Implementing a learning agenda on hepatitis B birth dose vaccine delivery in Africa

A case study from Ethiopia

PATH

Acknowledgments

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On the cover: A health extension worker provides mobile outreach for postnatal care and vaccinations in Ethiopia. Photo: PATH/Berihun Ali

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Abbreviations

AEFI	adverse event following immunization
ANC	antenatal care
BCG	bacillus Calmette-Guérin
CHW	community health worker
COVID-19	coronavirus disease 2019
CTC	controlled temperature chain
eCHIS	electronic community health information system
EPI	Expanded Program on Immunization
EPSS	Ethiopian Pharmaceutical Supply Service
FGD	focus group discussion
HBV	hepatitis B virus
HEP	Health Extension Program
Hep B	hepatitis B
HEW	health extension worker
HIV	human immunodeficiency virus
MAP	microarray patch
MeSH	medical subject headings
MNCH	maternal, newborn, and child health
MOH	Ministry of Health
OPV0	oral polio vaccine birth dose
PFS	prefilled syringe
PNC	postnatal care
TBA	traditional birth attendant
UNICEF	United Nations Children's Fund
VHL	village health leader
WDG	Women's Development Group
WHO	World Health Organization

Background

The World Health Organization (WHO) estimates that approximately 254 million people worldwide live with chronic hepatitis B (Hep B) infection, which can lead to serious health issues.[1] The burden is particularly high in low- and middle-income countries, including the WHO African Region, where an estimated 65 million people are infected.[1] Chronic Hep B infection is commonly the result of vertical transmission of the hepatitis B virus (HBV). Babies who are infected before they are one year old have a 90% risk of developing chronic Hep B.[2] The second most common cause of chronic Hep B is transmission during early childhood, with a 30% risk among children who are infected between one and five years of age.[2]

Vaccination is one of the most critical measures to prevent Hep B infection. When administered within 24 hours of birth, the Hep B birth dose can prevent 75% to 95% of vertical transmissions.[3] Since 2009, this vaccine has been endorsed by WHO, which recommends that all infants receive the first dose as soon as possible after birth, followed by two or three subsequent doses to complete the infant Hep B vaccine series.[4]

However, administering the vaccine within 24 hours of birth is challenging, particularly in contexts where births take place outside of health facilities. In many African countries, more than 40% of births occur at home.[5] While 63% of new Hep B infections are in the WHO African Region, only 18% of newborns receive the Hep B birth dose, with only 15 of 47 countries in the region offering it as part of their routine immunization programs.[6]

Project overview

With funding from Gavi, the Vaccine Alliance, PATH is implementing a learning agenda on Hep B birth-dose vaccine delivery in Africa, including a focus on synthesizing lessons learned from countries with decades of experience implementing the Hep B birth dose, as well as countries newly introducing the birth dose into routine immunization schedules.[7,8] The learning agenda includes questions around operational feasibility, acceptability, cost, market access, and the impact of innovative strategies to improve the reach of timely Hep B birth dose for babies born both within and outside of facility settings.

By exploring innovative delivery strategies, assessing the role of community health systems, and understanding stakeholder perspectives, the project's primary objective is to identify effective models for increasing Hep B birth-dose coverage. Evidence and insights from this initiative will apply to countries planning for Hep B birth-dose vaccine introduction as well as those seeking to deploy new strategies to increase coverage rates and timely administration within 24 hours of birth.

The project is being implemented in four countries—Ethiopia, The Gambia, Nigeria, and Uganda—selected based on several criteria, including a high HBV burden, moderate or high rates of home births, moderate or high birth-dose rates for oral polio vaccine zero dose (OPV0), demonstrating success with another type of birth dose, and an enabling environment for community health providers to administer vaccines. PATH also has a strong presence in these countries through long-standing collaborations with ministries of health. This case study presents insights from Ethiopia.

Ethiopian context

Ethiopia conducted its pilot introduction of Hep B birth dose in 2021-2022 and is planning a larger-scale national introduction at the end of 2025. The pilot was implemented in collaboration with WHO and the US Centers for Disease Control for a one-year period in four woredas of three regions (Tigray, Amhara, and Afar) and one city administration, Addis Ababa.[9] The pilot aimed to assess the

feasibility, acceptability, and effectiveness of introducing the Hep B birth dose into routine immunization schedules, including any programmatic or logistical challenges and overall lessons learned from implementation strategies. Findings from the pilot were encouraging, demonstrating that newborns delivered in health facilities could receive a timely birth dose, and health workers were able to integrate the new vaccine into existing workflows with minimal disruption.[9] The vaccine was administered by midwives or nurses in the delivery ward and in the EPI room. During off-hours, the vaccine storage protocol was to use on-site refrigerators at the delivery ward; if these were unavailable, vaccine carriers were used instead. For out-of-facility births, the strategy involved two methods: vaccination at a health facility and home-based administration by health extension workers (HEWs), integrated with postnatal care (PNC) services within 14 days of birth. While the initial findings were promising, the pilot also revealed significant challenges in reaching newborns born outside of health facilities, who represent about 50% of all births in Ethiopia.[10] The pilot report recommended exploring strategies for reaching newborns delivered at home, including better coordination with HEWs. Considering these findings, the Ministry of Health (MOH) and its partners are now exploring scalable context-appropriate models to ensure all newborns—regardless of place of birth—can access timely Hep B birth-dose vaccination.

In addition to the challenges associated with out-of-facility births, significant barriers also persist for facility-based deliveries, despite high coverage during the pilot phase. Recent evidence indicates that, although the MOH's policy requires all mothers and their newborns to remain in the health facility for at least 24 hours after delivery,[11] this policy is often not upheld.[12] A substantial number of mothers and newborns are discharged before the 24-hour period. This early discharge presents a critical challenge to administering the birth dose of the vaccine within the recommended 24 hours of delivery.

In 2024, Ethiopia submitted a new vaccine introduction application to Gavi for Hep B birth dose, which was approved by the Interagency Coordinating Committee in April 2025. On November 25, 2025, Ethiopia officially launched nationwide rollout of the Hep B birth dose. The introduction and scale up are jointly financed by Gavi, which has committed $2,409,863, and the government of Ethiopia which is contributing $951,640, including cofinancing at $0.20 per dose.

Given that nearly half of all births in Ethiopia occur at home, and up to four out of five births occur at home in pastoralist regions such as Afar, developing a strategy to deliver the Hep B birth-dose vaccine within the critical 24-hour period is essential. This case study presents the results of our work to design innovative, context-sensitive service delivery models that enable timely vaccination for both out-of-facility and in-facility births.

The role of Ethiopia's community health workers in immunization

Since its launch in 2003, Ethiopia's Health Extension Program (HEP) has employed HEWs, who are health professionals trained to deliver preventive, promotive, and selected curative services to rural and underserved populations. HEWs are based at health posts, which serve as the lowest-level fixed facility, and are responsible for both static and outreach immunization services, as well as conducting household visits and tracing defaulters. Although HEWs are involved in the Expanded Program on Immunization (EPI) implementation, based on literature and experiences from our study participants, HEWs vary in their ability to administer injections depending on training, cold chain capacity, and available supplies. In agrarian regions, nearly all HEWs are authorized to administer vaccines.

Women's Development Groups (WDGs)—also referred to as the Women's Development Army and Women's Development Unions—comprise a volunteer network introduced around 2010 to support the HEP by bringing health-promotion and early-detection functions closer to communities, under supervision by HEWs. Trusted individuals from the community are selected and help to identify pregnant women, track illness, encourage antenatal care (ANC) attendance, refer women for skilled birth attendance, notify HEWs of home births, and educate the community on preventative public health efforts. Yet because they are volunteers, they are not formally salaried, and their training is limited compared to HEWs.

The community health worker (CHW) program in Ethiopia has undergone a significant restructuring since 2021 to better fit the nation's evolving contexts and policies. The changes primarily affected the staffing of health posts and the structure of the voluntary CHW program. Under the new policy, the number of HEWs per health post is no longer fixed but now varies based on the location and population density it serves.[41]

The most substantial transformation occurred within the voluntary CHW program. While its structure now varies according to the context of each region, its core framework remains consistent nationwide. The program's backbone is formed by the village health leaders (VHLs), who are serving as the bridge between the HEWs and the broader volunteer base. Supporting the VHLs and the program's overall objectives are several other community groups, including WDGs, youth groups, men's development groups, and traditional community leaders.[57] This multilayered, localized approach is designed to enhance community ownership and participation in local health initiatives. VHL and WDG volunteers are not directly involved in administering vaccines in the community; those roles are currently reserved for HEWs and other facility-based providers.

Project approach

Ethics Review

The protocol was approved by the Ethiopian Public Health Association Institutional Research Ethics Review Committee (#EPHA|06|48312) and granted an exemption by the WIRB-Copernicus Group (WCG) institutional review board (#RES-00953) in the United States. All respondents gave informed consent prior to participating in the study.

Study sites and context

The study was conducted in the Afar and Sidama regions (Figure 1), which were purposively selected to compare pastoralist and agrarian contexts with a high burden of HBV and high rates of out-of-facility births. In Afar, two woredas, Chifra and Haruka, were selected due to the region's HBV prevalence (estimated at 25% in rural areas)[9] and to explore the distinct roles between formal and informal community structures through VHLs and civil society organizations. In Sidama, Loka Abaya woreda was selected as an agrarian setting with relatively high HBV prevalence (estimated at 9% in rural areas).[9] The expected number of health facility deliveries and basic health service coverage vary significantly across these woredas. For instance, in Loka Abaya, an estimated 62% of births occur in health facilities, whereas in Chifra and Haruka, an estimated 16% and 20% of births occur in health facilities, respectively (Table 1). Data were also collected at the national level through interviews with policymakers, EPI managers, technical experts, civil society representatives, and supply chain specialists.

Beyond delivery rates, operational differences exist among the woredas regarding the implementation of key community health initiatives. The new community engagement strategy, which involves VHLs, has already been rolled out in Loka Abaya and Chifra, but it has not yet been implemented in Haruka. Furthermore, an electronic community health information system (eCHIS) has been introduced in Loka Abaya, whereas this initiative has not yet been implemented in Chifra or Haruka. Urban areas were excluded from this study because of the low out-of-facility birth rates in these settings.

FIGURE 1. **Map of study sites in Afar (Chifra and Haruka) and Sidama (Loko Abaya).**

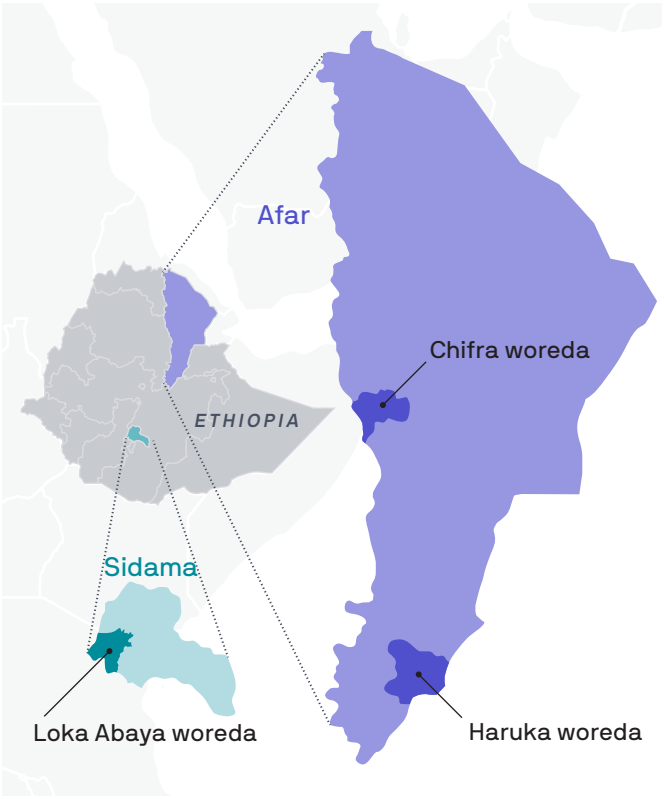


TABLE 1. **Health system structure and institutional delivery rates, by woreda.**

Health system indicators	Loka Abaya (Sidama)	Chifra (Afar)	Haruka (Afar)
Number of primary hospitals.	1	1	0
Number of health centers.	5	3	2
Number of health posts.	17	17	8
Number of health extension workers.	74	12	12
Average facility deliveries per month (2025).	204	40	28
Expected deliveries per month (2025).	330	250	140

Study design

The study used a multiphase qualitative design combining: (1) a literature review; (2) primary data collection involving key informant interviews and focus group discussions (FGDs) at national and subnational levels; and (3) human-centered design workshops at the woreda level.

