Determinants of immunization dropout among children under the age of two in Zambézia Province, Mozambique: A community-based participatory research study using Photovoice.

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Abstract

Determinants of immunization dropout among children under the age of two in Zambézia Province, Mozambique: A community-based participatory research study using Photovoice.

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Introduction: Immunizations are highly impactful, cost-effective public health interventions. However, there remain significant gaps and inequities in complete vaccination coverage. In Zambézia Province, Mozambique, 37.9% of children under-2 years start but do not complete the basic vaccination schedule. We aimed to describe caregivers' experiences with the immunization process and identify determinants of vaccine dropout in two districts in Zambézia.

Methods: Following a community-based participatory research approach, we used Photovoice and semi-structured in-depth interviews (IDIs) to explore vaccination experiences for ten and 22 caregivers of children aged 25-34 months who were fully-vaccinated and partially-vaccinated, respectively. We also collected data from 12 health workers via SMS exchanges and IDIs. The Increasing Vaccination Model informed the analysis, which focused on describing facilitators and barriers to vaccination. Themes were generated through identifying patterns between vaccination determinants, comparing caregivers'

experiences, disaggregated by vaccination status. Health worker data added depth to the themes and illuminated where caregiver and health worker perspectives did and did not align.

Results: Four main patterns of barriers leading to vaccination dropout emerged: 1) social norms and lack of family support place the immunization-seeking burden largely on mothers, 2) perceived poor quality of health services, including vaccine stockouts, reduces caregivers' trust in health services, 3) concern about side-effects, exacerbated by vaccine "accumulation" when catch-up doses are needed, leads to vaccine hesitancy, and 4) caregivers feel hesitant to seek and advocate for vaccination due to power imbalances between them and health workers. Vaccination dropout occurred after encountering multiple barriers that simultaneously influenced the vaccination process. Caregivers who completed vaccination noted specific strategies, including accompaniment to the health facility by their husbands or assistance with caring for other children while they were gone, that enabled them to overcome barriers and complete vaccination.

Conclusion: Barriers to immunization are multi-factorial and require strengthening health systems to overcome, including improving logistics to avert vaccine stockouts and building health worker capacity while emphasizing empathic communication with caregivers. Improving the reliability of routine immunization outreach services could address access challenges and improve immunization uptake, particularly for caregivers located far from health facilities and those who lack family support.

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Acknowledgements

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Introduction

Childhood immunizations are one of the most impactful and cost-effective public health interventions, estimated to save 2-3 million lives globally each year (1). In 1974, the World Health Organization (WHO) established the Expanded Program on Immunization (EPI), which has since guided the development and implementation of vaccination programs around the world. Since then, coverage of the initial four vaccines (protecting against diphtheria, tetanus, pertussis, measles, poliomyelitis, and tuberculosis) has increased from fewer than 5% of children in low- and middle-income countries (LMICs) to a global coverage of more than 85% (2,3). However, significant gaps in coverage of vaccination services remain. In 2019, an estimated 14 million children were unimmunized and 5.7 million were under-immunized(4), the majority from lower socioeconomic and rural populations in LMICs (5).

The Mozambique EPI, launched in 1979, is managed at the district level and provides immunization services free of charge. Through the EPI, health workers from the public sector deliver vaccines primarily at fixed health posts and routine mobile vaccination brigade outreach activities, and sometimes during campaigns for specific vaccines. The health workforce is overburdened, especially in rural areas, where few facilities have a complete team of health workers (6).

Rural communities continue to face challenges in accessing the existing health network (6). To address this gap, Mozambique has implemented several outreach strategies since the early 2000's, including the WHO/ United Nations Children's Fund (UNICEF) Reaching Every District/ Reaching Every Community (RED/REC) strategy, to improve outreach services in distant communities (6). According to the Mozambique EPI Manual, mobile vaccination brigades should provide vaccine outreach three to four times per year to communities residing further than eight kilometers from a health facility (7). These mobile brigades are important for facilitating access to vaccination services, as roughly 70% of the country's population lives in rural areas (8). However, country-wide implementation of immunization outreach strategies has been impeded by limited funds and material and human resources, leaving gaps in coverage (6).

Vaccination coverage in Mozambique increased dramatically from 47% in 1997 to 63% in 2003, but since 2003, progress has slowed, and by 2015, only 66% of children were fully vaccinated. Within Mozambique, Zambézia Province has the lowest vaccination coverage; in 2015, only 49.9% of children under-2 had received all recommended basic immunizations, and 37.9% of children under-2 had dropped out from the vaccination schedule (9). Data suggests that vaccination dropout may indicate a failure of the health system to meet caregivers' needs or expectations of service quality (10). Determinants of immunization dropout have been shown to be highly dependent on context, and include combinations of individual, inter-personal, and health systems factors (11). Qualitative and community based participatory research (CBPR) methods are best poised to assess contextual questions from the perspective of the community and provide rich data to address complex, multi-layered health concerns. We conducted interviews with caregivers of young children and health workers, using a CBPR approach, to identify key influences on under-two routine immunization dropout in two low vaccination coverage regions in Zambézia Province, Mozambique. Understanding multi-level influences on vaccination experiences from caregiver and health worker perspectives can identify specific barriers and facilitators influencing immunization coverage in Mozambique.

Methods

Study Design

This qualitative study was conducted as part of a larger project which included both research and solution ideation through human-centered design (HCD) workshops. Results of this analysis were used during HCD workshops to inform the identification and development of solutions to facilitate vaccination completion.

CBPR is an approach that engages community representatives throughout the research process, reducing power imbalances between researchers and participants, creating an environment in which participants feel comfortable discussing sensitive topics, and facilitating the co-creation of knowledge that is contextually-sensitive and community-centered (12). Four Mozambican caregivers from the local communities (referred to as Caregiver Researchers) were recruited and trained in qualitative methods and research ethics, led data collection activities, and assisted with data analysis.

The Increasing Vaccination Model, developed in 2017 by the World Health Organization's Behavioral and Social Drivers of Vaccination (BeSD) working group (13), was used as a framework to guide data collection and analysis. To better characterize caregiver vaccination experiences, we adapted the Increasing Vaccination Model to incorporate elements of the UNICEF Caregiver Journey Model, dividing the "practical issues" category into 3 sub-categories to capture the vaccination timespan (pre, during, post) (Appendix A).

Study Setting, Population, and Recruitment

The study was conducted between February 2020 and March 2021 in Gilé and Namarroi Districts, in Zambézia Province, Mozambique. Zambézia, the second-most populated province in the country, has many remote, hard-to-reach communities with among the worst health outcomes in the country; a child born in Zambézia is twice as likely to die before the age of five compared to a child born in the capitol city of Maputo (6,14). Of the province's 16 districts, Namarroi and Gilé have the highest estimated vaccination dropout rates, at 19.5% and 18.9%, respectively (15). Gilé District has 13 Expanded Program on Immunization (EPI) technicians across 11 fixed health facilities, serving a population of roughly 205,000. Namarroi District has 9 EPI technicians staffing 10 fixed health facilities, serving a population of approximately 155,000 (15).

