Use of targeted surveys to monitor immunization programming for zero-dose children and missed communities:

Evidence on pro-equity interventions to improve immunization coverage

*Part of a series, this evidence brief presents results from a **rapid review** of the literature to understand the effectiveness and implementation considerations for selected interventions, including targeted surveys, which could help achieve more equitable immunization coverage, specifically helping to increase coverage and reach zero-dose children and missed communities.*

EVIDENCE SUMMARY	
What are targeted surveys?	Targeted surveys involve data collection at the household or individual level among a specific population of interest (defined as implemented at the district-level or below) to measure vaccination coverage; understand reasons for lack of vaccination, vaccination timeliness, dropouts, and missed opportunities; and to assess whether an intervention to improve coverage has been successful. When used for monitoring purposes, targeted surveys occur across at least two time points to measure changes in coverage or other relevant outcomes as listed above. The purpose of this review was to understand how targeted surveys have been used to monitor immunization or other health-related programming for missed communities, to assess whether these efforts are effective at monitoring outcomes, and to understand major implementation considerations. The review included monitoring efforts related to immunization as well as other health conditions, including malaria, nutrition, and neglected tropical diseases (NDTs) due to shared inequities and populations facing similar vulnerabilities.
How effective are targeted surveys in monitoring programming for missed or otherwise vulnerable communities?	Targeted surveys have been used to monitor both routine immunization and supplemental immunization activities (SIAs) among populations in vulnerable contexts. Studies that compare results from targeted surveys to other data sources show surveys bring accuracy and value, and serve as an important means of informing programming for missed communities. While targeted surveys have primarily relied on "traditional" survey methodologies, such as multi-stage cluster household sampling, recent literature suggests increasing use of more novel methods, including the incorporation of geospatial technology and adaptive sampling strategies. Targeted surveys for monitoring have been implemented most in rural areas. There was less evidence of their application in conflict-affected and urban areas. Targeted surveys for monitoring immunization were used mostly in instances where coverage was generally low, or nonexistent (i.e., introduction of a new vaccine or one not routinely administered). Additionally,

 PROMISING INTERVENTION	while studies focused on vulnerable or marginalized populations, few focused on zero-dose children or communities. **For these reasons, using targeted surveys to monitor immunization programming is categorized as a "promising" approach for addressing equity.**
What are the main barriers and facilitators to implementation?	• **Major facilitators** include working with **experienced partners**, ensuring **data quality and rigor**, **communicating results to decision-makers** so they can be used for action, securing **community buy-in**, and using **existing tools and guidelines**. • **Major challenges** include introducing **potential biases**, **omitting hidden populations** from the sampling frame, addressing **logistical and budgetary issues**, conducting **cluster and household probability sampling**, and mismatching **indicators of interest** and **survey sample size**.
What are the key gaps?	**Key gaps** include a **lack of focus on zero-dose children and missed communities**, and **little understanding of implementation considerations**, including how to sample hidden and hard-to-reach populations. More research is needed on the application of **novel sampling methods**, including using geospatial technology and adaptive sampling in the context of immunization, and on the **cost of implementing** targeted surveys for monitoring purposes.

INTRODUCTION

What are targeted surveys?

According to the recently developed Targeted Survey Implementation Guide (1), a targeted survey, when applied in the immunization field, can be described as "a survey where the eligible respondents are a targeted subset of everyone who should receive vaccination services – e.g., a population living in urban slums or in hard-to-reach urban areas, who are nomadic, refugees or have been displaced, or belong to ethnic minorities and religious closed communities, among other high risk populations." Surveys can also be targeted to districts or other subnational administrative units where health inequities are known to exist (i.e., areas with persistently low vaccination coverage). For this topic, the focus was on surveys targeted at the district level or below and use some sort of probability sampling to identify respondents for purposes of monitoring immunization or other health-related programming. While targeted surveys may be of limited utility for monitoring immunization programs where coverage is relatively high, they potentially may play a larger role in monitoring and measuring vaccination activities among communities where coverage is generally low, as targeted surveys have the potential to relatively quickly ascertain whether progress is being made.

While targeted surveys are frequently conducted to monitor immunization, they are also used among other health areas, including neglected tropical diseases, nutrition, and malaria programming. Innovations in these other areas might hold relevance for immunization as well, particularly as these conditions often impact populations facing vulnerabilities similar to those faced by un-/under-vaccinated populations, thus this review was inclusive of these other fields as well.

Surveys can be used both to measure and evaluate coverage of routine immunization and supplemental immunization activities (SIAs), such as vaccination campaigns, at both national and subnational levels (2). Targeted surveys can also be used to assess if an intervention has been effective at increasing coverage and to determine reasons for lack of vaccination, timeliness of vaccination, dropout, and missed opportunities for vaccination (2). While targeted surveys can be used cross-sectionally (i.e., data collected at one point in time), the focus of this review was understanding how targeted surveys can be used to monitor immunization and other health programming, defined as conducting a targeted survey in the same geographic area with the same population across at least two time points to measure change.

Notably, many survey methods exist and can be applied with varying degrees of rigor. Some survey methods are, by design, meant to be less rigorous than others. For example, rapid convenience monitoring (RCM) uses non-probability sampling to quickly and efficiently get a sense of vaccination coverage, but its estimates should be interpreted with caution (3). Lot quality assurance sampling (LQAS) is another survey methodology that can be misunderstood (4). LQAS uses a system of classification to determine whether coverage is unexpectedly low in certain areas, which can be helpful to program implementers, but the opposite is not true, which can lead to misinterpretation. This review does not comment on the rigor of survey methods applied. For the most part, the review focuses on methodologies that involve probability-based sampling, although some nonprobability-based methods are mentioned (e.g., RCM and adaptive sampling).

How are targeted surveys relevant to achieving equity?

Despite decades of progress related to childhood immunization, recent data suggest progress has slowed, stagnated, or even declined in recent years, with certain populations being left behind for vaccination (5). The Immunization Agenda 2023 and Gavi's 5.0 Strategy both center around the concept of equity and finding ways to reduce inequities to achieve full vaccination coverage for all (6, 7). **Having accurate monitoring data about who has received immunization services and who has not is critical to understanding inequities in vaccination coverage and reasons for low coverage among certain subpopulations so these populations can be reached with improved vaccination programming.** While surveys are the "imperfect gold standard" to assess vaccination coverage (8), they can be prone to biases, including selection bias, that may miss certain subpopulations. The hidden subpopulations likely to be missed in surveys might also be those less likely to be receiving health services, including vaccination (2). Additionally, conducting household surveys are both time and labor intensive, thus impractical to conduct in every district (2). Despite these potential limitations, conducting rigorous, targeted coverage surveys within critical areas has the potential to monitor progress in reaching zero-dose children and missed communities to know what is working and what needs to be improved.