Literature review

First, we conducted a literature review to: (1) document existing delivery models for birth-dose delivery in in-facility and out-of-facility settings in Ethiopia, including their effectiveness, barriers, and facilitators; and (2) understand the roles of community-based providers such as CHWs, midwives, and traditional birth attendants (TBAs) in birth-dose delivery to date. These findings informed the design of interview guides for the primary data collection.

The literature review included 64 resources spanning peer-reviewed articles, policy documents, technical reports, and conference/webinar presentations. The initial search was conducted in PubMed using a combination of medical subject headings (MeSH) and text words related to immunization programs, neonatal vaccines, and specific vaccines—Hep B vaccine, bacillus Calmette-Guérin (BCG) vaccine, and OPV0—limited to publications from 2000 onward. This search identified 37 documents, which were supplemented with additional gray literature and secondary resources to capture a broader range of evidence. These supplementary materials provided further insights into the health system context, including determinants of facility-based delivery, ANC utilization, and service delivery strategies.

Qualitative data collection

Building on this foundation, the study proceeded with three phases of qualitative data collection.

- Phase 1 (n = 8) involved national-level interviews with policymakers, EPI managers, technical experts, civil society representatives, and supply chain specialists. These interviews examined past and current experiences and strategies to increase Hep B birth-dose uptake, and explored the value, feasibility, and operational considerations of introducing a controlled temperature chain (CTC) approach, including potential regulatory and technical barriers to CTC qualification, comparative programmatic implications of one-dose versus ten-dose presentations, and the feasibility of using both presentations concurrently across different contexts within the country, and wastage issues.
- Phase 2 (n = 6 regional level, n = 12 facility health providers) consisted of interviews with regional health officials; maternal, newborn, and child health (MNCH) and EPI staff; and professional associations. We assessed how national strategies were implemented locally, identified contextual challenges, and explored opportunities for new strategies or for adapting existing ones.
- Phase 3 (n = 15) consisted of FGDs at the community level with mothers, fathers, members of WDGs and men's development groups, HEWs, community leaders, and VHLs. These discussions focused on lived experiences and mapping individual and community-level barriers and facilitators to facility birth and newborn vaccination, as well as Hep B prevention and control.

Analysis

The study applied UNICEF's Journey to Health and Immunization framework,[13] which maps six stages in the caregiver and provider journey—specifically, knowledge and awareness, intent, preparation, cost and effort, point of service, experience of care, and after service—to examine barriers, facilitators, and implementation processes. This framework informed interview design and guided thematic analysis. All the literature review data were collated in Smartsheet, and the interview data were collected in Kobo Toolbox. Both were synthesized into memos to identify enablers, barriers, and potential adaptations for strengthening Hep B birth-dose delivery in Ethiopia.

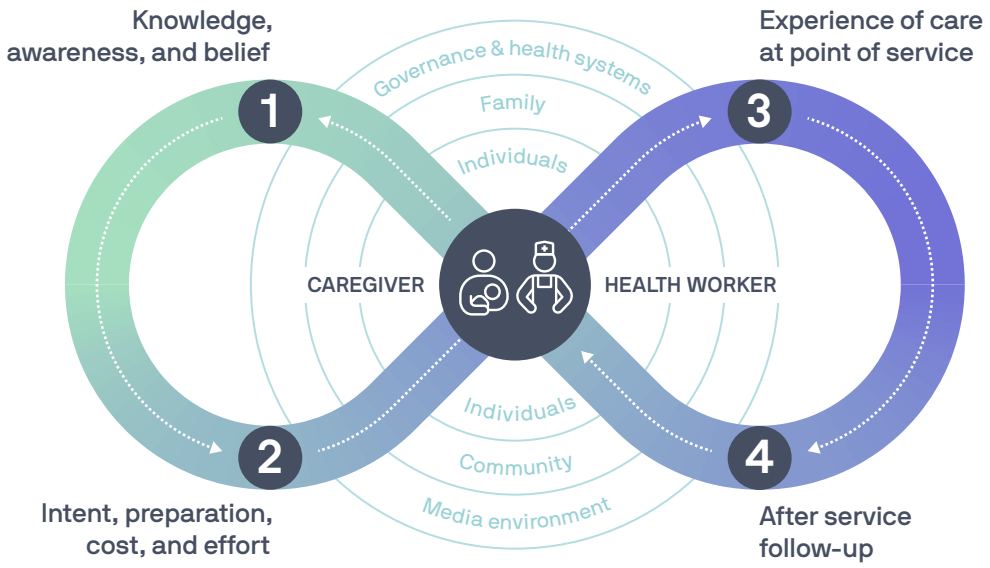
Our findings are presented in a modified framework, as seen in Figure 2, condensing it down to four stages where intent is combined with preparation, cost, and effort; and point of service is combined with experience of care, as these barriers and enablers identified were often interrelated and difficult to distinguish cleanly. Additionally, our stakeholders described the interactions with the health system as a single encounter, combining the point of service and experience of care. By combining these stages, our analysis maintains fidelity to the framework while ensuring that findings reflect how respondents themselves experienced the journey to immunization.

Human-centered design workshops

Following the analysis of the qualitative data, three human-centered design workshops were conducted at the woreda level—two in Afar (Chifra and Haruka) and one in Sidama (Loka Abaya)—to understand Hep B birth-dose vaccination activities based on findings from the qualitative data collection phases. Each workshop aimed to generate, test, and refine prototype concepts that could strengthen caregiver engagement and improve Hep B birth-dose vaccine uptake. Conducted over four days, the workshops brought together a diverse group of participants:

- **Day 1:** Caregivers, VHLs, spouses, and community leaders.
- **Day 2:** HEWs, health workers, and woreda health managers, including EPI focal persons.

FIGURE 2. **An adapted Journey to Health and Immunization Framework.**



Adapted from the Journey to Health and Immunization framework in the UNICEF Health Section/Innovation Office's report titled "Demand for Health Services: A Human-Centred Field Guide for Investigating and Responding to Challenges" (October 2018).

- **Days 3–4:** Collaborative prototyping sessions with mixed participant groups, focusing on iterative design, feedback, and refinement of prototype concepts.

A total of 88 participants (53% male) were involved across all the workshops, including 30 in Chifra, 28 in Haruka, and 30 in Loka Abaya. Participants included caregivers (both mothers and fathers), community leaders, non-paid CHWs, HEWs, EPI staff, primary health care unit directors, and woreda MNCH coordinators (see Appendix A.)

Before moving into the solution generation, co-creation workshop, participants were presented with the key barriers to administering birth-dose vaccines, particularly the Hep B birth-dose vaccine, as identified through FGDs and key informant interviews. Participants reviewed and validated these themes to ensure that they accurately reflected community realities. This validation step established a shared understanding of challenges and confirmed the relevance of the findings before transitioning to ideation.

To guide the ideation process, facilitators introduced "How Might We" questions that framed the challenges as opportunities/strategies for innovation. Participants then took part in a structured brainstorming session to generate potential solutions. Subsequently, participants used a prioritization matrix to identify the most feasible and impactful ideas for further development. For each prioritized idea, they created prototypes that included the following elements: concept description, proposed activities, external inspirations, potential challenges, and measurement indicators. The prototype designs were subsequently presented to Ethiopia's EPI task force for initial feedback and validation, particularly considering feasibility with respect to existing health systems constraints.

Findings

Overview of the implementation of current strategies for Hep B birth-dose introduction

In 2023, Ethiopia's National Immunization Technical Advisory Group recommended the universal inclusion of the Hep B birth-dose vaccine in the national immunization program to significantly accelerate progress toward global elimination goals. In 2024, Ethiopia submitted a new vaccine introduction application to Gavi, which was approved by the Interagency Coordinating Committee in April 2025. Ethiopia plans to officially launch the Hep B birth-dose rollout in the last quarter of 2025.

Ethiopia's political commitment to eliminating Hep B is reflected in several national plans, each setting ambitious but varied targets for birth-dose coverage, pointing to a greater need to coordinate across different MOH units, particularly the disease prevention and control office and the MNCH office (Table 2).

To achieve these targets, Ethiopia's strategy centers on facility-based deliveries and PNC. National policy recommends that mothers remain in a health facility for 24 hours after giving birth, ensuring access to essential

TABLE 2. **National targets for Hep B birth-dose coverage by policy.**

Policy name	Hep B birth-dose coverage target	Target year
National Strategic Plan for Triple Elimination of Mother-to-Child Transmission of HIV, Syphilis, and Hepatitis B Virus, 2021–2025.[14]	50%	2025
	90%	2029
National Strategic Plan for Prevention and Control of Viral Hepatitis in Ethiopia, 2021–2025.[15]	92%	2025
Hepatitis B birth-dose introduction plan.[16]	80% overall	Unknown
	70% within 24 hours	
	10% late (24 hours to 14 days)	

Abbreviations: Hep B, hepatitis B; HIV, human immunodeficiency virus.

PNC services, including the Hep B birth-dose vaccine.[11] In facility settings, the vaccine is administered by staff from the EPI or delivery wards, who are trained to deliver the birth dose promptly and safely.[16,17]

Recognizing that 51.4% of births occur at home in Ethiopia,[18] the strategy also leverages community health platforms to educate mothers about the importance of facility births and bringing newborns to a health facility immediately after delivery. Specifically, WDG volunteers are expected to register pregnant women in their communities, provide information about the importance of facility deliveries and ANC appointments, and may accompany women to health facilities for delivery.[19–21] When home births occur, WDGs, VHLs, and other volunteers are responsible for notifying the local HEW about ongoing labor and are expected to support mothers by arranging ambulance transportation for PNC or delivering the vaccines for the newborn at home.[11] During the Hep B birth-dose pilot, HEWs administered the birth dose during home visits as part of PNC, but tracking home births and reaching families within the 24-hour window remained challenging.[9]

The government's strategy, guided by a newly published training manual,[17] seeks to strengthen coordination across all levels of the health system to ensure delivery of the Hep B birth-dose vaccine as quickly as possible after birth.

Barriers and facilitators to Hep B uptake within and outside of facility settings

National stakeholders who reflected on barriers and facilitators related to Hep B birth-dose delivery highlighted both health systems and community-level factors that could influence timely Hep B birth-dose delivery. Health system challenges included weak identification and tracking systems for newborns born at home, concerns about multidose vial presentations of the Hep B birth dose due to wastage and delays in vaccination, HEW workloads and inadequate staffing, as well as supply, cold chain, and infrastructure constraints. At the community level, concerns centered on limited awareness and cultural practices of isolation and home-birth preferences that conflicted with recommendations for facility delivery and immediate vaccination.

Interviews with regional-level actors and health providers similarly underscored key health system challenges, primarily transportation barriers to health facilities, staff shortages and high turnover, limited cold chain availability, and inadequate infrastructure (e.g., electricity, refrigerators, heavy cold boxes). Within facilities, service delivery gaps persist as vaccines are only available during specific hours and days of the week. As a result, deliveries that occur after hours or over the weekend miss the opportunity for timely birth-dose vaccination. Some facilities are attempting to address these challenges by decentralizing vaccine refrigerators so delivery-ward staff can access them without having to rely on the EPI focal person to unlock them. However, even with this strategy, broader challenges were reported. Staff often hesitate to administer the vaccine immediately after birth due to fear of vaccine wastage when few newborns are present and misconceptions relating to the appropriate timing of the birth dose, indicating an important need for additional training on birth-dose vaccination practices and behavior change among health workers.

