as inputs into analysis since these are developed based on already-known relationships.
Causal quantitative evaluation

Causal evaluation combines data used in generating descriptive statistics with a hypothesised conceptual framework, enabling synthesis of multiple sources of quantitative data. There are numerous approaches to decomposing past outcomes into explainable and unexplainable factors, but EGH projects primarily use two types of approaches. One quasi-experimental approach involves using data from within the country being analysed and employing regression techniques in combination with hierarchical causal diagrams to identify effect sizes of each hypothesised causal factor. Alternatively, meta-analysis of pooled data from randomised control trials can produce estimates of risk factor effect sizes that are either the same across locations, or at least influenced by the observed effects in other countries.

In each approach, effect sizes are combined with estimates of changes in each explanatory factor to calculate how much each factor contributed to observed changes in the outcome of interest over the time period. The final product is a proportioning of explainable changes to a group of causal factors, many of which fall under the health system. Causal inference, already a difficult task, is further complicated by limited data and uncertainty about the pathways through which multiple factors combine to impact outcomes. Despite these concerns, causal evaluation can provide critical support for hypothesised high-impact activities.

Policy/programme analysis

Organising information on a country’s policies, programmes, and financing during the time period of evaluation can enable a clearer understanding of how that country was able to realise success. While details of some policies may be readily accessible without the support of in-country informants, conversations with key stakeholders often identify additional documentation of processes, financing and policies that were critical to the country’s success. Following up on these documents, combining them with the literature review and distilling them into a clear timeline of actions that each country took provides a clearer view of the policy mechanisms behind a country’s success. Extracting data on the financials behind policies can provide substantial additional insight, but often this is difficult to do given a lack of insightful novel measures. Our work uses a number of novel measures produced internally, like the slope index of inequality and concentration index, to measure absolute and relative socioeconomic inequalities in health outcomes, as well as externally produced numbers, like geospatial estimates from the Institute for Health Metrics and Evaluation (IHME), which leverage location data to estimate the subnational distribution of outcomes at a 5×5 km level of granularity. Through the development of descriptive statistics that span multiple strata, we explore variation across a range of dimensions, including space, time, gender, economic status and more.

Descriptive statistics

The aforementioned data sets enable independent calculation of relevant statistics and the development of

Box 4  Literature review features of EGH projects

The EGH approach encourages use of one or multiple literature review methodologies as appropriate to the question at hand. It is typical to deliberate such decisions a priori and adjust the literature review scope to research needs. For instance, in some cases, a systematic literature review may be the best approach. If the topic scope is too large, however, targeted searches may be more practical and allow for deeper dives into areas that emerge as important after an initial, more cursory literature review.

The EGH Stunting Project, for example, aims to collate causal evidence on “factors that were linked to stunting decline.” Given the existing breadth of literature on this topic in many countries, in addition to the need to assess quantitative associations systematically and objectively, researchers opt to conduct a thorough systematic literature review inclusive of statistical meta-analysis when possible. They explore more than 15 online databases (e.g., PubMed, Scopus, CINAHL) for peer-reviewed literature and more than 10 grey literature repositories (including government websites, NGO databases, and UN websites). They set inclusion and exclusion criteria (against which articles were identified, screened, and shortlisted for abstraction) and also conduct hand-searches of bibliographies. This process, applied to literature assessing stunting reduction determinants in Peru from 1990-2018, yielded 500 unique records, of which 159 underwent full text review, and of which 141 relevant studies were ultimately included in the final literature synthesis.

The EGH Under-5 Mortality Project, in contrast, opted to conduct a broad, iterative scoping review of literature using similar databases. This rapid review enabled researchers to identify emergent themes within a vast existing evidence base, while concurrently planning research goals and methods to fill existing evidence gaps. Similar work was done within the implementation science literature to identify relevant frameworks for adaptation.

The literature review can also reveal existing frameworks, models and methods for conducting research or analyses, to be considered for the topic of interest. For instance, the International Initiative for Impact Evaluation (3ie) produces evidence gap maps (EGM) that summarize evidence on the effects of development policies and programs in a particular sector, sub-sector, or thematic area, structured around a framework of interventions and outcomes. Previously developed EGMs, including those developed using the 3ie approach, on topics of interest may be a useful addition to the EGH toolkit. In the same vein, systematic tools for economic evaluation or other niche methods can be identified through this process.

As a final note, methods for synthesizing collated evidence dictated both by research objective and by available literature. The Vaccine Delivery Project team uses a literature review to assemble and harmonize operational frameworks for vaccine systems to develop a working model for the research. As shown in the EGH Stunting and Under-5 Mortality examples, the availability of several data-rich objective studies can facilitate quantitative meta-analyses, while qualitative reports may require syntheses for emergent themes. While a complete review of types, conduct, and syntheses of literature reviews is out of the scope of this protocol paper, we stress the importance of mobilizing literature review methodologies effectively at the outset and throughout the conduct of the case study to inform study planning and enrich results interpretation.
data availability. Drafting a policy timeline for expert stakeholders to review can be useful, as it enables them to point out missing initiatives that require further investigation. Multiple iterations of timeline review enable convergence towards a consensus timeline endorsed by experts (see figure 4 for a consensus stunting-related policy and programme timeline from Peru).

