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Improving hepatitis B birth dose in rural Lao People's Democratic Republic through the use of mobile phones to facilitate communication

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ABSTRACT

Background: Hepatitis B vaccine birth dose (HepB-BD) was introduced in Lao People's Democratic Republic to prevent perinatal hepatitis B virus transmission in 2008; high coverage is challenging since only 38% of births occur in a health facility. Healthcare workers report being unaware of home births and thus unable to conduct timely postnatal care (PNC) home visits. A quasi-experimental pilot study was conducted wherein mobile phones and phone credits were provided to village health volunteers (VHV) and healthcare workers (HCWs) to assess whether this could improve HepB-BD administration, as well as birth notification and increase home visits.

Methods: From April to September 2014, VHVs and HCWs in four selected intervention districts were trained, supervised, received outreach per diem for conducting home visits, and received mobile phones and phone credits. In three comparison districts, VHVs and HCWs were trained, supervised, and received outreach per diem for conducting home visits. A post-study survey compared HepB-BD coverage among children born during the study and children born one year before. HCWs and VHVs were interviewed about the study.

Findings: Among intervention districts, 463 study children and 406 pre-study children were enrolled in the survey; in comparison districts, 347 study children and 309 pre-study children were enrolled. In both arms, there was a significant improvement in the proportion of children reportedly receiving a PNC home visit (intervention $p < 0.0001$, comparison $p = 0.04$). The median difference in village level HepB-BD coverage (study cohort minus pre-study cohort), was 57% (interquartile range [IQR] 32–88%, $p < 0.0001$) in intervention districts, compared with 20% (IQR 0–50%, $p < 0.0001$) in comparison districts. The improvement in the intervention districts was greater than in the comparison districts ($p = 0.0009$).

Conclusion: Our findings suggest that the provision of phones and phone credits might be one important factor for increasing coverage. However, reasons for improvement in both arms are multifactorial and discussed.

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1. Introduction

Globally, approximately 240 million people have chronic hepatitis B virus (HBV) infection; an estimated 600,000 die from its complications yearly [1,2]. Perinatal transmission plays a significant role in the development of chronic infection; infants infected during the first year of life have a 90% chance of developing chronic infection [3]. Hepatitis B vaccine birth dose (HepB-BD),

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recommended for all newborns within 24 h of birth, with at least 2 additional doses of hepatitis B vaccine, are 85–90% effective in preventing perinatal transmission [4,5]. It is challenging to achieve high HepB-BD coverage in many countries, since many newborns are born at home and lack access to timely vaccination.

An estimated 8% of the Lao People's Democratic Republic (Lao-PDR) population has chronic HBV infection [6]. Since 2008, Lao-PDR's national policy is to provide HepB-BD to all newborns within 7 days of birth, preferably providing it within 24 h of birth. In 2014, 50% of newborns received HepB-BD [7]. One challenge to achieving high coverage is that only 38% of births occur in a health facility; furthermore, 2011–2012 data show that only 38% of mothers and newborns received a health check at delivery or a postnatal care (PNC) check within 2 days of birth [8].

One way to improve HepB-BD coverage is to improve access to healthcare services, specifically PNC outreach services, whereby a mother and newborn receive life-saving interventions such as a medical examination; education on early and exclusive breastfeeding and clean cord care; Vitamin A, folate, and iron administration for the mother; and vaccination of the newborn, including HepB-BD. In Lao-PDR, one reason anecdotally reported by healthcare workers (HCWs) for suboptimal PNC outreach is lack of awareness of imminent deliveries or recent births. Some village health volunteers (VHVs) use their personal phones to notify HCWs of births. However, reporting of births is sporadic, dependent on VHVs' awareness of a birth, access to a functional phone, ability to afford making a call, and awareness about what events should be communicated to HCWs. Mobile phones have been used in multiple settings to improve access to care, but few evaluations have been done to assess their health impact [9–15]. Despite limited evidence, a policy paper recommends providing mobile phones to community health workers to improve access to care [16].

To understand if mobile phones could improve access to care, a pilot study was conducted in Lao-PDR, in which mobile phones and phone credits were provided to VHVs and HCWs in intervention districts during April-September 2014, to assess the impact on HepB-BD coverage; secondary impact on timely birth notification and PNC home visits was also evaluated.

