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Impacts of community-led video education to increase vaccination coverage in Uttar Pradesh, India

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Summary

Childhood vaccination is one of the most effective and cost-effective public health interventions, yet millions of children are un- or under-vaccinated each year. In rural Uttar Pradesh, India, only 52 per cent of children received all necessary vaccines in 2012–2013 (Office of the Registrar General and Census Commissioner 2013). In this context, children and their caregivers face multiple barriers to vaccination, one of which is low awareness of and demand for vaccination. We hypothesized that a community-led intervention to increase caregivers' demand for vaccination could increase vaccination coverage in rural India.

To test this hypothesis, we adapted the Projecting Health intervention to target vaccination knowledge, attitudes and beliefs. The Projecting Health intervention is a multi-component intervention that: produces community-led, culturally appropriate, 'hyper-local' videos for targeted communication on health behavior change; strengthens implementation of monthly mothers' group meetings by community-based accredited social health activists (ASHAs) where the videos are shown; and encourages ASHA outreach and video screening to underserved and hard-to-reach (HTR) families. A local community-based organization implemented this intervention in two blocks (Airaya and Hathgaon) of Fatehpur District of Uttar Pradesh from February 2017 to January 2018, producing and showing 12 videos (6 focused on immunization) to communities.

To evaluate the Projecting Health intervention, we conducted a cluster-randomized, controlled trial. We pseudo-randomly selected 74 ASHA-village clusters within Airaya and Hathgaon blocks; ASHA-village clusters were excluded if the village(s) were contiguous to a village already included in the evaluation. Each cluster represents a single ASHA and the villages and hamlets they are responsible for serving. We pseudo-randomly assigned 37 clusters to receive the Projecting Health intervention and 37 clusters to act as controls. The aim of the evaluation was to measure the impact of the Projecting Health intervention on vaccination coverage, including the commonly used metric 'fully immunized child' (FIC), among children 6 to 17 months of age.

Intervention impact was assessed using a difference-in-difference estimator with cross-sectional household survey data collected at baseline (November 2016) and endline (September through October 2018). At baseline, we surveyed 1,229 mothers of children aged 6 to 17 months, 352 mothers-in-law and 353 husbands; at endline, we surveyed 1,257 mothers, 307 mothers-in-law and 293 husbands. The primary outcome of interest was the proportion of children 6 to 17 months of age who had received all age-appropriate vaccines in India's vaccine schedule. Secondary outcomes measured were timeliness of vaccination and retention through the vaccine series (dropout).

The intervention was implemented for 12 months, during which 1,558 video screening sessions were conducted by ASHAs, totaling 25,343 video views. Assignment of the intervention and control clusters was balanced at baseline with respect to mean village size, sociodemographic class and mean FIC coverage. However, other demographic characteristics remained unbalanced, with the intervention area having a higher proportion of mothers with low levels of education, families of Muslim religion, lower-income families, scheduled and general caste families, and families with female children. Two difference-in-difference estimates are presented: (a) unadjusted; and (b) adjusted for covariates that were unbalanced at baseline.

Among all 74 ASHA-village clusters included in the study, 52.9 per cent of children aged 6 to 17 months were fully immunized at baseline versus 64.3 per cent at endline. In the intervention clusters, there was a 3.3 percentage point increase in the probability that an infant was fully immunized compared with the control clusters, controlling for time-constant effects ($p = 0.561$). This change was statistically insignificant, meaning that it could have occurred by chance and not due to the intervention.

The household survey revealed only 52.0 per cent of mothers in the intervention areas had seen a Projecting Health video; estimating the effect of exposure among women in the intervention clusters revealed that having viewed a video was associated with a statistically insignificant 1.8 percentage point higher probability of having an infant who was fully immunized ($p = 0.805$). Given that the intervention reached only about half of the eligible population, there may be further benefits to be gained from expanding the reach of the intervention to those eligible pregnant and lactating women who were unreached.

Examining subgroups, among families in communities identified as HTR, the intervention resulted in a 22.9 percentage point increase in the probability that an infant was fully immunized compared with HTR children in control communities, which was statistically significant ($p = 0.040$), controlling for time. No other subgroup reported statistically significant effects of the intervention on FIC. The intervention also had a statistically significant intervention impact on children receiving all vaccine doses on time among families of low caste.

Through our prospective process evaluation, we found that the intervention was not able to achieve the intended magnitude of impact (a 15 percentage point increase in fully immunized children or FIC). This was due to key supply-side constraints that it was not designed to mitigate, including the quality and, to a lesser extent, availability of vaccinators and other factors it was not effective at modifying (for example, deeply held beliefs about side effects). Our process evaluation also uncovered additional drivers of vaccine coverage that were likely underestimated in our original theory of change, such as the importance of other family members in vaccine decision-making.

The process evaluation did indicate that the intervention improved ASHA outreach by providing more frequent supportive supervision and mandating screenings in HTR areas. The fact that HTR areas were the only subgroup differentially impacted by the intervention suggests the important role of outreach.

While the intervention did not produce the magnitude of effect hypothesized, the findings show a need for continued investment to increase child immunization rates. This evaluation points to the importance of high-quality clinical care to engender trust at community level, engagement of all household members in the vaccine decision-making process, and continued and expanded outreach to vulnerable communities.

Contents

List of figures and tables

Abbreviations

ANC	antenatal care
ANM	auxiliary nurse midwife
ASHA	accredited social health activist
BCG	Bacillus Calmette-Guérin
CAB	community advisory board
CSO	civil society organization
D-I-D	difference-in-difference
DPT	diphtheria-pertussis-tetanus
FGD	focus group discussion
FIC	fully immunized child(ren)
HTR	hard-to-reach
ICC	intracluster correlation coefficient
IMI	Intensified Mission Indradhanush
M&E	monitoring and evaluation
NYST	Nehru Yuva Sangathan-Tisi
OLS	ordinary least squares
OPV	oral polio vaccine
RGMVP	Rajiv Gandhi Mahila Vikas Parishad
SBCC	social and behavior change communication
TOC	theory of change
VHND	Village Health and Nutrition Day

1. Introduction

This final report describes the impact of the Projecting Health intervention on childhood vaccination rates in Uttar Pradesh, India, based on data collected at baseline and endline, and through a prospective process evaluation.

Vaccine-preventable illnesses account for 20 per cent of child mortality in India, and these deaths represent a large proportion of vaccine-preventable deaths globally (WHO 2014). In a UNICEF household survey, the main reasons provided by caregivers for non-vaccination were 'did not feel the need', 'not knowing about vaccines', and 'not knowing where to go for immunizations' (UNICEF 2009).

Uttar Pradesh accounts for a large share of India's vaccine-preventable illnesses and deaths (Megiddo et al. 2014). In 2012–2013, only 52 per cent of children in rural Uttar Pradesh were fully immunized (compared with the national average of 74%) and rates were lowest in migrant, tribal and Muslim populations. Seven per cent of children had not received any vaccine (Office of the Registrar General and Census Commissioner 2013).

In 2014, the Government of India's Ministry of Health and Family Welfare initiated Intensified Mission Indradhanush (IMI), an initiative to ensure full immunization of all children in India, which targets states and districts with the greatest need (Ministry of Health and Family Welfare, India 2015). Through a state-level task force, Uttar Pradesh is improving the implementation and monitoring of the routine immunization program. This effort includes new community-level programs working with government-supported frontline health workers (accredited social health activists [ASHAs]) and auxiliary nurse midwives (ANMs) to create up-to-date lists of newborns and mothers for targeting immunization messages.

In this context, routine vaccines are delivered by ANMs in communities during monthly Village Health and Nutrition Days (VHNDs) and the health system is increasingly governed by community structures (National Health Mission, n.d.). Each of these strategies and operational changes should affect treatment and control clusters equally. The aim of increasing vaccination coverage in rural Uttar Pradesh is consistent with global strategies to increase equitable uptake and coverage of vaccines (Gavi 2014; WHO 2013).

2. Intervention, theory of change and research hypotheses

2.1 Intervention description

Projecting Health is a multi-component intervention package consisting of:

- design and production of culturally appropriate, 'hyper-local' videos with tailored behavior change communication messaging to target root causes of suboptimal healthcare-seeking behaviors. These videos are co-created by a local community-based organization, Nehru Yuwa Sangthan-Tisi (NYST), ASHAs and village women
- video screening by ASHAs at mothers' group meetings, VHNDs, evening screenings for men and in-home screenings for mothers from hard-to-reach (HTR) or other vulnerable communities
- ASHA refresher training on mothers' group meeting logistics and facilitation skills.

Since 2012, PATH has worked closely with NYST to implement the Projecting Health intervention. A community advisory board (CAB) selected topics for the videos on maternal, newborn and child health, and board members with technical expertise provided key messages. In this iteration of the project, 6 videos of a total of 12 focused on immunization topics. Table 1 shows a list of the topics covered, as well as the months in which the videos were shown.

Table 1: Video topics and months shown

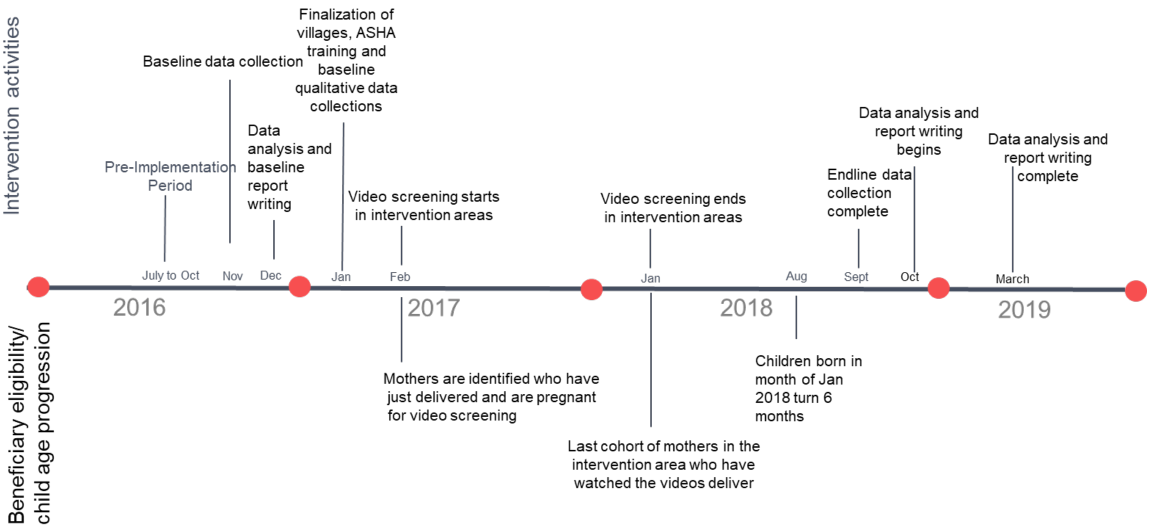
Month	Video topic
February 2017	Antenatal care for pregnant women
March 2017	Immunization video 1: Where do I get my child vaccinated?
April 2017	Institutional delivery and postnatal care
May 2017	Immunization video 2: Why get my child vaccinated? (Benefits of immunization)
June 2017	Exclusive breastfeeding
July 2017	Immunization video 3: When do I need to get my child vaccinated?
August 2017	Newborn care: Immediately after birth
September 2017	Immunization video 4: Is it safe to get my child vaccinated?
October 2017	Family planning
November 2017	Immunization video 5: What do pregnant women need to know about vaccination?
December 2017	Birth preparedness
January 2018	Immunization video 6: What to do if a vaccine is missed

Once the topics were chosen, community members from the intervention villages created the storylines and acted out the key messages; some efforts were made to directly involve known subpopulations, such as Muslim community members. A single video was produced for each topic in Table 1. Performances were recorded using handheld camcorders and video production occurred within a short time frame (approximately one month from storyboard to screening).

The videos were disseminated monthly by ASHAs in mothers' group meetings, at VHNDs and at ASHA home visits in HTR areas, using low-cost, portable projectors. The immunization videos (only) were also presented at quarterly men's evening screenings. Following all screenings, ASHAs facilitated discussion based on the videos, answered questions and reinforced key messages. For this implementation, a total of 1,554 video dissemination sessions were planned.

The entire project, including intervention and evaluation, was implemented from July 2016 to January 2018 in Airayan and Hathgaon blocks of Fatehpur District in Uttar Pradesh. Video production started in January 2017, with screenings conducted monthly between February 2017 and January 2018. Figure 1 shows the project timeline and beneficiary eligibility.

Figure 1: Project timeline and beneficiary eligibility



2.1.1 Study context

Fatehpur District was selected as it had not previously received an intervention of this nature, yet there was a reliable, consistent, well-networked community-based organization (NYST) working there. In addition, Fatehpur, positioned between three major cities in Uttar Pradesh, has remained underdeveloped and rural, with few donor-funded programs. According to the 2011 census, the district covers 4,152 square kilometers and has a population of 2.6 million (Fatehpur District 2020). Literacy is low, ranking 42nd within the state, and poverty is high, with 62 per cent of the population unemployed (Office of the Registrar General and Census Commissioner 2011). These demographic characteristics are associated with under-vaccination and increased dropout (WHO 2016). Migration is also high. Finally, the geographic spread and topography of Fatehpur make it a hard district for government programs, including immunization, to reach. From Fatehpur's 13 administrative blocks, we selected two neighboring blocks, Airaya (population 178,333) and Hathgaon (population 189,041), for the study (WikiVillage 2019a and 2019b). The blocks were selected based on an existing relationship and competency of the local civil society organization (CSO), as a strong implementing partner with local knowledge was required for the intervention. The selected blocks were reviewed for generalizability to Fatehpur more broadly, based on: (a) caste composition; (b) literacy; (c) occupation; (d) immunization sessions conducted; (e) rate of fully immunized children (FIC); and (f) rate of dropout (Bacillus Calmette-Guérin [BCG] to measles). These administrative blocks are approximately 30 kilometers from Fatehpur town; they comprise approximately 63 and 72 villages, respectively (Online appendix C). Neither of these blocks nor any neighboring village had ever received a Projecting Health intervention at the time of baseline data collection. In 2011, based on Indian census data, the average village size in this region was 2,000 people (Fatehpur District 2020).

As in other rural regions in Uttar Pradesh, routine immunization services are delivered at community level by ANMs as part of VHNDs. ANMs, who are based at health subcenter level, implement one VHND per village per month and are responsible for nutritional supplementation, basic care and family planning, in addition to immunization (Scott et al. 2014). ANMs receive limited initial training and virtually no refresher training; supportive supervision of ANMs is known to be weak, particularly for clinical matters. ANMs travel to VHNDs with basic supplies and cold chain officers drop off the vaccines themselves at a predetermined site. ANMs are meant to receive lists of which children are due for vaccines in this delivery.

ASHAs are female community members who work in the villages where they live on health promotion and mobilization activities. ASHAs may receive small performance-based payments for their work. ASHAs receive three to four weeks of training and, as of recently, receive additional supportive supervision through ASHA *sanginis* (supervisors) (Scott et al. 2014). During VHNDs, ASHAs work with the ANM to mobilize children who are due for vaccines and provide practical support to the ANM. While ASHAs are theoretically intended to implement mothers'/women's groups in their villages, this practice rarely occurs without support from an external partner and had not occurred in our evaluation area prior to this project.

Birth doses of vaccines are administered in facilities when a facility birth occurs; otherwise, the ANM should provide birth doses during a VHND. All other doses are available at VHNDs or at any health center.

2.1.2 Beneficiaries

The primary intended direct beneficiaries were pregnant and lactating mothers, who we aimed to reach at mothers' group meetings and at VHNDs. Additional screenings in HTR areas were planned to target pregnant and lactating mothers who live in hamlets that ASHAs do not frequently visit, or where mothers are far from vaccination sites. Household members of pregnant and lactating mothers were secondary beneficiaries.

Mothers-in-law were targeted through the mothers' group meetings and VHND screenings, while male household members (husbands, fathers-in-law) were targeted through men's evening screenings. Beneficiaries did not receive any incentive to participate, although refreshments were provided during mothers' group meetings. The main incentives for beneficiaries to participate were the opportunities to participate in mothers' group meetings and to watch videos created in their locality, in their own language and with local community actors.

2.1.3 Implementers

ASHAs were the primary implementers of the project, conducting all monthly screenings. As an incentive to participate in the intervention, ASHAs were paid 150 Indian rupees (US$2.14) for each screening conducted. ASHAs were also involved in the video creation and production process, as actors in the videos and as local contacts for identifying characters for videos. For their participation in all intervention activities, ASHAs were provided with training and recognition for their contributions to the project.

NYST oversaw implementation and ensured timely video production and screening. During start-up, NYST supervisors were involved in mentoring ASHAs and training ASHAs on operating pico (or pocket) projectors and facilitating discussions among mothers. During implementation, NYST conducted regular cluster meetings to monitor and follow up on video screenings, issues with the pico projector and any other field challenges. NYST also served as a liaison with district and block officials.

2.1.4 Training

In addition to the initial training on operating the pico projector and facilitating a mothers' group session, ASHAs received technical and logistical training to prepare them for conducting video screenings. At project launch, PATH provided initial technical trainings on immunization and general maternal and child health issues. During the intervention, PATH provided three refresher trainings on these topics. Additionally, throughout the intervention, ASHAs were provided with ongoing supervision and technical support by NYST staff on video screening, session facilitation and data collection.

To prepare NYST staff to support and monitor ASHAs during project implementation, PATH provided NYST with the same initial technical training on immunization and general maternal and child health issues. For logistical training, NYST staff were trained on operating the pico projector and facilitation skills, as well as on how to mentor, monitor and provide supportive supervision to ASHAs. NYST staff were also trained on data collection, data entry, data quality monitoring and documentation to support ongoing data capture of attendance and viewership. An external consultant provided additional training to the video production team on story writing, camera operating techniques and video editing.

2.1.5 Changes in the intervention

The project originally intended for ASHAs to load the videos on their mobile phones and share these videos with community members via mobile phone transfer. This would have allowed for greater informal dissemination and repetition of key messages when videos were re-watched at home. This, however, did not occur due to the lack of video-enabled phones and inconsistent mobile phone ownership among ASHAs.

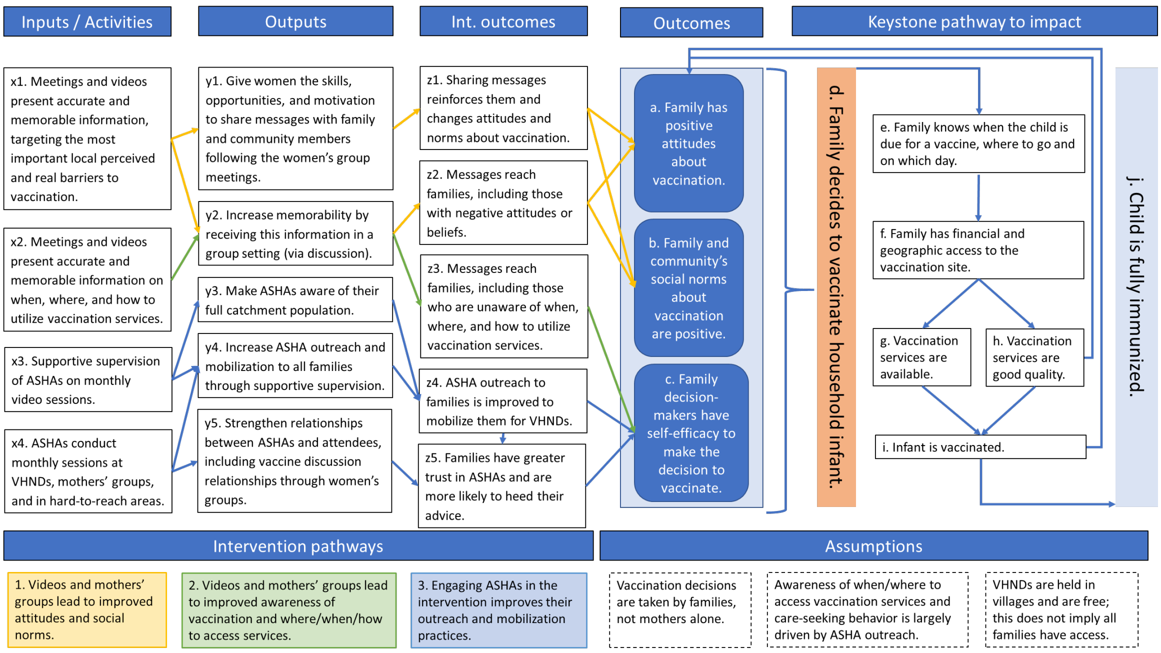
2.2 Theory of change

Online appendix A presents this study's original theory of change (TOC), including proposed causal pathways (inputs, outputs, outcome, impact). The TOC was developed together by the evaluation and implementation teams, which included experts in determinants of vaccination. The original TOC was informed by behavioral theories such as the theory of planned behavior (Ajzen 1991) and social cognitive theory, as well as recent empirical evidence on the contribution of social relationships and network change to health-related behavior change.

We anticipated that intervention components would effect changes at three levels: mothers' attitudes and beliefs, mothers' networks and social norms, and community attitudes and social norms. Although pregnant/lactating mothers were the targeted beneficiaries, we recognized that healthcare-seeking behavior change in rural India is highly dependent on family- and community-level attitudes and norms, and as such attempted to design and implement an intervention package that targeted husbands, families (including mothers-in-law) and communities. The focus of the original TOC was on behavioral determinants of vaccination, including knowledge, attitudes and norms. The intervention package was designed to primarily address those determinants.