Evidence synthesis and triangulation of evidence

While application of each of the aforementioned methods can independently contribute to the literature for a given country or topic area, our goal is to combine these pieces to tell comprehensive stories and fortify the weaknesses of each method. We undertake a rigorous and iterative triangulation process whereby each research output is synthesised collectively to build a coherent story of success factors. Although led by the research team, it is critical that input from country experts and TAG be incorporated during this process. To assist with the evidence synthesis process, it can be helpful to draw on pre-existing frameworks. For example, the CHW Project uses the ExpandNet scaling up framework to organise the outputs from each of the employed methods.

Dissemination products

Finally, research on exemplars should be accessible by and applicable to a wide audience, for instance, through national level dissemination events geared towards policy and actionable decision-making to drive progress. Accordingly, the narrative can be assembled into a variety of dissemination products (see table 1 for a table of EGH dissemination products) that align with preferences of various target audiences.

Several other outputs can be created to reach diverse audiences. Users of the EGH framework are encouraged to consider which products are best for their intended audiences. For instance, material from the CHW Project has been incorporated into ‘Strengthening Community Health Worker Programmes’, an open, online, university-level course hosted on HarvardX that reaches over 10000 current and future health systems leaders in over 170 countries.

Finally, in-person and virtual discussions can serve as both opportunities for dissemination and means of refining research findings for policy and action. Significantly, it will be important for stakeholders to interpret and adapt information from exemplar countries to their respective contexts. EGH provides a range of interactive services to support this interpretation and adaptation.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Exemplars in Global Health output formats and intended audiences</th>
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<tr>
<td><strong>Output format</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Online platform</td>
<td>Country narrative hosted on Exemplars website, with modular content on programmes, implementation, context and challenges</td>
</tr>
<tr>
<td></td>
<td>Format enables users to choose between high-level and in-depth versions of each narrative, and includes supporting data visualisations, exhibits and resources for further exploration</td>
</tr>
<tr>
<td>Long-form narrative</td>
<td>20 to 30-page exemplar country narrative composed as long-form PDF, with supporting data visualisations and exhibits</td>
</tr>
<tr>
<td>Two-pager</td>
<td>Succinct, non-interactive summary of key insights and contextual factors regarding an exemplar country narrative</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>Peer-reviewed publication</td>
<td>Academic research published in peer-reviewed journal</td>
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Our research question was developed to identify drivers of exemplary national performance. For this reason, patients were not involved in the design of the study.

CONCLUSION

Summary

The EGH framework offers guidelines and recommendations for conducting rigorous and objective research on global health success stories. With oversight by leading global experts, we propose mixed methods studies to develop systematic and comprehensive narratives of exemplar countries’ success stories. Data are presented in a way that enables other national or subnational governments, as well as global funding and implementing mechanisms, to prioritise strategies proven to work at scale. In short, EGH’s research-based implementation narratives explain how countries implemented, adapted and scaled interventions that work.

The merits of conducting systematic case studies to highlight global health successes is evident in the sheer number of previous published efforts. The Countdown to 2030 consortium has published dozens of country case studies, several as scientific articles. The International Food Policy Research Institute has published success narratives as book chapters, reports, brochures, and journal articles. Similarly, the 3-year multidisciplinary, multicity series of ‘success factor’ studies coordinated by Partnership for Maternal, Newborn and Child Health (PMNCH), WHO, World Bank and the Alliance for Health Policy and Systems Research aimed to understand how some countries accelerated progress to reduce preventable maternal and child deaths. The EGH framework builds on and consolidates lessons from these efforts, positing one common systematic approach that can be used across diverse topics and research groups.

Each of the framework elements aims to complement one another and strengthen emergent themes. We assemble topical technical advisors at the outset of each project. Their role is critical in identifying exemplar countries, fostering in-country partnerships, overseeing methods design and analyses, and commenting on interpretation of final results. Undertaking robust quantitative, qualitative and policy analyses provides the most useful inputs to understanding the exemplar story. Triangulation of all existing and novel analyses under the oversight of technical advisors and country experts is the critical final step in developing evidence-based narratives of success and actionable insights.

Implications of EGH approach

The merits of studying stories of success to understand transferable lessons cannot be understated. Methodologically rigorous, comprehensive and systematic narratives provide valuable insights that enable learnings from the past to be applied to current and future global health challenges. We believe that the EGH approach can be applied across diverse disciplines to catalyse such efforts. Importantly, the standardised EGH framework proposes cross-cutting principles while allowing room for flexibility by topic of research and/or researcher area of expertise.