The study population included caregivers of fully- or partially-vaccinated children who lived in the catchment areas of selected health facilities, and health workers who administer immunizations at those facilities. 'Caregivers,' defined as parents or other guardians who take primary healthcare-seeking responsibility for the child, were eligible if their child was between 25-34 months old, an age by which the child should have received all routine childhood immunizations according to the Mozambique immunization schedule (Table 2). Caregivers were placed in the fully-vaccinated (FV) group if their children had received all 15 recommended immunizations or the partially-vaccinated (PV) group if their children had received at least one but not all recommended immunizations. Health workers were eligible if they worked at the selected health facilities and if they were responsible for administering vaccinations to children under-2 years.

We purposively selected eight health facilities (four/district) as recruitment sites to achieve a mixture of rural and peri-urban environments. Thirty-two caregivers and 12 health workers were selected using

health facility immunization records. The study team visited caregivers' homes with the aim of enrolling approximately 20 caregivers of PV children and approximately 10 caregivers of FV children. During recruitment, we verified vaccination status via home-based vaccination cards, which were considered more accurate when there were discrepancies with health facility immunization records. Seventy-two FV and 165 PV children from the eight facilities were identified from facility records; 72 of their homes were located (with the assistance of community leaders). Twenty were deemed ineligible after review of home-based vaccination cards, 11 caregivers had relocated or were not at home, five children had died, and four declined to participate. Sixteen caregivers from each district were enrolled. The study team purposively recruited and enrolled six health workers from each district, including at least one health worker from each of the selected health facilities.

Data Collection

Caregiver Researchers who were representative of the study population were recruited via an open job posting advertised in Namarroi and Gilé Districts. Applicants had to have a child between two and three years old, and women were prioritized. Six women were selected based on these requirements and on their level of education, fluency in local languages, and prior research experience. They participated in a five-day training on qualitative research methods, and contracts were extended to the two women from each district with the best performance during the training.

Semi-structured interview guides were developed in English based on the Increasing Vaccination Model, and later translated into Portuguese (Appendices B and C). The guides were piloted with the Caregiver Researchers and one health worker and were revised prior to data collection. Caregiver Researchers provided participants with information about the study and those willing and eligible to participate provided written informed consent. Illiterate participants provided thumb prints instead of signatures. Basic demographic information was collected from all participants prior to each interview.

Photovoice and semi-structured interviews were used to document caregivers' experiences of the under-two immunization process and to identify barriers and facilitators to immunization completion. Photovoice is a tool through which people can share their stories using photographs that visually represent their experiences and perspectives. This method empowers participants to craft rich and nuanced stories, generating detailed data that might not be captured through standard interview techniques (16,17). Caregiver Researchers provided cameras to caregiver participants, gave detailed instructions on how to use them, and asked them to take photos related to their experiences with their child's under-two immunizations. Caregiver Researchers returned after two to six days, discussed the photos, and conducted audio-recorded, semi-structured interviews. Initial interviews and transcripts were reviewed by experienced study team members (EL, JP), who provided feedback and additional training to improve quality of subsequent interviews. Photo discussions and semi-structured interviews lasted an average of 38 minutes and were conducted in the local language of Elomué. Following each interview, Caregiver Researchers completed written interview debriefs, where they reflected on the interview and noted key insights.

A combination of SMS exchanges and semi-structured interviews were used to document health workers' perceptions of caregivers' immunization experiences, their beliefs about causes of dropout, and their experiences administering vaccines to children under two. SMS exchanges took place during January, 2021. Each health worker was provided a phone with the Telegram application installed and set up for

group chats with the Caregiver Researchers and supervisory study team members. Over the next three weeks, health workers were asked to send photos and messages whenever they had an experience or observation related to under-two immunizations. Caregiver Researchers replied to photos and messages with follow-up probes to collect additional information. If more than two days elapsed without any message exchanges, the Caregiver Researcher sent a follow-up reminder. Following the completion of SMS exchanges, Caregiver Researchers conducted audio-recorded, semi-structured interviews by phone in Portuguese, which lasted an average of 70 minutes.

Audio recordings for caregiver interviews were translated and transcribed from Elomué to Portuguese by Caregiver Researchers, audited for quality by supervisory study team members, and then translated into English by an external translator. Audio recordings and SMS exchanges with the health workers were transcribed and translated from Portuguese to English by an external translator.

Data Analysis

A team-based approach was used to perform a thematic analysis (18). An initial codebook was developed deductively based on the Increasing Vaccination Model. Additional codes were added inductively following a review of the first six transcripts, and the codebook was reviewed and updated by the Caregiver Researchers prior to coding. Two study team members (JP and EL) individually coded the first three transcripts, and an additional study team member (BM) reviewed the coded transcripts for intercoder agreement. JP and EL then divided and independently coded the remaining transcripts in ATLAS.ti Version 9, and summarized the main findings by vaccination status.

Caregiver Researchers participated in a virtual two-week participatory analysis process facilitated by Portuguese-speaking study team members (AD, AI, ME), in which they reviewed code summaries and representative quotations, identified themes, and drew comparisons between caregivers of PV and FV children. An online data collaboration platform (Miro, 2021) was used to facilitate team collaboration and establish consensus on themes. The photographs provided additional insight on what caregivers believed were the most important or significant aspects of their vaccination journeys. JP and EL reviewed the themes and photos to identify themes related to the Increasing Vaccination Model.

Patient and Public Involvement

The Caregiver Researchers, as representatives of the study population, participated in data collection and analysis. Study results were disseminated to participants during a follow-up workshop in April 2021. Participants will be involved in dissemination of results back to their communities and to local health authorities.

The Mozambique National Bioethics Committee for Health approved the study procedures (Ref:259/CNBS/20) and the University of Washington Institutional Review Board exempted the study from review (STUDY00011999).

Results

Participants

Thirty-two caregivers participated in the study, and all were the mothers of the children. The majority lived in catchment areas of rural health facilities. On average, the caregivers of PV children were older and less educated than those of FV children (Table 1). PV children were missing an average of 3.5 vaccines (range 1-14 missing vaccines), with the most commonly missed vaccines being Inactivated Polio and Measles-Rubella (Tables 1 and 2).