The original TOC included a number of assumptions, six of which are explicitly articulated in the graphic (Online appendix A). Our embedded prospective process evaluation allowed us to continually iterate and update our assumptions, in line with more recent evaluation guidance on the importance of iterating a TOC based on new evidence (Britt et al. 2017; Hekler et al. 2016; Hargreaves 2014). Figure 2 (also shown in Online appendix B) presents a revised TOC based primarily on the process evaluation evidence but also consistent with survey data. This revised TOC makes explicit revised assumptions, hypothesized mechanisms and determinants of vaccination, even if they were outside the scope of our evaluation. The new TOC includes two components: (1) a 'keystone' theory describing the determinants and causal pathways resulting in vaccination and full vaccination in Fatehpur; and (2) the intervention pathways that we expected to affect the realization of each determinant/result in the keystone theory.

Figure 2: Revised theory of change



Our 'keystone' TOC is informed primarily by this study's process evaluation, but also by newer systematic reviews of the determinants of vaccination (Phillips et al. 2017), in particular the Phillips review and conceptual framework, which suggests that vaccination determinants can be grouped into three major categories: community access, behavioral intent and health system readiness (Phillips et al. 2017). This framework aligns with our process evaluation data, which showed that despite high behavioral intention reported by mothers, vaccination was also determined by families' access to services (Figure 2, box f), which was only possible if families were aware of the need to go for vaccination (Figure 2, box e).

The prospective process evaluation also highlighted that not only is vaccine availability (an original assumption) a prerequisite, but so too is the availability of all inputs needed to run a successful VHND. These include ASHAs to mobilize families, well-trained ANMs to effectively and safely administer vaccines and provide education and counseling, and logistics and cold chain staff and supplies to ensure that vaccine freezer boxes are delivered to the site on time and with an adequate quantity of vaccines and supplies (Figure 2, box g).

In line with other evidence on how determinants of vaccination differ for the first dose versus subsequent doses (Phillips et al. 2017), we originally hypothesized that the intervention would likely have an effect on schedule completion more than initiation, presuming that initiation was driven to a larger extent by access, which we could not control. Growing attention to and evidence on the role of health system quality and responsiveness confirms that retention in care – including completion of vaccination schedules – is highly sensitive to health system quality (Kruk et al. 2018; Friberg et al. 2010).

We observed in Fatehpur the important influence of ANM performance and quality, including clinical and nonclinical skills, on mothers' decisions to return for subsequent doses. Our original TOC did not distinguish between the first dose and subsequent doses, whereas Figure 2 explicitly shows a feedback loop between quality (box h) and a family's attitude toward vaccination.

The new TOC provides additional granularity on our intervention assumptions and hypotheses, based on our continual observation of the intervention and its mechanisms (Online appendix B). An important observation and change from the original TOC was the importance of ASHA outreach as a necessary condition for vaccination: few families were aware of when to go for vaccination without the ASHA's prompting. As such, we added intervention pathway 3 and the role of ASHAs in ensuring that families are aware of vaccination needs and access.

Section 7 of this report, called Discussion, synthesizes all study evidence into this new TOC.

2.3 Monitoring plan of the intervention relevant to the impact evaluation

NYST completed detailed work plans for all staff members on intervention activities. It then submitted the work plans to PATH for review to assess the following outputs from the original TOC:

- Number of accurate, local videos produced
- Number of ASHAs trained

PATH also used data from screening sessions to monitor implementation of the intervention. At each screening, ASHAs completed the registration (in an attendance format) and submitted the documentation to their respective NYST supervisors. NYST staff then entered the attendance sheets manually in Altametrik software. The data entry program had built-in logical checks to reduce the chance of errors during data entry. A PATH monitoring and evaluation (M&E) officer audited the monitoring data quarterly, providing feedback to the implementation team. The following indicators were captured:

- Name of viewer and name of spouse
- Viewer demographics, including gender, marital status and type of viewer
- Session date
- Video shown at session
- Health worker conducting the screening
- Type of session (mothers' group, VHND, screening in HTR area, men's screening)

PATH used these monitoring data to assess the following output noted in the original TOC during program implementation:

- Number of video dissemination screenings

At endline, we analyzed the attendance records to assess implementation fidelity, using the following output indicator:

- Number of people reached through videos at mothers' group meetings

Monitoring data were used to understand the fidelity of implementation to the planned intervention and intervention reach. Section 4.1, Implementation fidelity, presents our findings.

3. Evaluation design and methods

3.1 Evaluation questions

Our primary evaluation question was: 'What is the impact and cost-effectiveness of a community-led video education intervention on vaccination coverage among children 6 to 17 months old living in rural Uttar Pradesh?'

The primary outcome of interest was FIC. Table 2 shows the vaccine doses required for children to be considered fully immunized.

Table 2: Schedule of vaccine doses required for full immunization

Birth doses	6-week doses	10-week doses	14-week doses	9-month doses
BCG				
OPV0	OPV1	OPV2	OPV3	
HepB0	HepB1	HepB2	HepB3	
	DPT1	DPT2	DPT3	
				MR1

Note: BCG = Bacillus Calmette-Guérin; DPT = diphtheria-pertussis-tetanus; HepB = hepatitis B; MR = measles-rubella; OPV = oral polio vaccine.

Our secondary evaluation questions were as follows.

What is the effect of the intervention on:

1. Vaccination timeliness and dropout?
2. Vaccination rates among vulnerable children?
3. Community attitudes and normative beliefs related to immunization?

and:

4. What effects do a woman's social ties and her perception of her friends'/acquaintances' vaccination behaviors have on her decision to vaccinate?
5. What is the population coverage of each intervention source and what is the differential effect of various sources and doses of exposure on decisions to vaccinate?
6. Why and how does the intervention work?

3.2 Evaluation design

We used a cluster-randomized, controlled trial design to estimate the impact of the intervention package on vaccination outcomes through an intent-to-treat framework. We used a difference-in-difference (D-I-D) estimator to isolate the effect of the intervention on FIC and secondary outcomes, comparing changes in indicators over time (baseline to endline surveys) and between clusters (intervention versus control clusters).

3.2.1 Sampling of clusters

Prior to the baseline survey, we pseudo-randomly[1] selected 74 ASHAs for study inclusion from Hathgaon and Airaya blocks in Fatehpur District of Uttar Pradesh. We selected ASHAs instead of villages, as ASHAs are the intervention unit of delivery. Each ASHA is responsible for at least one main village and may also cover small hamlets and *tolas* (neighborhoods). Each ASHA serves an approximate population of 1,000. ASHAs were eligible for selection if they covered a population of 750 people or more. Eligible ASHAs were listed in a spreadsheet, assigned a number and selected in step-wise fashion.

To prevent spillover and contamination effects, ASHAs identified through the random number generator were excluded if the village(s) where they worked were contiguous to a village already included in the evaluation, hence why we consider ASHAs pseudo-randomly selected. In the event that a newly selected ASHA worked in a village that was contiguous to a previously selected village, it was replaced. A full list of the villages surveyed can be found in Online appendix D. We communicated the selected ASHAs and villages to Nielsen, a household survey data collection agency contracted by PATH in India, for the baseline household survey.

3.2.2 Village characteristics

We chose to complete the baseline survey prior to allocating villages to the intervention and control arms in order to: (a) collect data necessary to calculate the true intracluster correlation coefficient (ICC) for these villages; and (b) use a balance algorithm to optimize the efficiency of the overall sample size and allocation. We used three criteria to define the allocation covariates: village size, socioeconomic class and FIC. Table A1 in Online appendix G presents the mean baseline village characteristics.

Village size

Village size was assessed using baseline data from the household listing. The average village size in our sample was 1,268 individuals.

Socioeconomic class

Socioeconomic class was determined using the new India socioeconomic classification methodology presented in Online appendix E. The baseline survey included questions on consumable goods and head of household education (questions B1, B2 and B3 on the mothers' questionnaire in Online appendix F), which corresponded to the axes of the matrix in the classification system (number of durable goods and education level of the chief income earner). Table A2 in Online appendix G includes the full baseline characteristics, including socioeconomic class results.

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[1] While we used a random number generator to select ASHAs, selected ASHAs were replaced if they worked in a village geographically contiguous to a previously selected ASHA.

Fully immunized children
Full immunization was measured as a binary variable equaling 1 if a child 6 to 17 months of age had received all scheduled infant vaccine doses (12 doses for children younger than 9 months, 13 for children 9 months and older); otherwise, equaling 0. The scheduled infant vaccine doses are: birth doses of BCG vaccine, oral polio vaccine (OPV) and hepatitis B vaccine; three infant doses each of OPV, hepatitis B vaccine and diphtheria-pertussis-tetanus (DPT) vaccine (at 6, 10 and 14 weeks); and a 9-month dose of measles-rubella vaccine. A child younger than 9 months was not required to have received the measles vaccine to be considered fully immunized.

Receiving a dose of the pentavalent vaccine counted equally as receiving the corresponding doses of DPT and hepatitis B vaccines. Originally, vitamin A (at 9 months) was included in this definition, but it was later removed due to the distinction of vitamin A as a nutritional supplement and not part of the course of routine immunization for disease prevention. The calculation of FIC coverage was based on data from the child's immunization card and/or the mother's recall. Mother's recall was taken in situations in which the card or specific data points on the card were missing.

3.2.3 Allocation of clusters
Following the baseline household survey, PATH's Seattle team allocated ASHA-village clusters to intervention and control groups. We based allocation on a cluster randomization approach, with a minimization procedure to reduce imbalance of baseline covariates between study arms (Carter and Hood 2008). During allocation, we paired villages by subcenter – the lowest administrative unit in India's health system – to facilitate administration of the intervention; specifically, so that two ASHAs could share a video projector and thus help to keep down implementation costs. We used three main covariates in the allocation of villages to minimize potential confounding effects across the intervention and control arms at baseline. The covariates taken into consideration when balancing were mean village size, socioeconomic class and mean coverage of FIC.

The team used an algorithm to enumerate each potential allocation of villages into two study arms (not yet defined as intervention and control groups). The algorithm calculated a balance statistic for each allocation, which is defined as follows:

$$\text{Balance} = \sum_{j=1}^{M}\left(\sum_{i=1}^{n_1}(x_{ik}w_{ij})\right)^2$$

$$i = 1, 2, \dots n_1,$$

$$j = 1, 2, \dots M,$$

$$k = 1, 2, \dots\ 2^{n_1}$$

where x_{ik} is the i^{th} unit (village pair) of the k^{th} allocation (1 or 0 depending on assigned study arm); w_{ij} is the value of the j^{th} baseline covariate for unit i; n_1 is the number of units allocated to the first block; and M is the number of baseline covariates (Carter and Hood 2008). The algorithm ranks the allocations based on the balance statistic and randomly chooses one out of a set of the most balanced (1,000 out of 262,144 possible allocations), preserving the ability for randomization inference. The two study arms in the allocation were then randomly assigned to the intervention or control group. Allocation was conducted using the programming language R. After allocation was complete, the list of intervention clusters was communicated to the implementation team.

Allocation was not concealed from investigators or the civil society implementing partner, although steps were taken to reduce potential spillover and contamination effects. Separate teams of staff worked on the implementation and evaluation, and ASHAs were not aware they were participating in a trial. To minimize bias during data collection and analysis, data collectors and the data analyst were blinded to the intervention status of the villages.

3.2.4 Study power

We powered the study to detect a 15 percentage point difference in the primary outcome indicator (FIC) based on a review of other behavioral interventions to improve vaccine coverage (Shea et al. 2009) and to reflect national and state targets, including the Government of India goal to achieve 90 per cent FIC by 2021. We assumed an alpha of 0.05 and a 1-beta (power) of 0.80. We calculated a two-tailed sample size based on Hayes and Bennett (1999). Clustered samples are less efficient than simple random samples due to the tendency of participants in the same cluster to behave similarly. The calculation for c, the number of clusters required for the desired power of 80 per cent (beta = 0.2), was as follows (Hayes and Bennett 1999):

$$c = 1 + \frac{\left(z_{\alpha/2} + z_{\beta}\right)^2 \left[\frac{\pi_0(1-\pi_0)}{n} + \frac{\pi_1(1-\pi_1)}{n} + k^2({\pi_0}^2 + {\pi_1}^2)\right]}{(\pi_0 - \pi_1)^2}$$

where $z_{\alpha/2}$ and z_{β} are standard normal distribution values of $\alpha = 0.05$; $\beta = 0.20$; π_0 and π_1 are the proportions of FIC in the presence and absence of the intervention; *n* is the number of individuals sampled per cluster; and *k* is the coefficient of variation. Using census data and expected response rate to the survey, we estimated an expected cluster size of 19 infants aged 6 to 17 months.

The coefficient of variation depends on the ICC and the overall proportion of FIC. The ICC compares the within-group variance for clusters to the between-group variance, and ranges from zero (high variation within clusters) to one (no variation within clusters). To calculate the required number of clusters, we estimated the ICC and overall FIC proportion based on data collected through the baseline household survey, which indicated that baseline FIC was 52 per cent and ICC for the clusters in this study was 0.08. Cost-effectiveness was not considered when powering the study.

3.3 Sampling and data collection

3.3.1 Sampling frame

We identified the sampling frame using slightly different methods at baseline and endline based on lessons learned at baseline.

At baseline, listers initially approached leaders of selected villages and asked them to provide information on the ASHA in the village, the number of households in the village, as well as any hamlets or *tolas* that were in the village area. Listers then contacted ASHAs and asked them to confirm which areas they permanently cover. Any hamlets or *tolas* that were not included as an ASHA's permanent responsibility were listed separately; this separate list of hamlets or *tolas* was appended to the sampling frame for that village to ensure full representation of children between 6 and 17 months and to ensure specifically that HTR children were included in the evaluation. Once the village areas were finalized, listers used ASHA service diaries/logs to record all eligible children.

Due to concerns about sufficient capture of HTR children who may not have been on the ASHA logs as well as completeness of the records, listers conducted a supplementary door-to-door listing of HTR areas as identified by ASHAs. In smaller hamlets (fewer than 100 households), listers visited all households; and in larger hamlets (more than 100 households), listers visited 50 per cent of households to validate the robustness of the sampling frame. For all other non-HTR locations, the listers visited the site and conducted a random check of 10 households to validate the information captured from the ASHA registers against ground reality. Listers triangulated the data collected from the ASHAs through discussions with key informants (for example, *panchayat* [local government] leaders, schoolteachers and shop owners) to ensure the sampling frame represented all the hamlets.

At endline, we decided to complete a full census of study clusters based on the baseline observation of the incompleteness of ASHA records, from which some eligible women had been omitted. Following established protocols (UNICEF 2013), listers prepared a hand-drawn map of the villages indicating the structure number of each household, the lanes and by-lanes, and important common property resources (for example, religious places, schools and playgrounds) (Online appendix H). In each structure, heads of household were approached and asked about the children between 6 and 17 months of age (Online appendix I). Once the head of household confirmed the availability of such children, each child's immunization card (or other documents) were requested to verify the date of birth of the child.

Once confirmed, child details were noted in the listing tool and the corresponding structure was marked on the listing tool in a different color for identification during the main survey. If a structure was locked, neighbors were asked about the presence of any child between 6 and 17 months. If a neighbor confirmed an eligible child, the household was marked in a different color on the tool and details of parents' availability were noted. If the team could not access a locked household after two consecutive visits, the respective ASHA was contacted to cross-validate the information reported by the neighbors. If the ASHA confirmed the same, the household was marked on the map as such. After completion of the mapping, the lister shared the map with the village elders to validate whether all the hamlets and *tolas* were represented. Once the villagers confirmed, the listing information compiled by village was entered into the sampling frame.

Given use of the household listing at endline, to account for incomplete ANM lists, there was a risk of sampling biases. ASHA records are likely to be biased toward less vulnerable families who more frequently seek care, thus excluding more vulnerable women at baseline. This had the potential to bias results downward, if vulnerable women (who are less likely to be vaccinated) were underrepresented at baseline. In addition, the baseline survey occurred during the time of multiple Hindu festivals, and data collectors reported multiple families per village being away from home to visit relatives (Figure 3). These absences from the sample likely affected Hindu families, perhaps of higher socioeconomic status and correlated characteristics such as education, and who had the resources to travel. This had the potential to bias impact results upward if well-off families (who are more likely to be vaccinated) were underrepresented at baseline.

A comparison of baseline and endline characteristics among all groups finds that there were statistically significant differences between the baseline and endline sample with respect to college education, scheduled caste, familial living arrangements, socioeconomic status and HTR residence (Table A2, Online appendix G). However, there were more HTR women sampled at baseline; and as such, we do not think the change in listing biased impact estimates downward. With respect to socioeconomic status, there were more low socioeconomic status households sampled at baseline, but there were significant differentials between treatment groups, with the treatment group having more low-socioeconomic status families. When considering both of these differentials, the potential bias introduced is discordant, which we hypothesized to thus have a negligible net effect.

After compilation of the village-level sampling frame, PATH randomly selected 26 households per cluster for the survey. If there were fewer than 26 eligible households in a particular cluster, all households were selected for the survey.

3.3.2 Household survey

Baseline data collection was done from 3 November to 30 November 2016. Endline survey data collection was done from 1 September to 21 September 2018. Training in both rounds for Nielsen data collectors included an overview of the project, an explanation of the survey tools and process of using the tablets, group discussion of survey questions and practice of field interviews. Each interviewer completed at least one practice field interview prior to survey launch. After two days of data collection at endline, a debriefing session was held, at which enumerators shared their experiences and clarified doubts or concerns.

At baseline, the study included the following data collected from the household survey:

- Electronic dataset of household listing and households with eligible child
- Electronic de-identified dataset of household survey

At endline, the study included the following data collected from the household survey:

- Electronic dataset of household listing and households with eligible child
- 74 hand-drawn social maps of the listed households within the selected villages
- Electronic de-identified dataset of household survey
- 800 digital images of immunization cards

Because cross-sections of respondents were selected at baseline and endline, respondents were not linked across survey rounds. Further information on the baseline household survey can be found in the *Projecting Health baseline evaluation* (PATH 2017).

3.3.3 Study participants

The study participants were women aged 18 to 45 years old with children aged between 6 and 17 months; the women’s husbands and mothers-in-law; and ASHAs, all of whom resided in the 74 selected study clusters in Airaya and Hathgaon blocks in Fatehpur District of Uttar Pradesh. Table 3 details the inclusion and exclusion criteria.

Table 3: Inclusion and exclusion criteria for evaluation

Inclusion criteria	
Households	**ASHAs**
• Mothers/primary caregivers of children 6 to 17 months of age at the time of the baseline survey, whose primary home was within the intervention village. • Husbands and mothers-in-law of these women. • Gave consent for the interview.	• ASHAs (>18 years old) in the intervention area who received training from the project and were willing to participate in the interview.
Exclusion criteria	
Households	**ASHAs**
For mothers: • Women under 18 years old and over 45 years old. • Did not have a child aged 6 to 17 months. • Did not agree to participate in the interview. For husbands and mothers-in-law: • Under the age of 18. • Did not agree to participate in the interview. • Mother declined to have them approached for an interview.	• ASHAs (<18 years) in the intervention area who had not received any training from the project and were not willing to participate in the interview.

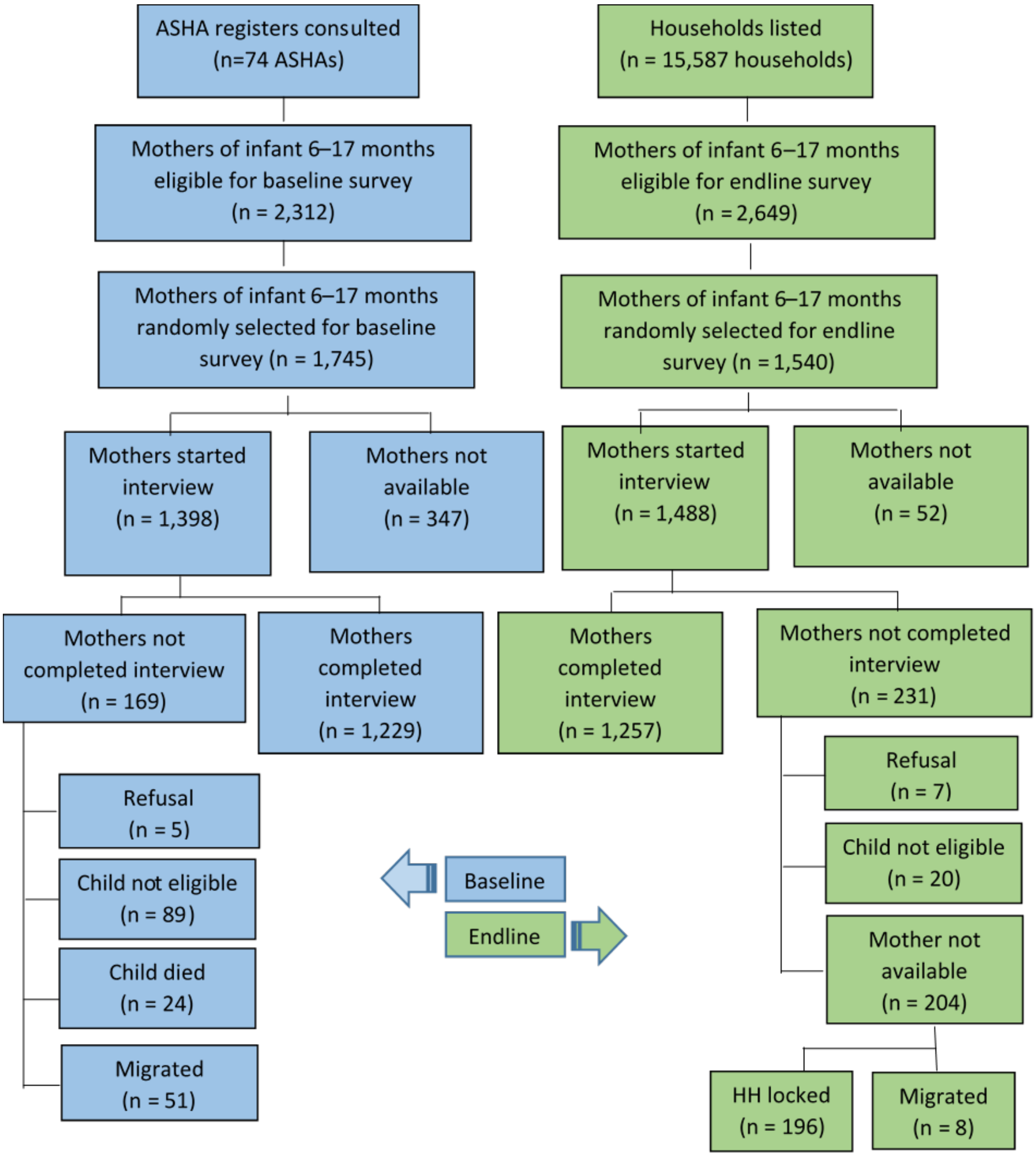
3.3.4 Response rates

Data collectors approached all the selected households for the survey. During the survey, if a household was found locked or the mother of the eligible child was unavailable for the interview, the data collector notified the supervisor for further investigation. The supervisor and data collectors subsequently confirmed the availability of the mother with other family members and planned to revisit the household. In such scenarios, households were visited a maximum of three times to gather survey responses.