Why was this evidence synthesis on targeted surveys undertaken?

The overall goal for this rapid review was to identify targeted survey approaches used for monitoring purposes within immunization or within health programs that could be adapted for use within the immunization sector (e.g., programs within the nutrition, malaria, and NTD sectors), among hard-to-reach or hard-to-vaccinate populations to inform the field what is working, and to identify research gaps. Through a comprehensive review of peer-reviewed and grey literature, this work aimed to address the following questions:

1. What types of targeted surveys—and sampling methodologies—are being used to monitor health outcomes resulting from delivery of intervention services related to immunization, nutrition, malaria, or NTDs, specifically among populations in vulnerable contexts, including those who are marginalized or underserved?
2. To what extent are targeted surveys effective in monitoring immunization and relevant health sector activities, specifically among zero-dose children, missed communities, or communities in vulnerable contexts, including those who are marginalized or underserved?
3. What are the main implementation considerations for carrying out targeted surveys to monitor health service delivery specific to zero-dose children, missed communities, or communities in vulnerable contexts?

This rapid review involved searching electronic databases of published literature, searching websites for unpublished literature, soliciting potentially relevant articles from experts, and secondary searching of references of included articles). To be included, studies/reports had to have been conducted in a low- or middle-income country, published (or posted) from 2010 to 2022, and report on targeted surveys (implemented at the district level or below) used to monitor programming for populations in vulnerable contexts, including those related to immunization, malaria, NTDs, and nutrition. More information on the review methods is presented in Appendix A.

RESULTS: What is known about targeted surveys regarding monitoring of health programming for missed communities or communities in vulnerable contexts?

Use case typology: How are targeted surveys used to monitor programming for communities in vulnerable contexts?

Categorization of use cases was informed by a typology originally developed by Cutts et al. (2).

To monitor routine immunization (RI) coverage at subnational levels

Five studies were identified from Malawi, China, India, and Nigeria that employed targeted surveys to monitor RI (9-13). In Malawi, teams surveyed 20 villages within a rural health area to assess coverage of pneumococcal conjugate vaccine (PCV13) and delays in timeliness of vaccine administration over time as part of a larger evaluation of the health system burden of pneumonia following vaccine introduction. LQAS methodologies were employed to conduct the surveys, and the random walk method was used to identify eligible infants (9). In China, standard World Health Organization (WHO) Expanded Program on Immunization (EPI) cluster surveys were used to assess RI coverage for counties in western China with historically low coverage rates. The surveys were used to evaluate an EPI strengthening intervention in the region (12). Similarly, the study in India evaluated the impact of the Muskaan Elk Abhiyan program (the "smile campaign") on RI coverage within districts in the state of Bihar using multiple survey sources, including data from India's District Level Household Survey (10). In Nigeria, approximately 100,000 children in Kaduna state were surveyed over a one-year period using a method in which 10 children were selected per settlement (11). The focus of surveys was to monitor progress with polio vaccination, although data were also collected on full versus partial immunization status and Penta3 coverage (11). A second study in Nigeria—in which the authors presented two uses of surveys, one for RI and one in

relation to an SIA—combined geospatial information with survey results, revealing detailed geospatial variation in measles coverage (13).

To monitor SIA and other health campaign coverage at subnational levels

Although many studies were identified that described the use of targeted surveys during SIAs or health campaigns (14-35), most used surveys to assess coverage only after the event (i.e., cross-sectional uses were most common). A smaller number (n=8) reported conducting at least two rounds of targeted surveys in conjunction with one or multiple events (28-35). Of these, surveys were used to identify antigens to target for vaccination campaigns and monitor coverage (29), assess coverage between rounds of SIAs or mass drug administration for NTDs to identify gaps and make improvements (31-35), or to identify barriers to vaccination to address (28, 31, 32). Studies mostly employed household-based cluster surveys, although a few studies used LQAS (32) or rapid coverage monitoring (34). Several studies triangulated results between multiple types of survey data, including using both LQAS and cluster surveys (32) or rapid coverage surveys coupled with seroprevalence data (34). In these instances, implementation of targeted surveys was concentrated within communities in which the SIAs or campaigns were occurring. Notably, one study occurred within a conflict-affected setting, specifically within communities in northern Syria. In this study, a pre-SIA survey was conducted to assess the antigen with the highest public health threat using a vaccine preventable disease risk assessment tool, and a post-SIA survey to assess increases in measles coverage (29). Other studies took place in both urban and rural settings.

To determine intervention has increased coverage

Many included studies (n=23) used targeted surveys to determine whether an intervention—typically a time-limited series of actions or activities delivered intentionally—was successful in increasing coverage, changing health behaviors, or affecting change in other health-related outcomes (36-51). Some studies in this category also assessed the impact of certain contexts (e.g., seasonality, environmental conditions) or events (e.g., COVID-19 pandemic), on outcomes such as food security and diet diversity (40, 52-56). Most studies took place in rural areas. Otherwise, one study occurred within the Democratic Republic of Congo to assess community health following a period of conflict (55), one study in Chad included both mobile and settled populations in a remote region (41), and two studies took place in hard-to-reach/underserved areas in Kenya and Sierra Leone, respectively (42, 57). Notably, many reports in this category were conducted as part of research studies, although many program evaluations were also included. Targeted surveys primarily encompassed multi-stage cluster household sampling, although a few studies used LQAS (38, 51) and one used chain referral sampling to reach members belonging to a certain group (dairy farmers in Kenya) (50). As with SIAs, studies often reported on or compared results from multiple data sources, including survey data, administrative data, and qualitative data from focus group discussions and key informant interviews.

Types of survey methodologies: What methods are being used to monitor programming for missed or otherwise vulnerable populations?

Cluster surveys

EPI cluster surveys and two-stage cluster sampling were used the most across targeted survey initiatives identified in this review as mentioned above.

LQAS

Less frequently, studies reported using LQAS as mentioned throughout the typology of uses. This approach seemed more common for monitoring SIA rather than RI coverage or evaluating whether an intervention succeeded in improving coverage but was still less commonly used than cluster surveys.