That said, the EGH approach is merely a starting point. Additional steps are required to translate lessons into implemented policy. The EGH Partnership offers support for implementation in the form of direct
technical assistance in policy-making and connection to experts. Other organisations provide similar support, as well as funding.

Limitations

Despite the potential of the EGH approach, several limitations are worth noting. First, retrospective analyses are challenging even in the most data rich settings. Often, direct measures of key variables are not collected, poorly measured or simply inaccessible due to poor institutional memory (eg, due to staff turnover) or data storage. Measuring some important constructs such as food security or quality of care is elusive and quantitatively challenging. Thus, reliance on ‘proxy’ measures is commonplace in retrospective studies, even though they may threaten reliability and accuracy if not carefully selected. Confounders of key associations may also be unavailable for analyses; therefore, exposure-outcome associations should be carefully interpreted. Additionally, quantitative analyses of ecological associations may be subject to ecological fallacy and the choice of statistical models may also influence results if incorrectly specified; conducting sensitivity analyses of key associations is thus critical to ensuring objective inferences. Key informants for qualitative research can be difficult to identify and connect with for interviews. Other important data (eg, dietary intake, from food frequency questionnaires) is almost always based on participant recall across long or short-term windows. Thus, recall bias in administered surveys and among interviewed country experts and beneficiaries is an ongoing challenge, and efforts to mitigate this bias in primary data collection must be considered. Triangulating qualitative and quantitative evidence mitigates risk of bias or uncertainty in inferences.

Future work

The EGH Consortium will continue to evolve and expand our research portfolio, with the framework presented in this paper underpinning all of our studies. Our aim is to not only provide funding agencies, multilateral agencies, governments and researchers with our learnings organised into a methodical framework, but also to share transferable and actionable knowledge for countries and foster partnerships with those interested in studying EGH. We also hope to promote improvements in the quality and comprehensiveness of data collection, as well as alignment on the appropriate quantitative methods for making inferences from data, by continuing to document EGH experiences in subsequent studies.

We believe that the methodical EGH approach to understanding case studies of successes in global health will provide objective evidence that can be used across diverse groups to accelerate improvements in the most pressing health outcomes and implementation strategies in low and middle-income countries. Learning from these stories of success could enable prioritisation of investments and programmatic action towards achieving the SDGs by 2030.

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REFERENCES


26 IFPRI. International food policy research institute [Internet]. Available: https://www.ifpri.org/ [Accessed 7 May 2020].


Appendix

Team-specific Methods Descriptions

Stunting

Country Exemplar Selection

**Objective:** To select countries that have experienced meaningful decreases in stunting prevalence over the past several decades. To identify *true exemplars* i.e. those having reduced stunting prevalence beyond the projected nutritional gains associated with general poverty reduction/economic growth.

**Inputs:** data on countries including - average annual rate of change (AARC) in absolute stunting prevalence, AARC in gross domestic product, World Bank income groups (low, lower middle, and upper middle), country populations, variability across income bands and geographic regions, physical accessibility, data availability, existence of contacts and local partners.

**Process:** We plotted the AARC in absolute stunting prevalence as a function of the AARC in gross domestic product (GDP) per capita spanning the period 2000-2015. We then stratified by the World Bank income groups (low, lower middle, and upper middle) so as to examine countries within comparable income bands. Using the plots, we identified countries with: i) steep declines in stunting rates over time, and/or ii) high AARC in stunting prevalence relative to AARC in GDP per capita. This allowed us to find those countries that demonstrated greater reductions in stunting prevalence that also had relatively smaller increases in GDP per capita.

**Outputs:**

*Step 1 Shortlisting:* Ten countries were shortlisted through this process. Expert stakeholders considered other factors including countries’ total population (minimum threshold of 5 million), variability across income bands and geographic region, physical accessibility/country security, feasibility of case study activities (e.g. qualitative data collection), and the existence of local contacts and potential partners. Two additional countries were considered based upon the aforementioned factors.

*Step 2: Final country selection:* The TAG decided on 5 country exemplars that represented diverse regions of the world: Peru, Kyrgyzstan, Nepal, Senegal and Ethiopia.

Literature Review

**Objective:** To synthesize information on contextual factors, national and subnational interventions, policies, strategies, programs and initiatives that could have contributed to reductions in child stunting in exemplar countries over the study period. Relevant literature would be iteratively synthesized and summarized to inform research questions and to contrast findings with existing evidence.

**Inputs:** access to 15 online peer-reviewed literature databases (e.g. MEDLINE, EMBASE), grey literature, organizational websites (e.g. Government websites).