Eleven health worker participants had completed secondary education or professional school, and one had completed elementary school. Their job titles included Preventive Medical Technician (6), General Nurse (4), Maternal and Child Health Nurse (1), and Nutrition Technician (1). They had been working as health workers for an average of 9.4 years (range 1-34 years) and had been working at the selected health facilities for an average of 4.7 years (range 1-14 years). Five had participated in immunization-specific trainings within the past five years, two had attended trainings five or more years prior, two had not attended formal trainings but had met with colleagues to discuss introduction of new vaccines, and three had never participated in vaccination trainings. Three (25%) were female. All had children of their own, including five with children under two years. On average, 66 message exchanges (range 26-108 exchanges) occurred between the health workers and Caregiver Researchers during the SMS data collection.

Key Influences on Vaccine Dropout

Vaccination barriers arose in all categories of the Increasing Vaccination Model. In general, dropout was not caused by a single barrier; instead, caregivers of PV children described abandoning vaccination after encountering multiple cross-domain barriers. Our analysis of caregiver experiences revealed four interacting patterns of barriers and facilitators to vaccination completion (Table 3). Data from health workers largely corroborated these findings and provided additional insight on dropout decisions.

Lack of family support and social norms overburden mothers and compound the challenges of accessing vaccination services

For many caregivers, traveling to the health facility required significant investments of time, energy, and cost. Some caregivers described selling crops or buying less food to save money for transport to the health facility. When they had no money for transportation, caregivers described having to walk for several hours while carrying their children, often through challenging and dangerous terrain and inclement weather, and even having to spend the night because the trip was too long to complete in a single day.

> *"The hospital is very distant. On the days we have to go on foot, we come home with all our feet swollen from so much walking. There are times when you cannot go back because it is late and you are forced to sleep there, even with nowhere to stay… On days when I don't have money to get a bus, I leave home at 4 am and arrive at the hospital at 10 am." – PV Caregiver from Gilé*

Given the long distances required to travel to receive vaccinations, lack of support from other family members was a major barrier to completing vaccination noted by PV caregivers. Lack of family support was in part due to community beliefs that vaccination is the responsibility of the mother and that fathers should not be involved in the process.

"The community has a myth that says children should only go to the hospital with the mother, and it is the woman who should take care of the children and the home." – HW from Namarroi

This social belief resulted in some mothers abandoning the process when they were unable to travel to the facility due to illness or injury, and their husbands and other family members did not help bring the children to the health facility. Several other mothers reported dropping out due to lack of support with managing other obligations that conflicted with the vaccination process, such as caring for other children in the family.

"[My aunt] had a toothache and couldn't stay with [my other children]. When she told me this, I was left with no way out; I couldn't go to the hospital and leave my children alone." – PV Caregiver from Gilé

To alleviate safety concerns, PV caregivers described strong social norms around traveling to the health facility in groups with other mothers. However, support from other mothers did not fully compensate for lack of support from family members.

Social support from family and friends helped caregivers of FV children to overcome barriers associated with the vaccination process. FV caregivers described receiving support in a variety of ways including reminders from family members, money for transport to the health facility, accompaniment to the facility by other caregivers or a family member, help with other household responsibilities, and support in taking the child to the facility when the mother is sick.

Both caregivers and health workers noted that reliable and consistent mobile brigades would help to address the practical barriers associated with traveling to the health facility, especially for those mothers who lack support from family members. Several caregivers mentioned that mobile brigades had enabled them to complete vaccinations of older children, but that the brigades had become infrequent and unreliable during the vaccination process of younger children. Health workers described barriers to running mobile brigades, including insufficient fuel and lack of health worker capacity to manage both fixed posts and outreach services.

"For activities to run smoothly we need material and financial resources… we need motorcycles and fuel so that we can run mobile brigades in the communities…. There are times when this doesn't happen 100% because the bikes are damaged, and we can't do maintenance. And the same happens when we do not have funds for fuel, sometimes the mobile brigades are paralyzed." – HW from Namarroi

Poor service at health facilities reduces caregivers' trust in the health system

Many caregivers began the vaccination process as highly motivated, active seekers of immunizations, and some described having positive experiences at health facilities. However, other caregivers were dissatisfied with their experiences at the service delivery point due to stockouts of vaccinations, long wait times, and inconsistent health facility hours.

"The last time I went to the hospital to vaccinate my child there was a vaccine stockout and I could not vaccinate. On the following month I went back, and they said the same thing about not having vaccines at the health facility. This caused me not to complete my son's vaccination because I did not return on the following months. I could not complete my child's vaccination because almost

every time I went to the hospital, I didn't find any vaccines, so I got frustrated and never went to vaccinate again." – PV Caregiver from Gilé

Caregivers of PV children also described being frustrated by interactions with disengaged health workers. After expending significant effort to reach the health facility, some caregivers arrived to find that health workers were late, or were busy talking on their phones, causing them to lose faith in the health system and lose motivation to vaccinate.

> *"On this day I arrived at the hospital at a good time, before the activities started. I was waiting for the nurses until the time they arrived… During the work, I was very indignant, since the nurses attended a person and interrupted to answer telephone calls that lasted many hours without consideration for mothers who live very far from the hospital." – PV Caregiver from Gilé*

These dissatisfying experiences extended to general health services too; several caregivers discussed visiting the health facility for treatment of malaria or other illnesses and receiving only partial doses of the treatment, leading them to also question the quality of vaccination services. Many caregivers chose to abandon the vaccination process, rather than invest significant time, effort, and money to continue with subsequent vaccines when they had doubts about the quality of care they would receive.

Health workers described their own challenges to delivering vaccines and providing quality care to every child, including stockouts of vaccines and other supplies and high work burden. Many health workers described vaccine stockouts lasting weeks to months with no guarantee when the vaccines would be available again. Several health workers raised concerns that aligned with those expressed by caregivers, noting fears that caregivers would not return after encountering stockouts due to the distance and difficulty associated with vaccine care seeking.

> *"The whole province did not have the [polio] vaccine, and we had no way of vaccinating children… The vaccine has been out of stock for 2 months… Considering that the vaccination program has a certain calendar, it is always embarrassing that this happens, because the children who should have had vaccinations in that period do not get them, so it is embarrassing to have these vaccine problems." – HW from Gilé*

Most health workers reported feeling overburdened due to lack of sufficient human resources. This may have contributed to the long wait times and perceptions of poor service that caregivers experienced.

Concern about side-effects, exacerbated by "accumulation" of vaccines, leads to hesitancy

Most caregivers reported that vaccines are important for promoting their child's health and began the vaccination process with a strong intent to complete their child's vaccinations. Some caregivers understood that side-effects are a normal part of the vaccination process and should not be a reason to stop vaccination. However, others expressed concerns about side-effects, namely fever and swelling at the injection site, that might last for several days after the vaccination. This concern was greater for caregivers who lived far away and felt that the long walk home aggravated the side-effects.