HEWs noted their reliance on WDGs, VHLs, and TBAs for registration and notification of pregnant women in the community and of home births. In Afar, the relationship

between TBAs and HEWs is strained. HEWs expressed frustration with TBAs for facilitating home deliveries for their own income and their unwillingness to promote facility births. However, in Sidama, TBAs were discussed as key collaborators in reporting home births to HEWs to facilitate follow-ups with the family. Overall, HEWs highlighted the challenge of conducting home visits due to transportation issues. In Loka Abaya, these accessibility issues focus more on topography, as they are in a mountainous region that limits certain types of transport; whereas in Chifra and Haruka, the issue focuses more on distance to health facilities due to the broader remote location and wide geography between kebeles.

FGDs with caregivers determined that there is little knowledge of birth-dose vaccines, but high awareness of the routine childhood immunizations starting at 45 days. During the delivery and immediately after, families (primarily fathers and elders) prioritize the mother's health and household responsibilities over the newborn care package, including vaccinations. This results in delayed care seeking for the newborn. Cultural practices of isolation and beliefs of the "evil eye" harming the mother and newborn limit the possibility for interaction outside the family, further delaying vaccination opportunities. That, combined with barriers in reaching the health facility due to long distances, challenging topography, clinic closures, and unavailable or costly transportation, encourages women and their families to stay home after delivery until the six-week check-up, where they receive the first package of vaccinations.

VHLs are not yet fully operational in all areas of the country, including in Haruka within our sample. In the areas where VHLs are present, communities have expressed high trust in them. Unlike the WDG volunteers and HEWs, VHLs have not yet encountered any of the negative sentiments of working for their own benefit rather than for the community's benefit. VHLs have been viewed as the linkage between the community and the health system. Community leaders, and especially religious leaders alongside VHLs, appear to be playing a central role in awareness and shaping acceptance of vaccines. In interviews, they expressed a strong commitment to modeling the behaviors they wish to see in their communities. Table 3 presents detailed findings from the published literature, interviews, and FGDs, organized by each stage of the modified Journey to Health and Immunization framework.

TABLE 3. **Barriers and facilitators to birth-dose immunization uptake.**

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Knowledge, awareness, and belief			
Caregiver knowledge and perceptions of birth-dose vaccines.	(+) 99.7% of caregivers believe childhood vaccines are effective and protective.[22] (-) 43.8% of caregivers express moderate hesitancy; 37.3% show high hesitancy for vaccinations generally.[23] (-) 25.7% are concerned about the serious side effects of new vaccines.[22] (+) A pilot of Hep B birth dose shows strong acceptance among caregivers; 75% of mothers receive information about the benefit of Hep B birth dose for infants.[9] (+) 66.1% of caregivers have sufficient vaccination knowledge; these caregivers are 3x more likely to vaccinate on time.[23] (+) Formal education of parents is linked to timely vaccination.[23–32]	(-) Birth doses are not common practice in or out of facilities, resulting in low awareness of the birth-dose vaccines. (-) Many caregivers do not understand the value of newborn vaccinations and believe routine childhood immunizations are only appropriate after the newborn phase. (+) Positive experiences with facility births and vaccination appear to be the easiest path to providing newborn vaccination.	"Mothers are more likely to take action if they understand the importance of the vaccine. They may choose to give birth at a health facility or visit a vaccination center immediately after home delivery if they recognize its significance." —National stakeholder (NS-E-02) "[I] did not have a follow-up appointment and was unaware of the importance of vaccination." —Mother, Loka Abaya (MOM-E-17) "After home delivery, newborns rarely get the 24-hour vaccine, as families believe the 45-day dose is enough. Mothers know the service but seldom seek it." —Mother, Chifra (MOM-E-30) "Not for home birth, even for facility births, there is no birth-dose vaccination. We are only appointed the 45-day schedule and then return." —Community Leader, Haruka (CL-E-19)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Health provider knowledge and confidence.	(+) 100% of health workers know the correct timing for the Hep B birth dose.[9] (+) 74% of health workers know the full dose Hep B schedule; 78% know the upper age limit.[9] (+) 100% of health workers are aware of Hep B birth-dose safety and understand Hep B transmission and prevention.[9] (+) Among HEWs, recognizing MNCH danger signs increases fidelity to newborn care interventions by 12.6%.[24]	(+) Mothers trust and feel supported by health providers. (-) Some providers lack practical knowledge and confidence in administering Hep B birth doses. (+/-) Some HEWs receive additional training to deliver an expanded range of services, including administering injectable antibiotics, while others lack the competency to administer injectables, indicating a need for further training. (+/-) Product presentation can contribute to whether HEWs understand how to administer the Hep B birth dose.	"I don't know the dose, timing, or administration site." —Health Provider, Haruka (HP-E-04) "Training midwives to vaccinate at birth is important [and creates] a big difference in our facility." —Health Provider, Loka Abaya (HP-E-05) "Those who lack training [VHLs, WDGs] should not be expected to take on this responsibility [vaccination]. Instead, their role is to raise awareness, mobilize the community, and encourage people to visit vaccination sites. Vaccination is not part of their duties." —National stakeholder (NS-E-08) "If the vaccine is administered orally, we could train CHWs to provide it. Additionally, methods like micro-patch, self-injection may be introduced. It is uncertain what new developments may arise in the future." —National stakeholder (NS-E-02)
Cultural and religious beliefs that shape care-seeking behavior.	(-) The cultural practice of isolation for 40 days postpartum limits the practice of mothers bringing newborns to the facility for vaccination.[33,34]	(-) Isolation periods after delivery typically last for 40 days. (-) Religious beliefs include that God will protect children from diseases. (-) Fear of the "evil eye" restricts non-family members from seeing the newborn.	"Cultural beliefs can hinder vaccination efforts. For example, many women are expected to remain at home for 40 to 80 days after giving birth, preventing them from taking their newborns to health facilities for vaccination. Additionally, some communities resist vaccination due to religious beliefs." —National Stakeholder (NS-E-08) "Culture prevents newborn vaccination due to fear of 'evil eyes' by elders, to not expose the mother and newborn." —Father, Loka Abaya (DAD-E-18) "Mothers who deliver at home are often restricted from going out during the first weeks due to fears that the 'evil eye' could harm both mother and newborn." —Health Provider, Haruka (HP-E-01) "Mothers and newborns traditionally do not leave the house for 40 days." —District Health Manager, Chifra (DHM-E-03)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Family and gender dynamics in health decisions.	(-) Negative experiences during care and discomfort with male providers make women underutilize health services.[35,36]	(+/-) While women have influence with their family structures on health decisions, fathers and elders have relatively more influence over decisions such as the location of birth and timing of vaccination. (-) A preference to avoid male midwives is a barrier to seeking facility-based care.	"Fathers are responsible for deciding the place of birth; not only the place of birth, but fathers can also decide to start ANC visit[s], to give birth at [a] health facility, and immunization for [a] newborn after birth." —Father, Loka Abaya (DAD-E-22) "Husbands' involvement in child vaccination is very low. The burden is placed entirely on mothers." —Community Leader, Haruka (CL-E-17) "It is not allowed to take the child to a health facility unless an elder of the household allows it." —Community Leader, Loka Abaya (CL-E-13) "Most Afar mothers [dislike being] attended by [a] male midwife, and they were disappointed. It's one of the main reasons to deliver at home." —Mother, Haruka (MOM-E-22)
Information sources.	(-) Home births result in limited exposure to vaccine messaging and demand creation.[9] (+) HEWs are a main, trusted source of information; 64.9%–97.0% of caregivers get vaccine information from HEWs.[22,23] (+) Radio dramas on infant immunization increase awareness and allow an alternative education method for those who cannot attend ANC or mothers' groups.[37]	(+) VHLs and WDGs are positioned to bridge cultural gaps. (+) Community leaders and religious leaders have a strong influence over the community and their decisions to vaccinate.	"[VHLs/WDGs] serve as trusted community mediators to prevent misinformation and facilitate communication to break cultural barriers and beliefs in [MNCH]." —Mother, Haruka (MOM-E-22) "If one religious leader vaccinates his newborn baby within 24 hours, the community will accept the vaccine. Religious leaders and health workers' practices [have an] influence on the community." —Community Leader, Chifra (CL-E-05)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Acceptance of facility deliveries.	(-) Cultural practices (e.g., porridge, coffee ceremonies), often not available at the facility, deter caregivers from PNC.[34] (+) WDGs advocate for health facilities to provide porridge after birth, but it is not implemented everywhere.[20] (-) Privacy is a strong cultural value, but facilities are crowded, with small working spaces, reducing willingness to return.[38] (-) Women fear being alone during delivery, and small delivery suites prevent their support network from being with them.[33] (-) Fear of C-sections and poor facility care discourages timely facility births and vaccination.[33]	(+/-) Most of the community, including WDGs, men's development groups, and VHLs, promote facility deliveries, but communities do not always welcome their advice; community members may perceive them as being motivated by incentives rather than genuine concern for community well-being. (-) Trusted community sources promote facility delivery, but most families choose home delivery. (-) TBAs have a conflict of interest with promoting facility births.	"TBAs do not advocate visiting health facilities." —HEW, Haruka (HEW-E-13) "I have four children, and all of them [were] born at home. I suggest [that] mothers attend facility delivery. However, Afar women prefer home delivery. They attend all ANC follow-up but give birth at home." —Father, Chifra (DAD-E-07) "During community mobilization activities, some people claim we are working for our own benefit (per diem) rather than for the community." —WDG volunteer, Haruka
Intent, preparation, cost, and effort			
Tracking and notification of home births.	(-) Illiteracy, lack of materials, and training gaps pose challenges for WDG tracking and registration support.[39] (-) Strong supervision is required to provide guidance and support to volunteers to feel confident in messaging.[40] (-) WDG functionality is declining due to leader and member burnout, insufficient support, and security problems.[19] (-) Little/no mobile phone networks hinder WDGs from notifying HEWs of home births.[33] (+) Plans promoted by the government include mentorship, linking hospitals to health centers, strengthening day-of-birth care, and deploying new cadres of health workers.[41]	(-) The existing system of WDGs visiting homes to track pregnancies/births and notifying HEWs is not reliable or timely. Although it requires all family members to be registered in the folder or the eCHIS, the data is often incomplete or recorded only several days after birth. (-/+) The responsibility of home-delivery identification and notification is unclear, but it has strong support in the community. (-) There is an inadequate number of HEWs to coordinate birth tracking and notification.	"CHWs often do not know which pregnant women are due to give birth." —National Stakeholder (NS-E-08) "Timely administration of the birth-dose vaccine remains a challenge for children born at home, primarily due to delayed birth notifications often occurring more than 24 hours after delivery. As a result, many of these children only begin their immunization schedule at the six-week mark."—Health Provider, Loka Abaya (HP-E-05) "Without enough HEWs, it is difficult to track and identify home delivery to reach newborns." —District Health Manager, Chifra (DHM-E-03) "[Reporting home delivery] is the responsibility of everyone." —Community Leader, Chifra (CL-E-06)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Accessibility and transportation to health facilities.	(-) Ambulances are frequently diverted for nonemergency uses (e.g., transporting civil servants to meetings).[33] (-) Nighttime requests often face barriers with driver reluctance.[33] (-) Ambulances may not be able to access homes, requiring stretcher transportation to main roadways.[20,33] (-) Informal payments (e.g. fuel costs) are sometimes requested from families.[33] (-) Difficulties in transportation, topography, and distance to health facilities result in underutilization of ANC services.[35,36] (-) Inconvenient clinic hours and long distances/waiting times limit timely vaccination.[23,30,34,38,42] (+/-) There are maternity waiting homes to aid with facility-birth access in rural areas, but fees, infrastructure quality, and meal provision are challenges.[20,45–51]	(-) Long distances and challenging topography limit facility attendance for ANC, delivery, PNC, and vaccination. (-) Unavailability of ambulances results in reliance on bajaj (i.e., three-wheeled motorcycle taxi), which is costly. (-) Families noted challenges of wanting home births and not having safe options for mothers to get to health facilities.	"From [village name], it takes more than 90 minutes on foot to reach the nearest health facility." —Mother, Loka Abaya (MOM-E-18) "[Some mothers] delay vaccination due to lack of money for transport." —Mother, Haruka (MOM-E-19) "It is impossible to bring [a] home delivery mother to [a] health facility by foot." —Father, Chifra (DAD-E-05) "No transportation options [are] available. Transportation is challenging [for the] community to access health services, including vaccination. Fuel cost and availability are also challenging. The available option is wasaka [traditional stretcher or carrier employed for the transportation of laboring or ill patients to a health facility]. Wasaka needs human resource[s]. It require[s] 24 person to reach [the] health facility about 15 kilometers from the home." —Father, Chifra (DAD-E-01)
Health facility infrastructure and limited human resources.	(-) Overburdened workloads and poor tracking systems lead to delays and missed home vaccinations.[9,43] (-) Lack of refrigerators at health posts increases transport time for HEWs.[9] (-) Lack of transportation reimbursement hinders HEWs from picking up vaccines and conducting home visits.[9,43] (-) Shortage of equipment and bed capacity reduces vaccination after birth.[34,38,44] (-) Limited infrastructure (e.g., fridges, electricity, running water), especially at health posts, prevents vaccine storage and access.[34] (-) There is a lack of MNCH guidelines, job aids, and posters to reference.[9,34,44]	(-) Cold chain unavailability in health posts requires reliance on cold packs. Health posts that lack refrigeration usually transport vaccines from nearby health centers using vaccine carriers, which often delays timely immunizations. (-) Poor infrastructure and lack of electricity at health centers limit the availability of vaccines and attendance.	"In many parts of the country, there are fewer than 50% [of] health posts equipped with refrigerators, and these are often requisitioned from health centers. This limitation has significant impact on vaccination efforts." —National Stakeholder (NS-E-02) "Lack of reliable electricity at health centers... makes [it] difficult [to produce] enough ice packs for outreach sessions." —District Health Manager, Chifra (DHM-E-03)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Experience of care at point of service			
Vaccine availability.	(-) Stockout of vaccines limits availability.[38] (-) Fear of vaccine wastage when few children are present can lead health workers to restrict multidose-vial use, which results in turning away unvaccinated children.[52] (-) To minimize multidose-vial wastage, some facilities offer immunizations on specific days of the week. Caregivers may not know which facilities have the vaccine available that day, increasing their time and costs, especially if they have to return on another day or travel to another facility.[38,52] (-) Vaccines are often unavailable in the off-hours (e.g., evenings or weekends).[9,34]	(-) Health posts do not have vaccines available. (-) Vaccines are unavailable outside working hours. (-) Fear of opening multidose vials due to wastage causes staff to intentionally delay vaccination.	"Vaccines [are] often unavailable at health posts." —Mother, Haruka (MOM-E-20) "A mother who delivers on a weekend or holiday misses the 24-hour window by default because services are unavailable." —Mother, Haruka (MOM-E-21) "We are often concerned about BCG vaccine wastage, knowing we'll vaccinate only if there are at least five newborns at [the] facility during that time." —Health Provider, Loka Abaya (HP-E-06) "If a birth happens at night or on a weekend when the EPI service is closed, the birth dose is missed." —District Health Manager, Chifra (DHM-E-03) "If the vaccine is available in ten-dose presentations, it is impractical to open a vial for just one child, necessitating a wait for additional newborns. This poses another obstacle. Since the pilot study was conducted using single doses, the arrival of ten-dose vials could lead to wastage as well as dropout similar to that seen with measles and BCG vaccines." —National Stakeholder (NS-E-02) "Using the HepB birth dose outside the cold chain would enable timely vaccination in remote areas, bridging access gaps."— Health Provider, Loka Abaya (HP-E-05)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Home vaccination feasibility and acceptance.	(+) A pilot program for Hep B introduction had HEWs transporting and administering vaccines at home for out-of-facility deliveries.[9] (+) HEWs and VHLs already practice home visits.[9]	(+) Caregivers highly prefer to have a health provider administer the vaccine at home after birth. (-) Overburdened health providers do not see a return for the high workload of vaccinating newborns in a home-to-home approach. (-) Outside the pilot, there is no structure for vaccinating newborns born at home before 45 days. (-) There are unclear expectations of where to go for newborn vaccines.	"Traveling for only one newborn [remains a challenge with the home-to-home vaccination strategy]." —Health Provider, Haruka (HP-E-01) "If possible, it is best [if] health workers visit home[s] to administer vaccine[s]." —Community Leader, Chifra (CL-E-04) "If a majority of women were to give birth at health facilities, it would be reasonable to expect that 100% or at least 90% of newborns would receive the Hep B birth-dose vaccination. However, the high rate of home births makes it challenging to access health facilities for vaccination immediately after delivery." —National Stakeholder (NS-E-02) "Honestly, there is no practice of vaccinating newborns within 24 hours for child vaccination except [at the] 45-day and above schedule. Didn't see any outreach following birth rather than monthly." —Father, Haruka (DAD-E-09) "HEWs and VHLs regularly conduct house-to-house visits and provide all integrated health services." —Father, Loka Abaya (DAD-E-21) "We encourage providing vaccine within 24 hours... [but] in home settings, administering BCG vaccine at birth is virtually impossible." —Health Provider, Chifra (HP-E-11) "No practice of addressing home-to-home immunization service." —Health Provider, Haruka (HP-E-04)
Competing priorities of caregivers.	(-) Household burdens of mothers make it difficult or impossible to participate in mothers' groups (education opportunities) or home visits.[40]	(-) A lot is happening after delivery, so families are not prioritizing newborn vaccination.	"The delivery process itself is challenging, and fathers often carry the burden of responsibilities. Due to this overwhelming situation on [the] father, he may not prioritize the newborn's care within the first day." —Father, Haruka (DAD-E-13) "Family members [prioritize the] mother's safety over newborn care, and neglect essential newborn care, including vaccines immediately after birth." —WDG volunteer, Haruka "Families are not concerned about birth dose [and] only focus on mothers after safe home delivery." —HEW, Haruka (HEW-E-09)