Geospatial methods

One study assessed layering in geospatial information with household survey data that had been collected both to assess measles RI and SIA activity in Nigeria (13). While the initial data collection was not targeted, layering geospatial data enabled the team to develop 1-by-1-km predicted maps to identify low and high coverage areas. The exercise helped demonstrate suboptimal RI systems in some parts of the country and the effectiveness of SIAs in filling gaps and improving coverage in specific areas (13). Additionally, a separate analysis compared the results of model-based geostatistics with WHO-recommended approaches to monitoring the prevalence of soil-transmitted helminth infection and other NTDs, and found that the models incorporating the geostatistics outperformed the WHO-recommended methods across case studies from Kenya, Sierra Leone, and Zimbabwe (58). Other studies made brief mention of using geospatial data or equipping surveyors with geographic information system (GIS) technologies, but it is unclear how these were incorporated into data collection and analysis (35).

Adaptive methods

One systematic review was identified on using adaptive sampling to reach disadvantaged populations for immunization programming. The review identified 23 studies that utilized one of these types of adaptive sampling—peer-driven (i.e., respondent-driven), geospatial, venue-based, ethnographic, and compact segment. Over half of these studies took place in high-income countries; examples of disadvantaged populations of interest included migrants, sex workers, and disadvantaged mothers and caregivers. The study noted a general underutilization of this type of sampling despite its potential importance for hidden subpopulations (59). One other study used chain referral sampling to identify women belonging to certain groups in Kenya, specifically dairy farmer associations (50).

Survey method comparison

Several studies directly compared the ability of various targeted survey methods to inform decision-making. A review by Johnson et al. found models incorporating geostatistical information outperformed WHO-recommended methods for estimating prevalence of NTDs, which could potentially reduce the cost of monitoring efforts but would require expertise in geostatistical approaches (58). A study by Knowles et al., developed “gold standard” datasets to test two alternative two-stage cluster design surveys that varied in terms of schools per district sampled and number of children per school surveyed for monitoring schistosomiasis control programs. The study consistently found that one model outperformed the other and, therefore, identified an optimal survey design for this specific application of targeted surveys (60). A modeling exercise by Hund et al. identified a flexible adaptation for LQAS methodologies that could allow for clustering, potentially improving its ability to detect variations in outcomes of interest (61). Finally, Gass et al. conducted a multi-country comparison of three different types of NTD coverage evaluation surveys, including EPI’s 30x7 cluster survey, LQAS with a stratified design using systematic sampling, and probability sampling with segmentation (PSS). The surveys were found roughly equal in terms of time and cost, but PSS demonstrated superior statistical advantages, thus authors concluded it was best (62).

EFFECTIVENESS: What is known about whether targeted surveys "work" to monitor immunization and other health programming for missed communities and other vulnerable populations?

Overall categorization of effectiveness

To help program planners consider use of an intervention, such as targeted surveys to monitor immunization programming for zero-dose children and missed communities, a categorization scheme is used below to rate interventions as: potentially ineffective, inconclusive, promising, or proven. A more detailed description of this categorization can be found in the general methodology for reviews in this series [linked on the evidence map website].

Categorization	Rationale
 PROMISING INTERVENTION	Targeted surveys have been used to monitor both routine immunization and supplemental immunization activities among populations facing vulnerabilities. Studies that compare results from targeted surveys to other data sources show surveys bring accuracy and value, and serve as an important means of informing programming for missed communities. While targeted surveys have primarily relied on "traditional" survey methodologies, such as multi-stage cluster household sampling, recent literature suggests the use of more novel methods, including the incorporation of geospatial technology and adaptive sampling strategies, might be on the rise. Targeted surveys for monitoring purposes were implemented most in rural areas. There was less evidence of their application in conflict-affected and urban areas. Additionally, while studies focused on vulnerable or marginalized populations, few specifically used surveys to identify zero-dose children and, instead, mostly monitored coverage of specific antigens in RI or during SIAs. For these reasons, using targeted surveys to monitor immunization programming was categorized as a "promising" approach for addressing equity.

What evidence exists on the effectiveness of using targeted surveys to monitor immunization programming for zero-dose children and missed communities?

Studies that demonstrated some measure of effectiveness (i.e., either compared results of targeted surveys to other data or described changes as a result of implementing targeting surveys on coverage) all found targeted surveys were useful for monitoring health programming, especially through comparing results with other data sources (e.g., administrative coverage or in-depth interviews with key stakeholders) to confirm results, or that survey results were useful in decision-making to refine intervention approaches to better reach missed populations.

Three studies provided some evidence on effectiveness (11, 33, 51), including one that implemented targeted surveys between rounds of SIAs and other interventions in Nigeria (33), another that used targeted surveys in Nigeria to monitor routine immunization coverage to guide program implementation (11), and a third that used targeted surveys to improve malaria treatment and prevention in India (51). The study focused on SIAs in Nigeria used LQAS to monitor implementation of an intervention bundle

along rivers of interest in the Kamacha basin to stop circulation of vaccine-derived poliovirus. LQAS was conducted pre-campaign, during the campaigns, between rounds, and after the campaigns. The study used multiple data sources, including vaccinator tally sheets, environmental surveillance, LQAS results, and surveillance among nonpolio-associated acute flaccid paralysis cases to determine effectiveness of the interventions. Results from LQAS were analyzed and shared during feedback sessions with stakeholders, and settlements with the highest number of missed children or poor access during the SIAs were prioritized for in-between SIA round activities. Results demonstrated LQAS data was corroborated by results from the other data sources and was used to inform program activities, especially to reach missed communities (33).

The study to inform RI in Kaduna state, Nigeria, used targeted surveys in which 10 children were selected per settlement for survey administration per "the standard protocol of the WHO field volunteer's checklist and field guide for staff." Vaccination status was determined through review of vaccination cards of selected children/caregivers, with results reported per category: fully immunized, partially immunized, and not immunized. Results were also presented separately for oral polio vaccine (OPV) and Penta3 coverage. Data were compared with administrative coverage data and shared at the state emergency operations center and quarterly program review meetings. Findings suggested that using surveys to inform programmatic intensification activities had a positive impact on local RI coverage, with increases in Penta3 coverage seen during the period when surveys were used; an increase also occurred in the number of surveys conducted over time, which the authors suggested is evidence of the impact of heightened awareness of the importance of surveys by local health administrators (11).