**Process:** Identifying the time period spanning stunting change of interest (e.g. 1990-2017); identifying key words for “factors” of change (e.g. determinants, policies, etc); identifying country name synonyms, acronyms, and non-English spelling (if applicable).

A systematic search of published peer-reviewed and grey literature, followed by relevance screening.

Relevance criteria:
Outputs: Set of previous literature/documents that have examined factors related to child stunting reduction in exemplar countries; data abstraction sheet with core fields for each article

In-Country Interviews

Objective: to understand the determinants of stunting reduction among children in exemplar countries through exploration of perspectives at the national and community levels.

Specific qualitative research objectives included:

1) To identify the nutrition-specific and -sensitive key events (policies/strategies/laws/legislations and programs) in exemplar countries that may have contributed to a reduction in child stunting;
2) To understand the main success factors and challenges of relevant nutrition-specific and -sensitive facilitators key events (policies/strategies/laws/legislations and programs) in exemplar countries;
3) To identify important contextual factors that have functioned as enablers or drivers of national-level stunting change in exemplar countries;
4) To document community-level perspectives and experiences on the stunting transition in exemplar countries by consulting mothers of young children and child care workers.

Inputs: in-depth interviews with national experts/stakeholders (e.g. government employee, UN, academia, etc), community childcare worker (e.g. front-line worker or local policy/program implementer); focus group discussions with mothers of under-5 children, including both mothers of young child during high stunting prevalence period (e.g. 1990-1994) and mothers of young children during low stunting prevalence period (e.g. 2012-2017).

Process: Participants were selected using purposive sampling strategies, including snowballing sampling. National stakeholders were selected purposively relating to their involvement in designing, implementing, monitoring, or evaluating nutrition-specific or -sensitive policies and programs. They were also asked to identify and refer other individuals with this knowledge or expertise. Individuals were contacted and recruited by phone. Semi-structured interview guides were administered to each participant.

Focus communities were selected to as those that had 1) substantial stunting prevalence reduction over time using AARC; 2) represented diverse geographical and cultural regions in the country. Local childcare workers were identified by the country Principal Investigator with input from local key informants (e.g. community leaders etc) using purposive sampling strategies. They were selected purposively relating to their involvement in the care for young children or designing, implementing, monitoring, or evaluating local nutrition–specific or –sensitive policies and programs. Individuals were contacted and recruited by phone or in-person. Semi-structured interview guides were administered to each participant.
Mothers were identified by local key informants (e.g. community leaders, community health workers) using purposive sampling strategies (e.g. younger and older mothers of under-5 children). They were selected purposively relating to care for and experience in raising a young child in that community in earlier vs later periods. Individuals were contacted by local key informants and requested to gather in meeting on a specified day and time. Semi-structured interview guides were used to guide the group discussions.

For all qualitative data collection: Notes were taken by interviewers during sessions. Interviews were audio recorded, transcribed and translated into English. Data was analyzed using the UNICEF Nutrition framework, Lancet Nutrition framework, and adapted framework for country case studies. Responses from national and community level stakeholders were analyzed separately. Thematic analysis was conducted to explore key themes that emerged based on stunting determinants including socioeconomic status (e.g., living conditions), migration, hygiene and sanitation, and nutrition and eating behaviors.

Outputs: A detailed synthesis and narrative of perspectives from national experts, and community stakeholders including childcare workers/local policy implementers and mothers of young children on factors that may have contributed to stunting decline in the country.

Specific outputs could include data on nutrition-specific and –sensitive events (policies/strategies/laws/programs) as well as successful factors and barriers to implementation; key trends in child undernutrition and contextual factors such as socioeconomic and lifestyle determinants; access to key resources (e.g., water/sanitation, health services; changes in dietary practices and food insecurity; etc.

Policy/Systems/Financing

Objective: To understand key nutrition – specific and –sensitive policies and programs that contributed to decreased in child stunting in exemplar countries. To track financial data linked to these initiatives with the aim tag a dollar amount to financial allocations/ actual disbursements and budgets/expenditures of the various programs, policies, interventions and other initiatives

Inputs: literature reviews, stakeholder consultations

Process: A desk review of literature identified through our systematic approach produced a suggested timeline. This timeline was shared with expert stakeholders to obtain their corroboration and insight on any missing initiatives. After reviewing additional literature and specific policy/program documents as suggested by experts, a second iteration of the timeline was proposed. This process ensued until consensus was reached between country experts and the exemplar country research team. A similar multi-pronged data collection and corroboration exercise was undertaken to track financial data linked to the nutrition policy and program timeline. The scan for financial commitments and spending spanned many sectors, including government, development partners, NGOs, others as applicable.

Outputs: A detailed and comprehensive timeline of nutrition policies and programs, and their associated financial allocations/ budgets. Products could include timeline visuals, detailed write-ups for each policy/program, tables/figures of financial information
Descriptive Statistics

Objective: To examine the distribution and trends in stunting prevalence over time in exemplar countries.