Theme	Barriers and facilitators (literature)	Barriers and facilitators (FGDs and key informant interviews)	Illustrative quotes
Negative experiences between providers and caregivers.	(-) Providers feel disrespected and unfairly held accountable for caregiver delays.[38] (-) Only 4.5% of caregivers receive the complete newborn care package.[53]	(-) Fear of negative perceptions from health providers delays facility care-seeking from mothers.	"Mothers are afraid that [health providers] would be angry with [them] for asking why [they] gave birth at home." —HEW, Haruka (HEW-E-10)
After service follow-up			
Tracking immunization and record systems.	(+) The eCHIS, with a mobile app and a web-based monitoring portal for easier entry and monitoring, has been implemented.[19,54] (-) Vaccination cards often get lost.[38,55] (-) No system is in place to follow the outcomes of children who are transferred out when vaccines are unavailable upon caregiver arrival.[52]	(+) HEWs maintain immunization records, track missed children, and report coverage data to all health centers. (+) In Loka Abaya, new tablets are available for HEWs to record and report immunizations; most MNCH services, including immunization, are digitized in the eCHIS. (-) In Haruka, home births are often unrecorded until days or a month later, preventing Hep B birth dose from being administered timely, if at all.	"Tracking of home births relies on routine home visits and support from various CHWs, such as WDGs and men's development groups. These activities occur weekly or monthly and are designed to ensure timely preparation for the 45-day immunization schedule and follow-up appointments."—DHM, Haruka (DHM-E-18)

Abbreviations: ANC, antenatal care; BCG, bacillus Calmette-Guérin; CHW, community health worker; eCHIS, electronic community health information system; EPI, Expanded Program on Immunization; FGD, focus group discussion; Hep B, hepatitis B; HEW, health extension worker; MNCH, maternal, newborn, and child health; PNC, postnatal care; TBA, traditional birth attendant; VHL, village health leader; WDG, Women's Development Group.

Operational feasibility considerations: Controlled temperature chain and product presentation

Interviews with a diverse group of respondents at the national and subnational levels explored perceptions of whether adjustments to vaccine handling and product formats could improve timely Hep B birth dose uptake. Respondents highlighted opportunities and challenges across three main areas: supply chain operations CTC, and product presentation.

Supply chain

There are three main vaccine delivery strategies for routine immunization services in Ethiopia: fixed, outreach, and mobile sites. Ethiopian Pharmaceutical Supply Service (EPSS), responsible for delivering vaccines to all areas, transports vaccines from national to regional to woreda to facility levels. Roughly 60% of facilities receive vaccines directly from EPSS hubs, whereas about 40% receive them indirectly via the woreda system, which is responsible for distributing the vaccines to facilities within its jurisdiction.

Service delivery models for the woreda system include: static or in facility; outreach through community sessions; mobile teams to cover pastoral/remote areas (e.g., Afar); and the supplementary approach of periodic intensification of routine immunization in low-coverage districts. Service delivery models are supported by the vaccine cold chain to maintain refrigerated storage and transport, including through using solar drive refrigerators and ice lined refrigerators, cold boxes, and vaccine carriers. Key challenges include inadequate cold chain infrastructure and unreliable transportation for reaching remote areas; limited availability of refrigerators, especially in maternity wards; dependence on HEWs; poor coordination between EPI and maternity units; and resource constraints.

In Ethiopia, the HEWs deliver about 80% of services to the communities, mostly using outreach, and frequency of outreach varies (weekly to monthly). Hep B birth dose does not follow other vaccines' delivery schedule, as it must be delivered within 24 hours of birth, which cannot be predefined. Therefore, planning must be done to ensure availability and supply of the vaccine at all levels of

delivery, including PNC and other vaccination sites where it is routinely administered. Within facilities, Hep B birth dose is given in the delivery ward, while other vaccines are administered in the EPI room. If these two units are not well coordinated, or if communication regarding the vaccine transfer from the EPI room to the delivery ward is poor, it could pose a risk of vaccine shortage, particularly outside of working hours. Sites that do not have vaccine refrigerators collect the vaccines scheduled for the session using a passive vaccine carrier from health centers or districts with a functional cold chain to manage maintaining cold chain environment (2-8 degrees Celsius).

CTC

Most respondents (95%, n = 22) believe that it would be beneficial if the Hep B birth-dose vaccine were qualified for CTC, particularly for reaching newborns delivered outside of facility settings (although this strategy is not currently being deployed for the Hep B birth dose). They emphasized that CTC could improve timely administration within 24 hours. Respondents noted that adoption would require policy reform, staff training, and integration of CTC into procurement and monitoring systems. Most respondents (61%, n = 23) also indicated that to achieve the maximum benefit of CTC, the vaccine should remain stable for 6 to 14 days. This would enable flexible outreach scheduling, improved coverage in remote areas, reduced wastage, reduced cold-chain dependency, and better integration with PNC.

Although there is no evidence to suggest that a WHO prequalification for CTC would increase the price of a Hep B birth-dose vaccine, respondents were asked whether they would be willing to pay more for a CTC-qualified product. All national respondents (n = 3) indicated willingness to pay slightly more per dose if CTC-qualified products were available.

Product presentation

Most respondents (67%, n = 21) felt it would be feasible to manage both one-dose and ten-dose vials (multiple presentations) for out-of-facility births, noting the value of having different options for different settings to help reduce wastage.