The third study involved a trial to assess the impact of using LQAS to provide more local information to district managers on malaria program outcomes in India. The Ministry of Health introduced LQAS in four matched high malaria burden districts and sampled four populations across three rounds of six-monthly surveys (households, children under 5, people with a fever in the past two weeks, and community health workers). Staff were trained to collect, analyze, and use data for program management purposes. The study found intervention districts improved more than control districts across treatment and prevention indicators, but investigators noted the presence of effective, experienced managers moderated the effect, with intervention districts staffed by experienced managers outperforming others (51).

Notably, other studies that used targeted surveys to monitor coverage pre, during, and after SIA events and those that used surveys to evaluate an intervention often described triangulating data from surveys with other data sources, such as administrative coverage data or qualitative findings from in-depth interviews. While studies did not always elaborate on results from this triangulation, the fact that it occurred indicates the value of targeted surveys as a complementary data source.

Finally, as noted above in the typology of targeted surveys, several studies directly compared types of surveys to understand which one performed optimally (58, 60-62). Although these studies often involved modeling, the results suggest survey methodologies are not equal and some outperform others, which is useful when considering the "effectiveness" of targeted survey approaches.

IMPLEMENTATION: What is known about "how" well efforts work to use targeted surveys to monitor immunization programming for zero-dose children and missed communities?

Summary of barriers and facilitators to implementation

Below is a summary of major facilitators and barriers to implementation identified within included studies. Of note, some studies pertained to coverage surveys in general and were not specific to targeted surveys. However, these were included given their potential relevance for targeted surveys.

Table 1. Facilitators and barriers to implementation

Major Facilitators	Major Barriers
• Work with experienced partners and collaborators (63, 64) • Provide regular feedback on survey results to local health authorities (11) • Become familiar with existing tools and the latest guidelines to use for planning, implementation, and analysis (64) • Secure community buy-in prior to data collection (65) • Have appropriate medical evaluation and treatment available, if applicable (ex: providing mebendazole to children with suspected internal parasites identified during survey administration)(65) • Strong coordination between teams and among team members (65) • Strengthen administrative systems and record keeping to bolster data quality (66) • Prior to implementation, understand survey goals, potential biases, level of precision attainable/required, and resource needs (66) • Design monitoring systems that allow for triangulation between data sources and for iteration (67) • Ensure comparability of measures over time (68) • When possible, collect verification of self-reported data (i.e., review home-based records) (66)	• Implementers with limited experience conducting household surveys (69) • Survey activities diverting staff away from program activities (69) • Challenges conducting accurate sample size estimation (69) • Difficulties securing sufficient funding (69) • Complex logistical planning (69) • Challenges adapting survey questions into digital data collection platform and developing a computer-assisted personal interviewing (CAPI) tool (69) • Sampling clusters and households using probability sampling, including cost and time of implementation (69) • Ensuring data quality (69) • Training mapping and survey teams (69) • Recruiting experienced mapping personnel • Limited expertise to analyze hierarchical data to account for complex designs (69) • Challenging to evaluate quality of work produced by consultants carrying out survey activities (69) • Lack of alignment between ability to make inferences from indicators of interest and sample size/budget (69) • Limitations in staffing and transportation contributing to potential biases (e.g., conducting surveys in certain communities, such as those close to health facilities) (11)

Below we elaborate on implementation considerations mentioned within specific studies.

Implementation considerations using targeted surveys for monitoring

Of 10 articles relevant to implementation, studies mainly focused on factors relevant to implementation and ways to improve study rigor, such as providing data on the accuracy of coverage survey recall (70); agreement among recall, home-based records, facility records, and other types of data (66); importance of ensuring comparability of measures of time (68); and providing examples of

flexible monitoring systems allowing for triangulation, diversity of measures, and iteration (67). One study, also included as an effectiveness study, elaborated on several challenges (e.g., only being able to collect data among communities close to health centers due to staff and transportation limitations) (11).

One report provided a summary and recommendations from a WHO meeting on the updated WHO Vaccination Coverage Cluster Survey Reference Manual pertaining to operational research considerations (71). Another report described implementation of vaccination coverage cluster surveys according to WHO recommendations, although this article was not specific to surveys being conducted at district level or below (64). Another study reported on the feasibility of three different sampling approaches (EPI cluster survey, stratified survey using LQAS, and PSS across multiple countries) and found all approaches were feasible to implement (62).

Only two studies focused on implementation of targeted survey activities (65, 69), including one that conducted a seroprevalence study in conjunction with a targeted immunization coverage survey (65), and one that described the development and implementation of a toolkit for conducting targeted surveys relevant to monitoring reproductive, maternal, newborn, and child health, and nutrition indicators (69). This study provided the bulk of challenges listed in the table above, so findings may not be generalizable to other survey programs.

One study reported on the costs of implementing targeted surveys. For each round of survey administration, Gass et al. reported that various survey approaches were similar in costs, ranging from US$3,200 to $4,500 per district, and each took 19 days on average to complete (62). The three approaches assessed included EPI cluster survey, stratified survey using LQAS, and PSS. Each approach was tested at the district level within Burkina Faso, Honduras, Malawi, and Uganda within the context on ongoing NTD programming (62). A report that summarized a global meeting in 2017 regarding the WHO Vaccination Coverage Cluster Survey Reference Manual suggested that the costs of conducting these types of surveys are seldom reported and thus little is known. During this meeting, participants questioned the cost effectiveness of conducting district-level coverage surveys, but also noted the perceived value for targeted surveys regarding decision-making at the local level (71).

Existing evidence gaps and areas for future research

This review identified several important gaps regarding the evidence base for using targeted surveys to monitor immunization programming for zero-dose children and missed communities:

- **Lack of focus on zero-dose children and missed communities:** Most studies focused on coverage of antigen-specific vaccines and were not specific to zero-dose children and missed communities. While these studies have relevance for identifying under/unimmunized populations, ones specifically focused on zero-dose children and missed communities could provide helpful examples to other EPI programs, as well as help build the evidence base on effectiveness and implementation.
- **Few studies described efforts to use targeted surveys to monitor programming among hard-to-reach populations:** Survey methods typically involved LQAS or cluster. While these survey methods employ a representative sample when conducted rigorously, they might miss hidden and hard-to-reach subpopulations—groups most likely to also be missed for vaccination services. Several studies mentioned that more research is needed to understand how to reach

hard-to-reach populations with surveys to ensure coverage and other outcomes are monitored among these hidden populations so services can be improved.