> *"After the vaccination the child can stay three days with swelling and fevers… This is because of the distance I have travelled with the child tied to my back... as soon as the child gets the vaccine we come back [home] and that makes the feet swell because of the vaccine associated with the walk." – PV Caregiver from Gilé*

Caregivers worried that "simultaneous" or "accumulated" vaccines – those given in the context of catch-up schedules when previous doses had been missed -- would exacerbate the fevers and swelling. Concerns about side-effects and vaccine "accumulation" caused some caregivers to drop out of the vaccination process, especially if their child had fallen behind on the immunization schedule (Table 3, Quote 3.C).

> *"…what made me abandon it were the side effects of the vaccine. I wanted to protect my son by abandoning the service and I didn't know I was harming the child... On the days that the child received the vaccines simultaneously, he would have many fevers and this happened when he spent many months without vaccinating." – PV Caregiver from Gilé*

Health workers recognized that some caregivers are fearful of side-effects, especially when missed vaccines are delivered simultaneously with those due per the child's age schedule. Health workers felt that caregivers are not always aware of side-effects of vaccines, and that better communication with caregivers is important for reducing dropouts that are caused by fear of side-effects.

> *"[The health worker] needs to sensitize the mother psychologically that the child needs to receive the vaccine… why the child is getting that vaccine, and what will be the post vaccination effect of that vaccine. For example if the child has fever after that vaccination you tell the mother not to worry because it is something normal after the vaccination...." – HW from Namarroi*

Power dynamics at the health facility make caregivers hesitant to seek and advocate for vaccination services

Several caregivers described negative interactions with health workers, including instances when either they or other mothers were yelled at by health workers or humiliated in front of other caregivers. Caregivers feared that health workers would scold them and send them home if they forgot to bring their vaccination card, did not bathe their child prior to the visit, or missed a prior immunization visit and were now coming out-of-schedule.

> *"If you have too many absences, when you arrive at the hospital you are insulted for not taking the child for the vaccination, even though you try to explain that it was not of your own will but because of the distance… For having missed many months we are insulted, and when this happens the child gets many shots at the same time, punishing the child." – PV Caregiver from Gilé*

There were strong social norms around bathing the child before vaccination to avoid being rejected or humiliated. Caregivers' fear of humiliation was exacerbated by the public nature of the health facility, where immunization activities and conversations take place in front of the other caregivers and health staff.

Caregivers frequently discussed the importance of vaccination cards. Mothers who had given birth outside of a facility often lacked vaccination cards and feared that if they requested one, health workers would admonish them for having had a non-institutional delivery. Caregivers who lost their cards feared being yelled at and rejected by health workers.

> *"[my child] didn't get all the vaccinations because she didn't have a card, when it got torn I arrived at the hospital to ask for a new card, I was told to get the previous one and I was left with no way." – PV Caregiver from Namarroi*

Similarly, health workers felt that lack of vaccination cards caused many caregivers to abandon vaccination services out of fear that they would not be served. Health workers noted that it took additional time for them to search through vaccination record books when caregivers arrived without cards. However, they said that it is possible to issue new cards and felt that mothers should not be afraid to return without them.

Caregivers noted that power dynamics at the health facility sometimes resulted in missed opportunities to vaccinate. A few mothers described instances when health workers sent them home without delivering any vaccinations, for instance due to the caregiver arriving too late or the health worker not checking the vaccination card. Even when caregivers believed that their children needed to be vaccinated, from either reviewing their vaccination card or prior experience vaccinating other children, they were hesitant to approach the health workers to request the vaccine, fearing that they would be yelled at.

> *"Many times I went to the hospital, they just sent my daughters to weigh and said they had already completed the vaccinations and didn't even check the children's card, but as a mother I knew that the last vaccine was missing and I couldn't question it for fear of being humiliated." – PV Caregiver from Gilé*

From the health worker perspective, however, some of these missed opportunities and instances of denial of vaccination services were due to challenges that they faced regarding vaccine delivery policies, cold-chain policies, and work schedules. Some health workers said that they did not deliver vaccines to children over the age of two, and one health worker described cold-chain policies that limited them to opening the vaccine freezers just once at the start of the vaccination session and once at the end. If caregivers arrived after the vaccines were put away, the health workers could not retrieve vaccines out of compliance with those policies. Additional missed opportunities to vaccinate occurred at two health facilities in instances when children were born on weekends, when vaccinations are not delivered; at one facility, there was no maternal and child health nurse to manage vaccination of newborns on weekends, and at the other health facility, the maternal and child health nurses had been trained in vaccination but were not administering them to newborns.

> *"All deliveries that take place on the weekends must return on Monday to vaccinate. Sometimes there are missed opportunities because some mothers live far away… [Maternal and Child Health] nurses have training in the area of vaccination, and it is possible to manage the vaccination of newborns, just apply the BCG vaccine and then dismiss the mothers, but this is not happening." – HW from Gilé*

The data suggest a breakdown in communication between health workers and caregivers; health workers do not always communicate the logistical and resource constraints that they face, and caregivers are afraid to ask about why their children are not receiving vaccines. This may also feed into caregivers' perceptions of poor-quality services.

> *"For a few months that I went to the hospital they just weighed the children and returned the card to me without saying anything, but I was afraid to ask. I was silent without knowing if it was a lack of vaccines at the hospital or bad luck for me." – PV Caregiver from Gilé*

Impacts of COVID-19 on Vaccination Experiences

Though some caregivers and health workers felt that COVID-19 had not impacted the vaccination process, others described changes to normal health services processes as well as additional barriers to vaccination resulting from the pandemic. In some cases, caregivers were hesitant to go to the health facility due to fear of contracting COVID-19 or general discomforts around the new health facility policies.

> *"I am currently worried because there are many things that happen like wearing a mask. In the hospital, without the use of masks, people are not attended, as well as on public transport. Our habits of shaking hands and staying close to our friends is also forbidden, these are things that make us distressed and worried without knowing how long it will take before it passes." – PV Caregiver from Gilé*

Mask requirements were another reported deterrent, as caregivers who do not have their own masks knew that they would not be served. At the health facility level, health workers described more vaccine stockouts and shortages of other supplies, such as gloves.

> *"At times, we lacked some complete vaccines because it was said that the borders closed and that brought about an insufficiency of vaccines, due to COVID-19… For example, we are currently without BCG and Polio vaccines, that is, due to COVID-19, because when we question them, they say that there is difficulty in mobility from where vaccines come here in the province." – HW from Namarroi*

Health workers also mentioned challenges due to social distancing requirements and limitations of health facility infrastructure; waiting rooms are too small to accommodate all of the caregivers, forcing them to wait outside even in the sun or rain.

Both caregivers and health workers noted that mobile brigades have been especially infrequent during the COVID-19 pandemic. Health workers described the difficulties in organizing and running mobile brigades due to social distancing requirements as well as lack of fuel and required supplies.