When asked about product preferences, most respondents favored one-dose presentations for out-of-facility administration, linking them to maximizing operational efficiency, reducing wastage, better acceptance, and reducing missed opportunities due to low client volume. Prefilled syringes (PFS) are considered user-friendly and reduce dosing errors, especially for outreach, but are less favored due to cost, fragility, and bulkiness. Ten-dose vials remain cost-effective for high-delivery sites but risk wastage in low-birth settings. Microarray patches (MAPs) are viewed as a future option for out-of-facility use due to ease of administration and reduced injection fear, though acceptance and affordability remain concerns.

When ranking product options, including products not yet commercially available (e.g., MAPs), 90% (19 of 21) selected a single dose presentation as their first preference, but the product breakdown varied by setting. A relatively higher proportion of respondents preferred the one-dose vial for in-facility (76%) compared to out of facility (52%) settings, citing cost as a factor. Conversely, a relatively higher proportion of respondents preferred PFS (19%) or MAPs (19%) for out of facility compared to in-facility settings (9.5% PFS; 4.5% MAPs), citing reduced dosing errors (PFS) and a non-injectable presentation (MAPs).

Co-creation workshops: Developing strategies to overcome barriers and increase the uptake of Hep B birth-dose vaccine

Crafting solutions: Ideation

Caregivers embarking on the journey to ensure their child receives the Hep B birth-dose vaccine often encounter obstacles along the way to health and immunization. Initially, challenges stem from a lack of awareness and the influence of traditional beliefs, which can prevent them from even seeking health services. Furthermore, even when a caregiver has a strong intent to vaccinate, this intent is frequently undermined by family and system-level barriers. To address the barriers to accessing and administering birth-dose vaccines, particularly the Hep B birth-dose vaccine, the three co-creation workshops began with a presentation of key themes and insights identified through the FGDs and key informant interviews. Participants reviewed and validated this list of barriers (Table 3) and confirmed that they reflected community realities.

Participants then took part in a structured brainstorming session to generate potential solutions, which resulted in more than 90 solutions across the three woredas and were grouped into five thematic areas:

1. Creating awareness and addressing cultural barriers.
2. Tracking pregnancies and home births.
3. Improving the delivery of the birth-dose vaccine for facility births.
4. Improving the delivery of the birth-dose vaccine for out-of-facility births.
5. Strengthening supportive functions to facilitate in-facility and out-of-facility Hep B birth-dose delivery.

Subsequently, participants used a prioritization matrix to identify the most feasible and impactful ideas for further development. A total of 16 prototype concepts were developed across the three woredas: five from Loka Abaya, five from Haruka, and six from Chifra. While some prototypes were unique to specific woredas, others

shared similarities across regions. Consequently, the total number of prototype concepts was reduced from 16 to 9 by excluding overlapping concepts. The prototypes address many of the hurdles throughout the caregiver's journey, starting with steps like improving awareness and increasing demand for the vaccine, and culminating in interventions focused on addressing and overcoming system-level barriers to ensure timely immunization.

During the validation phase, the MOH's EPI task force recommended two key adjustments. First, an additional prototype concept was included specifically to evaluate the effectiveness of the existing policy, which mandates the administration of the Hep B birth-dose vaccine at a facility setting, irrespective of the place of delivery. Second, the task force recommended some modifications to the features of the existing nine concepts. These modifications involved three changes: the exclusion of religious institutions as designated sites for vaccine administration, the requirement to integrate promotion of facility-based delivery across all activities, and strengthening linkages between EPI and delivery-ward teams. These adjustments resulted in a final set of ten prototype concepts, reflecting community-driven priorities that may require additional contextual adaptation for effective implementation across regions, as well as adaptations to ensure feasibility (see details of each in Appendix B). Table 4 outlines the similarities and differences of prototype concepts between the two regions.

Implementation strategies

Across the three co-creation workshops, three implementation strategies emerged as priorities, considering both facility and out-of-facility contexts. For home-birth settings, these include (1) administering the vaccine at home, integrated with other essential newborn services; and (2) facilitating the immediate transfer of the newborn and caregiver to a health facility for timely vaccination shortly after birth. Administering the vaccine at home was identified as the preferred approach by co-creation workshop participants, who expressed comparatively little enthusiasm for the alternative of bringing newborns to a facility setting for vaccination.

Implementation strategy 1: Vaccine administration at home

The HEP was established to provide community-based services aimed at empowering communities to manage their own health, with home-based services forming the backbone of its strategy. While literature notes implementation challenges,[56] home-based care is a core duty of HEWs. However, home-based vaccination is currently not listed among the vaccine delivery modalities in the national EPI service delivery strategy. Given the high rate of home deliveries across Ethiopia, community stakeholders, including caregivers, proposed three primary strategies to promote home-based birth-dose vaccine administration:

- **Establish community-level multi-stakeholder platforms for birth tracking:** For the home-based delivery of birth-dose vaccines to be successful, it must be supported by complementary strategies, including active tracking of pregnancies and births. This requires robust collaboration among a wide range of formal and informal community structures. In agrarian regions, where the community health structure is relatively functional, leveraging the existing structure can facilitate birth tracking, raise awareness by demystifying community beliefs, and generate demand. Conversely, in pastoralist regions, the traditional community structure—including clan leaders, religious leaders, and TBAs—is likely to be more productive.
- **Integrate Hep B birth-dose vaccination** with other essential home-based service packages, particularly immediate postpartum health checks for both the mother and the newborn.
- **Increase transportation access:** Increase access to and use of motorbikes, particularly in remote areas, to mitigate barriers posed by distance and reduce HEW fatigue associated with traveling long distances without reliable transport.

Crosscutting strategies: While focusing on birth tracking and home-based vaccine administration, several essential crosscutting strategies are required to facilitate both processes. These include debunking traditional beliefs, enhancing the knowledge and skills of vaccinators and volunteer CHWs (VHLs and WDGs), and securing male involvement. These strategies must be embedded across all implementation stages (indicated in blue text in the bubble at bottom of Figure 3).

Supporting strategies: Key supporting strategies (indicated in maroon text at the top of Figure 3) reinforce the primary strategies. These components include: the use of technology for enhanced birth tracking and notification; the deployment of referral slips as an alternative notification system in technologically limited settings; the provision of incentives and rewards, particularly targeting volunteer CHWs; the maintenance of an uninterrupted last-mile vaccine supply chain (including availing vaccine cold boxes and conditioned ice packs); and the strengthening of inter-facility linkage between health centers and health posts, which is essential to ensuring vaccine supplies and for improving monitoring throughout the implementation process. Figure 3 illustrates the home-based vaccine delivery prototype.

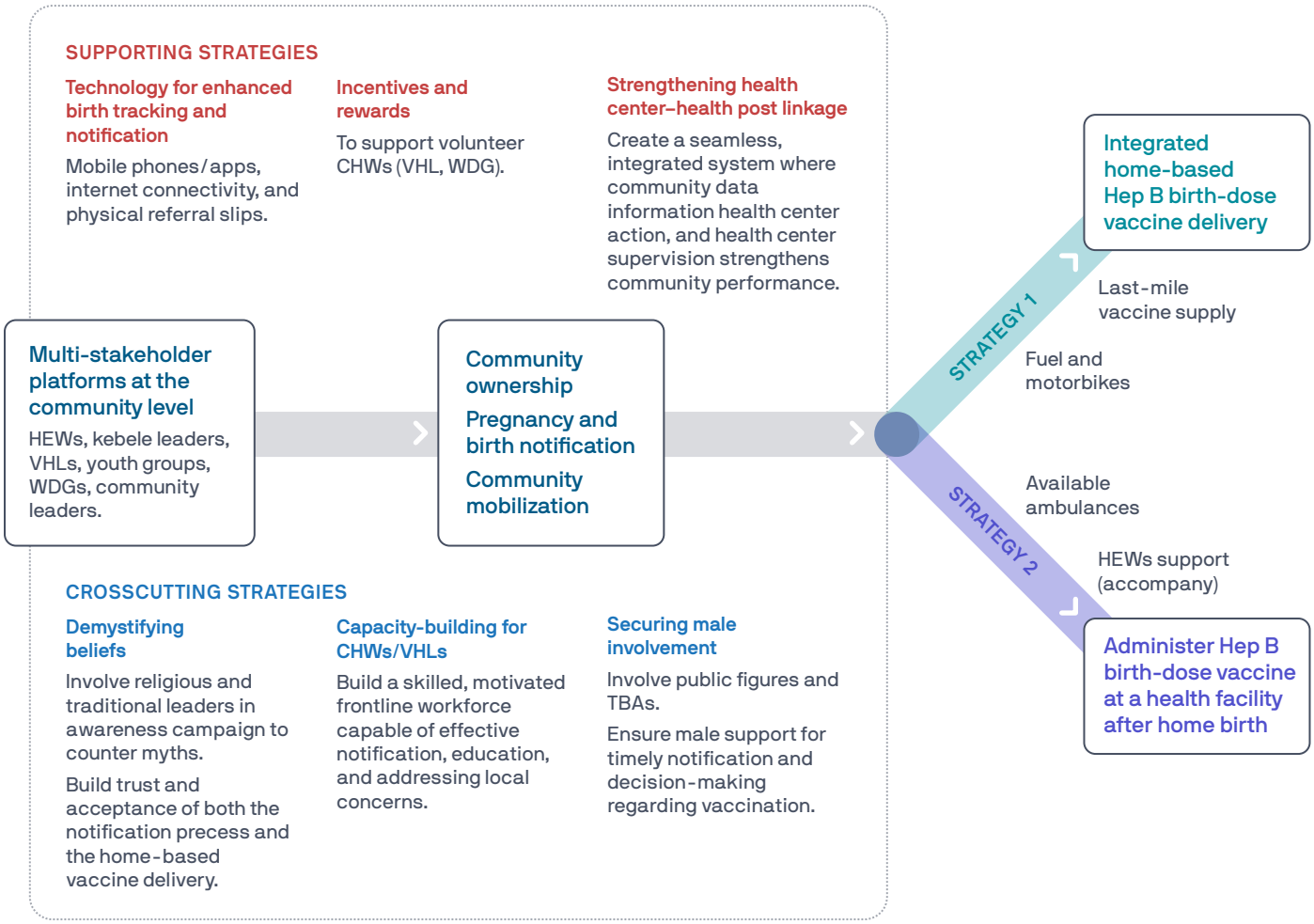
TABLE 4. **Prototype concepts, by thematic area.**

Prototype concepts applicable across regions	Prototype concepts unique to Sidama region	Prototype concepts unique to Afar region	Prototype refinement from EPI task force feedback
Theme 1. Creating awareness and addressing cultural barriers.			
Increase collaboration among community-level stakeholders.	Leverage the pregnant women's conference* by actively engaging spouses during the event. Build confidence to increase trust in HEWs.	Leverage traditional community structures such as religious figures and clan leaders to create demand and demystify myths	No additional task force feedback.
Theme 2. Tracking pregnancies and home births.			
Establish a systematic birth identification and notification mechanism. Strengthen health center–health post linkage.	No unique prototype concepts.	Leverage TBAs, who are trusted by the Afar community (particularly men), to support birth notification.	No additional task force feedback.
Theme 3. Improving the delivery of the birth-dose vaccine in home settings.			
Conduct home-based vaccination immediately after birth. Strengthen health center–health post linkage.	Administer birth-dose vaccines using tents and religious institutions in out-of-facility settings. Develop innovations to change vaccine presentations to facilitate administration by less-trained vaccinators in outreach settings	Leverage TBAs, who are still trusted by the Afar community (particularly men) to support vaccine administration. Build confidence and trust in HEWs	Deliver birth-dose vaccine at a facility setting after home delivery to test alternative delivery models. Avoid using religious institutions as vaccine delivery sites, as this may raise concerns among different religious groups.
Theme 4. Improving the delivery of the birth-dose vaccine in facility settings.			
Improve the quality of facility-based services to increase birth-dose vaccine uptake.	Strengthen health center–health post linkage.	Deploy female midwives for facility deliveries to align with community preference for female providers.	Strengthen linkage between EPI and delivery-ward teams. Continue engaging community figures to promote facility delivery.
Theme 5. Strengthening supportive functions to facilitate birth-dose delivery in home and out-of-facility settings.			
Improve monitoring, performance review, and accountability. Build the capacity of health workers, HEWs, and volunteers. Provide incentives for volunteer CHWs.	No unique prototype concepts.	No unique prototype concepts.	No additional task force feedback.