In cases in which respondents were available but declined to participate, or respondents were out of the village for the duration of the survey, their names were discarded from the interview list. All such nonresponse cases, including partially completed interviews, were noted by the data collectors. Informed consent was obtained prior to the start of data collection, with a copy of the consent form given to the respondent for further queries if desired.

At baseline, a total of 1,229 mothers, 352 mothers-in-law and 353 husbands were surveyed. Due to incomplete data, the data analyst was unable to link three mother-in-law surveys and three husband surveys to the associated mother’s survey. These were dropped from data analysis, leaving 349 mothers-in-law and 350 husbands surveyed. At endline, a total of 1,257 mothers, 307 mothers-in-law and 324 husbands were surveyed. Due to incomplete data, the data analyst was unable to link 26 mother-in-law surveys and 31 husband surveys to the associated mother’s survey. These were dropped from data analysis, leaving 283 mothers-in-law and 293 husbands surveyed. Figure 3 shows the flow of target participants.

Figure 3: Flow of target participant mothers



Note: HH = household.

3.3.5 Quality control measures

Multiple quality control measures were adopted throughout data collection. The following actions were taken:

- **Tool development:** The evaluation team pretested the data collection tools to assess understanding of the different questions, as well as the consenting process, flow of questions and skipping pattern, incorporation of local terminologies and time taken to complete the interview.
- **Data entry application design:** Data entry application was developed in CSPro 7.1 software to incorporate range checks, logical flow (skipping) checks and validity of response checks.
- **Data collection:** During data collection, team supervisors observed 5% of the interviews, while the study quality control team (PATH and NYST staff) observed an additional 10% of interviews; the quality control team revisited 5% of the

households, asking mothers random questions from the survey to validate the recorded responses. To ensure the quality of vaccination data collected, images were taken of immunization cards when available.

- **Data entry:** PATH randomly selected 10 per cent of immunization card images to cross-check against data entered by the enumerators.
- **Data analysis:** PATH generated frequency tables for selected variables and checked with respect to missing values and outliers.

3.4 Model specifications

We used a D-I-D estimator to isolate the impact of the intervention according to the following equation (1):

$$Y_{ihv} = \beta_0 + \beta_1 Post_t + \beta_2 T_v + \delta_1 Post_t T_v + \varepsilon_v$$

where Y_{ihv} is a binary variable indicating whether child *i* in household *h* in cluster *v* is fully vaccinated; $Post_t$ = 1 if measurement is taken at the endline survey and 0 otherwise; T_v is a dummy variable indicating treatment status of the cluster; and ε_v is the unobserved error term, clustered at the ASHA-village level. We used the same model for all outcomes of interest, unless otherwise specified as we report the findings. The unit of analysis is always the infant except in the case of vaccine timeliness, for which the unit of analysis is a vaccine dose. We estimated (1) in ordinary least squares (OLS) models, reflecting intent to treat at cluster level. The parameter of interest is δ_1, which is the D-I-D estimate of the effect of the intervention at endline relative to baseline in the intervention villages as compared with the control villages.

For all analyses, the p-value and impacts are reported at the 5 per cent significance level. To mitigate confounding and improve model precision, characteristics of villages were compared at baseline to ensure that the randomization procedure led to balance between the intervention and control groups. An adjusted D-I-D estimator is reported to control for any statistically significant differences observed at baseline. The following covariates were significantly different at baseline (Table A2, Online appendix G) and were included as covariates: mother's educational attainment, socioeconomic status, sex of child, resides in an HTR area, religion and caste. With these covariates, we report an adjusted D-I-D estimator, which is estimated with an OLS model (2):

$$Y_{ihv} = \beta_0 + \beta_1 Post_t + \beta_2 T_v + \delta_1 Post_t T_v + \beta_3 Covariates_i + \varepsilon_{ihv}$$

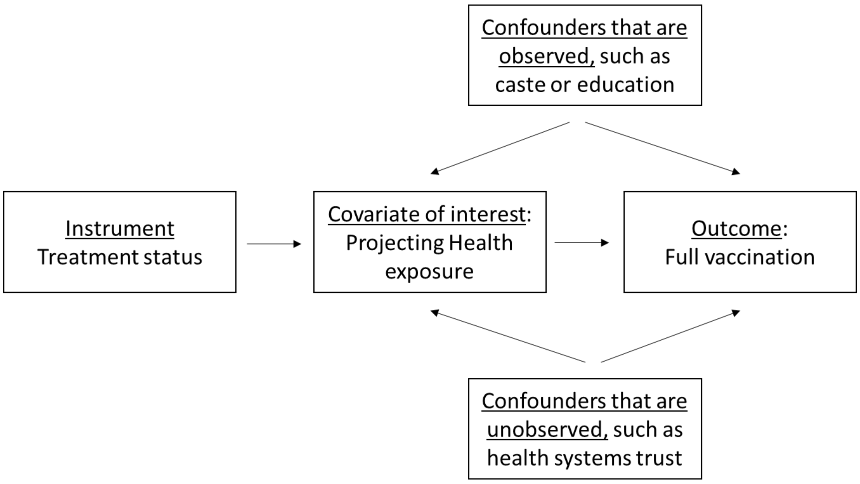
In addition to the D-I-D estimator used to examine intent-to-treat effects, to further examine as-treated effects we use an instrumental variable estimator to capture exogenous variation introduced by the randomized design. We use treatment status as an instrument for total intervention exposure, as treatment assignment predicts total intervention exposure. To estimate the instrumental variable approach, we use a two-stage least square estimator with the endline data to first estimate the extent to which intervention exposure is explained by treatment status and then use the predicated values of exposure to estimate vaccination status, as follows:

First-stage least squares: $Z_{ihv} = \beta_0 + \beta_1 T_v + \beta_2 Covariates + \varepsilon_{ihv}$

Second-stage least squares: $Y_{ihv} = \beta_0 + \beta_1 Z_v + \beta_2 Covariates + \varepsilon_{ihv}$

where T_v is a dummy variable indicating treatment status of the cluster; Z_{ihv} is a variable indicating the exposure to Projecting Health videos of individual *i* in household *h* in cluster *v*; and Y_{ihv} is a binary variable indicating whether child *i* in household *h* in cluster *v* is fully vaccinated. All other features are the same as within the D-I-D estimator, including the unit of analysis, clustering of standard errors and inclusion of covariates to control for confounding (Figure 4).

Figure 4: Schematic of instrumental variable analysis



3.4.1 Definition of dependent variables

Percentage of children aged 6 to 17 months fully immunized

The percentage of FIC aged 6 to 17 months was aggregated from each infant's binary measurement, equaling 1 if a child 6 to 17 months of age had received all 12 or 13 age-appropriate scheduled infant vaccine doses and equaling 0 otherwise.

Percentage of children aged 6 to 17 months who received on-time vaccination

We measured adherence to the expected vaccine schedule both as a percentage of vaccine doses received according to the Government of India routine immunization schedule and as a percentage of children aged 6 to 17 months who received all of their vaccine doses on time. We measured vaccine timeliness as a binary variable, equaling 1 if a vaccine was received within predefined time bounds and equaling 0 otherwise.

Children receiving all vaccines on time is not necessarily a measure of full immunization; rather, it is a measure of the timeliness of the vaccines that a child has received. We applied the Government of India routine immunization schedule to the infant's birth date to calculate due dates for each vaccine dose. Because the ANMs visit a given village only once a month to administer vaccines (through the routine VHND immunization session), 'schedule adherence' for this analysis means administration of any vaccine within a 31-day window before or after the vaccine was due.

Percentage of children aged 6 to 17 months who completed DPT1 but not DPT3; who completed OPV1 but not OPV3

We calculated dropout for the DPT and OPV series separately; we defined dropout as a binary variable equaling 1 if a child received the first dose of the given vaccine but did not receive the third dose, and 0 if the child received both the first and third doses. We did not consider children who never received the first dose in the calculation. We calculated dropout for DPT as the percentage of children who completed DPT1 but not DPT3. When determining whether children received DPT1 or DPT3, we also considered receipt of the corresponding pentavalent vaccine dose, as it includes DPT. We calculated OPV dropout as the percentage of children who completed OPV1 but not OPV3, excluding OPV0 to aid in comparability to DPT.

Percentage of individuals who intend to vaccinate their children
We calculated intention to vaccinate as a binary variable, equaling 1 if the survey respondent reported a desire for their child to receive all the scheduled vaccinations, and 0 if the respondent reported not desiring their child to receive all the scheduled vaccinations.

Percentage of individuals who reported knowing a key message
We calculated respondents' knowledge in key disease areas (breastfeeding, antenatal care (ANC), birth preparedness and immunization) as a binary variable, equaling 1 if the respondent could spontaneously recall any key messages and 0 if a respondent could not spontaneously recall any key messages. Key messages were identified at program outset for inclusion in the intervention videos, and respondents were queried at baseline and endline about what they knew to do, with regard to certain health behaviors, in order to elicit knowledge of key messages.

3.4.2 Definition of independent variables included in unadjusted and adjusted models

Treatment (all)
We calculated treatment as a binary variable, equaling 1 if a respondent lived within an intervention cluster and 0 if a respondent lived within a control cluster. Treatment does not measure actual exposure, but intent to treat.

Endline (all)
Endline was a binary variable, equaling 1 if the survey response was collected post-intervention in September 2018 and 0 if the survey response was collected pre-intervention during the baseline survey in November 2016.

Mother with no primary schooling (adjusted models)
Maternal education was calculated as a binary variable, equaling 1 if a mother had no primary school education and 0 if a mother had primary school education or higher. We identified mothers with no primary school education by survey responses, where responses included 'illiterate', 'literate, but no formal education', and 'schooling up to 4 years'.

Low socioeconomic status (adjusted models)
Socioeconomic class was determined using the new India socioeconomic classification methodology presented in Online appendix E. The baseline survey included questions B1, B2 and B3 on the mothers' questionnaire (Online appendix F), which corresponded to the axes of the matrix in the classification system (number of durable goods and education level of the chief income earner). Families of low socioeconomic class were determined to be those in the two lowest categories of the India socioeconomic classification scheme, E2 and E3.

Female infant (adjusted models)
Child sex was calculated as a binary variable, equaling 1 if the eligible child was female and 0 if the eligible child was male.

Hard to reach (adjusted models)
We included a child in the HTR subgroup (38%) if the ASHA identified the child's hamlet as HTR. This included primarily geographically HTR areas, areas that ASHAs did not visit, where mothers were reluctant to visit immunization sites and where there were high migration rates.

Muslim religion (adjusted models)
Religion was calculated as a binary variable, equaling 1 if a family was Muslim and 0 if a family was Hindu. Muslim families were identified through the mother's survey response.

Low caste (adjusted models)
Caste was calculated as a binary variable, equaling 1 if a family was of lower caste and 0 if a family was of higher caste. Lower castes were considered as 'scheduled tribe' and 'scheduled caste' and were identified through the mother's survey response.

3.5 Qualitative data

The team conducted interviews and focus group discussions (FGDs) as part of the prospective process evaluation. A total of 373 people participated from January 2017 to June 2018 (Table 4 shows breakdown by date and respondent type). In addition, we conducted 12 observations of VHNDs. Sample sizes were determined iteratively to ensure theoretical saturation. Differences in data reported between villages were examined to ensure theoretical saturation was achieved; for example, we continued performing FGDs prospectively until we were able to explain differences in perceptions and other thematic constructs between individuals in a village and across villages in the study.

The objectives of the prospective process evaluation were to:

- assess implementation fidelity
- identify the root causes of under-vaccination
- generate qualitative evidence on whether the intervention was achieving its intended outcomes (or not), and why and how it was achieving those outcomes (or not).

Table 4: Qualitative data collection

Baseline period			
FGDs	**Respondent type**	**Number of FGDs**	**Number of participants**
January 2017	ASHA	2	35
January 2017	Mothers' group	12	103
March to April 2017	Mothers' group	6	54
Total		**20**	**192**
Interviews	**Respondent type**	**Number of interviews**	**Number of participants**
January 2017	ASHA	5	5
January 2017	Mother	3	3
March to April 2017	Community member	8	8
March to April 2017	Healthcare provider	4	4
Total		**20**	**20**

Implementation period			
FGDs	**Respondent type**	**Number of FGDs**	**Number of participants**
July 2017	Community member	1	4
July 2017	Mothers' group	2	22
Total		**3**	**26**
Interviews	**Respondent type**	**Number of interviews**	**Number of participants**
June to July 2017	ASHA	5	5
June to July 2017	Community member	6	6
June 2017	Healthcare provider	4	4
Total		**15**	**15**
Endline period			
FGDs	**Respondent type**	**Number of FGDs**	**Number of participants**
Sept to Dec 2017	Mothers' group	6	66
May to June 2018	Mothers' group	3	26
Total		**8**	**92**
Interviews	**Respondent type**	**Number of interviews**	**Number of participants**
Sept to Dec 2017	Healthcare provider	7	7
Sept to Dec 2017	Community member	6	6
Sept to Dec 2017	ASHA	2	2
May 2018	Mother	7	7
May to June 2018	ASHA	6	6
Total		**28**	**28**

3.5.1 Methods

Qualitative data were collected using semi-structured instruments designed for both FGDs and interviews, created separately for health workers, mothers and community members. Instruments were designed based on the study TOC and continually updated to reflect data collected. In general, our local community-based implementing partner NYST notified the village that PATH's M&E officer would come to ask questions. Upon the M&E officer's arrival, the participants were mobilized for interviews and FGDs, which were conducted in as private a place as possible (for example, a community center, a quiet yard or a school room). The M&E officer read a consent form, after which individuals gave verbal consent. Interviews and FGDs were recorded with consent, transcribed, translated to English, and then coded and analyzed in ATLAS.ti 7.0 software.

The process evaluation also included VHND observations. We planned these observations by referring to the community health center microplans for both intervention and control villages and in coordination with NYST. The M&E officer observed all activities during the VHNDs, including ANC visits; vaccinations of newborns and children; record-keeping of vaccine stock; and counseling on health and vaccination provided by the ANMs to mothers who attended the VHNDs. Observations were recorded on a standardized observation form and supplemented with field notes. The total number of vaccines administered and people receiving vaccines were recorded on the observation form.

3.6 Strategies to avoid bias

We attempted to mitigate spillover and contamination between intervention and control villages by selecting villages that were not geographically contiguous and ensuring that ANMs supervising ASHAs were completely clustered in either intervention or control communities. We counseled NYST on the importance of following the study protocol. The process evaluation did not observe any instances of intentional spillover.

In real-world conditions, we could not control the implementation of other similar interventions; however, our process evaluation recorded their reach in order to interpret how they may have affected study outcomes. The use of the D-I-D estimator controlled for non-intervention-related secular improvements, or improvements attributable to other interventions.

To minimize bias in the qualitative process evaluation, selection of FGD respondents was based on a convenience sample. To ensure that there was no bias toward the intervention, the implementers were not engaged in qualitative data collection activities, and the interviewer did not participate in implementer trainings or activities.

We avoided the Hawthorne effect by asking questions during the household survey and qualitative interviews in a way that was not leading and did not make explicit references to the Projecting Health project. Respondents were asked in the household survey about their exposure to the intervention, but to avoid bias the respondents were not asked about the intervention or CSO by name and were instead queried about whether they had attended mothers' groups where they saw videos. If so, specific content questions on the videos were asked to ascertain the videos' origin.

3.7 Ethics and transparency

To ensure that the highest ethical standards of conduct were upheld, the evaluation received ethical approval from the PATH institutional review board (the Research Ethics Committee) and the Centre for Operation Research and Training (a local ethics committee based in Vadodara, India). The principal investigator and lead site investigator briefed the local institutional review board on study protocol and ethical adherence measures prior to receiving approval. All members of the study team completed an online training course on human subjects research developed by the Collaborative Institutional Training Initiative. Key team members from the data collection agency (Nielsen) also completed the training course on human subjects research.

A separate session on human subjects research ethics was conducted during the data collector training. The session articulated the consenting process, the importance of consenting, and do's and don'ts prior to approaching respondents for an interview. The consent form was simplified (readability score 8.0) and translated into the local language (Hindi).

During data collection, the team supervisor randomly checked for consenting by asking study participants questions on the consenting process and physically verifying the copy of the consent form handed to participants by the enumerator. The PATH quality monitoring team observed the consenting process for 10 per cent of respondents and validated consenting during the back-check. To assess respondents' understanding of the consenting process, a set of questions was designed and incorporated into the data entry application. If the response to any of the questions was negative, the enumerators were instructed to repeat the consenting process and explain the relevant sections of the consent form.

During consenting, all study participants were informed to contact the lead site investigator and local NGO partners for any further queries related to the study. The lead site investigator received three calls: one respondent inquired for more details of the study and benefits; the other two callers expressed grievance that they were not included in the survey. The investigator explained the necessary information to them until they were satisfied with the responses.

The pre-analysis plan is available for review in Online appendix J. The study is registered publicly with the Clinical Trials Registry of India under CTRI/2017/04/008379.

3.7.1 Deviations from original protocol

The PATH team had planned to estimate network density as a secondary outcome by measuring each respondent's ego network and constructing a community-wide network based on survey respondents. We had anticipated that it would be feasible to match individuals named in the network survey based on a unique identification of the individual's full name and their husband's full name. However, during survey implementation, we learned that it was a local norm not to use given names; for example, it was far more common to call a woman by her child's name (for example, mother of Peehu).

Ultimately, we were able to capture a count of a respondent's social ties but not connect these ties through a unique identifier to construct a network map. As such, we were not able to compute network density or identify specific person-to-person relationships. Due to these challenges in measuring networks, as well as the length of the survey, we opted not to measure friendship networks.

We aimed to estimate the differential effect of various sources of exposure (for example, mothers' group meetings, VHNDs, home visits) on outcomes. We erroneously removed 'home visit' as an exposure source from the endline survey tool. We realized only after the survey that the way in which the exposure question was programmed allowed selection of only one option (mothers' group or VHND), not both. Further, due to an error in data collection, among the 355 survey respondents in the intervention area who had seen a Projecting Health video at endline, only 58 per cent were shown the question on the source of video exposure. As a result of these multiple errors, we opted not to present findings related to source of exposure.

Last, due to resource constraints, the project was not able to implement the intervention component for sharing videos from phone to phone using Bluetooth technology. As such, we were not able to measure this source of exposure.

4. Findings

4.1 Implementation fidelity

The study planned 1,554 screenings in the 37 ASHA-village intervention clusters over the 12-month implementation period. Through monthly mothers' group, VHND and HTR screenings, as well as bimonthly men's screenings, each village was scheduled to receive 42 video screening sessions in total. Table 5 shows the total number of planned and actual screenings by type, based on monitoring data.

Table 5: Planned versus actual implementation activities

Session type	Planned number of sessions	Actual dissemination sessions	Number of views
Mothers' group	444	446	7,551
Village Health and Nutrition Day	444	445	7,540
Hard-to-reach	444	444	7,087
Men's screening	222	223	3,165
Total	**1,554**	**1,558**	**25,343**

The intervention was delivered at the planned scale, with 1,558 screenings conducted, for an average rate of 42 sessions per village over the 12-month intervention period. Implementation fidelity was also strong over time, with all villages receiving sessions every month. As planned, half of the screened videos were on immunization; the remainder were on ANC, birth preparedness, breastfeeding, newborn care, institutional delivery and family planning.

The types of screenings were conducted as planned, with 446 mothers' group screenings, 445 VHND screenings, 223 men's screenings and 444 HTR screenings (Table 6). Within a single village, this translated to an average of 12 sessions held in mothers' groups, 12 held in VHNDs, 12 held in HTR areas and 6 held in men's groups. Sessions were timed such that men's groups received all of the immunization videos and no others. An extra four screening sessions were conducted: one on immunization in a mothers' group; one on family planning in a mothers' group; one on immunization in a men's group; and one on ANC in a VHND.