> *"…for 2021 we already planned [mobile brigade] activities, but we don't have available resources and with COVID-19, things got worse, and there are no funds for the maintenance of motorcycles and fuel." – HW from Namarroi*

Caregivers commented that they are unaware of brigade schedules due to closures of schools and churches, which previously were their main sources of information about brigades. When mobile brigades did happen, health workers reported that far fewer caregivers than usual brought their children to be vaccinated due to fears of congregating in groups.

> *"Now we go to the community and we find there are not enough children due to the pandemic, and messages are arriving in the communities saying that we cannot concentrate a number of fifty people together… If yesterday, before COVID-19, I could reach 200 children in immunization, today when I go, I can only reach 50 to 30 children. This has changed a lot because people are afraid to stay in the concentrations." – HW from Namarroi*

Discussion

Our study highlighted the immense effort that caregivers put into vaccinating their children, but the barriers they face are numerous and difficult to overcome. Primary barriers identified in our study included: practical issues related to health facility access, unreliable and perceived poor service quality, negative interactions with health workers, caregiver lack of awareness of vaccine side-effects, and unsupportive household dynamics. Our findings are consistent with some, but not all, barriers that have previously been identified in systematic reviews, which found that the main determinants of vaccination dropout in LMICs included vaccination systems (including access, health worker availability, missed opportunities, and service reliability), family characteristics (including maternal education, family dynamics, and poverty), parental knowledge and attitudes (including lack of motivation, fear of side-effects, and mistrust of the health system), and poor communication and information around immunizations (including health staff attitudes and behavior) (11,19). Cross-sectional studies in Mozambique found that dropout related to lack of access to vaccination sites, lower maternal education, household decision-making processes, and children born at home or outside of Mozambique (20,21).

Our study also generated several new findings related to caregivers' interactions with health workers and their perceptions of service quality, caregivers' hesitancy related to vaccine "accumulation," and the importance of family support. Fear of humiliation or reprimand contributed to caregivers' perceptions of poor service and discouraged them from resuming the vaccination process once their child had fallen off schedule. Additionally, the perceived poor quality of *general* health services influenced some caregivers' decisions to stop seeking vaccination services. Communication breakdowns may have made caregivers unaware of health workers' constraints, exacerbating their perceptions of poor service quality. These findings all point to a need to improve both interactions between caregivers and health workers and overall service quality. Many caregivers in our study were more fearful of side-effects when they believed that their child was receiving too many vaccines simultaneously and especially in the context of catch-up vaccine administration, and better messaging and education on vaccine schedules and expected side-effects may alleviate these concerns. Finally, our findings showed that family support is a strong facilitator that enables mothers to overcome many of the main vaccination barriers, and there is a need to better mobilize communities and families around vaccination.

For the caregivers in our study, the vaccination journey was cyclical. Each new immunization experience added to the cumulative immunization experience, and informed a caregiver's decision to either continue with or abandon the vaccination process. Individual and combinations of barriers shifted over the course of the vaccination process. Vaccine dropout was related to combinations of barriers that interacted together to eventually tip the scales in favor of abandoning the vaccination cycle. This study has generated a more comprehensive understanding of how those barriers come together and which barriers are the primary drivers of vaccination dropout in different contexts. This new knowledge provides a powerful foundation for developing solutions to improve complete vaccination coverage.

Implications on Policy and Practice

Globally, there has been increasing focus on health systems strengthening (22), and our findings support the need for this approach to increase vaccination completion, including improved supply chains to

ensure adequate stocks of vaccines and other supplies, sufficient health workforce, and health facilities that allow for privacy and confidentiality. Capacity building of health workers, including training, retraining, and supportive supervision is also needed (23). These capacity building approaches should not only focus on technical content, but should help support health workers in respectful, empathic, and patient-centered communication (24). There is a specific need for improved communication and messaging between health workers and communities regarding vaccine availability, scheduling and hours of immunization sessions, expected side-effects (especially when vaccines are delivered off schedule), and policies around issuing of new vaccination cards. Involvement of community leaders, religious leaders, and community health workers in those communication strategies may improve vaccination uptake (25). Ultimately, however, enhanced relationships with patients and the community also requires a sufficient and motivated health workforce (24).

Our findings suggest that additional investment into community-centered outreach services to administer vaccines could improve vaccination completion rates. Regularly scheduled outreach events have the potential to greatly facilitate access to immunization services in distant communities, especially when communities are involved in planning them (26). The WHO and UNICEF have endorsed the RED/REC strategy since 2002 , promoting community-centered outreach services (26,27), but our findings suggest that there has been inadequate resource allocation and an insufficient health workforce to implement RED/REC in the study communities.

To successfully implement these recommendations, there is a need for further research on best channels of communication between health facilities and the communities they serve, as well as further research on how best to design and implement trainings for health workers focused on empathy-building. Additionally, there is a need to better understand how to engage husbands and other family members in the vaccination process to reduce the burden on mothers.

Our study has several limitations. The specific barriers identified related to vaccination dropout may not be generalizable to other contexts because influences on vaccine dropout are highly context dependent, and determinants relate to social norms, health service policies, and geography. However, the complex and cyclical influence of multiple factors, rather than the significant influence of a single barrier, may translate to other settings. An additional limitation is that this study was conducted during the COVID-19 pandemic, when many health services were disrupted. While this provided a unique opportunity to examine vaccination barriers caused by this crisis, this also may have biased our findings about vaccination dropout during non-pandemic times. Despite these limitations, this study demonstrates that immunization dropout is complex, with caregivers facing a combination of barriers and facilitators that can change with each new vaccination experience. Solutions that improve vaccination coverage for *all* caregivers must address multiple barriers. The findings highlight the need for improved quality and reliability of vaccination services and for community-centered solutions that remove practical barriers and empower caregivers to complete the vaccination process.

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Tables and Figures

Table 1: Characteristics of caregiver participants and their children.