Abbreviations: CHW, community health worker; EPI, Expanded Program on Immunization; HEW, health extension worker; TBA, traditional birth attendant.

*This is a forum where pregnant women meet, usually monthly, to discuss their pregnancy, develop their birth plans, promote peer support, strengthen demand for ANC, and promote support for women development groups in pregnant women identification and notification.

FIGURE 3. **Implementation strategies 1 and 2 for Hep B birth-dose vaccination within 24 hours of home birth.**



Abbreviations: CHW, community health worker; Hep B, hepatitis B; HEW, health extension worker; TBA, traditional birth attendant; VHL, village health leader; WDG, Women's Development Group.

Implementation strategy 2: Vaccine administration at health facility after home birth

The alternative strategy for administering the Hep B birth dose within 24 hours of home delivery involves bringing the newborn and caregiver to a health facility immediately after birth. Although this approach places a clear cost burden on caregivers, it is recognized in MOH documents as a viable strategy to reach newborns delivered at home.[16] The national implementation guide for 24 hours postnatal care and stay also emphasizes this approach to ensure the full package of essential newborn services is provided promptly after birth. While community actors did not identify this as the preferred option, it warrants further testing to compare its feasibility and cost-effectiveness with the home-based vaccination strategy.

Two primary strategies were identified to support facility-based birth-dose administration following home births:

- **Ensuring ambulance availability** to transport both the newborn and caregiver to the nearest health facility as soon as possible after delivery.
- **Supporting HEW facilitation and follow-up:** HEWs play a more active role in notifying facilities of home deliveries and coordinating transport for newborns and their families to a health facility to ensure timely vaccination and PNC upon arrival.

In transitioning between the models, the strategies employed for birth tracking and cultivating community demand and ownership in the first model should be retained for the second. Similarly, actions aimed at debunking traditional beliefs, enhancing the skills and

knowledge of vaccinators and volunteers, and securing male involvement must be maintained, even though the setting for service delivery has changed. Figure 3 illustrates this strategy.

Considerations for adapting strategies for pastoralist versus agrarian contexts

Adapting the two implementation models requires acknowledging the unique social and structural contexts of each region. While male involvement is a recognized priority in both Sidama and Afar, it demands greater strategic emphasis in Afar, given the cultural context of pastoralist areas. Regarding workforce capacity, while training for health workers and volunteers is universally important, respondents in Afar particularly stressed the necessity of training and deploying female midwives, a priority less pronounced in Sidama. Furthermore, both regions share a common cultural belief that mandates postpartum women and newborns remain at home for the first 40 days after birth. To address this barrier, the adaptation strategy must differ: pastoralist regions (like Afar) should prioritize strengthening the traditional community platform and male engagement, whereas agrarian regions (like Sidama) should focus on leveraging the existing formal community structure, though the inclusion of religious figures remains vital in both.

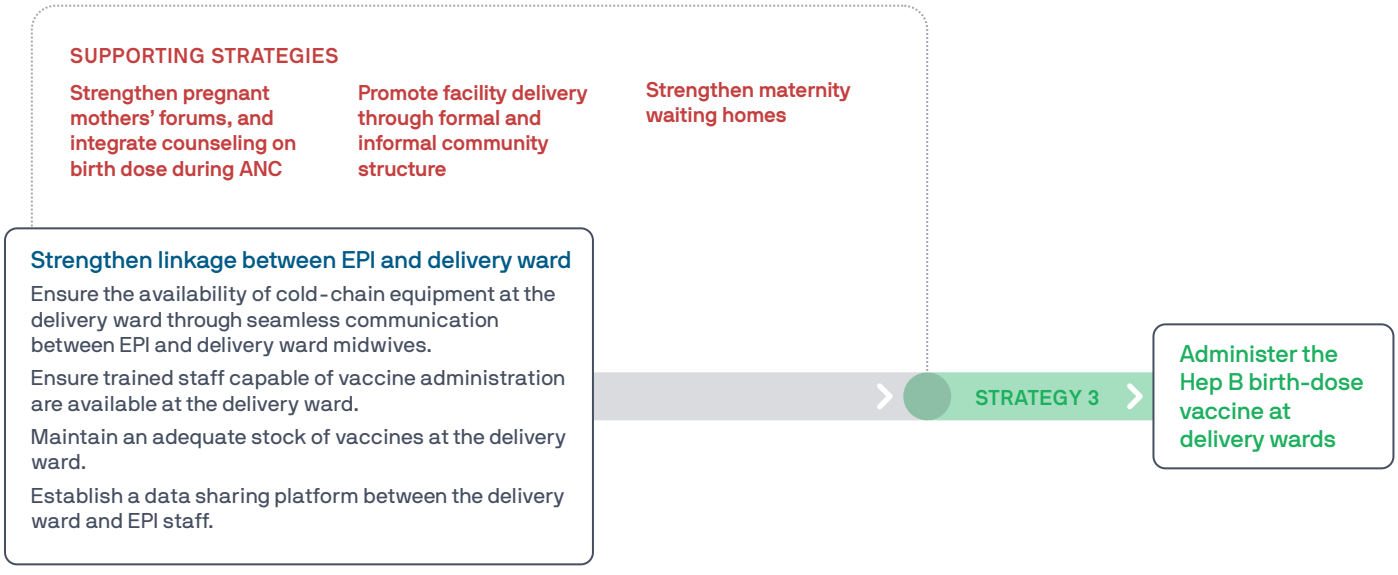
Implementation strategy 3: Facility births

For facility births, the proposed strategy is to administer the Hep B birth-dose vaccine in the delivery ward immediately after birth. However, the limited availability of vaccines in delivery wards and gaps in the knowledge and skills of midwives have been identified as major challenges to successful implementation. Although Hep B birth dose is not the first vaccine intended to be given at birth—BCG vaccine and OPV0 have long been part of this schedule—our qualitative findings revealed that these vaccines are often not administered immediately after birth. Key reasons include fear of vaccine wastage, largely due to limited understanding of the open vial policy among midwives, and the absence of a system to ensure consistent vaccine supply at delivery wards. As a result, vaccination services are not available 24/7 in most health facilities, leading to frequent missed opportunities.

To address these challenges, participants proposed several key strategies to strengthen facility-based Hep B birth-dose delivery:

1. Ensure the delivery ward's access to vaccine stocks through resupply, using vaccine carriers or dedicated refrigerators where available.
2. Expand immunization training for midwives working in delivery wards. With appropriate training, midwives can administer vaccines safely and document data accurately that can be shared with the EPI team.
3. Establish a data sharing platform between the delivery ward and EPI staff to support effective monitoring and follow-up, and timely information sharing.

FIGURE 4. **Implementation strategy 3 for predischarge Hep B birth dose after institutional birth.**



Abbreviations: ANC, antenatal care; EPI, Expanded Program on Immunization; Hep B, hepatitis B.

Supporting strategies: The top of Figure 4 illustrates supportive strategies that would help facilitate the timely administration of the Hep B birth dose within facility settings:

- Strengthen the pregnant mother's forum to raise awareness about the importance of delivering in health facilities and receiving newborn vaccinations immediately after birth.
- Integrate counseling during ANC to reinforce the importance of timely newborn vaccination.
- Reinforce the importance of facility delivery to ensure immediate access to newborn health services.
- Increase access to maternity waiting homes that encourage women living far away to deliver in facilities, which could ensure a healthy delivery and timely vaccination for the newborn.

Promoting facility delivery necessitates acknowledging the contextual disparities between agrarian and pastoralist regions. In Afar, participants stressed that creating demand requires robust engagement with traditional community leaders. Conversely, the focus in Sidama was primarily on enhancing the quality of care in health facilities, particularly the provision of compassionate and respectful care, alongside the reinforcement of the community health program.

Policy and program implications and the way forward

The comprehensive synthesis derived from the scoping review, primary qualitative data collection, and co-creation workshops provides an evidence-based foundation for three distinct implementation strategies designed to optimize the timely administration of the Hep B birth-dose vaccine. These prototypes—two targeting out-of-facility births and one designed for facility births—have been shaped by diverse participant input and validated by the national EPI task force on critical dimensions of feasibility, including implementation cost, policy alignment, and equity. The findings mandate a two-pronged approach for effective Hep B birth-dose delivery, grounded in a commitment to iterative refinement and strategic policy alignment.

Implementation science research and iterative scale-up

The immediate policy implication is the recommendation for an intensive, evidence-based testing phase using an implementation science framework. Given the rich, co-created nature of the implementation strategies, successful national scale-up hinges on evaluating their effectiveness under real-world conditions. The priority should be research to assess key implementation outcomes: feasibility within culturally diverse communities, acceptability by both caregivers and health providers, fidelity of execution, appropriateness across varying contexts, effectiveness and cost-effectiveness, and the long-term cost implications for sustainability. This research should not merely be evaluative but iterative, allowing for continuous program refinement and due diligence before a full, nationally scaled deployment is authorized.

Dual strategy for vertical elimination

The government's continued efforts toward achieving universal institutional delivery must remain the paramount policy objective. However, the persistence of home births necessitates a pragmatic, time-bound programmatic strategy. Policy authorization and funding support are recommended for the immediate implementation of the two prototypes designed for out-of-facility deliveries as a high-priority, interim measure to urgently eliminate the vertical transmission of Hep B. This dual strategy (promoting facility births while actively reaching home births) is essential to meet immediate public health goals. Furthermore, the long-term policy framework must incorporate a built-in sunset clause, dictating that the complex strategies for out-of-facility births will be systematically phased out as institutional delivery rates achieve universal coverage, allowing program focus and resources to transition entirely to the facility-based prototype. Until that universal goal is met, sustained implementation with continuous learning is critical.

Conclusion: Summary of opportunities for strategies to increase Hep B birth-dose coverage

As Ethiopia gears up to launch the Hep B birth dose nationally, discussions with stakeholders made it clear that many of the same challenges affecting other birth-dose vaccines—such as delays linked to service availability, weak referral systems, and limited awareness among caregivers—will need to be addressed to make timely Hep B birth-dose delivery feasible. For countries introducing the Hep B birth dose as well as those seeking to improve coverage rates, insights presented in this study offer practical guidance and perspectives from diverse health actors and community representatives on solutions to address key barriers. Taken together, these can help inform targeted Hep B birth-dose implementation strategies adapted to local contexts. Priority opportunities are summarized in Table 5, according to policy and systems level, provider knowledge and awareness, and

service delivery considerations.

At the policy and systems level, respondents pointed to relatively straightforward opportunities. Ensuring that birth doses are consistently offered at health facilities and building messages into ANC visits could help close gaps in awareness and encourage families to seek vaccination for their newborns as soon as possible.

District health managers spoke more about day-to-day realities and how new strategies might fill them. For instance, they saw potential in expanding outreach and strengthening the Makafta system (i.e., VHLs) to reach newborns who might otherwise miss vaccination if they do not come to a facility. They also highlighted that service hours and coordination between delivery wards and EPI units are a real bottleneck: If a baby is born at night or on the weekend, the birth dose is often missed. Solutions they proposed—such as adopting single-dose or CTC-approved vaccines, improving linkages between maternity and immunization staff, and providing transport for both families and health workers—directly tackle those gaps. Training TBAs and CHWs, strengthening male involvement, and using digital notifications to track home births were also seen as ways to bridge the divide between communities and the formal health system.