- **More understanding of implementation considerations and how survey results may be used to inform decisions is needed:** Most identified studies focused on the analytical results of targeted survey implementation and did not elaborate on facilitators of or barriers to implementation. There were a few notable exceptions but, in general, information on implementation was lacking. A few examples mentioned that survey results informed decisions, but lacked detail on how and to whom data were presented, and on the results of such discussions.
- **Few examples of innovative survey method application, such as geospatial technology and adaptive sampling:** Most studies identified in this review relied on traditional survey methodologies; however, reviews were found that described implementation of novel methodologies, including adaptive sampling and geospatial. The reviews noted these methods are currently underutilized. More research is needed on their applicability for monitoring immunization programming among zero-dose children and missed communities.
- **Lack of cost data:** Few studies identified presented information on costs of conducting targeted surveys, which demonstrates a significant gap in understanding.

Limitations

Despite undertaking a comprehensive search strategy, this synthesis involved a rapid literature review and involved a topic that is both vast (surveys) and conceptually new and underdeveloped (using targeted surveys to monitor programming among zero-dose children and missed communities); it is likely relevant citations were missed. This topic merits further conceptual clarity and would benefit from more in-depth, focused reviews, such as ones specific to certain disease/vaccination areas or survey types. Additionally, this review included only relevant peer-reviewed publications and publicly available grey literature sources. It is likely more evidence exists, especially programmatic data that might not be available through the sources searched. Also, despite the use of standardized forms and trained staff members, data interpretation is somewhat subjective, especially given that formal, quantitative synthesis of outcomes was infeasible. Few studies presented outcomes specific to zero-dose children and missed communities, thus limiting our ability to understand effectiveness and implementation considerations. Finally, concepts such as *effectiveness* are typically used to describe whether an intervention demonstrates change within specific outcomes of interest. Applying effectiveness to a data collection method (targeted surveys) is not ideal, yet the term was used both for consistency with other topics assessed in this series and to help answer the research question of whether using targeted surveys for monitoring purposes is effective. Similar challenges were found with the term *implementation*, yet it was used for the same reasons. Despite these limitations, this review provides an initial understanding of how targeted surveys have been used to monitor missed communities and other vulnerable populations across the fields of immunization, NTDs, nutrition, and malaria, and provided an initial assessment as to whether these methods are effective and implementable.

Conclusions

Despite the lack of identified studies that used targeted surveys to monitor immunization programming for zero-dose children and missed communities, evidence is promising they can play a meaningful role, specifically regarding monitoring for RI and SIAs, and helping determine whether an intervention has successfully increased coverage among specific populations. Several studies encouragingly reported how

targeted surveys were used to take action to improve services for those previously missed by immunization services.

How should pro-equity programming shift based on findings?

Using targeted surveys to monitor immunization programming among populations in need of vaccination services can help determine whether missed communities are being reached by existing programming and, if not, they can be used to identify reasons why communities are being missed so that appropriate interventions can be developed. To further shift targeted survey efforts toward monitoring programming specifically for zero-dose children and missed communities, the following steps could be taken:

- ***Identify* locations where a high prevalence of zero-dose children and missed communities** are expected to be found so targeted surveys can be used efficiently and effectively to confirm program success.
- **Pair targeted survey monitoring approaches with pro-equity *reach* interventions** to monitor whether the interventions are working.
- **Communicate survey results** back to program managers and local health authorities so results can be used for action.
- **Ensure use of a representative sampling frame** so conclusions drawn from the survey will be relevant to all within the population group of interest.
- **Reduce biases and improve survey rigor by following existing guidelines**, such as the WHO Vaccination Coverage Cluster Survey Reference Manual (72) and the forthcoming WHO Practical Guide for Targeted Surveys to Assess Non- and Under-Immunized Communities and Zero-Dose Children (1).
- When feasible, **compare survey data to other data sources** to understand potential gaps or inaccuracies in routine data collection that might be masking existing groups or populations being missed by immunization services.

Based on the findings, should targeted surveys for monitoring purposes with an equity perspective be brought to scale?

Based on review findings, scaling up the use of targeted surveys to monitor immunization programming for zero-dose children and missed communities is a promising pro-equity approach. However, as few identified studies were specific to those groups, critical questions related to scale-up remain unanswered. Additional research and careful review of the evidence are needed to understand how and when targeted surveys should be used for monitoring purposes. Some overarching findings relevant to scale-up include:

- **Make survey results and analyses more user-friendly** for policymakers, decision-makers, and program implementers to increase the likelihood of results being acted upon.
- **Identify and report on replicable ways to use targeted surveys** to monitor immunization programming for zero-dose children and missed communities.
- **Report and share relevant cost information** of targeted survey activities to help inform this existing gap.

Developing rigorous learning agendas would help determine how and when to use targeted surveys at scale for monitoring of immunization programming for zero-dose children. Notably, given targeted

surveys are by nature meant to be deployed strategically, scale-up of targeted surveys would never encompass an entire country. Instead, scaling up targeted surveys in a systematic way within certain areas of countries where coverage is low could become an important tool to reach populations facing vulnerabilities.

Appendix A. How was this evidence synthesis conducted?

SEARCHING, DATA EXTRACTION, AND ANALYSIS: The review followed a general methodology for all topics in this series. In brief, the methodology involved comprehensively searching electronic databases from 1 January 2010 through 7 March 2023, conducting a grey literature search, screening through all citations, and developing topic-specific inclusion criteria. Data were extracted into standardized forms, and results were synthesized narratively.

INCLUSION CRITERIA: We included studies that took place in low- or middle-income countries, evaluated or described the use of targeted surveys (defined as implemented at district level or below) to monitor health programming related to immunization, nutrition, malaria, and neglected tropical diseases. To be eligible, studies needed to use surveys across at least two time points within the same geographic area and similar population. We mainly focused on studies that used probability sampling to identify respondents, although some using nonprobability methods were included. We included both effectiveness studies (defined as using a multi-arm design or using pre/post or time series data that evaluates the monitoring of programs using targeted surveys to some alternative comparator) and implementation studies (defined as any study containing descriptive or comparative data relevant to implementation outcomes), as well as studies that described the conduct of targeting surveys for monitoring purposes to address our first research question. For effectiveness studies, we included ones that directly compared different types of targeted surveys, such as modeling studies using simulated data to demonstrate which designs work best. We also included studies that directly described how results of targeted surveys led to changes in coverage. For implementation studies, we included several specific to implementing immunization coverage surveys that were not specifically targeted given their relevance to the topic.