		Partially-Vaccinated Group (n=22)	Fully-Vaccinated Group (n=10)
District	Namarroi	11 (50%)	5 (50%)
	Gilé	11 (50%)	5 (50%)
Health Facility Geography	Rural	16 (73%)	7 (70%)
	Peri-Urban	6 (27%)	3 (30%)
Caregiver Age (years)	Median	26	21
	IQR	22-30	20-21.8
	Range	19-39	19-39
Caregiver Education	Some primary	11 (50%)	3 (30%)
	Completed Primary	11 (50%)	7 (70%)
Child Age (months)	Median	30	31.5
	IQR	30-32	29.3-32
	Range	27-32	28-33
Child Sex	Female	9 (41%)	6 (60%)
Number of Missing Vaccines (of 15 possible)	Mean	3.5	0
	IQR	2-8.8	-
	Range	1-14	-

Table 2: Vaccination calendar and vaccination status of the PV children

Vaccine	Dose	Age of administration per Mozambique EPI schedule		PV children who received the dose (n=22)*
		Ideal	Min. and Max. Age Range	
Tuberculosis	BCG	Birth	Birth – 23 months	22 (100%)
Oral Polio	OPV 0	Birth	Birth – 6 weeks	16 (72.7%)
	OPV 1	2 months	6 weeks – 23 months	20 (90.1%)
	OPV 2	3 months	10 weeks – 23 months	16 (72.7%)
	OPV 3	4 months	14 weeks – 23 months	13 (59.0%)
Pentavalent contains: Diphtheria, Pertussis, Tetanus, Hepatitis B, Haemophilus influenzae type B	DPT-HepB-Hib 1	2 months	6 weeks – 23 months	20 (90.1%)
	DPT-HepB-Hib 2	3 months	10 weeks – 23 months	15 (68.1%)
	DPT-HepB-Hib 3	4 months	14 weeks – 23 months	12 (54.5%)
Pneumococcal conjugate	PCV 1	2 months	6 weeks – 23 months	20 (90.1%)
	PCV 2	4 months	14 weeks – 23 months	16 (72.7%)
	PCV 3	9 months	9 months – 23 months	11 (50.0%)
Rotavirus	RV 1	2 months	6 weeks – 23 months	17 (77.3%)
	RV 2	3 months	10 weeks – 14 weeks	12 (54.5%)
Inactivated Polio	IPV	4 months	14 weeks – 23 months	6 (27.3%)
Measles, Rubella	MR 1	9 months	9 months – 23 months	1 (4.5%)
	MR 2**	18 months	18 months – 23 months	1 (4.5%)

*Note: Vaccination status is according to vaccination cards, or health facility records when no cards were available

**Note: The second dose of MR was added to the Mozambique EPI schedule in November, 2017. Due to the timing of the study, completion of MR 2 was not considered when determining vaccination status.

Table 3: Representative quotations and photos

Lack of family support and social norms overburden mothers and compound the challenges of accessing vaccination services	
Distance: *"If it weren't for the distance, the children would be fully vaccinated, but we have to wait to sell the crop from our farm to have enough money and take the child to vaccination." – PV Caregiver from Gilé* Physically Challenging: *"If there is a possibility of a mobile brigade, with advance warning, I will take advantage of completing my daughter's missing vaccine, otherwise I have no alternative. Since walking to [the health facility] with this summer sun is very difficult." – PV Caregiver from Gilé* Family Support: *"The father has always helped me to remember the dates set to take the children to the hospital. He would wake me up early to bathe the children to go to vaccinate, and on the way back he would run to meet me to carry one of the children, because he knew that on the days that the children vaccinated they cried a lot." – PV Caregiver from Gilé* Women's Role in Society: *"I was talking to the caregiver [who didn't complete vaccination], and she explained that she was sick and could not come to the health unit or to the mobile brigades, and we asked her about her husband? She explained that in the community it is the woman who takes care of the children, men are concerned with other things." – HW from Namarroi*	 *"This photo reminds me of when I came back from the hospital and sat here on the mat… My leg was in a lot of pain again on my way to the hospital and I ended up not vaccinating [my child]. I'm not going there anymore… when I ask my husband to accompany our child to the hospital he says that he is not able to take the child on his back… But walking from here to the hospital is complicated with so much pain that I feel." – PV Caregiver from Namarroi*

Perceived poor service at health facilities reduces caregivers' trust in the health system	
Dissatisfaction: *"I am just lamenting very much, about the dosage of pills we are given when we go to hospital; when we have travelled a long distance with a sick child to get half a pill, that is demotivating… If we go to the hospital with malaria they should give us malaria and paracetamol tablets with full dosages... In this case we would be satisfied despite the distance." – PV Caregiver from Gilé* Stockouts: *"Sometimes when we arrived at the hospital, they claimed that there were no vaccines so the child was just weighed…. When that happened, I'd regret the distance I had to travel… the following month I would not return with fear of spending money and not find the vaccine." – PV Caregiver from Gilé* Human Resources: *"Well, many times there is lack of human resources, and I believe that human resources are never complete… So it is a challenge, it is a major effort that I have made in order to satisfy everyone who came to seek our services." – HW from Namarroi*	 *"[In this photo], it's me with my daughters sitting in the courtyard of my house with their vaccination cards. For me it represents the day I went to the hospital to vaccinate my daughters and came back because they had no vaccines… I went to the hospital and they just weighed in and told us to come back because they didn't have vaccines. Having no other alternative to resort such as going to another health facility due to the lack of money for transportation, I went back to bus stop to take the transport back home and had no more opportunities to return to the hospital to vaccinate the children… I did not return to the hospital to see if they had received the vaccines or not." – PV Caregiver from Gilé*