Frontline health providers reinforced many of these points but also focused on the tools and conditions that make service delivery possible. They stressed the importance of uninterrupted power and a reliable cold chain to avoid missed opportunities. They also noted that up-to-date job aids, registers, and monitoring charts would give health workers clearer guidance and improve follow-up. Beyond the health facility, they emphasized the value of working with community leaders to build awareness and trust, encouraging more families to deliver in facilities, and offering practical support such as transportation or small incentives. Regular outreach to remote areas was described as essential for reaching the children who are consistently left out of timely birth-dose services.

TABLE 5. **Summary of opportunities for strengthening existing strategies or developing new strategies to improve the timely administration of the Hep B birth dose.**

Level	Opportunities for strengthening existing strategies or developing new strategies
Policy and systems	• Ensure policy emphasis on facility-based delivery of Hep B birth dose. • Incorporate education on Hep B vaccination during ANC visits. • Strengthen Makafta (i.e., VHLs) and community structures to link mothers and newborns to services. • Update and disseminate national guidelines, tools, and job aids (e.g., monitoring charts, registers, and materials on social and behavioral change). • Create incentives to increase institutional deliveries.
Knowledge and awareness	• Educate mothers and families on Hep B birth dose during ANC and community outreach. • Train community leaders, TBAs, and CHWs to promote timely vaccination. • Strengthen male engagement in newborn health and immunization. • Expand community awareness campaigns on the benefits of facility deliveries and early vaccination.
Service delivery	• Improve coordination between delivery wards and EPI units, including weekends/nights. • Use single-dose and CTC-approved vaccines for facility and home births. • Provide transportation support for both caregivers and health workers. • Integrate vaccination with PNC services. • Improve cold chain capacity and ensure uninterrupted power supply. • Deploy additional staff to reduce workload and increase coverage. • Conduct regular outreach to remote areas. • Use digital tools for real-time birth notification and follow-up.

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Appendix A. Co-creation workshop participant summary by region, woreda, participant type, and gender

Region	Woreda	Participant type	Male	Female	Total
Sidama	Loka Abaya	District health manager and EPI focal	2	0	2
		Health worker	4	0	4
		HEW	0	8	8
		Caregiver	0	4	4
		VHL/WDG	1	3	4
		Community leader	4	0	4
		Father	4	0	4
Afar	Chifra	District health manager and EPI focal	1	1	2
		Health worker	4	0	4
		HEW	3	5	8
		Caregiver	0	4	4
		VHL/WDG	1	5	6
		Community leader	2	0	2
		Father	4	0	4
	Haruka	District health manager and EPI focal	2	0	2
		Health worker	2	2	4
		HEW	6	1	7
		Caregiver	0	4	4
		VHL/WDG	0	4	4
		Community leader	3	0	3
		Father	4	0	4
Total			**47**	**41**	**88**

Abbreviations: EPI, Expanded Program on Immunization; HEW, health extension worker; VHL, village health leader; WDG, Women's Development Group.

Appendix B. Ten prototype concepts identified through the co-creation workshops in Afar and Sidama

Concept 1: Engage community-level multi-stakeholder involvement and action in awareness creation, birth tracking, and notification.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="2">Administering the Hep B birth-dose vaccine within 24 hours is challenged by the absence of an effective system for timely tracking and notification of pregnant women and home births. Additionally, these women frequently miss early ANC.
So, how might we design a system for tracking and notifying pregnant women and home births to inform them of relevant health services and link them to health facilities to receive birth-dose vaccines?</td><td>• Community referral slips.
• Joint review and feedback.
• Home-birth identification and notification.
• Established accountability mechanisms.
• Role identification.
• Joint awareness creation and community engagement.
• Community dialogue with involvement of VHLs and other community groups.
• Debunked myths shared by public and religious figures.</td><td>• Kebele administrations buy-in.
• Knowledge transfer (from health workers to VHL).
• Religious and clan leaders buy-in.
• Health workers/HEWs to VHL/community leaders' linkage and referral.
• VHLs' increased capacity for identifying and reporting births within 24 hours.
• Increased interest in reporting births immediately after home birth.
• Increased knowledge of Hep B birth-dose vaccine among communities.</td></tr>
<tr><td>Potential barriers</td><td>Measurement plans</td></tr>
<tr><td></td><td>• Some community stakeholders may expect incentives.
• Competing priorities among community groups may affect the implementation of this strategy.
• Kebele leaders may not always be available because of competing priorities.
• HEW unavailability at some health posts may undermine collaboration.</td><td>• # of referral slips distributed.
• # of home births identified and notified per stakeholder.
• # of review meetings and joint appraisals conducted.
• # of community engagement sessions conducted.</td></tr>
<tr><td>Scoring</td><td>Description</td><td>Inspiration</td></tr>
<tr><td>Desirability: 95
Sustainability: 90
Viability: 90</td><td>This refers to the active involvement and collaboration of health workers, HEWs, VHLs, kebele leaders, and community leaders in awareness creation, birth tracking, birth notification, and integrated outreach vaccination.</td><td>Community dialogue and the involvement of public figures as stakeholders consistently yield positive results in reproductive and MNCH projects in all districts.</td></tr>
</table>

Concept 2: Debunk myths by leveraging community and religious figures.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="3">Data synthesized from key informant interviews and FGDs confirms the pervasive community beliefs of postpartum confinement, mandating a minimum 40-day period of seclusion for mothers and their infants. The adherence to this practice is fundamentally driven by a deeply ingrained fear of the “evil eye” and established community traditions. This resultant seclusion acts as a barrier, preventing mothers who deliver at home from accessing essential PNC follow-up, particularly birth-dose vaccines at designated health facilities, and restricting social contact. Given this constraint, how might we develop and implement culturally sensitive health strategies that effectively address this confinement barrier and guarantee timely access to birth-dose vaccines?</td><td>• Advocacy to convince community leaders that administering the vaccine on time is necessary.
• Education through public figures, such as Sheikhs in Mosques.
• Trusted community members to educate the public.
• Testimonials (e.g., a wife of a respected community figure goes out of the home immediately after birth and tells her community that both the mother and her baby are healthy).
• Community figure encouragement to be role models by vaccinating their children on time.
• Public figure testimonials during public meetings, such as religious ceremonies, and by using mass media.</td><td>• Religious and clan leaders’ buy-in.
• Increased knowledge of Hep B birth-dose vaccine among communities.
• Caregivers’ and community buy-in.</td></tr>
<tr><td>Potential barriers</td><td>Measurement plans</td></tr>
<tr><td>• Competing priorities among community leaders may affect the implementation of this strategy.
• Overcoming deeply ingrained community beliefs requires extensive work and time.</td><td>• # of advocacy workshops conducted.
• % of caregivers who perceive immediate post-delivery outdoor activity as safe.</td></tr>
<tr><td>Scoring</td><td>Description</td><td>Inspiration</td></tr>
<tr><td>Desirability: 80
Sustainability: 95
Viability: 85</td><td>This refers to engaging key community figures, such as clan and religious leaders, to demystify myths related to hiding after childbirth. Currently, many mothers and their babies are kept in seclusion for over 40 days due to a fear of the “evil eye,” which makes timely vaccine administration challenging. Therefore, it is vital to debunk this belief through trusted community leaders.</td><td>Use of public figures consistently yielded positive results during the COVID-19 pandemic, particularly during the deployment of the emergency vaccine.</td></tr>
</table>

Concept 3: Train midwives to administer vaccines, and train VHLs to raise awareness about immunizations and track births.

Design challenge	Features	Impact areas
The timely administration of birth-dose vaccines, such as the BCG vaccine and OPV0, is frequently suboptimal, a finding corroborated by qualitative data. This issue stems partially from a deficit in immunization knowledge and skills among midwives working in delivery wards. Furthermore, VHLs often lack the necessary expertise to effectively generate community awareness, conduct active home-birth tracking, and promptly notify vaccinators. So, how might we enhance the knowledge and skills of midwives and VHLs to improve community awareness, home-birth tracking, and the timely administration of the Hep B birth-dose vaccine?	• Training for health workers at delivery wards and VHLs. • The right training for the right person. • On-site training by trained health workers for other staff members. • Role and responsibilities revisions for the delivery team. • Promote task sharing among health facility staff. • Supportive supervision and feedback. • Revision of routine immunization training guides and manuals to ensure that the Hep B birth dose is addressed properly. • Online training tools that can be used by health workers regularly. • Experience-sharing meetings and review meetings to share experience among vaccinators and midwives. • Mentoring and coaching for midwives on counseling skills, interpersonal communication, and vaccine administration service. • VHLs trained on awareness creation, counseling caregivers, and tracking pregnancies and home births. • Text reminders and information for all term pregnancies.	• Knowledge and skills of delivery ward staff. • Knowledge of VHLs on Hep B birth-dose vaccine. • Uptake of Hep B birth dose both for facility and out-of-facility births.
	Potential barriers	**Measurement plans**
	• The cost of training the entire delivery ward staff and VHLs across the country is a financial obstacle.	• % of midwives at delivery wards who received training on the Hep B birth-dose vaccine. • % of VHLs who received training on the Hep B birth-dose vaccine. • % of midwives who said that they have confidence in administering the Hep B birth-dose vaccine.

Scoring	Description
Desirability: 95 Sustainability: 75 Viability: 70	This refers to providing targeted training for midwives and other delivery-ward staff. The focus will be on enhancing their counseling skills, improving interpersonal communication, and promoting integrated service delivery to improve care immediately postpartum. Crucially, the training scope must extend beyond facility staff to include VHLs to empower them to create awareness, increase caregiver knowledge, and accurately track pregnancies and home births. Furthermore, the training must adopt a holistic approach, integrating not only the Hep B birth-dose vaccine information but also content on other essential services and priority community needs. Communities are unlikely to be convinced to prioritize the vaccine unless the health care system demonstrates an ability to address their other pressing health concerns concurrently with the Hep B birth-dose program.

Concept 4: Use public figures and TBAs to directly secure male engagement.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="2">The paradox of male authority versus low male engagement in childhood vaccination is a critical issue. Wives, who are typically the primary caregivers, face two main barriers: requiring spousal permission to vaccinate the newborn and lacking the economic autonomy to pay for the transportation required to reach health facilities. So, how might we significantly strengthen men's involvement to empower both parents' involvement in vaccinating their newborns with birth-dose vaccines?</td><td>• Advocacy with religious leaders and respected community members to help convince men.
• Sensitization meetings and awareness-creation campaigns with TBAs and public figures.
• TBA mobilization to educate men, as TBAs are highly trusted and respected in Afar, especially among fathers.
• Community-level conversations with men's/fathers' groups.</td><td>• Religious and clan leaders' buy-in.
• TBAs' increased involvement in awareness creation.
• Increased men's demand for birth-dose vaccines.</td></tr>
<tr><td>Potential barriers</td><td>Measurement plans</td></tr>
<tr><td></td><td>• TBAs and community leaders may expect incentives.
• It may take a lot of time to reach all men and convince them through public figures.</td><td>• # of TBAs engaged.
• # of public figures engaged.
• # of men who accompanied their spouses during immunization.</td></tr>
<tr><td>Scoring</td><td>Description</td><td>Inspiration</td></tr>
<tr><td>Desirability: 70
Sustainability: 85
Viability: 85</td><td>This means that involving fathers, in addition to other caregivers, facilitates timely vaccination because fathers are key decision-makers whose instructions are widely respected in households. Since men often regard public figures and TBAs highly, communicating the importance of men's involvement through these groups will effectively convince and engage fathers in childhood vaccination efforts.
"Afar men highly trust TBAs. If they are away from their home during pregnancy, they usually ask TBAs to support their spouses, as they trust them." – VHL</td><td>Through this strategy, previous initiatives have demonstrated effectiveness in raising animal vaccination rates and decreasing the prevalence of female genital mutilation.</td></tr>
</table>