Table 6: Implementation fidelity by screening platform

Outcome	Total	Mothers' groups		Village Health and Nutrition Days		Men's groups		Hard-to-reach	
		n	% of total	n	% of total	n	% of total	n	% of total
Total attendance	25,343	7,551	29.80	7,540	29.75	3,165	12.49	7,087	27.96
Number of unique attendees	13,960	5,237	—	5,170	—	2,066	—	4,608	—
Number of sessions	1,558	446	28.63	445	28.56	223	14.31	444	28.50
Immunization sessions	890	223	25.06	222	24.94	223	25.06	222	24.94
Other sessions	668	223	33.38	223	33.38	—	—	222	33.23
Number of villages	37	37	100.00	37	100.00	37	100.00	37	100.00
Avg. attendance per village	684.9	204.1	29.80	203.8	29.75	85.5	12.49	191.5	27.96
Avg. number of attendees per village	377.3	141.5	37.51	139.7	37.03	55.8	14.80	124.5	33.01
Avg. number of sessions per village	42.1	12.1	28.63	12.0	28.56	6.0	14.31	12.0	28.50
Avg. number of attendees per session	16.3	16.9	—	16.9	—	14.2	—	16.0	—

There were 25,343 views of Projecting Health videos during the implementation period. Of those views, 29.8% (n = 7,551) came from mothers' groups, 29.8% (n = 7,540) came from VHNDs and 28.0% (n = 7,087) came from HTR screenings, indicating that women were the primary participants in the intervention; men's screenings accounted for 12.5% (n = 3,165) of views.

To identify the unique number of attendees in the monitoring data, we assigned viewer identification codes to participants using fuzzy matching of participant name and spouse name within clusters (Christen 2006). This allowed us to identify each individual uniquely and calculate: (a) the first time a viewer saw a video; and (b) any subsequent views of videos. The total number of unique Projecting Health viewers was 13,960 individuals, indicating that the average participant viewed a Projecting Health video more than once. At the cluster level, this translates to an average of 377 unique attendees over the 12-month implementation period.

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To estimate the proportion of target beneficiaries who were exposed to the intervention, survey respondents were asked about whether they had ever seen an intervention video. When aggregating across all survey respondent groups, 43.5% of respondents reported having seen a video; however, pregnant and lactating women (mothers) reported higher viewership (56.2%) than other survey respondents; mothers-in-law and husbands participated significantly less often, with 21.5% and 11.9%, respectively, recalling watching a video. Overall, the reach of the intervention was broad, engaging more than one-third of target beneficiaries. Based on the survey data findings, we estimate that about half of pregnant and lactating mothers in a village participated in the intervention. While this leaves opportunity to expand the intervention further, there may be challenges in effectively reaching all eligible mothers in a village, as described below.

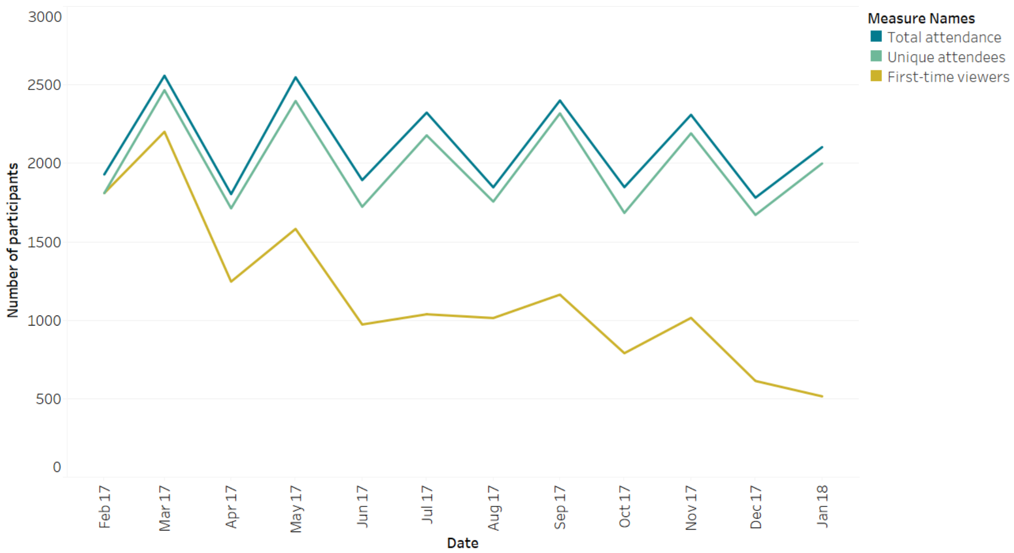
Table 7: Proportion of population that reported seeing a video, by data source

Data source	% of people who reported seeing a Projecting Health video	Population denominator
Weighted average, all household survey respondents	43.45	1,857
Mothers – household survey	56.17	1,257
Mothers-in-law – household survey	21.50	307
Husbands – household survey	11.89	293

We examined uptake into the intervention over time, using views, number of unique attendees and number of first-time viewers (Figure 5) from the monitoring data. The monthly peaks in the figure indicate months in which men's screenings occurred, increasing the overall number of views and attendees. Initial uptake into the intervention was high, with 1,929 views and 1,810 unique viewers in February 2017. Slight attrition of participants was experienced over the course of the intervention, with 1,781 views and 1,671 unique viewers in December 2018. The total views were on average 6 per cent higher than the total number of unique attendees, indicating a consistent pattern of repeat viewers each month (represented as the difference between the top lineand the middle line in Figure 5). Table A4 in Online appendix G shows implementation over time.

While overall attrition in the intervention was low, the rate of first-time viewers quickly declined after the first three months of implementation (represented as the bottom line in Figure 5). In the second month of implementation (March 2017), on average 59 participants in a village were new attendees; by the fifth month of the intervention (June 2017), that number had dropped to 26 participants per village. In the final month of implementation (January 2018), only 13 participants in a village were newly attending. Based on a crude birth rate of 0.0264 measured in Uttar Pradesh in the 2012–2013 Annual Health Survey (Office of the Registrar General and Census Commissioner 2013) and the average village size, we would expect an average of 94 new pregnancies per month in the intervention area, indicating that new viewership was not driven solely by newly pregnant women.

Figure 5: Implementation over time



We posit that the decline in first-time viewers over time is the result of the intervention initially enrolling a broad base of community members who were easily mobilized and amenable to the intervention. After the initial recruitment period of pregnant and lactating mothers and other community members who were easily engaged, there remained fewer new beneficiaries to enroll, except perhaps newly pregnant women if they were not already enrolled. Process evaluation data indicate that some families were never enrolled due to a combination of factors related to household socioeconomic status, cultural and community norms, and ASHA behaviors and practices. For instance, ASHAs encountered families who actively avoided video screenings for cultural reasons. The following quotation illustrates one of these outliers:

> There is a Hindu family also who is very rigid and against vaccination. They are from Paswan community. They even do not allow to show video near her place and always shoo us away. I thought if I screen near her place then they will watch but they do not even allow that. — Interview with ASHA, June 2017

4.1.1 Fidelity to planned beneficiaries

To examine the extent to which beneficiaries matched the intervention's intended target population, take-up of the intervention was examined by group using monitoring data. The following definitions from the monitoring data are used in Table 8, based on classification of the attendees, attendee sex and attendee marital status:

- Pregnant and lactating mothers.
- Women without children: Women who were newly married (without children) and unmarried adolescents (10 to 24 years old) without children. No formal record of children was taken at attendance, but given the very low incidence of pregnancy out of wedlock, this is assumed to be a proxy for women without children.
- Female elders: Women who were beyond child-bearing age. For the purposes of comparison with our target populations, this was used as a proxy for mothers-in-law.

- Women with non-infant children: For all attendees who did not fit into one of the other categories, the ‘other’ designation was used. Examination of the group characteristics showed that 93 per cent were female adults who did not fit into one of the other fertility descriptions. This is assumed to be a proxy for women with non-infant children, although we acknowledge this is an imperfect measure.
- Men: No group classification was used to document men in the attendance register. However, among the ‘unknown’ group classification, 99 per cent of viewers were male adults; this was an oversight in the creation of the group classification and ‘unknown’ is assumed to indicate men.

Table 8: Implementation fidelity, by attendee type (monitoring data)

Outcome	By viewer type				
	Pregnant and lactating mothers	Women without children	Female elders	Women with non-infant children	Men
Total attendance	9,740	4,887	3,079	4,765	2,872
% of total attendance	38.43	19.28	12.15	18.80	11.33
Total number of unique attendees	4,936	3,050	2,001	3,206	1,936
Total number of villages	37	37	34	37	37
Avg. attendance per village	263.2	132.1	90.6	128.8	77.6
Avg. number of attendees per village	133.4	82.4	58.9	86.6	52.3
Avg. number of monthly attendees per village	11.1	6.9	4.9	7.2	4.4

Broadly, the beneficiaries of the intervention were as intended: 38.4% of attendees were pregnant or lactating mothers, which aligns with the primary intended beneficiaries of the intervention, while 12.1% of attendees were female elders/mothers-in-law and 11.3% attendees were male household members, representing the secondary intended beneficiaries of the intervention. In total, more than 60% of the beneficiaries were as initially targeted by the intervention package. Participants who were not explicitly targeted in the planning of the intervention were women without children (19.3% of views) and women with non-infant children (18.8% of views). While these individuals were not explicitly targeted in the intervention planning, no community member was excluded from screenings – both VHNDs and mothers’ groups were open to anyone.

4.1.2 Constraints to implementation fidelity

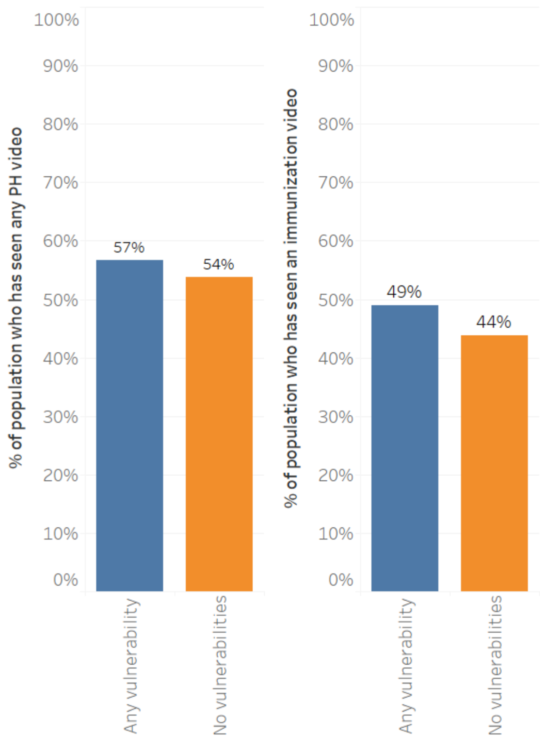
While fidelity to the planned intervention design was high, with good reach of the intervention and beneficiaries as intended, eligible participants were still missed within the community, particularly husbands and mothers-in-law.

It is unknown why some women in the intervention area were exposed to the Projecting Health videos, while others were not. Significant between-site variation as a result of screening sites would not be expected, as the same videos were screened at all sites, and videos were predominantly screened in central locations for mothers’ groups and at VHNDs. It is possible that variation in ASHA mobilization and facilitation capabilities influenced mothers’ participation in and uptake of the intervention. It is also feasible that household characteristics had an impact on which women participated.

We hypothesized that people with characteristics of vulnerability (such as HTR area residence or Muslim household) would be less likely to participate in the intervention, but Figure 6 shows that viewership was not associated with maternal characteristics that would indicate vulnerability. Among households in which the mother had one or more characteristics of vulnerability, viewership was marginally higher than among households with no vulnerabilities. This suggests that the program was successful in reaching families who may traditionally face barriers to vaccination through components such as the HTR area screenings. There may still be unobserved characteristics that influenced women's participation; for example, women with greater self-efficacy may have been more likely to attend a video screening.

It remains unclear which population factors are associated with uptake of the intervention, and which population-specific barriers would need to be removed to reach a greater number of eligible participants. Based on the process evaluation, we identified two key constraints in implementation that could have influenced reach: the targeting strategy of eligible participants and the program design for men and mothers-in-law.

Figure 6: Video viewership by vulnerability status



Note: PH = Projecting Health. Vulnerability indicates mothers who belonged to one or more of the specified subgroups: from a low caste, from a low socioeconomic status household, Muslim, residing in an HTR area, or those with limited education.

The targeting strategy did not provide sufficient tools or monitoring and supervision to ensure ASHAs were reaching every eligible participant. ASHAs were not trained in the different types of participants or how to identify and mobilize women using their knowledge of eligible mothers. Thus, while pregnant and lactating women were prioritized, ASHAs had discretion in who they targeted first, which we hypothesize resulted in first engaging those who were easier to reach or easier to mobilize.

Greater monitoring and triangulation with existing resources (such as the ASHA register of pregnant women) or collaboration with village leaders could have improved targeting to ensure all eligible participants were reached. While we tailored implementation strategies to reach socially isolated households (for example, by screening the video in their home instead of asking them to join a group setting), implementation strategies could have been further tailored to reach families in greatest need.

Male household members and mothers-in-law were also under-mobilized. While they were key beneficiaries of the intervention and are influential in decisions to vaccinate, the video messaging was not specifically created for or targeted at them. Greater targeting and recruitment efforts for these groups could improve uptake among all beneficiaries. Section 6, Challenges and lessons, contains further information.

We did not measure other intervention component outputs that we later observed as being important in determining vaccination; namely, number and quality of ASHA outreach visits and effect of ASHA trainings on facilitation and mobilization skills.

While we consider the intervention to have been well implemented, the association observed as a result of intervention exposure does present a potential opportunity for further gains, with an estimated half of pregnant and lactating women in a village remaining unreached. Identifying why women did (or did not) participate in the intervention and expanding intervention uptake beyond the current level has the possibility for further improvements in immunization coverage. Future iterations of this intervention should tailor the intervention and its implementation strategies based on formative research and ongoing rapid cycle testing to maximize reach, particularly among the most vulnerable and household decision makers.

In the endline household survey, control group members were asked whether they had heard of an intervention at which videos were screened in mothers' groups: 22 (0.32%) female survey respondents living in control communities reported seeing a Projecting Health video, indicating minimal spillover of the intervention. Of those 22, 4 indicated that while they had seen a Projecting Health video, it was screened by a supervisor (instead of an ASHA), suggesting that they likely saw a video from another intervention program and confused it for Projecting Health (section 6.2, Challenges during implementation, contains further information). Of the remaining 18 women, there was no discernible pattern to which village they resided in and thus where spillover would have occurred.

Possible explanations for this spillover include: (a) mothers traveling outside of their village, who then attended a Projecting Health screening; and (b) friendship ties with women outside their village who made them aware of the Projecting Health program. It is not possible to determine the exact cause of the spillover, as control respondents are not identifiable in monitoring records (participants were not required to provide addresses) and the network survey was not designed to map whole networks across villages. Given that only 22 members of the control group reported having seen a video, we find it unlikely that any changes observed in the control group can be attributable to spillover and are instead largely attributable to exogenous factors, including the implementation of IMI throughout Fatehpur.

4.2 Descriptive statistics and balance table

At baseline, the balance algorithm procedure resulted in a number of population characteristics being unbalanced between the intervention and control groups, with statistically significant differences (Table 9; full table, Table A2, Online appendix G). This was the trade-off for balancing characteristics of interest and optimizing the ICC; while we had sought to avoid over-balancing/over-correcting the allocation, our approach resulted in a major limitation of this evaluation. The most notable imbalances are in:

- maternal education, with the intervention group being less educated on average
- religion, with the intervention group having more Muslim members on average
- caste, with the intervention group having more scheduled caste and general caste members on average
- sex of child, with the intervention group having more female children on average
- resides in an HTR area, with the intervention group having fewer HTR children on average
- socioeconomic classification, with the intervention group having fewer members of higher socioeconomic class on average.

At endline, the majority of these differences between intervention and control clusters had disappeared, with only two characteristics having statistically significant differences, notably:

- sex of child, with the intervention group having more female children on average
- socioeconomic classification, with the intervention group having fewer members of higher socioeconomic class on average.

Possible sampling biases could be the reason why some of the observed differences between intervention and control communities disappeared. At baseline, we enumerated the eligible population based on ASHA records, not through a household census, as was the approach at endline. ASHA records are likely to be biased toward less vulnerable families who more frequently seek care. It is unknown why other observed differences disappeared.

4.3 Impact

Impact estimates are reported by assignment group (intervention versus control clusters), reflecting intent to treat at the cluster level. We report the percentage point change in the probability of the outcome of interest due to the intervention at the child level in the intervention arm. Table 9 and Table A2 in Online appendix G present unadjusted estimates as well as estimates adjusted with model covariates for demographic characteristics that were statistically significantly different between the intervention and control groups at baseline. Throughout the narrative, we describe adjusted estimates.

As shown in Table 10, among the 74 ASHA-village clusters included in the study, 52.9 per cent of children aged 6 to 17 months were fully vaccinated at baseline versus 64.3 per cent at endline. Relative to the control group, the probability of being fully vaccinated was 3.3 percentage points higher for children in the intervention group at endline, controlling for time-constant effects ($p = 0.561$).

Table 9: Key baseline and endline characteristics of mothers surveyed

Characteristic	Baseline								Endline							
	Total		Intervention		Control		Diff. (%)	p-value	Total		Intervention		Control		Diff. (%)	p-value
	N	Mean (%)	N	Mean (%)	N	Mean (%)			N	Mean (%)	N	Mean (%)	N	Mean (%)		
Mother's highest level of education																
Illiterate	1,229	38.98	618	43.20	611	34.70	8.5	0.002	1,257	37.23	632	39.56	625	34.88	4.68	0.087
Literate, no formal schooling	1,229	2.69	618	2.75	611	2.62	0.1	0.886	1,257	1.19	632	1.27	625	1.12	0.15	0.815
Schooling up to 4 years	1,229	6.67	618	5.83	611	7.53	–1.7	0.232	1,257	5.73	632	5.22	625	6.24	–1.02	0.440
5–9 years' schooling	1,229	26.04	618	24.27	611	27.82	–3.6	0.156	1,257	28.08	632	28.32	625	27.84	0.48	0.849
HSC/SSC	1,229	16.84	618	16.99	611	16.69	0.3	0.890	1,257	15.75	632	14.72	625	16.80	–2.09	0.312
Some college, but not graduated	1,229	1.79	618	1.62	611	1.96	–0.3	0.648	1,257	5.65	632	5.22	625	6.08	–0.86	0.513
Graduate/postgraduate	1,229	7.00	618	5.34	611	8.67	–3.3	0.022	1,257	6.36	632	5.70	625	7.04	–1.34	0.332
Religion																
Hindu	1,229	88.85	618	87.06	611	90.67	–3.6	0.044	1,251	89.85	628	88.22	623	91.49	–3.28	0.055
Muslim	1,229	11.15	618	12.95	611	9.33	3.6	0.044	1,251	10.15	628	11.78	623	8.51	3.28	0.057
Caste																
Scheduled caste	1,228	36.65	618	39.81	610	33.44	6.4	0.021	1,206	41.63	603	41.29	603	41.96	–0.66	0.816
Scheduled tribe	1,228	1.14	618	1.78	610	0.49	1.3	0.033	1,206	0.91	603	1.33	603	0.50	0.83	0.158
Other backward caste	1,228	49.19	618	43.69	610	54.75	–11.1	0.000	1,206	46.35	603	45.27	603	47.43	–2.16	0.453
General caste	1,228	13.03	618	14.73	610	11.31	3.4	0.075	1,206	11.11	603	12.11	603	10.12	1.99	0.274
Sex of selected child																
Boy	1,229	51.75	618	48.22	611	55.32	–7.1	0.013	1,257	51.95	632	49.05	625	54.88	–5.83	0.039
Girl	1,229	48.17	618	51.78	611	44.52	7.3	0.011	1,257	48.05	632	50.95	625	45.12	5.83	0.039
Hard-to-reach children																
Hard-to-reach	1,229	37.51	618	33.17	611	41.90	–8.7	0.002	1,229	37.51	618	32.04	610	35.25	–3.21	0.235
Socioeconomic classification																
High	1,202	8.07	607	5.93	595	10.25	–4.3	0.006	1,209	12.32	602	10.63	607	14.00	–3.37	0.076
Medium	1,202	28.62	607	29.54	595	27.56	2.0	0.449	1,209	48.30	602	46.84	607	49.75	–2.91	0.312
Low	1,201	63.31	607	64.42	595	62.19	2.2	0.423	1,209	39.37	602	42.53	607	36.24	6.28	0.026

Note: HSC = Higher Secondary Certificate; SSC = Senior Secondary Certificate.

Table 10: Baseline and endline immunization outcomes

Outcome	Baseline									Endline									D-I-D [OLS] Unadjusted		D-I-D [OLS] Adjusted	
	Total		Intervention			Control			p-value	Total		Intervention			Control			p-value				
	N	%	N1	%	SD	N0	%	SD		N	%	N1	%	SD	N0	%	SD		Coeff.	p-value	Coeff.	p-value
FIC	1,229	52.88	618	51.94	0.50	611	53.85	0.49	0.504	1,257	64.28	632	64.72	0.48	625	63.84	0.48	0.746	0.028	0.619	0.033	0.561
Vaccines delivered according to schedule[a]	10,022	49.65	4,939	49.22	0.50	5,083	49.83	0.50	0.540	9,215	54.49	4,618	53.98	0.50	4,596	55.03	0.50	0.315	–0.004	0.901	0.005	0.830
Children who received all vaccines on time[a]	1,199	12.09	604	11.59	0.32	595	12.61	0.33	0.590	1,115	14.11	585	14.02	0.348	570	14.21	0.35	0.925	0.008	0.786	0.017	0.590
FIC who received all vaccines on time[a]	1,199	7.08	604	6.95	0.25	595	7.23	0.26	0.854	1,115	10.13	585	10.60	0.31	570	9.65	0.30	0.593	0.012	0.574	0.024	0.279
DPT1–DPT3 dropout[b]	1,104	16.93	554	19.86	0.39	550	14.00	0.35	0.010	1,105	12.30	557	11.85	0.32	548	12.77	0.33	0.640	–0.068	0.066	–0.074	0.061
OPV1–OPV3 dropout	1,051	17.31	520	20.19	0.40	531	14.50	0.35	0.015	1,119	13.13	565	13.10	0.34	554	13.18	0.34	0.970	–0.058	0.127	–0.058	0.115
DPT3 receipt	1,229	81.04	618	78.64	0.41	611	83.47	0.37	0.031	1,257	87.35	632	88.77	0.32	625	85.92	0.35	0.129	0.077	0.055	0.079	0.050
Received no vaccines	1,229	1.55	618	2.10	0.14	611	0.98	0.10	0.111	1,257	1.27	632	1.27	0.11	625	1.28	0.11	0.982	–0.011	0.389	–0.011	0.417

Note: SD = standard deviation.

a. Only considered children with immunization card data available.

b. Administration of pentavalent vaccine 1 and pentavalent vaccine 3 is included when measuring DPT dropout.