Inputs: DHS and MICS original survey datasets; published/available stunting prevalence estimates from global estimation groups (e.g. WHO/World Bank/UNICEF Joint Malnutrition Estimates, IHME for 5X5 mapping, Federal University of Pelotas Equity Group)

Process: Identification of all available national surveys that have collected anthropometry in the country through a dataset mapping (e.g. checking JME for surveys used, conducting rapid survey assessment from government websites etc); early vetting of identified datasets (e.g MICS, DHS) for sample sizes, anthropometry data availability for child population of interest (e.g. all under-5), quality (if possible) of anthropometry data.

Data from selected surveys are obtained from all available online databases and country collaborators. Where possible, we re-calculated the below descriptive analyses and compared to those available from other groups; our own calculations were prioritized in any case of discrepancy as they were re-checked/validated for the purposes of our objectives.

Geospatial Analyses: We calculated stunting prevalence by subnational area (e.g. province) within exemplar countries to visualize geospatial patterns in stunting across the country and overtime; IHME 5X5 stunting prevalence maps were used to assess sub-province level distribution.

Equity Analyses: stratified stunting prevalence by wealth quintile, maternal education, residence (urban vs rural), child gender, and double disaggregation (wealth and residence); estimates were used create equiplots so as to examine both absolute and relative inequalities. We also calculated Slope Index of Inequality (SII) and Concentration Index (CIX) to measure absolute and relative socioeconomic inequalities, respectively. Average annual % point change in stunting (AARC) were estimated through ordinary least square regression models. We also calculated compound annual growth rate (CAGR) to assess relative change in stunting prevalence over time for each region. These analyses were download from by the Federal University of Pelotas Equity Group repository and re-calculated by our team for newer surveys or to validate estimates.

Kernel Density Plots: The distributions of HAZ scores for children under the age of 5, were plotted using Kernel density plots. These plots produce smooth curves which estimate the probability density function of the continuous variable HAZ. Additionally, we calculate the kurtosis, or the sharpness of the peak of the curve. The kurtosis is a measure of whether the data are heavy or light tailed relative to a normal distribution.

Child growth curves [Victora curves]: Display predicted child HAZ from smoothed local polynomial regressions that have been plotted against child age. We plotted four curves using data from the four surveys with a 95% confidence interval band around each.

Outputs: Various figures and tables (e.g. plots, maps) allowing for appropriate evaluation and triangulation of key messages related to descriptive stunting change in the country
Causal Evaluation

**Objective:** To determine key predictors of change in child stunting/HAZ in the exemplar country during critical time periods.

**Inputs:** DHS and MICS, ecological variables

**Process:** Identify causal conceptual framework for selected potential determinants of child stunting; our study examined the UNICEF Nutrition framework and the Lancet 2008 and 2013 Nutrition frameworks to create an adapted framework for all analyses; operationalize the outcome of interest, e.g. we selected child HAZ as the main outcome for causal quantitative analyses given that it’s a continuous measure and is not susceptible to misclassification or limitations set forth by using dichotomous variables. Harmonize panel survey datasets to have common outcome and determinant definitions.

**Linear multivariable regression:** The linear regression based on panel datasets uses a difference-in-difference analysis framework where time*covariable interactions are used to assess factors impacting HAZ decline. First, the multiple cross-sectional surveys are assembled into panel datasets that have synchronized outcome and “determinant” variables across all rounds. Next, univariate statistics are estimated using means/standard deviations and frequencies/proportions. Interaction estimators in unadjusted regression are applied to estimate the DID effect (e.g. time*covariable). Hierarchical model building strategies are used to select those candidate determinants (i.e. significant main effect and/or interaction effect) into the final multivariable regression model; control factors in all models include child age, sex and region. All analyses are adjusted for survey design and weights.

**Oaxaca-Blinder decomposition:** The Oaxaca-Blinder decomposition is based on the same set of survey data (with ecological variables) assembled into panel datasets. However, by design, the decomposition only uses two survey time points in a given analysis and thus “ignores” in-between survey rounds and any intermittent fluctuations in the predictors. Linear least square regression models are used to assess associations between HAZ and outcome variables using hierarchical multivariable model building techniques. These associations are multiplied by HAZ change during the study period to obtain the predicted change in HAZ due to the change in each determinant. All analyses are adjusted for survey design and weights.

**Outputs:** Variables tables and figures displaying results of each analyses e.g. final multivariable models, DID significant effects as marginal plots, HAZ decomposition pies, etc.

Under-5 Mortality

**Country Exemplar Selection**

**Objective:** Establish a set of Exemplar Countries within which to investigate effective strategies for reducing under-5 mortality (U5M).

**Inputs:** Time-series estimates of USM (IHME, IGME, CHERG) and gross domestic product (World Bank). Expert consensus (Technical Advisory Panel).