SEARCH RESULTS:

- 892 unique articles were identified in the published literature search.
    - 776 articles were excluded during the title and abstract screening (116 citations were retained and included in the full-text review)
    - 75 articles were excluded during the full-text review, leaving 41 citations for inclusion
- 7 additional articles were identified through other means (contacting experts in the field, secondary searching of references of included studies)
- In total, 48 articles and reports were included:
    - 41 articles that described using targeted surveys for monitoring purposes among populations in vulnerable contexts, including 3 articles relevant to effectiveness and three articles that describe some aspect of implementation.
    - 7 articles that only reported on some aspect of implementation (e.g., cost, design, carrying out implementation).

References

1. The World Health Organization (WHO) and Gavi. Practical Guide: Targeted survey to assess non- and under-immunized communities and zero-dose children (in draft form). 2022.
2. Cutts FT, Claquin P, Danovaro-Holliday MC, Rhoda DA. Monitoring vaccination coverage: Defining the role of surveys. Vaccine. 2016;34(35):4103-9.
3. Luman ET, Cairns KL, Perry R, Dietz V, Gittelman D. Use and abuse of rapid monitoring to assess coverage during mass vaccination campaigns. Bull World Health Organ. 2007;85(9):651.
4. Rath RS, Solanki HK. Review of Lot Quality Assurance Sampling, Methodology and its Application in Public Health. Nepal J Epidemiol. 2019;9(3):781-7.
5. Galles NC, Liu PY, Updike RL, Fullman N, Nguyen J, Rolfe S, et al. Measuring routine childhood vaccination coverage in 204 countries and territories, 1980–2019: a systematic analysis for the Global Burden of Disease Study 2020, Release 1. The Lancet. 2021;398(10299):503-21.
6. Gavi the Vaccine Alliance. Strategy: Phase V (2021–2025) Available from: https://wwwgaviorg/our-alliance/strategy/phase-5-2021-2025. 2021.
7. Organization WH. Immunization agenda 2030: a global strategy to leave no one behind. Geneva: WHO. 2020.
8. Pond R, Mounier-Jack S. Comments on "Monitoring vaccination coverage: Defining the role of surveys". Vaccine. 2016;34(50):6111.
9. Bondo A, Nambiar B, Lufesi N, Deula R, King C, Masache G, et al. An assessment of PCV13 vaccine coverage using a repeated cross-sectional household survey in Malawi. Gates Open Res. 2018;2:37.
10. Goel S, Dogra V, Gupta SK, Lakshmi PV, Varkey S, Pradhan N, et al. Effectiveness of Muskaan Ek Abhiyan (the smile campaign) for strengthening routine immunization in bihar, India. Indian Pediatr. 2012;49(2):103-8.
11. Nomhwange TI, Shuaib F, Braka F, Godwin S, Kariko U, Gregory U, et al. Routine immunization community surveys as a tool for guiding program implementation in Kaduna state, Nigeria 2015–2016. BMC Public Health. 2018;18(4):1313.
12. Zhou Y, Xing Y, Liang X, Yue C, Zhu X, Hipgrave D. Household survey analysis of the impact of comprehensive strategies to improve the expanded programme on immunisation at the county level in western China, 2006-2010. BMJ Open. 2016;6(3):e008663.
13. Utazi CE, Wagai J, Pannell O, Cutts FT, Rhoda DA, Ferrari MJ, et al. Geospatial variation in measles vaccine coverage through routine and campaign strategies in Nigeria: Analysis of recent household surveys. Vaccine. 2020;38(14):3062-71.
14. Ado JM, Etsano A, Shuaib F, Damisa E, Mkanda P, Gasasira A, et al. Progress toward poliomyelitis eradication in Nigeria. J Infect Dis. 2014;210 Suppl 1:S40-9.
15. Andrade AL, Ternes YM, Vieira MA, Moreira WG, Lamaro-Cardoso J, Kipnis A, et al. Direct effect of 10-valent conjugate pneumococcal vaccination on pneumococcal carriage in children Brazil. PLoS One. 2014;9(6):e98128.
16. Chesnaye N, Sinuon M, Socheat D, Koporc K, Mathieu E. Treatment coverage survey after a school-based mass distribution of mebendazole: Kampot Province, Cambodia. Acta Trop. 2011;118(1):21-6.
17. Coulborn RM, Nackers F, Bachy C, Porten K, Vochten H, Ndele E, et al. Field challenges to measles elimination in the Democratic Republic of the Congo. Vaccine. 2020;38(13):2800-7.
18. Danovaro-Holliday MC, Rhoda DA, Lacoul M, Prier ML, Gautam JS, Pokhrel TN, et al. Who gets vaccinated in a measles-rubella campaign in Nepal?: results from a post-campaign coverage survey. BMC Public Health. 2022;22(1):221.