There was a 0.5 percentage point lower probability that a vaccine dose was received on time in the intervention group than in the control group, controlling for time-constant effects ($p = 0.830$). The effect on timeliness of vaccination among children was marginal, with a 1.7 percentage point increase ($p = 0.590$) in the probability that a child in the intervention arm received all vaccines on time and a 2.4 percentage point increase ($p = 0.279$) in the probability that a fully immunized child received all vaccines on time in the intervention group relative to the control group, controlling for time-constant effects. These changes are not statistically significant.

The probability that a child received the first but not the third dose of DPT (i.e. dropout) decreased by 7.4 percentage points in intervention villages relative to control villages, controlling for time ($p = 0.061$). The intervention had a slightly smaller effect on OPV (orally administered) dropout, with a 5.8 percentage point reduction in the probability of dropout in the intervention villages compared with the control villages, controlling for time ($p = 0.115$).

The probability that an infant received no vaccines declined slightly (– 1.1 percentage points) in intervention compared with control clusters, controlling for time-constant effects, but was not statistically significantly ($p = 0.417$). At baseline, 1.5 per cent of children surveyed had received no vaccines for which they were age eligible; this proportion was 1.3 per cent at endline. FGDs implemented through the process evaluation counted 67 women who attended video screenings and who had not previously vaccinated a child but had vaccinated their current infant.

While all outcome indicators changed in the direction we expected, their magnitude was not statistically significant, with the exception of DPT dropout, which was driven by an unusually high dropout rate in the intervention group at baseline (19.9%, compared with 14.0% in the control group). This study was powered to detect effect sizes of 15 percentage points in FIC, thus no outcome achieved statistical significance at the $p < 0.05$ level. All outcomes improved in the control villages across time points, although not as much as in intervention villages, demonstrating the importance of the D-I-D design. The D-I-D estimator in the unadjusted models changed the significance of the DPT dropout estimate, but for all other unadjusted estimates the significance remained unchanged. The directionality of the effects remained the same, except for vaccine doses delivered on time, which was negative by 0.04 percentage points.

Timeliness indicators changed less than dose-receipt indicators due to the intervention. Our process evaluation findings suggest that timeliness is highly driven by ASHA outreach and mobilization prior to and during VHNDs, thus it was probably less likely to be affected by a behavioural intervention than dose receipt.

Our process evaluation sheds light on the drivers of improved outcomes in the study area, in particular the contribution of the Government of India’s IMI campaign, which has been implemented to improve vaccination coverage through greater emphasis on microplanning and quality assurance, and by targeting HTR and under-immunized geographies and populations (Gurnani et al. 2018). During the study period, IMI activities were implemented across all intervention and control villages, including activities such as identifying areas with low vaccination coverage or where the ANM position had been vacant. During the study period, IMI was conducted for seven months, in which one full day was given to each village apart from their routine immunization sessions. Endline survey data suggest there was little to no contamination or spillover from intervention to control villages, and that observed improvements in vaccination coverage in control clusters (53.9% to 63.8%) are likely attributable to IMI. The majority of observed improvements in vaccination coverage in intervention clusters (51.9% to 64.7%) are likely attributable to IMI, with additional marginal improvement (3.9%) from the intervention.

4.4 Impact among subgroups

Table 11 shows primary and secondary outcome indicators among subgroups to estimate the intervention's effect among children born to the following vulnerable subgroups: mothers with no primary school education, families of Muslim religion, families of lower caste, families in the lowest income quintile, HTR families and families with female children. The D-I-D coefficient estimates the effect of the intervention within these populations and can be compared with D-I-D coefficients in Table 9 for all respondents. While the study explores differential impacts in order to understand the relevance of the intervention to immunization equity, the study was not powered to detect statistically significant intervention effects within these subgroups.

We observed no statistically significant intervention impacts among children of mothers with no primary school education. Among this subgroup, the probability of FIC was 12.5 percentage points lower in children in intervention clusters compared with control clusters at endline, controlling for time-constant effects ($p = 0.083$). For vaccine doses delivered on time, there was an increase of 2.3 percentage points among children of mothers with no primary school education, controlling for time-constant effects and treatment ($p = 0.668$).

The probability of receiving all vaccines on time increased by 5.9 percentage points for children in the intervention compared with control clusters at endline, controlling for time-constant effects ($p = 0.252$). The probability of FICs having received all their vaccines on time increased by 2.6 percentage points in the intervention compared with control clusters at endline ($p = 0.544$). DPT dropout and OPV dropout increased from baseline to endline among children of mothers without primary school education in the intervention group (7.7 percentage points and 6.6 percentage points respectively), controlling for time ($p = 0.262$ and $p = 0.302$, respectively).

We observed no statistically significant intervention impacts among children of Muslim families. The probability of FIC was 21.4 percentage points higher in children of Muslim families in the intervention group at endline, controlling for time-constant effects ($p = 0.091$). The probability that a vaccine dose was received on time decreased 0.6 percentage points in the intervention group at endline ($p = 0.960$). Among children of Muslim families in the intervention group, the probability that an infant received all vaccine doses on time decreased by 6.6 percentage points; but the probability of on-time vaccination increased 3.0 percentage points among children who were fully immunized, controlling for time ($p = 0.467$; $p = 0.617$). The probability of DPT dropout decreased by 6.6 percentage points and OPV dropout decreased by 3.3 percentage points in Muslim families in the intervention group, controlling for time ($p = 0.480$; $p = 0.740$).

Table 11: Subgroup immunization outcomes by subgroup status

Variable	Baseline							Endline							D-I-D [OLS] Unadjusted		D-I-D [OLS] Adjusted	
	In group			Outside group			p-value	In group			Outside group			p-value				
	n	%	SD	n	%	SD		n	%	SD	n	%	SD		Coeff.	p-value	Coeff.	p-value
Mothers with no primary school education																		
FIC	594	47.14	0.50	635	58.27	0.49	<0.001	555	62.88	0.48	702	65.38	0.48	0.358	-0.106	0.149	-0.125	0.083
Vaccine doses delivered on time	4,536	49.07	0.50	5,486	49.91	0.50	0.406	3,969	54.81	0.50	5,246	54.27	0.50	0.604	0.014	0.810	0.023	0.668
Children with only on-time vaccines	576	12.67	0.33	623	11.56	0.32	0.554	508	14.76	0.36	647	13.60	0.34	0.574	0.042	0.421	0.059	0.252
FIC with only on-time vaccines	576	7.29	0.26	623	6.90	0.25	0.793	508	11.02	0.31	647	9.43	0.29	0.373	0.027	0.543	0.026	0.544
DPT1–DPT3 dropout[a]	515	19.61	0.40	589	14.60	0.35	0.027	485	15.67	0.36	620	9.68	0.30	0.003	0.079	0.255	0.077	0.262
OPV1–OPV3 dropout	494	21.05	0.41	557	14.00	0.35	0.003	490	15.92	0.37	629	10.97	0.31	0.015	0.058	0.373	0.066	0.302
Families of Muslim religion																		
FIC	137	48.91	0.50	1,092	53.39	0.50	0.322	127	59.06	0.49	1,130	64.87	0.48	0.195	0.184	0.149	0.214	0.091
Vaccine doses delivered on time	1,032	49.71	0.50	8,990	49.51	0.50	0.904	837	50.90	0.50	8,377	54.86	0.50	0.028	0.007	0.953	-0.006	0.960
Children with only on-time vaccines	134	8.21	0.28	1,065	12.58	0.33	0.144	109	11.01	0.31	1,046	14.44	0.35	0.329	-0.038	0.676	-0.066	0.467
FIC with only on-time vaccines	134	5.22	0.22	1,065	7.32	0.26	0.372	109	5.50	0.23	1,046	10.61	0.31	0.093	0.042	0.470	0.030	0.617
DPT1–DPT3 dropout[a]	113	16.81	0.38	991	16.95	0.38	0.97	101	8.91	0.29	1,004	12.65	0.33	0.276	-0.041	0.654	-0.066	0.480
OPV1–OPV3 dropout	108	19.44	0.40	943	17.07	0.38	0.538	102	9.08	0.30	1,017	13.47	0.34	0.296	-0.002	0.984	-0.033	0.740
Families of lower caste																		
FIC	464	49.57	0.50	765	54.90	0.50	0.07	513	63.74	0.48	744	64.65	0.48	0.742	-0.114	0.222	-0.125	0.193
Vaccine doses delivered on time	3,656	51.17	0.50	6,366	48.55	0.50	0.013	3,801	56.23	0.50	5,073	53.64	0.50	0.015	0.077	0.110	0.083	0.097
Children with only on-time vaccines	449	12.69	0.33	750	11.73	0.32	0.622	474	14.77	0.36	634	14.20	0.35	0.789	0.107	0.036	0.140	0.007
FIC with only on-time vaccines	449	6.90	0.25	750	7.20	0.26	0.847	474	11.60	0.32	634	9.31	0.29	0.213	0.058	0.169	0.061	0.163
DPT1–DPT3 dropout[a]	410	18.05	0.39	694	16.28	0.37	0.45	469	14.68	0.36	645	10.54	0.29	0.035	0.098	0.131	0.111	0.106
OPV1–OPV3 dropout	390	17.69	0.38	661	17.10	0.38	0.805	463	14.47	0.35	656	12.20	0.32	0.267	0.066	0.336	0.087	0.235
Families in lowest income quintile																		
FIC	268	41.79	0.49	934	56.00	0.50	<0.001	145	60.69	0.49	1,064	64.47	0.48	0.374	0.076	0.460	0.087	0.412
Vaccine doses delivered on time	1,942	48.30	0.51	7,874	49.86	0.50	0.218	1,011	57.57	0.49	7,830	54.13	0.50	0.039	0.079	0.301	0.092	0.222
Children with only on-time	201	11.49	0.32	912	12.17	0.33	0.767	132	15.15	0.36	976	13.93	0.35	0.708	-0.056	0.497	-0.030	0.707

Variable	Baseline							Endline							D-I-D [OLS] Unadjusted		D-I-D [OLS] Adjusted	
	In group			Outside group			p-value	In group			Outside group			p-value				
	n	%	SD	n	%	SD		n	%	SD	n	%	SD		Coeff.	p-value	Coeff.	p-value
vaccines																		
FIC with only on-time vaccines	261	5.75	0.23	912	7.35	0.26	0.372	132	11.36	0.32	976	10.14	0.30	0.665	-0.055	0.393	-0.031	0.600
DPT1–DPT3 dropout[a]	224	24.11	0.43	855	15.09	0.36	0.001	124	24.19	0.43	937	10.78	0.31	0.000	0.112	0.208	0.118	0.179
OPV1–OPV3 dropout	209	24.88	0.43	819	15.38	0.36	0.001	124	15.12	0.42	951	12.09	0.33	0.001	0.050	0.583	0.075	0.400
Hard-to-reach families																		
FIC	461	51.19	0.50	768	53.91	0.50	0.357	413	59.81	0.49	815	66.87	0.47	0.015	0.232	0.032	0.229	0.040
Vaccine doses delivered on time	3,599	47.10	0.50	6,423	50.90	0.50	3E-04	2,947	55.28	0.50	6,063	54.08	0.50	0.286	0.215	0.002	0.218	0.002
Children with only on-time vaccines	439	12.07	0.33	760	12.11	0.33	0.987	376	13.83	0.35	754	14.19	0.35	0.870	0.117	0.051	0.120	0.045
FIC with only on-time vaccines	439	7.06	0.26	760	7.11	0.26	0.977	376	10.11	0.30	754	10.21	0.30	0.956	0.097	0.039	0.096	0.045
DPT1–DPT3 dropout[a]	400	18.75	0.39	704	15.91	0.37	0.227	361	16.90	0.38	719	10.29	0.30	0.002	-0.075	0.325	-0.097	0.236
OPV1–OPV3 dropout	385	19.22	0.39	666	16.22	0.37	0.215	364	17.58	0.38	730	11.10	0.31	0.003	-0.119	0.140	-0.138	0.098
Families with female children																		
FIC	592	54.39	0.50	637	51.49	0.50	0.309	604	61.09	0.49	653	67.23	0.47	0.023	0.071	0.312	0.044	0.560
Vaccine doses delivered on time	4,822	49.25	0.50	5,200	49.79	0.50	0.593	4,481	54.36	0.50	4,733	54.64	0.50	0.791	-0.043	0.458	-0.052	0.392
Children with only on-time vaccines	576	11.98	0.33	623	12.20	0.33	0.907	563	14.39	0.35	592	13.85	0.35	0.794	-0.018	0.757	-0.019	0.741
FIC with only on-time vaccines	576	7.29	0.26	623	6.90	0.25	0.793	563	9.77	0.30	592	10.47	0.31	0.692	-0.049	0.292	-0.049	0.318
DPT1–DPT3 dropout[a]	533	16.89	0.38	571	16.99	0.38	0.964	536	11.75	0.32	569	12.83	0.33	0.587	-0.058	0.253	-0.033	0.554
OPV1–OPV3 dropout	507	17.75	0.38	544	16.91	0.38	0.72	543	13.63	0.34	576	12.67	0.33	0.637	-0.044	0.388	-0.024	0.672

Note: SD = standard deviation.

a. Administration of pentavalent vaccine 1 and pentavalent vaccine 3 is included when measuring DPT dropout

A statistically significant intervention impact was observed in children receiving all vaccine doses on time among low-caste families, although no other statistically significant intervention impacts were observed. However, the study was not powered to detect subgroup effects. Among children in this subgroup, the probability of FIC was 12.5 percentage points lower in the intervention group than the control group, controlling for time-constant effects ($p = 0.193$). Conversely, the probability of a vaccine dose delivered on time increased 8.3 percentage points, controlling for time ($p = 0.097$).

Among children of low-caste families in the intervention group, the probability of receiving all vaccine doses on time increased 14.0 percentage points, and this probability among FIC children increased 6.1 percentage points, controlling for time ($p = 0.007$; $p = 0.163$). The probability of DPT dropout was 11.1 percentage points higher, and OPV dropout was 8.7 percentage points higher, in children of low-caste families in the intervention group compared with the control group, controlling for time ($p = 0.106$; $p = 0.235$).

We observed no statistically significant intervention impacts among children of low-income families. Among children in this subgroup, the probability of FIC was 8.7 percentage points higher in the intervention group compared with the control group, controlling for time-constant effects ($p = 0.412$). Controlling for time-constant effects, the probability of a vaccine dose being administered on time increased by 9.2 percentage points in the intervention group compared with the control group ($p = 0.222$).

Among children in the lowest income quintile in the intervention group, the probability of receiving all vaccine doses on time decreased 3.0 percentage points, and decreased 3.1 percentage points among children who were fully immunized, controlling for time ($p = 0.707$; $p = 0.600$). The probability of dropout was 11.8 percentage points higher for DPT and 7.5 percentage points lower for OPV among children from low socioeconomic families in the intervention group compared with these children in the control group, controlling for time ($p = 0.179$; $p = 0.400$).

We did observe statistically significant impacts among children of families in communities identified as HTR, although we reiterate that the study was not powered to detect differences within subgroups. In this subgroup, the intervention resulted in a 22.9 percentage point increase in the probability of being fully immunized compared with the same children in control communities, controlling for time, which was statistically significant ($p = 0.040$). The probability of a vaccine dose being administered on time increased 21.8 percentage points among families in HTR areas compared with the control group, controlling for time, significant at the 5 per cent level ($p = 0.002$).

For children in communities identified as HTR, the probability of receiving all their vaccines on time increased by 12.0 percentage points ($p = 0.045$) and by 9.6 percentage points among children fully immunized in this group. On-time vaccination among FIC was statistically significant at the 5 per cent level ($p = 0.045$). Among HTR children, the intervention resulted in a 9.7 percentage point decrease in the probability of DPT dropout and a 13.8 percentage point decrease in the probability of OPV dropout ($p = 0.236$; $p = 0.098$).

We did not observe statistically significant impacts among female children. For children in this subgroup, the probability of being fully immunized was 4.4 percentage points higher in the intervention group compared with female children in the control group, controlling for time-constant effects ($p = 0.560$). The probability of a vaccine dose being administered on time decreased 5.2 percentage points among female children in the intervention group compared with female children in the control group, controlling for time ($p = 0.392$). The probability that a female infant received all vaccine doses on time decreased 1.9 percentage points and by 4.9 percentage points among fully immunized female children, compared with female children in the control group and controlling for time ($p = 0.741$; $p = 0.318$). The probability of dropout was 3.3 percentage points lower for DPT and 2.4 percentage points lower for OPV among female children in the intervention group compared with female children in the control group, controlling for time ($p = 0.554$; $p = 0.672$).

The evaluation was not powered to measure statistically significant changes among subgroups, and none were observed except in the case of children of families living in HTR areas and children of families of lower caste (all doses administered on time). Based on our process evaluation and updated TOC, we posit that the intervention had a greater impact among children in HTR areas because of the type of vaccination constraint they faced prior to the intervention, and because they were easily identified and targeted due to their geographic definition.

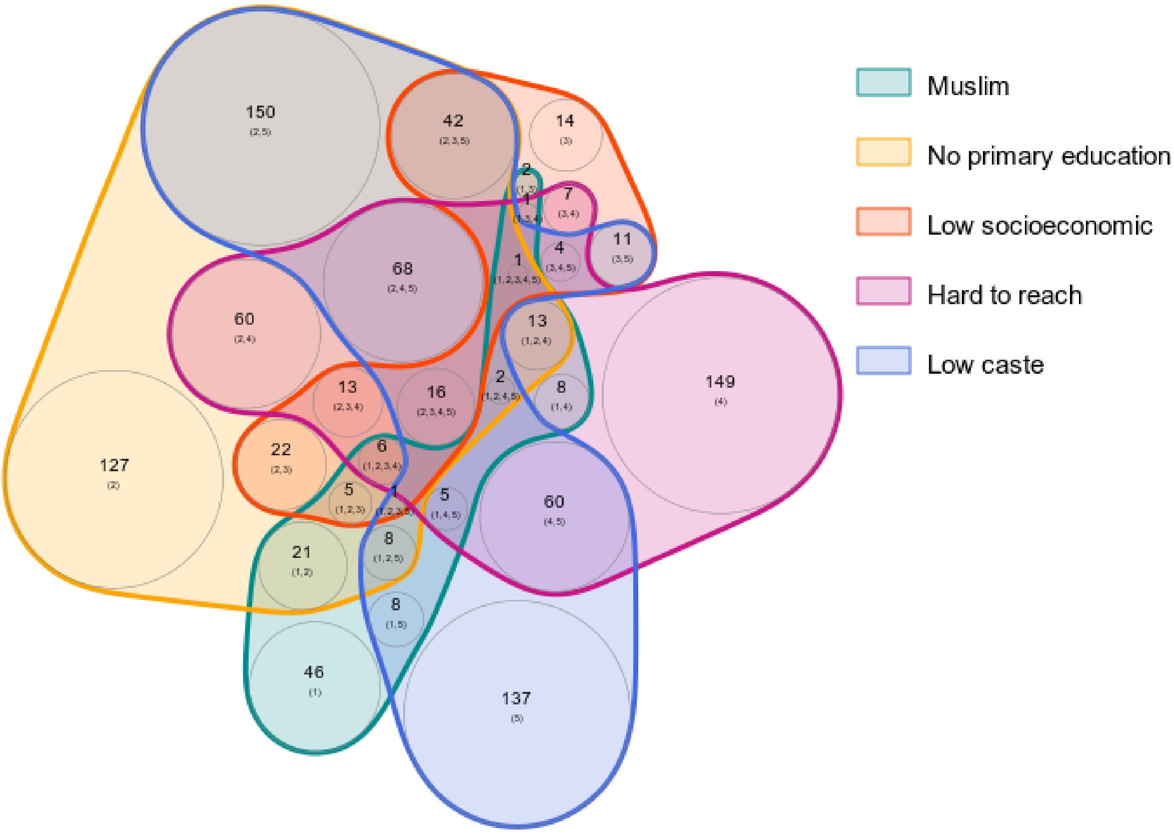
Process evaluation data indicate that a primary constraint to vaccination faced by families in HTR communities was lack of awareness of the need to vaccinate and where and when to go. In part due to their geographic location, ASHAs were often not likely to visit these families as part of their outreach and mobilization efforts prior to the intervention. The intervention increased the likelihood that ASHAs engaged with these families, including through targeted video screenings with smaller groups of HTR women in their homes. ASHAs reported using the videos as a tool to engage with mothers and facilitate discussion. The following quote reflects this point which was commonly held across all ASHAs:

> Actually it helps me to engage with people. If I have to screen for 10 minutes but half an hour is spent in talking and engaging with them. If I am forgetting something, then videos help me to remember those messages. –– Interview with ASHA, September 2017

We also posit that low awareness is a relatively easier constraint to overcome than belief-based constraints, such as deeply held beliefs. Our process evaluation suggested there was a difference between modifiable beliefs (such as fear of side effects), versus deeply held beliefs which are less mutable (such as the belief among some Muslim families that vaccines cause infertility). For instance, despite efforts to include Muslim actors in the videos and address deeply held beliefs, the intervention was not successful in increasing vaccination in this subgroup. Conversely, the HTR group had a relatively more modifiable constraint of low awareness and was easily targeted based on geographic constraints. Other vulnerabilities were not as successfully targeted.