**Process:** Control for economic growth. Exclude countries that are very small, lack of data, or have circumstances where we would have difficulty conducting primary research. Look at positive deviants
after comparing epi outcomes to economic growth. Look at strata of interest. Apply inclusion and exclusion criteria. TAP used Delphi approach to rank countries.

**Outputs:** A subset of countries which performed exceptionally well in the outcome, represent a range in geographies, income bands, populations, and approaches to improving the USM. Alternate countries.

**Literature Review**

**Objective:** Synthesize information on contextual factors, national and subnational interventions, policies, strategies, programs, and initiatives that may have theoretically contributed to reductions in under-five mortality. Initial review reveals key topics for follow-up search.

**Inputs:** Literature from online databases (MEDLINE, Google Scholar) using the search teams “child mortality” and “under 5 mortality”. Additional review of gray literature and review of existing data sources including CountDown 2015 and 2030, DHS, multilateral donor reports (ex. GFATM, GAVI), implementing partner reports and other sources. Further targeted searches included specific EBIs, causes of death, or contextual factors as search terms (e.g. “insecticide-treated nets”, “malaria”, or “community health workers”).

**Process:** Initial desk research was synthesized and then reviewed for accuracy and completeness. The review was an iterative process, with ongoing additions occurring throughout the primary research process as additional sources (published articles, reports, case studies) were identified or gaps in knowledge for further exploration. We purposely did not include in-depth reviews of important broad interventions that contributed to USM reduction but not targeted to amenable causes explicit, including education, poverty reduction, water and sanitation, broad health systems strengthening and programs designed to improve nutritional status. However as these were important contextual factors, background information on timing, scope and coverage were included where available. This secondary data were also supplemented where possible by review of relevant country policy and evaluation reports.

**Outputs:** Organized and summarized literature. List of key areas for follow up in future investigation.

**In-Country Interviews**

**Objective:** Obtain first-hand accounts of how the interventions were chosen, adapted, implemented, adapted and work to maintain within the country and learn of potential data and documentation that could assist with making inference.

**Inputs:** Key stakeholders including global and national level actors, Ministry of Health actors, project managers and implementers for specific causes of death or EBIs, and others.

**Process:**

Key informants were chosen based on the EBIs and leading causes of death (from IHMS and IGME). Additional potential KIs were also identified from the literature review and snowballing from KIs. This was done in close collaboration with the in-country partner, prioritizing those EBIs that were reported as most successful, as well as any major EBIs for which no evidence of implementation was found in the literature. These key informants included current and former Ministry of Health employees responsible for overall direction or identified key specific disease or intervention areas. We also interviewed key
individuals from NGOs, multilateral organizations or donor organizations, who had managed partner-supported or partner-led activities. We focused on individuals active in the time period between 2000 and 2015, but were able to also capture some experiences before 2000 and after 2015.

Informed by the framework and review of relevant literature on contextual factors, EI implementation and implementation outcomes, we developed core interview guides for four main routes of inquiry. These were:

- Global and national level actors;
- Ministry of Health (MOH) actors;
- Project managers and implementers for specific causes of death or EBIs; and
- Other partners

The interviews were designed to address the EBI implementation process, from exploration to identify the problem and identify potential interventions, preparations following the decision to implement including adaptation, implementation and ongoing adaptation to sustainability. The interviews also explored critical contextual factors at the relevant global, national, ministry, and local levels. The interviews also identify additional sources of data and information which could be added to the knowledge base and understanding already developed from the desk review. Follow-up interviews were conducted as gaps or additional needs were identified. Interviewees were informed about the goals and structure of the project, and consent for participation and recording was obtained separately from the interview (recording was solely for the purpose of reviewing notes). All interviews except one were led by one of the project PIs with one to two note-takers. Following the close of the interview, notes were combined and the tape recording (if allowed) was used to clarify areas as needed.

** Outputs: In depth understanding the implementation process, contextual facilitators and barriers as well as adaptations made during planning and implementation. In addition, understanding and identification of key implementing strategies for individual EBIs. This includes the process for deciding upon implementing the intervention, the plan for implementation, the actual implementation, and efforts to make the intervention sustainable were all extracted from interview transcripts. The synthesis across a country to include common strategies as well as transferable knowledge for uptake by other countries. These interviews also led to identification of additional data or documents that could lend additional insight into the country’s actions.

**Policy/Systems/Financing**

**Objective:** Assess available information on the policies, systems, and financing that contributed to U5M decline

**Inputs:** Published literature. Documents and literature identified by key informants

**Process:** Conduct a targeted literature search to screen published literature for information on policies. Follow-up on documents and literature identified as important during key informant interviews.

**Outputs:** Implementation Science framework
**Descriptive Statistics**

**Objective:** Organize available estimates of key outcomes, intervention coverage, risk factors, and contextual factors within a country that could assist with hypothesis generation or highlight interesting insights through stratification of estimates.