Concept 5: Conduct participatory monitoring, performance review, and accountability.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="2">The timely delivery of birth-dose vaccines is hindered by two service issues: The vaccine is sometimes not administered even when a health facility is accessed, and services are not consistently available 24/7. This inadequate service has led to a community perception that childhood vaccinations only begin at 45 days of age. Furthermore, HEWs often reside away from their deployment sites, limiting their ability to provide essential services when needed. So, how might we ensure birth-dose vaccination services are consistently available 24/7 and administered to every eligible newborn who accesses a health facility?</td><td>• Supportive supervision.
• Strong monitoring systems.
• Auditing services that regularly use community score cards.
• Review meetings, evaluations, and feedback.
• Job descriptions for HEWs and health workers.
• Performance evaluation.
• Kebele leader participation in the monitoring and immediate resolution of issues.
• Health committees to evaluate community feedback.</td><td>• Health posts provide services regularly, and providers are always available at service sites.
• Increase in birth-dose vaccine uptake.</td></tr>
<tr><td>Potential barriers</td><td>Measurement plans</td></tr>
<tr><td></td><td>• Some health posts lack appropriate living facilities for HEWs, resulting in HEWs being forced to reside far from their assigned kebeles.</td><td>• # of supervisions conducted.
• # of performance reviews conducted.
• Community score cards completed.
• % of HEWs and health workers who have job descriptions.</td></tr>
<tr><th>Scoring</th><th>Description</th><th>Inspiration</th></tr>
<tr><td>Desirability: 95
Sustainability: 90
Viability: 90</td><td>A robust system for monitoring, supervision, and evaluation is essential to ensure accountability and facilitate continuous learning, such as establishing clear monitoring procedures, defining the type of supervision to be conducted, and regularly evaluating the work accomplished with full participation of communities. By reviewing what has been done, we can identify areas for improvement, fine-tune our approaches, and enhance future implementation. Furthermore, this system ensures accountability for any activities or actions that are not completed as planned.</td><td>The use of community scorecards for quality improvement yielded positive results in previous projects in various districts.</td></tr>
</table>

Concept 6: Use motorbikes to deliver integrated outreach and home-based vaccine delivery.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="2">A major challenge is the lack of house-to-house/outreach vaccination services and inadequate modalities for reaching newborns from home births within the critical 24-hour window. Although house-to-house visits are part of the HEWs' role, the substantial distance of many households from health posts prevents these visits from occurring consistently. So, how might we innovate outreach and house-to-house vaccination strategies to effectively reach all home births within the critical 24-hour window for birth-dose vaccination?</td><td>• Motorbike provision for health post staff.
• Driver's license obtainment support.
• Fuel and other operational costs covered.</td><td>• HEWs/health workers: reduced travel times, and time saved for other activities.
• Communities in remote areas: increased access to birth-dose vaccines and other essential PNC services.</td></tr>
<tr><td>Potential barriers</td><td>Measurement plans</td></tr>
<tr><td></td><td>• The cost of motorbikes is a financial obstacle.
• There must be accountability mechanisms to prevent the misuse of motorcycles and fuel for unrelated activities.
• It requires continuous budgeting for fuel.</td><td>• # of health posts/health centers with motorbikes.
• # of health post/health center staff with a motorbike driver's license.
• # of health centers with allocated budget for fuel.
• # of remote villages reached using motorbikes.
• % of babies in remote villages who received vaccines within 24 hours of birth.</td></tr>
<tr><th>Scoring</th><th colspan="2">Description</th></tr>
<tr><td>Desirability: 95
Sustainability: 60
Viability: 50</td><td colspan="2">This refers to ensuring the availability and use of motorbikes by health post staff, enabling them to reach distant villages immediately upon birth notification and provide Hep B birth dose and other essential services at home.</td></tr>
</table>

Concept 7: Strengthen health center–health post linkage.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="2">While health posts are situated close to communities, their inability to provide 24/7 services poses a barrier to timely vaccination. Consequently, newborns may miss receiving the vaccine within the critical 24-hour window due to vaccine unavailability at the health posts. Furthermore, health posts often lack essential equipment, such as cold-chain equipment. The credibility of HEWs at health posts is sometimes compromised, as communities may perceive them as lacking adequate knowledge and skills. So, how might we improve the capacity of health posts and make vaccination services available 24/7?</td><td>• Adequate health center staff, as required to conduct mentoring and coaching for health posts.
• Transportation to conduct mentoring.
• Standardized checklist.
• Adequate vaccine availability.
• Availability of cold-chain equipment.
• EPI focal person at all health centers.
• Strong reporting and data use platform.</td><td>• Improved documentation both at health centers and health posts.
• Improved capacity of health posts in data use and reporting.
• Improved capacity of health centers in mentoring, coaching, and data use for decision-making.
• Improved availability of vaccines at health posts.
• Improved trust in HEWs among the community.</td></tr>
<tr><td>Potential barriers</td><td>Measurement plans</td></tr>
<tr><td>• There are budget and materials shortages, commitment problems, transportation challenges, and an absence of recognition.</td><td>• # of health centers with a focal person for health center–health post linkage.
• # of mentorships done by health centers in a month.
• # of health posts with cold-chain equipment.
• # of health posts with capacity to administer birth-dose vaccine after mentorship.
• % of health posts with adequate stocks of vaccines.</td></tr>
<tr><td>Scoring</td><td colspan="2">Description</td></tr>
<tr><td>Desirability: 95
Sustainability: 90
Viability: 75</td><td colspan="2">This strategy focuses on strengthening the health post–health center linkage and enhancing the health post capacity. The enhancement includes mentoring and coaching to boost human resource capacity, ensuring the availability of cold-chain equipment, and improving service provision. The goal is to improve the coverage of birth-dose vaccination within 24 hours of birth.</td></tr>
</table>

Concept 8: Provide incentives and rewards (e.g., mobile top-up for VHLs to support birth tracking).

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="3">Despite the availability of both paid and unpaid CHWs, service delivery is sometimes hampered by a lack of motivation among various actors. Reports from the WDGs and VHLs indicated that they face challenges, such as harsh environmental conditions, while conducting home-to-home visits. They noted that the absence of any compensation or rewards for their demanding work—particularly in high-temperature areas without access to drinking water—is significantly demotivating. So, how might we motivate all actors, including paid and unpaid personnel, to improve birth tracking, increase awareness, and enhance the uptake of the vaccine?</td><td>• Duty payment to health workers (which is on and off to date).
• Mobile top-up for VHLs.
• Certificate of recognition for high-performing VHLs.
• Transport allowances for HEWs during home-to-home visits in remote areas.</td><td>• VHL buy-in.
• Increased awareness and knowledge of birth-dose vaccines among the community.
• Improved timely birth notification rate.
• Increase birth-dose vaccine uptake rate.</td></tr>
<tr><th>Potential barriers</th><th>Measurement plans</th></tr>
<tr><td></td><td>• # of home births notified timely by VHLs.
• % of newborns who received the birth-dose vaccine timely after home births.</td></tr>
<tr><th>Scoring</th><th colspan="2">Description</th></tr>
<tr><td>Desirability: 95
Sustainability: 50
Viability: 60</td><td colspan="2">Offering incentives and rewards motivates health workers, HEWs, and VHLs to mobilize the community, actively track births at home, and administer vaccines within 24 hours of birth.</td></tr>
</table>

Concept 9: Strengthen the linkage between the EPI unit and the delivery ward.

<table>
<tr><th>Design challenge</th><th>Features</th><th>Impact areas</th></tr>
<tr><td rowspan="3">Previous experiences with other birth-dose vaccines have highlighted a weak operational linkage between EPI staff and delivery ward personnel. Poor interdepartmental communication means that delivery-ward staff rarely inform caregivers about the necessity of the birth-dose vaccine, leading to a widespread misconception that vaccination should only begin at 45 days postpartum. Compounding this issue is the inconsistent availability of vaccines at delivery units and the absence of strong data-sharing protocols between the delivery and EPI teams. So, how might we improve the provision of accurate vaccine information and ensure timely vaccine delivery at the delivery ward?</td><td>• Cold-chain equipment at the delivery ward.
• Trained staff capable of vaccine administration at the delivery ward.
• An adequate and maintained stock of vaccines at the delivery ward.
• Data sharing platform between the delivery ward and EPI staff.</td><td>• Increased delivery ward staff buy-in.
• Improved availability of birth-dose vaccines at the delivery ward.
• Increased rate of birth-dose vaccine uptake at the delivery ward.
• Improved data recording and reporting to the EPI unit.</td></tr>
<tr><th>Potential barriers</th><th>Measurement plans</th></tr>
<tr><td>• There are heavy workloads and inadequate staff at the delivery wards.
• There is inadequate cold chain equipment.</td><td>• # of facilities with cold chain equipment at the delivery ward.
• # of facilities with all delivery staff trained on birth-dose vaccine administration.
• % of facility-delivered newborns who received birth-dose vaccine within 24 hours after birth.
• % of facilities with delivery ward staff that report the number of newborns vaccinated to EPI staff regularly.</td></tr>
<tr><th>Scoring</th><th colspan="2">Description</th></tr>
<tr><td>Desirability: 95
Sustainability: 95
Viability: 95</td><td colspan="2">This refers to improving communication, vaccine and task sharing, and data sharing between the delivery ward and the EPI unit. A strong operational linkage will enable the EPI team to ensure an adequate stock of vaccines is continuously available at the delivery ward. Concurrently, midwives in the delivery ward will be responsible for administering the vaccine within 24 hours after birth, accurately registering the data, and promptly sharing it with EPI staff.</td></tr>
</table>

Concept 10: Bring newborns to health facilities post-home delivery for critical 24-hour vaccination.

Design challenge	Features	Impact areas
The administration of birth-dose vaccines faces a significant challenge due to the high rate of home births. Currently, there is no established policy to deliver vaccines via home-to-home services. So, how might we ensure the timely administration of birth-dose vaccines following a home birth?	• Awareness creation for families regarding birth-dose vaccines. • Orientation training for TBAs on birth-dose vaccine. • Father and other advocates during Friday prayers on birth-dose vaccine. • Ambulance readability in areas where ambulances are available, to ensure they are ready to transport the newborn, along with the caregiver, to health facilities.	• Increased knowledge and intention of caregivers and families on Hep B birth dose. • Increased knowledge of TBAs on birth-dose vaccines. • Increased number of TBAs accompany postpartum women for birth-dose vaccines. • Increased uptake of birth-dose vaccines on time after home birth.
	Potential barriers	**Measurement plans**
	• Access to transport in areas where ambulances are not available can be a challenge. • Transportation and opportunity costs present financial obstacles for families who travel with the newborn. • Cultural barriers prevail, as postpartum women are not allowed to be out of the home for days, sometimes months.	• % of newborns who receive vaccines at health facilities on time after home birth.
Scoring	**Description**	
Desirability: 50 Sustainability: 75 Viability: 60	This concept focuses on bringing newborns to health facilities within 24 hours of birth for birth-dose vaccination. It necessitates coordinated action among various community and health actors, specifically families, TBAs, HEWs, and community volunteers, who must collaborate to promptly notify health workers, arrange transportation for the newborn, and ensure that vaccination is administered. Successful execution of these activities requires clear communication and teamwork involving mothers, fathers, family members, TBAs, HEWs, health facility staff, and community leaders.	

Abbreviations for all tables in this section: ANC, antenatal care; BCG, bacillus Calmette-Guérin; CHW, community health worker; COVID-19, coronavirus disease 2019; EPI, Expanded Program on Immunization; FGD, focus group discussion; Hep B, hepatitis B; HEW, health extension worker; MNCH, maternal, newborn, and child health; OPV0, oral polio vaccine zero dose; PNC, postnatal care; TBA, traditional birth attendant; VHL, village health leader; WDG, Women's De

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