Based on other empirical evidence generated since this study was designed (Gavi 2018), we hypothesized that intervention impact might be associated with fewer vulnerabilities, which tend to compound and produce a multiplicative effect, unless the intervention could effectively overcome all of them. While we expected that families in HTR communities would face other vulnerabilities and thus barriers to vaccination, Figure 7 illustrates the overlap of vulnerabilities measured and shows that nearly one-third (n = 149) of HTR families experienced no other compounding vulnerability measured in this study.

Figure 7: Interaction of subgroup demographics



Each color indicates an individual with the specified subgroup characteristic (binary indicator). Overlapping colors indicate individuals who are members of multiple subgroups.

4.5 Impact among exposed

In terms of exposure, 56 per cent of survey respondents reported viewing a Projecting Health video (Figure 8) and nearly half (48%) reported viewing an immunization video (Figure 9). Among those who reported seeing a video, respondents viewed an average of 6.1 videos, of which an average of 3.0 were immunization videos.

Figure 8: Number of Projecting Health videos seen (survey data)

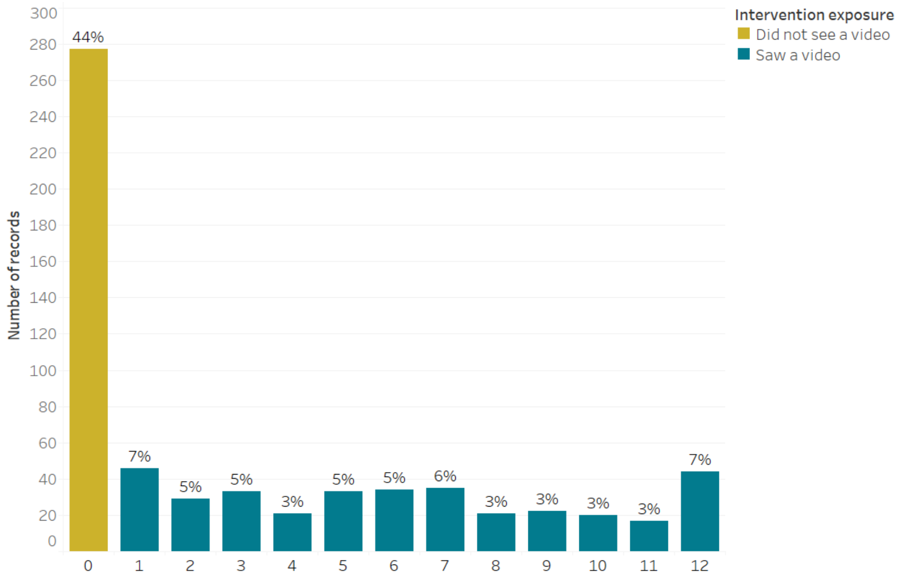


Figure 9: Number of Projecting Health immunization videos seen (survey data)

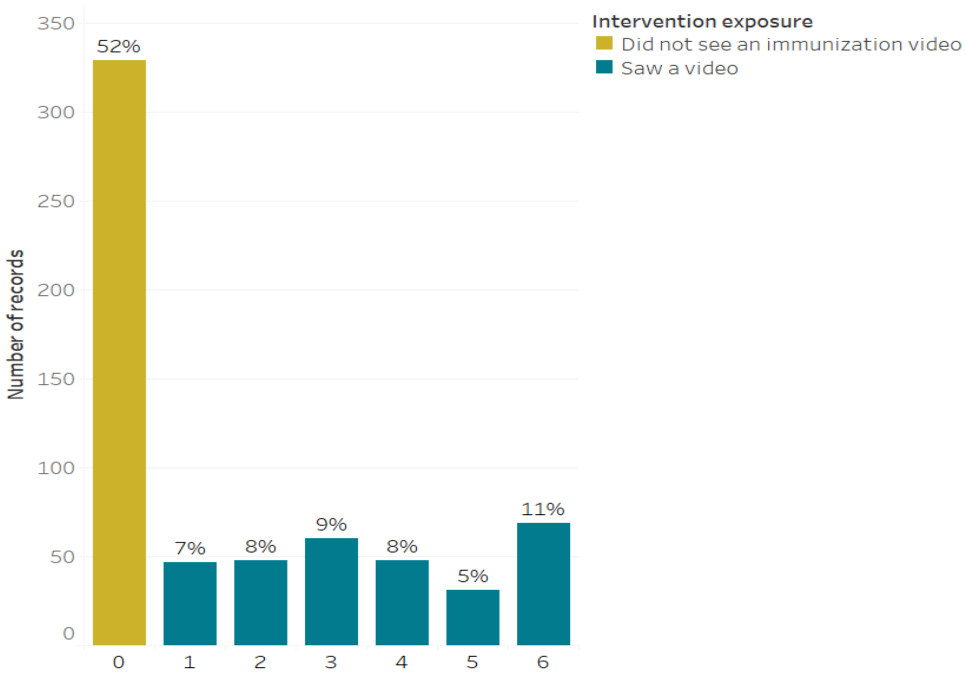


Table 12 shows primary and secondary outcomes among survey respondents who reported exposure compared with non-exposed individuals living in the intervention clusters. We estimated the effects of exposure (as treated) by instrumenting OLS models on intervention status, to capture: (a) any exposure to Projecting Health videos; and (b) the number of videos exposed to. The coefficient estimates the relative impact of exposure instrumented on intervention status (the product of the second-stage OLS). We treat intervention assignment as an instrument, as we expect the variable to predict an individual's total exposure to the intervention. Furthermore, given that assignment was random, there are likely to be no observed factors relating to assignment status that might systematically influence both exposure and immunization status. The study was not powered to detect statistically significant dose-response effects.

Table 12: Exposure and dose-response effects of the intervention

Variable	Among all individuals at endline											
	Unadjusted											
	Saw a Projecting Health video			Saw an immunization Projecting Health video			Count of Projecting Health videos seen			Count of immunization Projecting Health videos seen		
	n	Coeff.	p-value	n	Coeff.	p-value	n	Coeff.	p-value	n	Coeff.	p-value
FIC	1,257	0.016	0.806	1,257	0.018	0.805	1,257	0.003	0.806	1,257	0.005	0.806
Vaccines delivered according to schedule	9,214	–0.018	0.682	9,214	–0.020	0.682	9,214	–0.003	0.682	9,214	–0.007	0.683
Children who received all vaccines on time	1,155	–0.003	0.931	1,155	–0.004	0.931	1,155	–0.001	0.931	1,155	–0.001	0.931
FIC who received all vaccines on time	1,155	0.016	0.621	1,155	0.019	0.620	1,155	0.003	0.620	1,155	0.007	0.619
DPT1–DPT3 dropout[a]	1,105	–0.016	0.765	1,105	–0.018	0.765	1,105	–0.003	0.765	1,105	–0.005	0.765
OPV1–OPV3 dropout	1,119	–0.001	0.980	1,119	–0.002	0.980	1,119	0.000	0.980	1,119	0.000	0.980
Variable	Adjusted											
	Saw a Projecting Health video			Saw an immunization Projecting Health video			Count of Projecting Health videos seen			Count of immunization Projecting Health videos seen		
	n	Coeff.	p-value	n	Coeff.	p-value	n	Coeff.	p-value	n	Coeff.	p-value
FIC	1,181	0.0269	0.668	1,181	0.0314	0.668	1,181	0.0043	0.668	1,181	0.009	0.668
Vaccines delivered according to schedule	8,644	–0.0149	0.738	8,644	–0.0171	0.738	8,644	–0.0024	0.738	8,644	–0.006	0.738
Children who received all vaccines on time	1,084	0.0029	0.944	1,084	0.0033	0.944	1,084	0.0005	0.944	1,084	0.001	0.944
FIC who received all vaccines on time	1,084	0.0353	0.321	1,084	0.0408	0.320	1,084	0.0057	0.319	1,084	0.014	0.319
DPT1–DPT3 dropout[a]	1,037	–0.0245	0.645	1,037	–0.0280	0.645	1,037	–0.0039	0.645	1,037	–0.008	0.645
OPV1–OPV3 dropout	1,051	–0.0016	0.976	1,051	–0.0018	0.976	1,051	–0.0003	0.976	1,051	0.0000	0.976

Note: a. Doses of the pentavalent vaccine are included in DPT totals.

As shown in Table 12, the probability of FIC was 2.7 percentage points higher among children born to mothers who reported seeing any Projecting Health video compared with children born to mothers in intervention clusters who did not see a video (p = 0.668). The probability of a vaccine dose being administered on time was 1.5 percentage points lower among children whose mother saw a video compared with children whose mother did not see a video in the intervention clusters (p = 0.738). Yet the probability that an infant received all their vaccine doses on time was 0.3 percentage points higher (p = 0.944) and 3.5 percentage points higher (p = 0.321) for FIC among children whose mother saw a video. The probability of dropout was 2.5 percentage points lower for DPT (p = 0.645) and 0.2 percentage points lower (p = 0.976) for OPV among children whose mother saw a video compared with those who did not, in the intervention clusters.

Exposure to a Projecting Health video on immunization was associated with a 3.1 percentage point higher probability of FIC compared with non-exposure to a Projecting Health video in the intervention clusters (p = 0.668). The probability of doses administered on time was 1.7 percentage points lower when immunization videos were seen (p = 0.738). Conversely, the probability of children receiving all vaccine doses on time was 0.3 percentage points higher (p = 0.944), yet the probability of receipt of on-time doses among FIC was 4.1 percentage points higher (p = 0.320) when immunization videos were watched. The probability of DPT dropout was 2.8 percentage points (p = 0.645) lower and the probability of OPV dropout was 0.2 percentage points (p = 0.976) lower when immunization videos were watched.

Increasing the units of exposure (dose response) had a similar effect. A one-unit increase in the number of videos seen was associated with a 0.4 percentage point higher probability of FIC (0.668). A one-unit increase in the number of videos seen was associated with a 0.3 percentage point decrease in the probability of doses received on time (p = 0.738). A unit increase in the number of videos seen was associated with a 0.1 percentage point increase in the probability of children who received all vaccines on time (p = 0.944); it was associated with a 0.6 percentage point higher probability of FIC who received all doses on time (p = 0.319). The probability of DPT dropout was 0.4 percentage points lower (p = 0.645) and the probability of OPV dropout was 0.03 percentage points lower (p = 0.976) for every unit increase in videos seen.

The same trends were observed for increasing the units or dosage of exposure for immunization videos specifically. A unit increase in the number of immunization videos seen was associated with a 0.9 percentage point higher probability of FIC (p = 0.668). The probability of vaccine doses received on time was 0.6 percentage points lower for each additional unit of immunization videos seen (p = 0.738). A one-unit increase in immunization videos seen was associated with a 0.1 percentage point higher probability of children who received all vaccines on time (p = 0.994) and with a 1.4 percentage point higher probability of FIC who received all vaccines on time (p = 0.319). Each additional immunization video seen was associated with a 1.8 percentage point decrease in probability of DPT dropout (p = 0.645) and a 0.0 percentage point change in probability of OPV dropout (p = 0.976).

In short, there appears to be an association between intervention exposure and FIC above the intent-to-treat effect of the intervention, with the greatest association among women who watched an immunization video. FIC, children who received all vaccines on time (fully immunized or not) and dropout indicators express associations with exposure in the direction we would expect, although none are significant.

During FGDs with mothers who attended women's group meetings, some expressed that viewing the videos changed their perspective on side effects and vaccination. The following comment is reflective of a small subset of the overall population who had previously not vaccinated their children but who decided to after viewing a video.

> None of my children are vaccinated. Only one child was born in hospital. I am very scared of injection but what say now, I am doing this out of compulsion for good health of my children. What to do? It's all because of information provided by you all that I have started doing it. Last vaccination I got on Anganwadi centre and I have come for next one here. — Interview with mother, November 2017, intervention village

4.6 Outcomes: Intention and knowledge

We measured multiple outcomes and intermediate outcomes in the Figure 2 (Online appendix B) to assist in explaining why and how the intervention worked or did not work.

This section describes the effect of the intervention on behavioral intent, knowledge and beliefs measured through the survey and estimated using the D-I-D estimator (Table 13). It also describes differences at endline in these indicators among respondents who reported viewing at least one video versus those who did not, in intervention clusters (Table 14).

Table 13: Community attitudes and normative beliefs, by intervention and control group

Outcome measure	Baseline							Endline							D-I-D [OLS] Unadjusted		D-I-D [OLS] Adjusted	
	Total		Intervention		Control		p-value	Total		Intervention		Control		p-value				
	N	%	N1	%	N0	%		N	%	N1	%	N0	%		coeff.	p-value	coeff.	p-value
Among mothers																		
Mothers who want to fully immunize their child	1,229	97.72	618	97.57	611	97.87	0.725	1,257	98.64	632	98.73	625	98.56	0.789	0.005	0.682	0.005	0.657
Mean maternal knowledge score	1,229	5.35	618	5.27	611	0.54	0.330	1,257	5.75	632	5.83	625	5.68	0.369	0.301	0.507	0.346	0.429
Antenatal care knowledge (7 messages)	1,229	1.59	618	1.55	611	1.63	0.309	1,257	1.89	632	1.90	625	1.87	0.666	0.105	0.541	0.128	0.432
Birth preparedness knowledge (7 messages)	1,229	1.91	618	1.88	611	1.93	0.520	1,257	1.98	632	2.01	625	1.94	0.284	0.126	0.497	0.153	0.406
Breastfeeding initiation knowledge (3 messages)	1,229	0.97	618	0.96	611	0.98	0.789	1,257	1.08	632	1.07	625	0.11	0.829	0.001	0.996	–0.007	0.956
Immunization knowledge (4 messages)	1,229	0.88	618	0.87	0.895	0.47	0.465	1,257	0.80	632	0.82	625	0.78	0.190	0.070	0.288	0.073	0.262
Mothers who can recall at least one key immunization message	1,229	74.20	618	75.73	611	72.67	0.221	1,257	71.60	632	72.15	625	71.04	0.662	–0.019	0.664	–0.016	0.728
Family members whom mothers perceived to want to fully immunize their child																		
Mothers-in-law	1,229	77.46	618	76.86	611	78.07	0.613	1,257	75.58	632	74.84	625	76.32	0.542	–0.003	0.944	0.005	0.909
Husbands	1,229	96.33	618	96.28	611	96.40	0.910	1,257	96.97	632	96.36	625	97.60	0.200	–0.011	0.520	–0.033	0.442
Fathers-in-law	1,229	67.37	618	69.58	611	65.14	0.097	1,257	69.13	632	68.20	625	70.08	0.470	–0.063	0.126	–0.051	0.255
Family members who want to fully immunize their child																		
Mothers-in-law	352	98.01	175	97.71	174	98.28	0.709	307	98.37	144	97.92	137	99.27	0.340	–0.008	0.723	—	—
Husbands	350	96.57	171	95.91	179	97.21	0.505	293	98.29	143	99.30	150	97.33	0.195	0.033	0.206	—	—
Family members who can recall at least one key immunization message																		
Mothers-in-law	352	68.75	174	69.71	174	67.24	0.620	307	71.66	144	66.67	137	77.37	0.046	–0.132	0.084	—	—
Husbands	350	72.86	171	71.93	179	73.74	0.704	293	87.37	143	88.81	150	86.00	0.471	0.046	0.548	—	—

Outcome	Baseline							Endline								D-I-D [OLS] Unadjusted		D-I-D [OLS] Adjusted	
	Total		Intervention		Control		p-value	Total		Intervention		Control		p-value					
	N	%	N1	%	N0	%		N	%	N1	%	N0	%			coeff.	p-value	coeff.	p-value
Mean ASHA knowledge score	67	14.91	33	14.94	34	14.88	0.948	62	16.94	31	16.90	31	16.97	0.947		–0.122	0.926	—	—
Antenatal care knowledge (7 messages)	67	4.01	33	4.00	34	4.03	0.918	62	4.66	31	4.55	31	4.77	0.550		–0.196	0.675	—	—
Birth preparedness knowledge (7 messages)	67	3.99	33	3.94	34	4.03	0.775	62	4.44	31	4.55	31	4.32	0.558		0.316	0.522	—	—
Breastfeeding initiation knowledge (3 messages)	67	2.10	33	2.27	34	1.94	0.067	62	2.08	31	2.10	31	2.06	0.829		–0.299	0.203	—	—
Immunization knowledge (9 messages)	67	4.81	33	4.73	34	4.88	0.706	62	5.76	31	5.71	31	5.81	0.825		0.058	0.922	—	—
Mean ASHA facilitation score[a]	67	3.16	33	3.18	34	3.15	0.847	62	2.71	31	2.74	31	2.68	0.715		0.030	0.906	—	—

Note: a. Facilitation score is not included in knowledge; this represents an ASHA's self-assessment of ability to facilitate groups, on a five-point scale.

Table 14: Community attitudes and normative beliefs, by exposure status

Outcome measure	Among all individuals in the treatment group at endline							
	Saw immunization video			Did not see immunization video			Difference	p-value
	N1	%	SD	N0	%	SD		
Knowledge								
Mothers who want to fully immunize their child	291	99.66	0.06	341	97.95	0.14	1.71	0.056
Mean maternal knowledge score	291	6.25	3.14	341	5.46	2.84	0.79	0.001
Antenatal care knowledge (7 messages)	291	1.96	1.41	341	1.85	1.36	0.11	0.284
Birth preparedness knowledge (7 messages)	291	2.26	1.42	341	1.81	1.25	0.45	0.000
Breastfeeding initiation knowledge (3 messages)	291	1.15	0.90	341	1.01	0.86	0.14	0.042
Immunization knowledge (4 messages)	291	0.87	0.61	341	0.79	0.61	0.08	0.112
Mothers who can recall at least one key immunization message	291	74.57	0.44	341	70.09	0.46	4.48	0.211
Family members whom mothers perceived to want to fully immunize their child								
Mothers-in-law	291	71.13	0.45	341	78.01	0.41	–6.88	0.047
Husbands	291	97.94	0.14	341	95.01	0.22	2.93	0.051
Fathers-in-law	291	65.64	0.48	341	70.38	0.46	–4.74	0.202

Note: SD = standard deviation.

4.6.1 Intention

Table 13 illustrates the frequency of beliefs and knowledge measured through the household surveys. Mothers reported very high behavioral intention at baseline (97.7%) and endline (98.6%). We observed a minor increase in probability of reporting intent to vaccinate (0.5 percentage points) among the intervention compared with the control clusters, controlling for time effects, but the increase was not statistically significant ($p = 0.657$). Comparing intention between intervention cluster respondents who reported viewing an immunization video at endline versus those who did not illustrates that viewing videos was associated with higher intent in the intervention clusters; women who reported viewing videos had a 1.71 percentage point higher probability of intent to vaccinate at endline ($p = 0.056$) (Table 14).

As indicated in our TOC, we hypothesized that the intervention would increase intent to vaccinate, but it did not. Intent to vaccinate was already high at baseline (97.9% of mothers reported wanting to fully vaccinate their children). While exposure was associated with a marginally higher intent to vaccinate, it is also feasible that this was a product of intervention participants already having greater self-efficacy or intention to vaccinate than those women who did not attend. The discussion section below explains possible reasons why high behavioral intent did not translate to actual behavior (vaccination).

It is worth noting that, in contrast to the high intent recorded through the household survey, the process evaluation indicated there were individuals who actively chose not to vaccinate their children. This may be a function of social desirability bias in the household survey, although we posit that it may also reflect family constraints or logistical barriers that prevent mothers from taking a vaccine decision regardless of their own personal intention to vaccinate. As noted elsewhere, mothers are not the sole or primary decision makers and other family members reported lower intent to vaccinate.

4.6.2 Knowledge

The calculated mean maternal knowledge score, a composite of 21 knowledge questions on the survey, increased marginally (0.35 percentage points) in the intervention compared with control clusters, controlling for time effects ($p = 0.429$). Examining topic-specific knowledge, there was no statistically significant gain in knowledge on ANC, birth preparedness, breastfeeding or immunization attributable to the intervention package. The probability of surveyed mothers recalling at least one immunization message decreased in the intervention relative to the control communities (– 0.02 percentage points), controlling for time effects; this drop was not statistically significant ($p = 0.728$).

Table 14 illustrates that an association exists between viewing a video and having greater knowledge, but we cannot rule out the role of unobservable factors influencing both of these. At endline, women who reported viewing at least one video had a mean knowledge score that was 0.79 points higher than women in the same intervention communities who had not seen a video ($p = 0.001$); issue-specific knowledge was also higher (0.11 for ANC [$p = 0.284$], 0.45 for birth preparedness [$p = 0.000$], 0.14 for breastfeeding [$p = 0.042$] and 0.08 for immunization [$p = 0.112$]). However, even among exposed women, overall knowledge recall was low, with 74.6 per cent of women able to recall at least one immunization message, compared with 70.1 per cent among non-exposed women ($p = 0.211$).

The process evaluation corroborated these findings, showing an increase in maternal knowledge among those women who were exposed to the intervention. The process evaluation suggests that maternal knowledge increase was particularly noticeable among women who reported little to no prior knowledge of vaccination.

> I felt very guilty that day after watching the video that I did a big mistake of not vaccinating my son because of my ignorance. — Interview with mother, November 2017, intervention village

4.6.3 Perception of others' intent

Probability of whether mothers perceived their mothers-in-law, husbands and fathers-in-law as wanting the household children fully immunized decreased slightly from baseline to endline in the intervention versus control communities by a difference of 0.5, 3.3 and 5.1 percentage points, respectively (p = 0.909, 0.442 and 0.255; refer to Table 13).