**Inputs:** Demographic and Health Surveys (DHS), Country reports.

**Process:**

*Geospatial Analyses:* 5x5 km U5M maps from IHME.

*Equity Analyses:* Stratified U5M by wealth quintile, maternal education, residence (urban vs rural), child gender, and double disaggregation (wealth and residence); estimates were used to create equiplots so as to examine both absolute and relative inequalities. These analyses were downloaded from the Federal University of Pelotas Equity Group repository and re-calculated by our team for newer surveys or to validate estimates.

**Outputs:** 5x5 km area U5M estimates. U5M and intervention coverage estimates stratified by wealth quintile and geographic region.

**Causal Evaluation**

**Objective:** Using available data and quantitative methods, decompose the decline in under-5 mortality into explainable and unexplainable factors.


**Process:**

*IHME:*

1. Calculate exposure to risks or coverage of intervention
2. Establish relative risk for each specific disease outcome through literature review – mixture of RCTs, before-after, case-control and natural history models
3. Generate population attributable fraction
4. Decompose using Das Gupta method*
   a. Divide overall difference between years into contributions from:
      i. **Population growth:** Change in total population size
      ii. **Population age structure:** Change in relative size of each age group
      iii. **Exposure or intervention coverage:** Change in exposure or coverage to a selected set of 30 risks and interventions
      iv. **Healthcare Access and Quality (HAQ) Index:** Change in risk-deleted mortality related to changes in HAQ
      v. **Other factors:** Change in the risk-deleted mortality that is not related to changes in HAQ
5. Regress risk-deleted mortality on Health Access Quality (HAQ) index to identify changes in mortality due to improvements in HAQ
**LiST:** Lives Saved Tool (LiST) calculates changes in cause-specific mortality based on intervention coverage change, intervention effectiveness for that cause, and the percentage of cause-specific mortality sensitive to that intervention. Coverage data come from large-scale household surveys - typically Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) - as well as WHO/UNICEF and the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP). Default effectiveness values come from systematic reviews, meta-analyses, Delphi estimations, and randomized control trials based upon the Child Health Epidemiology Reference Group (CHERG) guidelines. Baseline mortality is drawn from country-level estimates from DHS, WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division and the UN Inter-agency Group for Child Mortality Estimation (IGME). These high quality data sources as inputs translate into estimates that can be trusted. Additionally, users who have more recent or better data can easily replace default data with their own.

**Outputs:** The percent decline in USM attributable to each EBI for which data were available.

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**Community Health Workers**

**Country Exemplar Selection**

**Objective:** Identify best in class national, government led integrated CHW programs from which other countries can learn as they scale their own CHW programs.

**Inputs:** Data on CHW programs including number of CHWs, CHW density (CHWs per 1,000 total population, with recognition that some CHW programs serve subnational patient populations), incentive and training characteristics and cross-country time trends on key health intervention coverage and outcome metrics, including: % change in family planning prevalence, % change in under-five mortality, % change in antenatal care visits, % change in skilled birth attendance, % change in facility-based delivery, and % change in maternal mortality ratio.

**Process:** Last Mile Health assembled a 7-member Technical Advisory Panel of global health experts in the Community Health and Primary Health Care fields to select case study countries and advise on research approach, methods and case study content. In collaboration with the Technical Advisory Panel, Last Mile Health employed a rigorous approach to case study country selection, including the following three steps:

- **Created shortlist of potential case study countries:** Used academic literature and country case studies to enumerate ~60 large scale CHW programs in low- and middle-income countries. Developed shortlist of ~20 programs based on research feasibility, data quality, regional diversity and availability of CHW scale estimates. For example, we excluded countries for which we could not find an estimate for the number of deployed CHWs (assuming it is unlikely that an exemplary CHW program will have an unknown estimate for number of CHWs).

- **Developed criteria and data visualizations to inform country selection:** Developed five criteria to help inform selection process, including: Scale of CHW program; changes in
national population health outcomes over time; changes in national health intervention coverage over time; government stewardship; and integration into the primary health care system. Used data visualizations to plot cross-country time trends for available metrics like FP coverage and under-5 mortality against community health worker density to help select positive outlier countries. Stewardship and integration were ranked qualitatively by our technical advisory panel.

- **Rank ordered potential case study countries**: Based on selection criteria, data visualizations, and expert knowledge, the technical advisory panel rank ordered their top choices for each of three geographic regions (Latin America and the Caribbean, Asia Pacific and Sub-Saharan Africa). Based on these rankings, a total score was developed for each country. Last Mile Health facilitated a discussion of the ranking results to develop consensus among the technical advisory panel members on the selected countries. The final selection decision sought to also ensure diversity of selected countries by income classification, demographics, political, social and economic context, CHW program scale and model/approach as well as program maturity. Liberia was recommended by the Technical Advisory Panel as a fourth case study because of its potential relevance to other settings.