19. Gali E, Mkanda P, Banda R, Korir C, Bawa S, Warigon C, et al. Revised Household-Based Microplanning in Polio Supplemental Immunization Activities in Kano State, Nigeria. 2013-2014. J Infect Dis. 2016;213 Suppl 3(Suppl 3):S73-8.
20. Gelormini M, Gripenberg M, Marke D, Murray M, Yambasu S, Koblo Kamara M, et al. Coverage survey and lessons learned from a pre-emptive cholera vaccination campaign in urban and rural communities affected by landslides and floods in Freetown Sierra Leone. Vaccine. 2023.
21. Grout L, Conan N, Juan Giner A, Hurtado N, Fermon F, N'Goran A, et al. Local discrepancies in measles vaccination opportunities: results of population-based surveys in Sub-Saharan Africa. BMC Public Health. 2014;14:193.
22. Kabir SH, Mandlhate C, Okiror SO, Onuekwus IU, Njeru I. Inactivated poliovirus vaccine campaign in Kenya: lessons learned. African Health Monitor. 2015(No.19).
23. Mbabazi W, Lako AK, Ngemera D, Laku R, Yehia M, Nshakira N. Maiden immunization coverage survey in the republic of South Sudan: a cross-sectional study providing baselines for future performance measurement. Pan Afr Med J. 2013;16:110.
24. Newtonraj A, Vincent A, Selvaraj K, Manikandan M. Status of coverage of MR vaccination, after supplementary immunization activities in a rural area of South India: a rapid immunization coverage survey. Rural Remote Health. 2019;19(3):5261.
25. Priyadharshini, Jasmine A. Coverage survey of Measles-Rubella mass vaccination campaign in a rural area in Tamil Nadu. J Family Med Prim Care. 2019;8(6):1884-8.
26. Teixeira AM, Samad SA, Souza MA, Segatto TC, Morice A, Flannery B. Brazilian experience with rapid monitoring of vaccination coverage during a national rubella elimination campaign. Rev Panam Salud Publica. 2011;30(1):7-14.
27. Uddin MJ, Wahed T, Saha NC, Kaukab SS, Khan IA, Khan AI, et al. Coverage and acceptability of cholera vaccine among high-risk population of urban Dhaka, Bangladesh. Vaccine. 2014;32(43):5690-5.
28. Boyd A, Won KY, McClintock SK, Donovan CV, Laney SJ, Williams SA, et al. A community-based study of factors associated with continuing transmission of lymphatic filariasis in Leogane, Haiti. PLoS Neglected Tropical Diseases. 2010;4(3):e640.
29. de Lima Pereira A, Southgate R, Ahmed H, O'Connor P, Cramond V, Lenglet A. Infectious Disease Risk and Vaccination in Northern Syria after 5 Years of Civil War: The MSF Experience. PLoS Curr. 2018;10.
30. Elias Chitio JJ, Baltazar CS, Langa JP, Baloi LD, Mboane RBJ, Manuel JA, et al. Pre-emptive oral cholera vaccine (OCV) mass vaccination campaign in Cuamba District, Niassa Province, Mozambique: feasibility, vaccination coverage and delivery costs using CholTool. BMJ Open. 2022;12(9):e053585.
31. Griswold E, Eigege A, Ityonzughul C, Emukah E, Miri ES, Anagbogu I, et al. Evaluation of Treatment Coverage and Enhanced Mass Drug Administration for Onchocerciasis and Lymphatic Filariasis in Five Local Government Areas Treating Twice Per Year in Edo State, Nigeria. Am J Trop Med Hyg. 2018;99(2):396-403.
32. Kim SH, Pezzoli L, Yacouba H, Coulibaly T, Djingarey MH, Perea WA, et al. Whom and where are we not vaccinating? Coverage after the introduction of a new conjugate vaccine against group A meningococcus in Niger in 2010. PLoS One. 2012;7(1):e29116.
33. Musa AI, Shuaib F, Braka F, Mkanda P, Banda R, Korir C, et al. Stopping circulatory vaccine-derived poliovirus in Kaduna state by scaling up special interventions in local government areas along rivers of interest- kamacha basin experience, 2013-2015. BMC Public Health. 2018;18(Suppl 4):1303.
34. Peng ZQ, Chen WS, He Q, Peng GW, Wu CG, Xu N, et al. Evaluation of the mass measles vaccination campaign in Guangdong Province, China. Int J Infect Dis. 2012;16(2):e99-103.

35. Ferreras E, Matapo B, Chizema-Kawesha E, Chewe O, Mzyece H, Blake A, et al. Delayed second dose of oral cholera vaccine administered before high-risk period for cholera transmission: Cholera control strategy in Lusaka, 2016. PLoS One. 2019;14(8):e0219040.
36. Abay KA, Berhane G, Hoddinott J, Tafere K. COVID-19 and food security in Ethiopia: do social protection programs protect? Washington, USA: World Bank; 2020.
37. Aguayo VM, Bhattacharjee S, Bhawani L, Badgaiyan N. India's vitamin A supplementation programme is reaching the most vulnerable districts but not all vulnerable children. New evidence from the seven states with the highest burden of mortality among under-5s. Public Health Nutr. 2015;18(1):42-9.
38. Aritra D, Sanchita M, Mala GS, Indrajit C, Tanmay M. Association of frontline worker-provided services with change in block-level complementary feeding indicators: an ecological analysis from Bihar, India. PLoS One. 2016;11(11):e0166511.
39. Brenner JL, Kabakyenga J, Kyomuhangi T, Wotton KA, Pim C, Ntaro M, et al. Can volunteer community health workers decrease child morbidity and mortality in southwestern Uganda? An impact evaluation. PLoS One. 2011;6(12):e27997.
40. Ceballos F, Hernandez MA, Paz C. Short-term impacts of COVID-19 on food security and nutrition in rural Guatemala: Phone-based farm household survey evidence. Agric Econ. 2021;52(3):477-94.
41. Erismann S, Gami JP, Ouedraogo B, Revault D, Prytherch H, Lechthaler F. Effects of a four-year health systems intervention on the use of maternal and infant health services: results from a programme evaluation in two districts of rural Chad. BMC Public Health. 2021;21(1):2304.
42. Kisia J, Nelima F, Otieno DO, Kiilu K, Emmanuel W, Sohani S, et al. Factors associated with utilization of community health workers in improving access to malaria treatment among children in Kenya. Malar J. 2012;11:248.
43. McQuestion MJ, Quijano Calle A, Drasbek C, Harkins T, Sagastume LJ. Social integration and health behavioral change in San Luis, Honduras. Health Educ Behav. 2010;37(5):694-708.
44. Mukuria AG, Martin SL, Egondi T, Bingham A, Thuita FM. Role of Social Support in Improving Infant Feeding Practices in Western Kenya: A Quasi-Experimental Study. Glob Health Sci Pract. 2016;4(1):55-72.
45. Mwinzi PN, Montgomery SP, Owaga CO, Mwanje M, Muok EM, Ayisi JG, et al. Integrated community-directed intervention for schistosomiasis and soil transmitted helminths in western Kenya - a pilot study. Parasit Vectors. 2012;5:182.
46. Omale UI, Azuogu BN, Alo C, Madubueze UC, Oka OU, Okeke KC, et al. Social group and health-care provider interventions to increase the demand for malaria rapid diagnostic tests among community members in Ebonyi State, Nigeria: a cluster-randomised controlled trial. Lancet Global Health. 2021;9(3):e320-e30.
47. Rajbhar M, Mohanty SK. Reproductive and child health services and demographic change in the districts of Uttar Pradesh, 2002-13. J Biosoc Sci. 2017;49(5):685-709.
48. Schellenberg JR, Maokola W, Shirima K, Manzi F, Mrisho M, Mushi A, et al. Cluster-randomized study of intermittent preventive treatment for malaria in infants (IPTi) in southern Tanzania: evaluation of impact on survival. Malar J. 2011;10:387.
49. Walters D, Ndau E, Saleh N, Mosha T, Horton S. Cost-effectiveness of sunflower oil fortification with vitamin A in Tanzania by scale. Matern Child Nutr. 2019;15 Suppl 3(Suppl 3):e12720.
50. Walton C, Taylor J, Ogada I, Agon N, Raynor L. Associations among food security, BMI, diet diversity and food consumption patterns of women in rural Kenya. African Journal of Food, Agriculture, Nutrition and Development. 2020;20(5):16290-308.
51. Valadez JJ, Devkota B, Pradhan MM, Meherda P, Sonal GS, Dhariwal A, et al. Improving malaria treatment and prevention in India by aiding district managers to manage their programmes with