Among women exposed to an immunization video in intervention communities (Table 14), perceptions that their mothers-in-law wanted the household children fully vaccinated was 6.88 percentage points lower compared with the non-exposed mothers surveyed, which was statistically significant (p = 0.047); 97.9 per cent of exposed women thought that their husbands wanted their children fully vaccinated versus 95.0 per cent of non-exposed women (p = 0.051). Similar to the directionality of their perceptions of their mothers-in-law but not statistically significant, fewer respondents (4.74 percentage points) exposed to an immunization video thought that their father-in-law wanted the household's infant fully vaccinated compared with women in the same communities who were not exposed to a video (p = 0.202).

We hypothesize that this change in perception of household members' desire to vaccinate was a product of increased dialogue between mothers and family members due to the mothers' group. As a result of this increased discussion, mothers' perceptions of others' attitudes were re-adjusted based on familial responses and behaviors.

4.6.4 Changes in family members' intention and knowledge

Self-reports of the intentions of mothers-in-law and husbands to vaccinate and of their vaccine knowledge showed no statistically significant change from baseline to endline, controlling for time (Table 13). The probability of the intention of mothers-in-law to fully vaccinate the children in their household decreased 0.7 percentage points from baseline to endline (p = 0.723), while the probability of husbands' intention to fully vaccinate children in their household increased 3.3 percentage points (p = 0.206). Intent to vaccinate among household members was high at both baseline and endline: 98.0% of mothers-in-law reported intent to vaccinate at baseline and 97.9% reported intent at endline; 96.6% of husbands reported intent to vaccinate at baseline and 99.3% at endline.

As shown in Table 14, the probability of mothers-in-law recalling knowledge of at least one key message was 13.2 percentage points lower from baseline to endline, but the study was not powered to detect differences in outcomes among sub-populations. This change was driven predominantly by an increase in the knowledge of mothers-in-law in control areas from 67.2% to 77.4%; in the intervention area, knowledge of any key messages declined slightly, from 69.7% to 66.7%. Conversely, probability of husbands' recall of at least one key message increased 4.7 percentage points from baseline to endline.

4.7 Outcomes: ASHA knowledge and facilitation skills

Among ASHAs, the calculated mean knowledge score, a composite of 26 knowledge questions, decreased slightly (– 1.2 percentage points) in intervention villages compared with control villages, controlling for time ($p = 0.926$), but the study was not powered to detect differences in this subgroup. For topic-specific knowledge, marginal declines were shown in ANC and breastfeeding knowledge, and marginal increases were shown in birth preparedness and immunization knowledge. No effects were statistically significant.

ASHAs' self-reports of facilitation skills declined in both the intervention and control groups from baseline to endline, although less so in the intervention group; no effects were statistically significant. The mean reported facilitation score at baseline (out of 5 points) was 3.2 and the mean facilitation score at endline was 2.7. The change in probability from baseline to endline, controlling for time effects, was a 0.02 percentage point increase ($p = 0.906$).

While no statistically significant effects were observed in ASHA knowledge and facilitation measured through the survey, some ASHAs in the process evaluation reported benefits from the intervention (see section 4.4).

We posit that there is likely some variation in ASHA knowledge retention and facilitation skills, even within the intervention area, dependent on prior ASHA experience, level of engagement in the intervention (for example, recipient of videos versus actor in videos) and assigned supervisory staff. As with all respondents' knowledge responses, the time lag between intervention end and endline survey may have contributed to recall bias. Irrespective of knowledge gains, several ASHAs did cite the intervention as reducing their workload. The work of mobilizing people for VHND sessions, which is often labor intensive and lengthy, was reduced as people gathered in one place to watch the videos.

> Earlier I had to go several times to call people for vaccination, but because of videos mothers used to easily come. I got a lot of help and it saved my time in mobilizing people on VHND day. — Interview with ASHA, May 2018

4.8 Outcomes: Networks

In line with other studies of mothers' groups that showed a positive health impact despite no measurable knowledge gains (Valente et al. 1997), we designed our study to test the hypothesis that mothers' groups improve healthcare-seeking behaviors by diffusing positive norms through establishing or strengthening social networks.

When asked to name other individuals with whom respondents discussed vaccine-related questions, mothers reported a mean of 1.20 individuals at baseline, compared with 1.22 individuals at endline (Table 15). Comparing intervention to control communities and controlling for time, the mean number of vaccine discussion ties was lower in the intervention communities (– 0.06) but not statistically significantly so ($p = 0.511$).

Table 15: Vaccine discussion networks

Outcome measure	Baseline							Endline							D-I-D (OLS) Unadjusted		D-I-D [OLS] Adjusted	
	Total		Intervention		Control		p-value	Total		Intervention		Control		p-value				
	N	Mean	N1	Mean	N0	Mean		N	Mean	N1	Mean	N0	Mean		coeff.	p-value	coeff.	p-value
Mean degree of ties in mothers' vaccine discussion network	1,229	1.20	618	1.20	611	1.21	0.896	1,257	1.22	632	1.18	625	1.26	0.063	–0.073	0.440	–0.061	0.511

Note: D-I-D = difference-in-difference; OLS = ordinary least squares.

4.8.1 Network effects among exposed

An examination of how network ties are associated with intervention exposure demonstrates that there was a slight, statistically significant, positive association between having viewed an immunization video and the number of vaccine discussion ties reported (Table 16). In intervention communities at endline, women who reported having viewed an immunization video reported a mean of 1.24 vaccine discussion relationships compared with 1.13 among women who had not viewed an immunization video: 0.11 more ties on average (p = 0.037).

Table 16: Vaccine discussion networks by exposure

Outcome measure	Among all individuals in the treatment group at endline							
	Saw immunization video			Did not see immunization video			Difference	p-value
	N1	#	SD	N0	#	SD		
Network outcomes								
Mean degree of ties in network	291	1.24	0.71	341	1.13	0.64	0.11	0.037
Listed ASHA as a network tie	291	0.35	0.48	341	0.25	0.43	0.09	0.009

Note: SD = standard deviation.

4.8.2 Composition of relationships

Among the treated population, women who saw an immunization video reported a different composition of social ties at endline compared with baseline and control clusters, with a greater proportion of these women's ties going to ASHAs. This is consistent with other findings: the intervention seemed to have a positive effect on the ASHAs' engagement with community members, even outside the video screenings.

In conclusion, the intervention did not increase the number of reported vaccine discussion relationships in these communities. Because the formation and dissolution of relationships were not monitored prospectively, we do not know whether there may have been an initial effect that disappeared by the endline survey. It is also possible that while the intervention brought women together in groups, the group intervention was not explicitly designed, based on behavioral and network theory, to encourage relationship-building; for example, by encouraging peer mentoring or buddying. As with other outcomes that were positively associated with intervention exposure, we cannot rule out confounding.

5. Cost analysis

The cost analysis is presented from an implementer perspective: that is, what would be the total cost of operating the program. The societal perspective is not captured; thus, the analysis does not account for the time that participants spent engaged in the intervention and the opportunity cost of their attendance. All dollar values presented are in 2017 US dollars ($); conversion from Indian rupees is estimated at 67 Indian rupees to $1 (Table 17). For comparison, we present the costs of both DPT3 and full vaccination.

For our analysis, the costs of the Projecting Health intervention are presented against the costs of the 'status quo' immunization program. The status quo is selected as the cost of the government of Uttar Pradesh's routine vaccination service delivery, which includes the standard information, education and communication activities, although these tend to be limited in scope and not targeted to specific populations or communities. Recent estimates show the cost of routine vaccination service delivery per FIC is $28 in Uttar Pradesh at community health centers and $30 per child receiving DPT3 (Chatterjee et al. 2018). The cost of routine service delivery includes the cost of government personnel, the vaccines and vaccine supplies, and costs of routine vaccine administration. For the purposes of this cost analysis, we assume that the costs of routine immunization are standard across both intervention and control villages.

Due to the limited cost data available from other studies of social and behavior change communication (SBCC) interventions in immunization programs, it is difficult to cite an accurate comparator for the intervention evaluated, and there are limitations in selecting the costs of routine immunization as the comparator. Firstly, routine immunization administration in India benefits from economies of scale, which brings down the unit cost of vaccination in a way that our intervention is not similarly able to do. Secondly, routine immunization in India includes limited information, education and communication and SBCC activities, so the package of activities compared is not equal.

It is more appropriate to consider the intervention as a complement to the existing routine immunization package, as opposed to a substitute. As a result of these limitations, we would expect the cost of the intervention to be relatively higher than the cost of the comparator. In light of these limitations, to contextualize these findings further, we also frame the cost-effectiveness of the intervention relative to similar complementary SBCC interventions.

5.1 Methods

A micro-costing approach was taken to determine the actual cost of the intervention. To measure costs, an ingredients approach was used, with all of the relevant inputs of the intervention (the 'ingredients') identified and subsequently valued (Levin 2018). Using the valued ingredients of the intervention, we were able to construct a complete portrait of the total intervention cost.

Data on the cost of the ingredients were collected retrospectively through expenditure tracking with all implementing partners. Ledgers of expenses were collected from PATH and NYST, and then reviewed with organization staff to ensure appropriate assignment of cost categories to each line item. Cost inputs were adjusted to ensure accurate representation of implementation costs, as follows:

- Exclusion of all research-related costs
- Partial allocation of salary expenditures for support staff who worked on multiple projects (for example, accountants), per staff interviews
- Annualization of capital costs according to the expected lifespan of the item (for example, a pico projector has a functional lifespan of three years) and a discount rate of 7 per cent

Two analyses are presented: (a) average unit cost; and (b) incremental cost-effectiveness ratio. The following equations were used:

a) $$Avg. unit\ cost = \frac{\sum C_t}{n_t}$$

b) $$ICER = \frac{C_t - C_c}{E_t - E_c}$$

Where C_t is the cost in the treatment area, C_c is the cost in the control area, n_t is the number of individuals treated, E_t is the effect in the treatment area and E_c is the effect in the control area. For both analyses, the intention-to-treat assumption is used, which may understate the actual cost per individual reached with the intervention.

5.2 Results

Both financial and economic costs are presented. Financial costs are a measure of the actual expenditures of the program inputs; economic costs are a measure of in-kind costs. For our program, economic costs include the use of personal amenities necessary for the intervention (such as motorcycles and telephones) or inputs that were purchased in prior iterations of the project but were used in this intervention period (such as computers and video cameras). We present the total cost of the intervention as the summation of these economic and financial costs. Costs reflect the cost of operating the Projecting Health intervention; all costs associated with evaluation of the program have been excluded.

Costs incurred during start-up are those that were incurred in 2016, prior to the start of the project. These include costs that would typically be considered one-time expenses related to project launch, such as contracting a CSO for implementation, formation of the CAB, creating a video production plan and identifying key messages, sensitization of local officials, and training of the ASHA's and CSO staff. One-time capital costs are captured under implementation because they are required to operate the program and require intermittent replacement. Costs incurred during implementation were those that were incurred in 2017, during implementation of the project. These include costs that would typically be considered recurrent costs, such as operating the mothers' groups and VHNDs, incentives for ASHAs, supportive supervision of ASHAs during screenings, transportation for CSO staff and regular CAB meetings. All costs presented for implementation are annualized, to capture the operating cost of the intervention for a single year.

Table 17: Total cost of intervention

Cost category	NYST		PATH		Total ($)	% of total
	Financial ($)	Economic ($)	Financial ($)	Economic ($)		
Start-up costs						
Personnel	6,041	—	17,635	—	23,676	54.8
Communication	176	—	668	—	844	2.0
Facilities	666	—	4,534	—	5,200	12.0
Transport	6,196	—	3,795	—	9,991	23.1
Program activities						
Training workshops	768	—	392	—	1,160	2.7
Training materials	147	—	12	—	159	0.4
CAB formation	52	—	—	—	52	0.1
Incentives for ASHAs	2,007	—	—	—	2,007	4.6
Supportive supervision	149	—	—	—	149	0.3
Start-up subtotal	16,202	—	27,035	—	43,237	100.0
Implementation costs						
Personnel	18,953	—	53,265	—	72,218	56.2
Communication	556	447	532	—	1,535	1.2
Facilities	1,919	—	9,093	—	11,012	8.6
Transport	18,736	2,236	6,960	—	27,931	21.7
Program activities						
CAB operations	246	—	—	—	246	0.2
Creation/editing of videos	67	—	—	—	67	0.1
Refresher training	1,584	—	—	—	1,584	1.2
Training materials	354	—	1,817	—	2,171	1.7
Incentives to ASHAs	7,999	—	—	—	7,999	6.2
Operations of MGs/VHNDs	721	—	—	—	721	0.6
Supportive supervision	385	—	—	—	385	0.3
Capital costs						
Computer materials	351	226	—	—	577	0.4
Pico projectors	—	—	1,071	—	1,071	0.8
Video materials	576	423	—	—	1,000	0.8
Implementation subtotal	53,969	4,397	72,737	—	128,517	100.0
Total	**70,171**	**4,397**	**99,773**	**—**	**171,754**	**—**

Note: MG = mothers' group.

5.2.1 Total cost of implementation

The total cost of the intervention was $171,754 over the 18-month intervention period. The majority ($169,994) of costs were financial; a small proportion ($4,397) were economic. A quarter of the project costs ($43,237) were incurred during the start-up period (from July 2016 to January 2017); the remaining costs ($128,517) were incurred during implementation (February 2018 to January 2019).

The main driver of costs was personnel, which accounted for 55 per cent ($23,676) of costs during start-up and 56 per cent ($72,218) during implementation; this included supervisory staff in the state capital, which is not indicative of the expertise actually needed to implement the intervention. Sensitivity analyses are noted, which present the cost of the intervention excluding the cost of these personnel and their associated travel and facilities costs.

Travel was the second-largest cost driver, accounting for 23 per cent ($9,991) of costs during start-up and 22 per cent ($27,931) of costs during implementation. Supervisors from the implementing partner traveled weekly to supervise video screenings and monitor ASHA facilitation; the dispersion and rurality of the intervention sites resulted in high transport costs.

The actual cost of program activities was relatively low: 8 per cent ($3,527) for start-up and 10 per cent ($13,173) over the course of implementation. Initial capital costs for the video creation materials and pico projectors were also low, totaling $6,992 in economic and financial costs. While the duration of the intervention was one year, the lifespan of the capital goods is estimated to be three years; the annualized cost of capital goods is thus estimated at $2,648. A detailed description of each spending category is listed below:

- **Personnel:** Personnel covers the cost of implementing staff at NYST, including field supervisors (three staff), the video production team (two staff) and a project coordinator (one staff). A small percentage of costs is associated with the organization director and administrative and accounting staff. NYST staff are paid a typical salary for a rural Indian NGO. Implementation staff at PATH include a project director and administrative staff. PATH staff are paid a typical salary for an international NGO country office.
- **Program activities:** Program activities covers the cost of intervention operations. At start-up, the costs included initial training of participating ASHAs and formation of the CAB. During implementation, this category included costs associated with creating and editing videos, incentives paid to ASHAs for participation, refreshments and any needed supplies for operating mothers' groups and VHNDs, the ongoing cost of operating the CAB and any refresher trainings.
- **Communication:** Communication includes costs associated with mobile phone and internet services, and any costs associated with contacting and mobilizing ASHAs for participation.
- **Facilities:** Facilities costs include the cost of office infrastructure used by NYST and PATH staff. For facilities that were not exclusively used for Projecting Health, a percentage was calculated based on use.
- **Transport:** Transport costs include the cost of transport to and from field sites for NYST and PATH staff. Costs of vehicles, maintenance, fuel and per diems as appropriate are included.

- **Capital costs:** Capital costs include all upfront purchases required to operate the intervention. These include pico projectors for screenings, video cameras for filming, and computers and software for video editing. Costs are annualized over three years.

Expansion or continuation of the intervention may allow additional cost savings through economies of scale, as fixed costs are spread across greater time periods and more participants. For instance, the start-up period, which accounted for 25 per cent of program costs, is a one-time fixed cost that would decrease as a proportion of program costs if the intervention were to run for longer than a year.

There are possibilities for costs to be controlled further, if replication were taken up by the government. The cost of additional personnel and transport (the two largest cost categories) would decrease, as there are existing Ministry of Health and Family Welfare transport and supervisory staff. ASHAs are already trained and supervised for other activities, which decreases the cost of monitoring and supervising them. However, existing staff and facilities have finite resources, so there would be an opportunity cost of re-allocating time and resources to Projecting Health intervention operations.

5.2.2 Cost and economic evaluation of the intervention

The cost-effectiveness analysis expresses the intervention cost as the cost per unit of desired outcome. Table 18 presents the cost-effectiveness.

Table 18: Cost-effectiveness of intervention

Cost category	Total cost	Unit costs			
		Per village treated	Per child treated (intention to treat)	Per FIC	Per child receiving DPT3
Unit		37	791	512	702
Start-up costs	$43,237	$1,702	$55	$84	$62
Implementation costs	$128,517	$4,155	$162	$251	$183
Total	**$171,754**	**$4,642**	**$217**	**$336**	**$245**

To calculate the cost-effectiveness ratio of the intervention, the cost per unit is calculated for multiple outcomes:

- **Per village treated:** The intervention was administered in 37 ASHA-village clusters; the cost per cluster was $4,642 for a 12-month implementation. This assumes that the same video can be scaled across further villages; if additional villages necessitate the creation of additional videos, capital and personnel costs would need to be commensurately adjusted to account for additional teams of videographers.
- **Per child treated:** Based on the household listing conducted at endline, 791 eligible children between the ages of 6 and 17 months are estimated to reside in the 37 clusters. The cost per child treated is $217 for a 12-month implementation. The cost per child treated is calculated with the assumption of intent to treat.
- **Per fully immunized child:** Based on the household survey conducted at endline, the FIC coverage rate is 65 per cent, translating to 512 children (out of 791 in the study area) who were fully immunized within the study area and study period. The

cost per FIC in the study period is thus $336 for a 12-month implementation. The cost per FIC is calculated with an assumption of intent to treat.

- **Per child who received DPT3:** Based on the household survey conducted at endline, the DPT3 coverage rate is 89 per cent, translating to 702 children (out of the 791 in the study area) who received DPT3 within the study area and study period. The cost per child who received DPT3 in the study period is thus $245 for a 12-month implementation. The cost per DPT3 is calculated with an assumption of intent to treat.

The incremental cost-effectiveness ratio expresses the intervention cost as incremental cost per additional unit of desired outcome. As the cost of routine immunization is assumed to be the same across control and intervention areas, the only change in cost is presumed to be the additional cost of the intervention. The change in outcomes is measured by the D-I-D estimation. Table 19 presents the incremental cost-effectiveness ratio.

Table 19: Incremental cost-effectiveness of intervention

Cost category	Total cost	Unit costs	
		Per additional FIC[1]	Per additional DPT3[1]
Unit		31	62
Start-up costs	$43,237	$1,390	$691
Implementation costs	$128,517	$4,133	$2,057
Total	**$171,754**	**$5,524**	**$2,749**

[1] To calculate the cost per additional outcome, the adjusted estimates from the D-I-D estimation are used (Table 10).

- **Per additional child fully immunized (adjusted):** The marginal positive effect on FIC in the intervention area when adjusted for population characteristics (3.93 percentage points, when controlled for time) translates to an additional 31 children who were fully immunized within the intervention area. The incremental cost per additional FIC is assessed at $5,524. The increase in children who were fully immunized is not statistically significant.
- **Per additional child who received DPT3 (adjusted):** The marginal positive effect on DPT3 receipt in the intervention area when adjusted for population characteristics (7.90 percentage points, when controlled for time) translates to an additional 62 children who were fully immunized within the intervention area. The incremental cost per additional child who received DPT3 is assessed at $2,749.

5.2.3 Cost discussion

Examining the unit cost of delivery of the intervention against the status quo, the unit cost of status-quo delivery is $28 per FIC. In comparison, the unit cost of the intervention is $336 per FIC. The unit cost of status-quo delivery is $30 for DPT3 and the unit cost of the intervention is $245 for DPT3. It is important to note the cost of the intervention does not cover the same costs as routine immunization, and would be an additional cost for targeted mobilization and sensitization of the community. The high cost of the intervention relative to the cost of routine immunization is largely due to the small scale of the intervention (and consequently low number of eligible individuals), the limited impact of the intervention, and project settings that do not perfectly replicate real-world conditions.

To explore the possible cost of scaling up further, we conducted a sensitivity analysis that excludes supervisory state-level staff (and associated travel and facilities costs), as their level of expertise would not be required for scaling the intervention. The cost per unit excluding state-level costs would be $163 per FIC or $119 per DPT3 child. The cost per unit could be further decreased through expansion and integration of the intervention, as cost savings are spread across more participants, and integration leverages existing resources (for example, using existing governmental staff in lieu of hiring additional staff as the project did).

Cost-effectiveness estimates aim to highlight the relative efficiency of a program when compared with the status quo. The cost of this intervention was $5,524 for each additional child fully immunized and $2,749 for each additional child receiving DPT3. While cost-effectiveness data are limited for other SBCC studies, two other complementary SBCC interventions serve as useful context.

An intervention in Uttar Pradesh provided mothers with information on the benefits of vaccination through face-to-face home visits where a script of key messages was delivered. The cost per additional child vaccinated with DPT3 in this intervention was $165, considerably lower than in the Projecting Health intervention (Powell-Jackson et al. 2018). Similarly, an intervention in Bangladesh produced a nationalized 26-episode television drama containing health messaging, and included local promotional activities through radio, group meetings and rallies. The cost per additional child receiving DPT3 was $37 (although the estimate for local promotional costs was drawn from urban areas) (Hutchinson et al. 2006).