**Outputs**: The TAP decided on 4 exemplar countries that represented diverse regions of the world:
Bangladesh, Brazil, Ethiopia and Liberia

**Literature Review**

**Objective**:
- To synthesize information on contextual factors, key policies, decisions, strategies, programs and initiatives that contributed to the design, scale, adaptation and sustainability of each exemplar country’s CHW program.
- To synthesize population level progress related to key health intervention coverage and health outcome metrics aligned with the activities and services offered by each country’s CHW program.

**Inputs**: Qualitative literature review, including peer-reviewed journal articles, published reports, impact evaluations, government and NGO strategy and policy documents, meeting presentations and other grey literature. Quantitative analysis of publicly available data, including health financing, coverage and outcome data from demographic health surveys, annual government reporting and other globally recognized data sets such as the Institute for Health Metrics Evaluation, the World Bank and the World Health Organization (WHO), among others.

**Process**: 
Relevant literature was iteratively synthesized and summarized to inform research and interview questions in advance of field trips and to complement interview data and insight generation after field trips.

The literature review sought to detail the evolution of pioneering CHW programs utilizing two frameworks: WHO ExpandNet and Primary Healthcare Performance Initiative (PHCPI). The WHO ExpandNet framework enabled Last Mile Health to systematically explore the scaling-up process of these exemplar CHW programs. Through the lens of ExpandNet, the project investigated specific elements of the Primary Healthcare Performance Initiative (PHCPI) framework, most notably governance and leadership, health workforce, health financing, facility infrastructure, and service delivery.

**Outputs:** Synthesis of literature and documents that have examined factors related to design, scale, adaptation, and sustainability as well as ongoing challenges related to community health worker programs in exemplar countries to inform research and interview questions as well as production of case study content; data collection excel sheet that synthesized key data elements for each exemplar country (i.e. changes in key health coverage and outcome metrics, health and primary health care financing, density of community health care workers, other complementary health workers and facilities, etc.).

**In-Country Interviews**

**Objective:** To better understand how the scale-up process unfolded and to identify unique characteristics of the programs that drove design, scale, adaptation and sustainability over time.

**Inputs:** In collaboration with local partners, Last Mile Health conducted research visits to each country. These trips included site visits to the CHW program and in-person, semi-structured interviews with up to 30 key stakeholders. Stakeholders included current and former Ministry of Health leaders, directors of professional associations, national and international NGOs, research institutions as well as representatives of multilateral and bilateral institutions.

**Process:** In each case study country, Last Mile Health closely engaged with an in-country research partner to identify stakeholders that 1) played a leadership role in the CHW implementation process and 2) could help Last Mile Health better understand program characteristics and key drivers of scale, adaptation and sustainability. Last Mile Health identified participants representing a range of perspectives across key sectors, including the government, NGO, donor, and academic sectors. Interview questions were organized around the ExpandNet scaling up framework and were adapted to a smaller set of interview questions for several types of stakeholders.

**For qualitative data collection and analysis:** Notes were taken by interviewers during sessions. When possible, interviews were audio-recorded and transcribed. Interview transcripts were analyzed according to the thematic areas pursued in the interview guide. Using inductive reasoning, Last Mile Health explored the key factors that contributed to the successful scale-up and implementation of community health efforts in each CHW exemplar country. To ensure the anonymity of research participants, no quotes are attributed to specific individuals in the case study without explicit permission. Wherever possible, Last Mile Health triangulated interview data with the literature and sought additional guidance from in-country stakeholders to ensure accuracy.
**Outputs:**

The case study interviews addressed several overarching themes which allowed Last Mile Health to better understand the specific program characteristics and contextual factors that made scale up of the CHW program possible and were key to program effectiveness. These themes included: Program inception, program evolution, success factors, outstanding challenges, and future vision.

**Policy/Systems/Financing**

**Objective:** To ensure the reader was able to quickly understand the basic program characteristics, structure and evolution, Last Mile Health developed a variety of graphics, including:

1. Chronological timeline that synthesized the key policies, contextual factors and program changes over time
2. A standardized assessment of each country’s key program characteristics, like scale/density, services offered, roles/responsibilities, selection process, qualifications, training, management and supervision model, incentives regime, integration into the PHC system, etc.
3. A schematic of the country’s primary health care system and CHW program, including relevant cadres, referral and intervention pathways.

**Inputs:** literature review, in-country interviews and stakeholder consultations

**Process:** Desktop literature review produced a suggested timeline, program characteristics table and program structure visual. These outputs were shared and validated with expert stakeholders in each exemplar country and revised as needed before incorporation into the case studies.

**Outputs:** Timeline, program characteristics table and program structure visual.