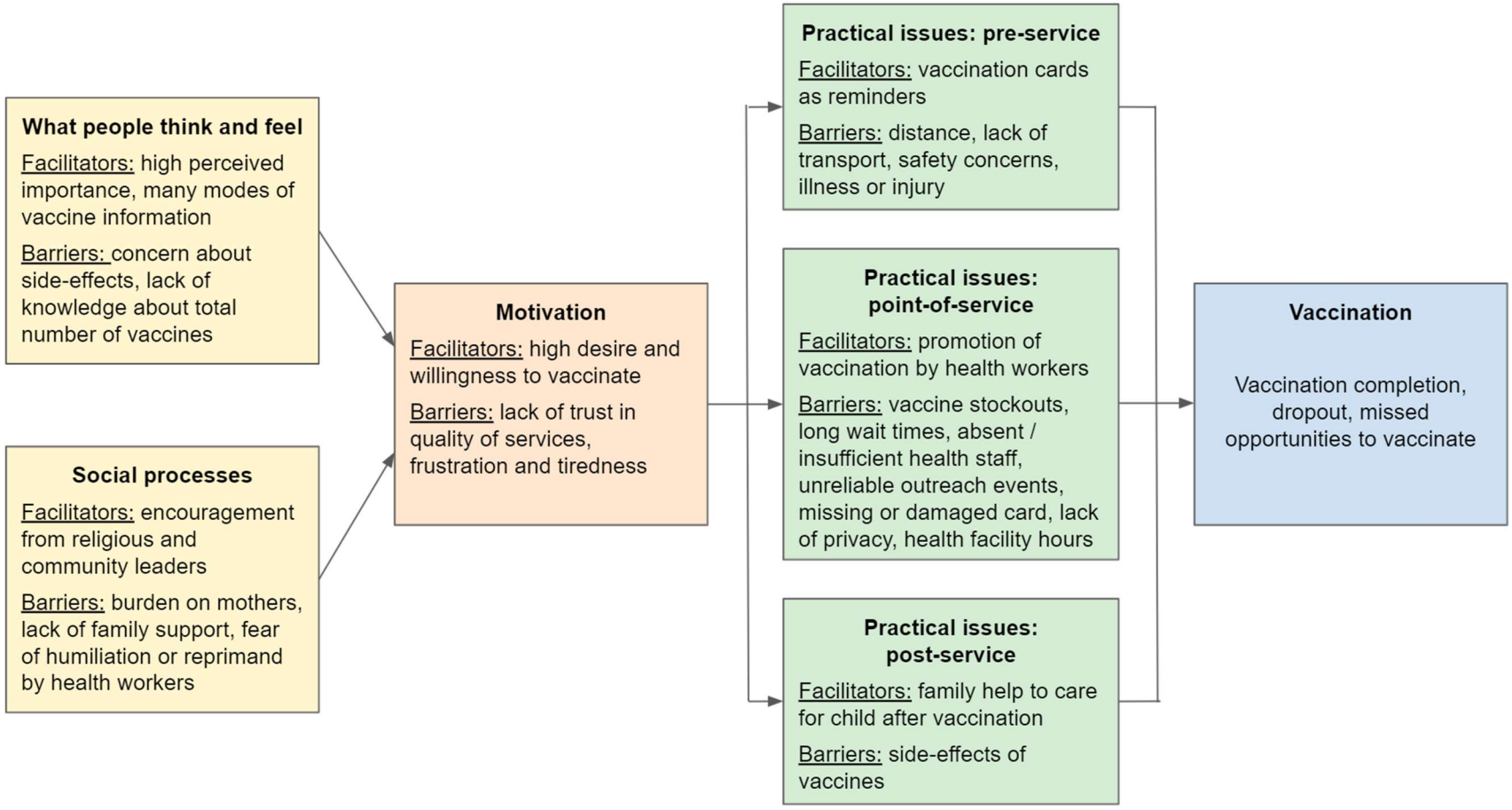
Concern about side-effects, exacerbated by "accumulation" of vaccines, leads to hesitancy	
Fear of Vaccine "Accumulation": *"[Caregivers] know that when a mother missed vaccinations, the child will receive more vaccines to cover those vaccines that are missing. No mother likes to see her child being given 3 or more vaccines; it is painful for the child." – HW from Gilé* Normal Side-effects: *"The vaccine is important. We have to get the children vaccinated, and even with the fevers and swelling the child gets after a vaccine, we cannot give up. It will pass and the child will continue playing." – PV Caregiver from Gilé*	 *"[This photo] represents the moment when I came back from the hospital after a vaccine and came home. The child caught fevers, so I'd leave her lying down to rest and I sat beside her to calm her down. Sometimes she had two or three days with fevers and swollen legs. She got more fever in the months that I had multiple vaccines at the same time. As I was not informed about the side effects of getting different vaccines at the same time, the child would get home with many fevers and worry me." – PV Caregiver from Gilé*

Power dynamics at the health facility make caregivers hesitant to seek or advocate for vaccination	
Out-of-Schedule: *"We should take the child to hospital for vaccinations to avoid being yelled at, because all mothers who do not take their children on the scheduled dates are yelled at." – FV Caregiver from Gilé* Vaccination Cards: *"Some mothers, when they lose or get the child's health card wet, they get afraid of returning to the health facility to continue with the child's vaccinations." – HW from Namarroi* Vaccination Session Hours: *"There are mothers who live far away and do not have motorbikes or bicycles, therefore coming on foot to the health facility. There are also mothers who prefer to arrive later to avoid the floods that occur in the morning… However, if the mother arrives after 3PM, it will no longer be possible because the technician has already finished his activities… This is because the opening of a refrigerator has rules, and it should be opened only twice a day, in the morning and in the afternoon." – HW from Gilé*	 *"I want to show that I always bathe my son before taking him to the hospital to vaccinate. I am afraid to vaccinate my child without bathing and have him feel sick. On the other hand, I am afraid that other mothers would laugh at me! Whenever I take my child to the hospital to vaccinate, I first bathe to avoid rejection and other illnesses that can be caught due to poor hygiene. Since when you take the child without bathing, it will not be vaccinated, it is refused… When taking the child without bathing, I am afraid that other mothers will laugh and consider me as a dirty person." – PV Caregiver from Gilé*

Impacts of COVID-19 on vaccination experiences
Fear of COVID-19: *"Since the beginning of coronavirus I have not gone to the hospital. I was afraid of getting coronavirus." – PV Caregiver from Namarroi*
Masks: *"I have even found in some communities, mothers saying that I don't take my child to the health unit because I don't have a mask and if I don't have a mask I can't go… And they end up staying at home and not vaccinating because they don't have masks." – HW from Namarroi*
Advance Notice of Brigades: *"In the old days, warnings for vaccination were sent in schools and churches, but with the closure of these institutions we are surprised and often receive the information on the same day that the brigade arrives while we are in the farm; it makes it difficult, since our farms are far away." – PV Caregiver from Gilé*

Appendices

Appendix A: Adapted Increasing Vaccination Model



Appendix B: Semi-Structured Interview Guide for Caregiver Interviews

Introduction: Good morning/afternoon. I am back to go over the photographs and conduct the remainder of the interview with you. Is now still a good time?

Introduction to in-depth interview:

- This interview will last about 1.5 hours.
- Please know that what you say to us is confidential. We know how important this is to you. We also ask the other participants keep our discussions confidential.
- We would like to record the conversation so that we can document all the information you provide.
- To better understand immunization in your community, it is really important that you share your true beliefs and attitudes towards vaccination, as well as your personal experiences in vaccination of your children.

Informed consent for photos and recording the interview: Now before we get started, I would like to request your informed consent again to review the photographs and record the interview. As mentioned last week, your participation is voluntary and there is no penalty for not taking part. You may refuse to answer any question or withdraw from the study at any time.
Do you have any questions or would you like me to read the informed consent again?

If agree, have them sign the lines on the consent forms for the photographs and recording of the interview!

Discuss "Ground Rules" for the In-depth Interview

- Please don't answer your cell-phone during this interview.
- Do you have any other questions before we get started?

Review of Photovoice:

- Ask them to show the photos they have taken on the camera
- Ask them to pick 3-5 photos that best represent their experience of immunizing [child's name].
- Make sure to pick photographs that are clear!
- **Note: If there are any photos of them, their child or family members, request a signed photo release form by each individual in the photo! If it is the child, they can sign for their child.**
- Upload the selected photos to the computer and paste them in PowerPoint and begin the photovoice session and interview.
    - If the computer isn't working, review the photos on the digital camera and note down the photo number for future reference
- Turn on the recorder!
- Begin the interview using the interview guide

Semi-Structured Discussion Guide for Photovoice In-depth Interview

Instructions: To elicit rich descriptions from participants, when asking follow-up questions or encouraging them to talk more or give you more examples/details, use the following probes:

- *What do you mean by ____ ?*
- *Tell me more about ____.*
- *Can you give me an example of ____ ?*
- *Can you tell me about a time when ____ ?*
- *Can you tell me about the last time ____ ?*
- *Is there anything that made ____ easier?*
- *Is there anything that made ____ harder?*
- *(Can you tell me) Who ____?*
- *(Can you tell me) When ____ ?*
- *(Can you tell me) Where ____ ?*

Probes are completed using only verbatim participant words or phrases.