2. Methods

2.1. Pilot study overview

The study design was a quasi-experimental design where the intervention was district-level non-random assignment, similar to a previous pilot where HepB-BD was stored outside the cold chain [17]. The design included a control group, and an evaluation of a cohort of children born before the study. Because of low reported HepB-BD coverage (reported administrative coverage in 2011: 2–15%), three districts (Ngoy, Nambark, and Phoukhoun) in Luang Prabang province and one district (Parklai) in neighboring Xayabuly province were selected to participate in the 6-month study. Three other districts (Phonxay, Chomphet, and Viengkham) in Luang Prabang and one district (Xienghone) in Xayabuly were chosen as comparison districts because of similar birth rates and reported HepB-BD coverage (reported administrative coverage in 2011: 2–13%). These districts are rural, located in the northern part of the country. In 2011, the intervention districts had 5083 births, while the comparison districts had 4236 births. Only health centers (HCs) with a functional cold chain (needed for vaccine storage) were enrolled. All intervention and comparison villages in the catchment area of the enrolled HCs were enrolled unless there was no VHV; in the intervention arm, villages were excluded if the VHV could not charge a phone or the village lacked network coverage.

The catchment area of the enrolled HCs consisted of 4–16 villages. Villages were classified as fixed, outreach, or mobile, depending on travel time and distance between the HC and village. Fixed villages had a HC within the village or one located a few kilometers away. Outreach villages were further from a HC, but HCWs could make a roundtrip visit in one day. Mobile villages were far from HCs, requiring HCWs to stay overnight during visits. [16]

2.1.1. Intervention districts

VHVs and HCWs received a one-day training on when VHVs should call HCWs (imminent delivery, mother/baby with danger signs, birth notification), what PNC services HCWs should provide, how HCWs should administer HepB-BD, and how to use the phones provided. One trained VHV from every enrolled village and every HC received a phone and US $6 of phone credit monthly to facilitate communication between the VHV and HC. To cover the cost of conducting outreach, standard government per diem (US $5) was provided to HCWs for each home birth they attended and PNC home visit conducted.

2.1.2. Comparison districts

VHVs and HCWs received identical training provided in the intervention districts except training on phones. These staff were not provided with mobile phones or credits, but they were given identical per diem for each home visit.

2.2. Household evaluation survey

From October to December 2014, an evaluation survey was conducted, using similar methods to a pilot to improve HepB-BD coverage among health facility births, where data on children born before the study (12–21 months of age, considered the baseline) and on children born during the intervention (0–9 months of age) were collected [17]. The survey was designed to evaluate the difference in the change in HepB-BD coverage between intervention and comparison districts. A sample size of 14 villages per arm had a 90% power to detect a difference of 10% in HepB-BD coverage between the intervention and comparison arms, with an estimated standard deviation of 0.10 and a significance level (alpha) of 0.05, using a two-sided Wilcoxon test assuming that the actual distribution was normal. This was inflated to 18 villages per access strata (fixed, outreach, mobile) to account for attrition due to poor access or lack of births.

In this stratified cluster survey, we defined three access strata because we expected access to affect improvement. Intervention HCs served 16 fixed, 52 outreach, and 71 mobile villages; comparison HCs served 13 fixed, 36 outreach, and 29 mobile villages. Three mobile intervention villages were $\geqslant$360 min away from their respective HCs and were excluded. In the first stage of sampling, 18 villages (or all villages if <18) were chosen per stratum by systematic random sampling. In each village, all children born between April 1, 2013-September 30, 2013 (pre-study cohort) and between April 1, 2014-September 30, 2014 (study cohort) were eligible. (Supplemental Fig. 1)

In each village, enumerators conducted a census of all age-eligible children born during the study and born one year prior to the study, including age-eligible deceased children. For each eligible child, consenting caregivers were administered a questionnaire, which collected demographic data, birth and PNC details, and documented vaccination history. After completing the interviews, teams reviewed vaccination registers at the villages' primary HCs to obtain vaccination data on all children identified, as well as age-eligible children who were missed. Children without any documented vaccination data were assumed unvaccinated.