local information: a trial assessing the impact of Lot Quality Assurance Sampling on programme outcomes. Trop Med Int Health. 2014;19(10):1226-36.
52. Fentahun N, Belachew T, Coates J, Lachat C. Seasonality and determinants of child growth velocity and growth deficit in rural southwest Ethiopia. BMC Pediatr. 2018;18(1):20.
53. Fledderjohann J, Vellakkal S, Khan Z, Ebrahim S, Stuckler D. Quantifying the impact of rising food prices on child mortality in India: a cross-district statistical analysis of the District Level Household Survey. Int J Epidemiol. 2016;45(2):554-64.
54. Hoke MK. A biocultural examination of home food production and child growth in highland Peru. Am J Hum Biol. 2020;32(4):e23438.
55. Robinson E, Crispino V, Ouabo A, Soung Iballa FB, Kremer R, Serbassi ME, et al. Mortality and health survey, Walikale, Democratic Republic of the Congo, 2017: an example of the use of survey data for humanitarian program planning. Confl Health. 2019;13:56.
56. Travasso SM, Joseph S, Swaminathan S, John AT, Makkar S, Webb P, et al. Impact of the COVID-19 lockdown on household diet diversity in rural Bihar, India: a longitudinal survey. Nutr J. 2023;22(1):13.
57. Yansaneh AI, Moulton LH, George AS, Rao SR, Kennedy N, Bangura P, et al. Influence of community health volunteers on care seeking and treatment coverage for common childhood illnesses in the context of free health care in rural Sierra Leone. Trop Med Int Health. 2014;19(12):1466-76.
58. Johnson O, Fronterre C, Amoah B, Montresor A, Giorgi E, Midzi N, et al. Model-Based Geostatistical Methods Enable Efficient Design and Analysis of Prevalence Surveys for Soil-Transmitted Helminth Infection and Other Neglected Tropical Diseases. Clin Infect Dis. 2021;72(Suppl 3):S172-s9.
59. Koyuncu A, Ishizumi A, Daniels D, Jalloh MF, Wallace AS, Prybylski D. The Use of Adaptive Sampling to Reach Disadvantaged Populations for Immunization Programs and Assessments: A Systematic Review. Vaccines (Basel). 2023;11(2).
60. Knowles SCL, Sturrock HJW, Turner H, Whitton JM, Gower CM, Jemu S, et al. Optimising cluster survey design for planning schistosomiasis preventive chemotherapy. PLoS Negl Trop Dis. 2017;11(5):e0005599.
61. Hund L, Pagano M. Extending cluster lot quality assurance sampling designs for surveillance programs. Stat Med. 2014;33(16):2746-57.
62. Gass K, Deming M, Bougma R, Drabo F, Tukahebwa EM, Mkwanda S, et al. A Multicountry Comparison of Three Coverage Evaluation Survey Sampling Methodologies for Neglected Tropical Diseases. Am J Trop Med Hyg. 2020;103(4):1700-10.
63. Grundy J, Biggs BA. The Impact of Conflict on Immunisation Coverage in 16 Countries. Int J Health Policy Manag. 2019;8(4):211-21.
64. Wagai JN, Rhoda D, Prier M, Trimmer MK, Clary CB, Oteri J, et al. Implementing WHO guidance on conducting and analysing vaccination coverage cluster surveys: Two examples from Nigeria. PLOS ONE. 2021;16(2):e0247415.
65. Travassos MA, Beyene B, Adam Z, Campbell JD, Mulholland N, Diarra SS, et al. Strategies for Coordination of a Serosurvey in Parallel with an Immunization Coverage Survey. Am J Trop Med Hyg. 2015;93(2):416-24.
66. Dansereau E, Brown D, Stashko L, Danovaro-Holliday MC. A systematic review of the agreement of recall, home-based records, facility records, BCG scar, and serology for ascertaining vaccination status in low and middle-income countries. Gates Open Res. 2019;3:923.
67. Special Section: Focus on coverage assessment. Field Exchange - Emergency Nutrition Network ENN. 2012(No.42):33-44.

68. Dandona R, Pandey A, Dandona L. A review of national health surveys in India. Bulletin of the World Health Organization. 2016;94(4):286-96.
69. Munos MK, Maïga A, Sawadogo-Lewis T, Wilson E, Ako O, Mkuwa S, et al. The RADAR coverage tool: developing a toolkit for rigorous household surveys for reproductive, maternal, newborn, and child health & nutrition indicators. Glob Health Action. 2022;15(sup1):2006419.
70. Budge PJ, Sognikin E, Akosa A, Mathieu EM, Deming M. Accuracy of Coverage Survey Recall following an Integrated Mass Drug Administration for Lymphatic Filariasis, Schistosomiasis, and Soil-Transmitted Helminthiasis. PLoS Negl Trop Dis. 2016;10(1):e0004358.
71. Danovaro-Holliday MC, Dansereau E, Rhoda DA, Brown DW, Cutts FT, Gacic-Dobo M. Collecting and using reliable vaccination coverage survey estimates: Summary and recommendations from the "Meeting to share lessons learnt from the roll-out of the updated WHO Vaccination Coverage Cluster Survey Reference Manual and to set an operational research agenda around vaccination coverage surveys", Geneva, 18–21 April 2017. Vaccine. 2018;36(34):5150-9.
72. World Health Organization. World Health Organization vaccination coverage cluster surveys: reference manual. World Health Organization; 2018.

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