Interview Guide:

Before we discuss the photos more, can you tell us about how the photovoice process went for you? Did you discuss the task with anyone else in your family or community or have any help in taking the photos?

If yes, Did they have any influence on any of the photos you took?

- If so, in what way?
- Can you provide an example of how they impacted the photos you took and selected?

Once photos are selected, ***ask for each photo:***

- What do we see in this photo?
- What does this represent to you?
- How does this photo represent your vaccination journey?

Now, based on our activity with the photos, we have learned more about your experience, thank you. Now we have some more questions to better understand your experience immunizing your child and the things that influenced [child's name] immunization status. Do you have your child's immunization card which we can refer to during this interview?

1) To start, can you tell me about how people in your community talk about immunizations?
    a) How does this relate to how you feel about immunizing [child's name]?
    b) Has this changed at all with COVID-19?
        i) If yes, why and how?
        ii) If no, why not?

2) Can you describe to me what the experience was like getting immunizations for [child's name]?
    a) How many times did [child's name] get immunizations before the age of two? *(look at immunization card)*?

b) When did they get these immunizations?
    i) [if they got immunizations more than once] Were these experiences the same? Different?
    ii) How so?
c) Where did [child's name] get their immunizations?
    i) Did they get them all there?
    ii) What did you think about getting the immunizations there?
d) Who immunized [child's name]?
    i) How do you feel about that?
    ii) Did you trust the [health worker/nurse/doctor] who gave the immunizations?
        (1) Why or why not?
e) How satisfied were you with the experience(s) of immunizing [child's name]?
    i) What lead to you feeling this satisfied/dissatisfied?

3) When deciding to immunize [child's name], what things did you consider?
a) Was there anyone who helped you make that decision?
    i) Who? How did they help?
b) Did you intend for your child to be fully vaccinated according to the recommended schedule?
    i) If yes, why?
    ii) If no, why not?
c) Did you have questions about the recommendations for immunizing [*child's name*]?
    i) Why or why not?
d) How important did you feel getting these immunizations was, if at all, for [*child's name*]?
e) Have things changed since COVID-19?
    i) If so, how?

4) What kind of information, if at all, did you receive about immunizing your child or about immunizations in general?
a) When did you receive this information?
b) Where did this information come from?
    i) Health center?
    ii) Social media (Facebook, WhatsApp)?
    iii) Neighbours?
c) How often, if at all, did you receive information?
d) To what extent did you trust this information?
e) Did you get information about how many immunizations your child needed and when they were needed?
f) Did this change with COVID-19? How?

5) [for those who have a child who dropped out] Can you describe why [child's name] didn't receive all their vaccinations by age two?
    a) What factors do you think contributed to that?
        i) Probe on:
            (1) What kind of information did you receive about your child's immunization schedule, if at all?
            (2) Did you know what your child's immunization schedule was?
            (3) COVID-19
    b) What was hard about trying to immunize [child's name]?
        i) Can you provide an example?
        ii) How, if at all, has this changed since COVID-19?
    c) What was easy about trying to immunize [child's name]?
        i) Can you provide an example?
        ii) How, if at all, has this changed since COVID-19?

6) [for those who have a fully-immunized child] What factors do you think contributed to being able to fully immunize [child's name] by the age of two?
    a) What was hard about trying to immunize [child's name]?
        i) Can you provide an example?
        ii) How, if at all, has this changed since COVID-19?
    b) What was easy about trying to immunize [child's name]?
        i) Can you provide an example?
        ii) How, if at all, has this changed since COVID-19?

7) How do you wish the experience of getting all the recommended immunizations for [child's name] could be easier, if at all?
    a) What would you change?
    b) What would you keep the same?
    c) How would these changes look in times where there is no COVID-19?
    d) How does it look now with COVID-19?

Conclusion: Are there any final thoughts you wish to share about your experiences with immunizing your 2-3 year old child?

We would like to thank you for taking the time to discuss this important topic with us!

Appendix C: Semi-Structured Interview Guide for Health Worker Interviews

Introduction to Structured Phone Interview: The purpose of the debrief activities is to reflect on and discuss your messages with the healthcare workers you corresponded with. You will use the message notes to debrief with the healthcare workers about the immunization process. This is a rough guide of questions to ask the healthcare workers, and additional questions or topics can be discussed based on specific observations that you made from the messages.

Interview Questions

1) Now, I am going to walk through some of the activities you mentioned in your messages, and I would like to get your perspective on:
    a) Were these typical [experiences, processes, observations]?
        i) If so, how? If not, how did they vary from normal?
    b) Is there anything else you would like to share or explain about the [experience, process, observation] that may not have been captured in the messages?

2) How do you see your role in immunizations?
    a) How do you feel about that role?
    b) Do you feel supported in your role? If not, why? If yes, how so?
    c) How do you generally feel about the tasks associated with immunizations?

3) How do you feel about how immunization records are reported?
    a) How do you feel about overall system for immunizations?
    b) What about management of immunizations?

4) Now, I would like to get a better sense of your work around immunizing children under the age of two. Can you walk through a typical day of conducting immunizations for children under the age of two? [Probe on what activities they do to prepare for immunizations, conduct immunizations, document immunizations, educate around immunization]
   For each step/activity?
    a) Why do you take that particular step?
    b) Who is typically involved in that step?
    c) What you feel when going through that step?
    d) What factors make that step easier/harder?
    e) Can you guide me through the steps that you took today when administering a vaccination?
    f) Are there any cases where you would not administer a vaccination to a child? Why or why not?

5) Are there other, non-typical ways that you provide immunizations?
    a) Can you tell me about those?

6) Outside of conducting immunizations, what else do you do?
    a) Can you tell me about how under-two vaccinations fit into this workload?

7) What is challenging about administering under-two vaccinations?
    a) Did you encounter any of those challenges over the past month? If so, which ones? How did that make your job more challenging?

8) What factors make it easier for you to administer vaccinations?
    a) Did you encounter any of those factors over the past month? If so, which ones? How did that make your job easier?

9) What are your personal beliefs around vaccinations?

10) Can you describe the conversations you usually have with caregivers while administering vaccines?
    a) What about how you see your role in providing advice or convincing caregivers to vaccinate their children under the age of two?

11) What do you view as the primary drivers of under-two immunization drop-outs?
    a) Can you provide an example?