In both cases, these interventions benefited from economies of scale (180 villages and national reach, respectively), as well as greater effects (although in the Bangladesh case, an experimental design was not used). Given this context, the Projecting Health intervention is likely not to be highly cost-effective, although that determination can only be made based on the number of disability-adjusted life years averted by this intervention.

Again, a sensitivity analysis that excludes supervisory state-level staff (and associated travel and facilities costs) was conducted and shows an incremental cost-effectiveness of $2,683 per each additional FIC child and $1,335 for each additional child receiving DPT3. The incremental cost-effectiveness of the intervention could potentially be increased by limiting the delivery of the intervention to high-impact areas (such as HTR areas, where a 22.9 percentage point gain was observed) and scaling the intervention to distribute costs further.

Beyond the costs discussed, there may be additional downstream benefits of this intervention, which are not captured in the current cost-effectiveness analysis. For instance, increasing FIC coverage has been shown to have economic value, as treatment costs are averted and economic productivity is increased (Rémy et al. 2015; Quilici et al. 2015; Mirelman et al. 2014). This analysis does not estimate possible downstream economic gains.

6. Challenges and lessons

The project faced challenges in implementation of the intervention and its evaluation. The following section describes how challenges were mitigated and reflects on lessons learned for future implementers and evaluators.

6.1 Challenges during implementation

We encountered several challenges during implementation. On the community side, societal norms around gender introduced constraints to men's screenings and screenings for newly married women. Community constraints around screening spaces and economic activities also introduced challenges. On the implementer side, staff turnover at NYST and research activities introduced delays in video production. ASHAs' multiple responsibilities introduced time constraints and competing responsibilities. Table 20 details all challenges, the magnitude of the challenges and how they were addressed.

Table 20: Implementation challenges faced and adaptive management

Challenge	Magnitude of challenge	How it was addressed
Initiation of the video production and screening were delayed due to timing of baseline data collection.	Initial video launch was planned for November 2017; the two videos planned for December 2017 and January 2018 were delayed.	Video screenings began two months later than planned, in February 2018. The intervention duration was 12 months as planned.
ASHAs are required to cover their faces in front of men and are limited in their ability to initiate conversations due to traditional beliefs.	This was observed in nearly all intervention villages.	ASHAs were able to set up the pico projector for screenings, but the actual screenings were conducted by their male counterparts or children.
Lack of suitable space to conduct screenings, particularly in HTR areas.	This was observed in nearly all intervention villages.	Screenings were done in small groups as needed to accommodate space constraints.
The main income source in Fatehpur is farming; therefore, attendance decreased during peak farming seasons.	This was a concern in nearly all intervention villages during sowing and harvest season (July–October and March). The remainder of the year, it was not a problem.	Times of screenings were adjusted in consultation with community members.
Traditional conventions prohibit newly married women from leaving their houses to join video screenings.	This was observed intermittently. It is a tradition, but enforcement is at the discretion of the mother-in-law.	ASHAs attempted to convince mothers-in-law and husbands to allow attendance. If that failed, the videos were shown in the home for newly married women.
Due to multiple government campaigns (Pulse Polio, IMI, Japanese encephalitis, National Deworming Day, Safe Motherhood Week and Bal Swasthya Poshan Mah), ASHAs faced time constraints in conducting video screenings.	This was observed in all intervention villages.	Video screenings were re-scheduled in consultation with ASHAs to accommodate their multiple responsibilities.
The video production team at NYST (the implementing partner) left NYST, which delayed video production.	This occurred in August of 2017.	The video production team was replaced, although hiring and re-training introduced delays.

6.2 Challenges during evaluation

Additional challenges to implementation included the activities of other community-based organizations. In April 2017, Rajiv Gandhi Mahila Vikas Parishad (RGMVP), another community-based organization, began operating in Hathgaon block of Fatehpur District; in July 2017, they expanded their operations to Airaya block. They operated in both the control and intervention clusters within the study area. Like Projecting Health, they communicate health messages through videos screened on pico projectors.

RGMVP's videos cover the following health topics: breastfeeding, maternal danger signs, newborn infection, oral rehydration salts and zinc, thermal care and immunization. They also screened videos on financial inclusion and livelihoods. Their implementation model differed: RGMVP employed supervisors to administer the videos; while in Projecting Health, the ASHAs administered the intervention videos.

During the endline survey, we asked differentiating questions to understand if this intervention was seen by beneficiaries. However, possible contamination was introduced by this similar intervention. Other challenges are detailed in Table 21.

Table 21: Evaluation challenges faced and adaptive management

Challenge	Magnitude of challenge	How it was addressed
The completion of the sample frame was delayed during listing due to households with missing immunization cards and households that were locked.	Approximately 5% of the households were found locked during the listing exercise.	Households were revisited (maximum three visits) by the listing supervisors. Respective ASHAs were contacted if the parents were not available after three visits. Such households were again approached during the main survey.
Recall of specific video titles was a challenge among mothers, as the screenings were completed six months prior to the endline data collection.	This was identified and remedied during the pretest period.	A flipbook depicting screenshots of the video characters and storylines was prepared as an aid for data enumerators to use in the household survey.
Recall of vaccine names was a challenge among mothers, as they did not know the specific antigen.	This was identified and remedied during the pretest period.	Vaccines were described by physical site of administration. To ensure further uniformity, a card showing a child's image and the site of each vaccination was developed as an aid for enumerators to use in the household survey.
Incomplete or missing immunization cards during data collection posed a concern for calculating key outcomes pertaining to timeliness.	Nearly a fifth of households were found to be missing immunization cards during the endline household survey.	All records with missing immunization cards were identified. A consultant was hired to approach respective ANMs and copy the immunization card data from their vaccination logs to capture missing data. Using this approach, we were able to retrieve copies of missing vaccine cards resulting in > 90% availability of card data at both baseline and endline.

7. Discussion

Over the course of this evaluation and through ongoing analysis of process evaluation data, we revised our TOC to reflect a more comprehensive and multi-level set of determinants of childhood vaccination in rural Uttar Pradesh. At the outset of this project, we focused largely on behavioral or demand-side barriers to vaccination and designed the intervention accordingly. Over time, we observed the health systems-related constraints to full vaccination and the more nuanced and context-specific roles of certain attitudes and decision-making structures.

We believe the intervention did not achieve the intended magnitude of impact (a 15 percentage point increase in FIC) because of supply-side constraints to vaccination (ANM quality and, to a lesser extent, ANM availability) and the inability of the intervention to change behavioral intentions of family decision makers, including in-laws.

7.1 Household and community-level determinants of vaccination

The intervention explicitly sought to change knowledge, attitudes, beliefs and norms about immunization, which at baseline we believed to be significant constraints to immunization. The updated TOC and our findings illustrate that these may not have been the most significant constraints, or that they cannot be addressed in isolation. We observed that a range of beliefs existed to discourage or encourage behavioral intent.

The deeply held belief related to infertility remains a small but significant barrier that was largely unchanged by this low-intensity intervention. Results of in-depth probing during FGDs and ASHA interviews suggest that this belief continues to persist in some subcommunities in this district and is more strongly held among older generations, who tend to be decision makers in traditional households, as well as in Muslim communities.

A commonly held negative belief at baseline was that common side effects of vaccination – fever, boil or swelling – were serious enough to outweigh the benefits of vaccination, as illustrated in this quote, which reflects the common perception of side effects among mothers at baseline:

> My son had fever at 5 to 6 months, since [then] I have stopped giving injection to my kid. So he takes only oral vaccine. My son just got DPT and BCG, and I was so scared that I don't take my son for vaccination. I thought now every time I vaccinate, my child will have to go through like this so I just stopped vaccinating him. — Mothers' FGD, February 2017, intervention village (baseline)

We observed changes in how FGD respondents discussed side effects over the course of the study, from a perception that they were severe and not worth the risk of vaccination, to a sense that they could be handled and were not a reason to forgo vaccination.

> I also took my child for vaccination. She cried for two days and I said let her cry; at least she will be safe in future from diseases. — Mothers' FGD, September 2017, intervention village

Taken together, this evidence suggests that the video intervention component may be effective at changing modifiable beliefs, such as the severity of side effects or the effectiveness of vaccines. To optimize the impact of this intervention, it may have been more effective to focus on attitudes and beliefs that were possible to change, particularly among key decision makers. Localized knowledge of the social context and beliefs is critical to design messaging that specifically targets modifiable beliefs, which Projecting Health did not identify during program design. Future iterations should conduct initial rapid testing cycles to identify local beliefs and effective messaging.

Recommendation: Implementers of SBCC interventions should use best practice to test and tailor messages with a focus on addressing modifiable beliefs.

Our original TOC likely underestimated the influence of other family members on vaccination decision-making. Our data indicate that the decision to vaccinate a child is not often the mother's decision alone, which is consistent with other evidence on gender inequality and traditional decision-making hierarchies in Indian households (Jayachandran 2014).

> If there is a daughter-in-law who is pregnant in their family and we approach them for vaccination, then they say she has got vaccination in her parent's place while I know she has not been vaccinated. They do not allow children also to be vaccinated.
>
> You know when daughter-in-law gets separated from in-laws then they easily vaccinate themselves as well as their children. — Interview with ASHA, June 2017

The recent meta-analysis published by Seward and colleagues (2017) on the impact of women's groups on neonatal mortality found that behaviors more amenable to control by women themselves were impacted to a greater extent. A 2016 systematic review found that women with less autonomy over their own healthcare-seeking decisions in India had lower utilization of antenatal and maternal health services (Osamor and Grady 2016). Most of the existing literature on women's autonomy in healthcare decision-making focuses on decisions related to reproductive health; there is little to no literature from India that explores women's autonomy in decision-making for immunization services for their children (Osamor and Grady 2016).

It stands to reason that women with lower autonomy would also be less likely to successfully obtain immunization services for their children. Studies have identified relationships between women's autonomy and socioeconomic and demographic characteristics, including wealth, age and parity. Our finding that mothers reported vaccinating their current child, but not earlier children, may also be related to a growing stock of autonomy that women amass as they age and raise more children.

This is also reflected in a recent finding by Gram and colleagues (2018), who showed that household agency was a prerequisite for actualizing the benefits of participatory learning and action groups. Thus, the design of this intervention was not adequately tailored or targeted to household decision makers or to produce changes in attitudes and beliefs of husbands and in-laws. While the intervention sought to address husbands and in-laws through men's screenings and community-wide screenings during VHNDs, these efforts may not have been sufficient.

ASHAs reported cultural barriers in calling men to screenings and messages were neither targeted nor tailored to address the beliefs and attitudes of these groups. CAB members expressed that a broader strategy for video dissemination should be used to capture a wider range of respondents, including other family members within the household.

> If there is population of 1,000 people in a village, then we should make sure that video is shown to whole population in coordination with village head. We should reach out to all the hamlets and involve village head in planning the same. — Interview with CAB member, December 2018

Recommendation: Policymakers and partners who design interventions to increase vaccination coverage should consider how these interventions can more effectively target and reach other family members within the household who serve as decision makers (for example, male household heads, elder women).

We identified low awareness of when and where to be vaccinated as a barrier to universal vaccination coverage. While the intervention was not explicitly designed to increase awareness of when and where to go for vaccination services, we observed that many families did not have this information without ASHA outreach and mobilization; very few families, if any, used their child health card to recall when to go for vaccination. Compounding this, many ASHAs did not actively visit or mobilize families living in HTR communities prior to the intervention.

> Today also no one comes to our area, and when no one comes to our village then how will we come without knowing. Once they had come to our area and called, then both of us [two mothers] had come for vaccination. That time she was pregnant and I was also pregnant. — Interview with mother, January 2017, intervention village

The section below describes other evidence related to ASHA performance; considering the gap in caregiver awareness, more evidence is needed on how to improve caregiver awareness. Multiple interventions exist to send reminders to parents and these should be explored in this context, with a particular emphasis on their effectiveness among vulnerable households and how to incorporate household decision-making dynamics (Obi-Jeff et al. 2019; Jacobson Vann et al. 2018; Oyo-Ita et al. 2016; Bangure et al. 2015).

7.2 Barriers and enablers in the local health system

The intervention was not designed to address supply-side constraints, which we originally anticipated would be less pervasive or impactful than demand-side barriers. Because VHNDs are held in villages, we hypothesized that few access or availability barriers would constrain vaccination. However, through the process evaluation we observed that variables related to access and availability interacted with local context to produce a range of outcomes.

For example, the existence of ANM vaccinators did not ensure their quality, and we observed that suboptimal clinical ANM quality discouraged retention across the vaccine schedule and perhaps negatively impacted beneficiaries’ trust in the health system. ANM clinical performance has an important effect on caregivers' perceptions of and attitudes toward vaccination and thus on retention across the schedule, as noted by an ASHA *sangini* when asked why fewer people participated in one ANM's VHND.

> Yes, the way she vaccinates children, either they get a boil or it always swells up, so people are scared. They do not trust her; therefore, they do not go to her for vaccination. —– Interview with ASHA *sangini*, December 2017

The feedback loop from health systems quality to behavioral intent has been demonstrated elsewhere for immunization and requires urgent attention (Phillips et al. 2017). ANMs in this district had not received any recent refresher or in-service clinical training, and evidence from elsewhere in India suggests that ANMs receive little or no refresher training despite this being the official policy and few or no performance appraisals to identify competency gaps and take targeted corrective action (National Health Systems Resource Centre 2012; National Health Systems Resource Centre n.d.). These issues are exacerbated in rural and remote regions. Initial training and qualifications of ANMs in Uttar Pradesh lag behind the rest of the country, as does ANM density.

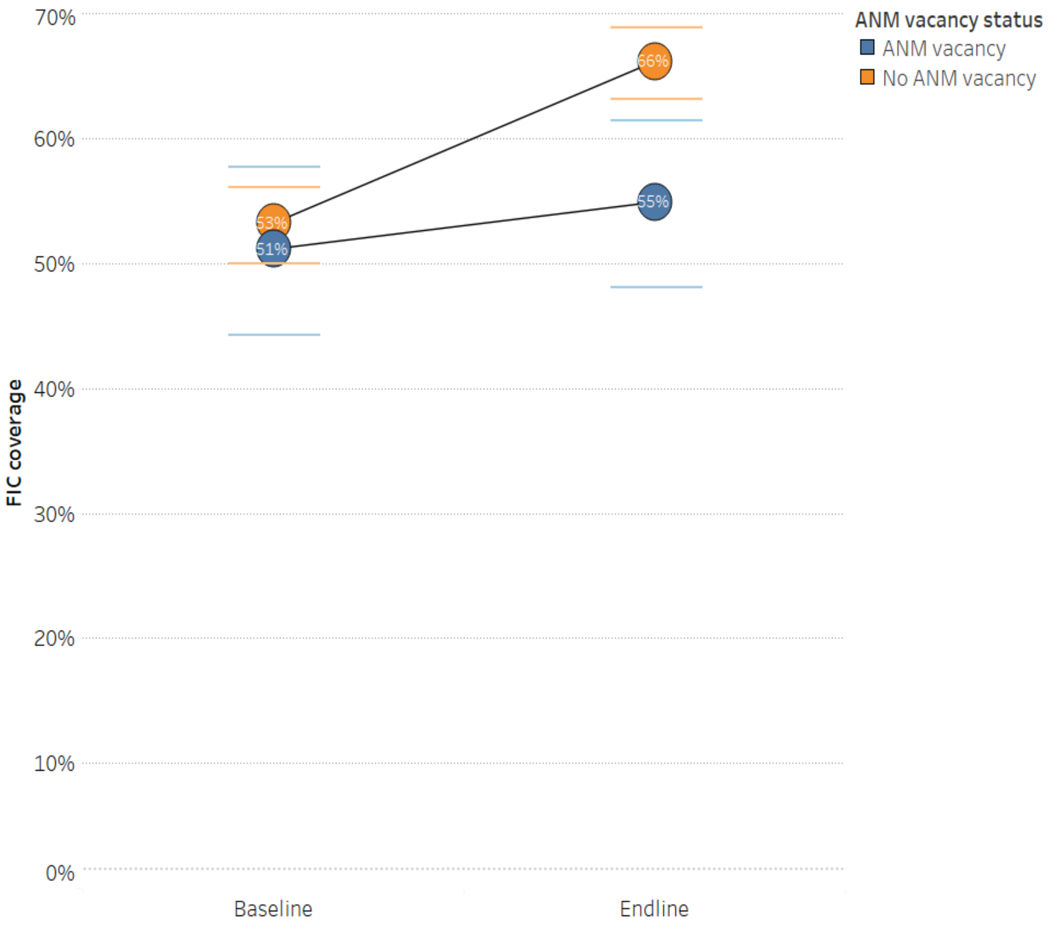
Recommendation: Fatehpur health district should adopt and implement best practice for refresher training and in-service training of ANMs based on identified competency gaps.

In addition to suboptimal ANM clinical quality, nine ANM posts were vacant during the study period, resulting in suboptimal availability of services in some communities, which was beyond our influence (Figure 2, box g). ANM vacancies are pervasive in Uttar Pradesh, and government efforts to contract ANMs have been only partly effective in filling the gap. Analysis of coverage changes over time stratified by ANM availability suggests that villages affected by ANM vacancies experienced a smaller increase in coverage during the evaluation period than villages with ANMs. Interview respondents reported that caregivers in these villages were encouraged to go to a nearby subcenter for vaccination, but as this ASHA noted:

> I suggested they go to nearby subcenter or go to hospital for vaccinating their children. Some mothers did go, but some say it's too far and they will have to spend money on travel and all. So they do not go. —– Interview with ASHA, June 2018, intervention village

While many stakeholders hypothesized that the presence of IMI may have mitigated the negative effect of these vacancies, this does not seem to be the case, as illustrated in Figure 10.

Figure 10: Fully immunized children (95% confidence interval) at baseline and endline, by auxiliary nurse midwife vacancy



Recommendation: State and district officials should identify barriers to ANM hiring and retention and address them through carefully implemented human resources for health strategies. This will ensure the availability of vaccine services, engendering trust in the health system.

Synthesizing across data sources, we found that ASHAs are rarely able to perform at the level and across responsibilities as they are expected to. ASHAs are a voluntary lay cadre, and although supervision of ASHAs has recently improved through the introduction of a cadre of ASHA *sanginis*, mechanisms to ensure their engagement and effectiveness are limited and vary extensively across communities (State Innovations in Family Planning Services Project Agency n.d.).

ASHAs face multiple barriers to performance, as documented elsewhere: dissatisfaction with remuneration structure; lack of time to perform their responsibilities as volunteers with existing household responsibilities; lack of career progression opportunities; and harassment, including sexual harassment (Ved et al. 2019). In our evaluation, we documented that ASHAs were often unaware of the tasks for which they should be remunerated and they reported delays in receiving remuneration.

However, recent policy changes have sought to address some of these challenges (Ved et al. 2019), although implementation of ASHA-targeted interventions varies by district. In a recent study using Uttar Pradesh data, 46.1 per cent of women who were pregnant in the last year received an ASHA visit, and while there was no difference in the likelihood of a visit based on household characteristics (including caste, religion and wealth), there were pro-poor and pro-marginalized differences in utilization of maternal health services among households visited by ASHAs. Similar to our findings, this study suggests that ASHAs can have an effect on reducing health inequities and such an effect could be increased if their reach and competencies were improved (Seth et al. 2017).

Process evaluation data from this evaluation identified pathways to improve ASHA outreach and mobilization practices by providing more frequent supportive supervision from the implementing partner, by incentivizing them through small amounts of remuneration, and by the simple fact of training them to reach all families in their catchment area. ASHAs reported satisfaction with the intervention, reflecting other evidence that ASHAs are motivated in part by their feeling of self-efficacy and effectiveness in their communities (Ved et al. 2019).

> Yes, videos have been quite helpful. Usually to meet mothers you have to go only when some work is there, but for showing videos, if you have to go, then go. It gives a chance to meet and interact with all the mothers. — Interview with ASHA, June 2018, intervention village

Although we measured no improvements in knowledge of ASHAs or beneficiaries due to the intervention, we hypothesize that the videos acted as a significant source of reliable information at the community level, overcoming variability in ASHA knowledge due to recall.

Recommendation: Districts should improve the design and implementation of ASHA training and supervision to ensure effective and consistent outreach to all families within their respective catchment areas.

In contexts such as Fatehpur, stakeholders should consider local community needs and ASHA gaps and abilities when tailoring strategies to support ASHAs in their role. Based in their communities, ASHAs are uniquely placed to engage with families and directly address hesitancy related to vaccination, but will need additional resources and tools to do so effectively.

7.3 Barriers and facilitators to the impact of the video intervention

We note throughout this report that slightly more than half of surveyed women reported viewing at least one video, indicating the videos reached approximately half of eligible target beneficiaries. What is notable is that the intervention seemed to reach a larger proportion of women belonging to one of the subgroups measured, indicating a pro-equity effect of the intervention or the implementation strategy. As noted above, reach to husbands, in-laws or other household decision makers was as expected according to the implementation strategies used, but ultimately this proved to be a limiting factor.

7.3.1 Why was the intervention package successful in HTR communities and what can we learn from this?

FIC increased by 22.9 percentage points ($p = 0.040$) among children in HTR intervention communities compared with HTR control communities, controlling for time effects. The intervention resulted in improvements in on-time vaccination of 12.0 percentage points (p = 0.045) and on-time FIC of 9.6 percentage points (p = 0.045), and reduced DPT dropout (– 9.7 percentage points; p = 0.236) and OPV dropout (– 13.8 percentage points; p = 0.098) among children in HTR communities.

The fact that HTR communities were the only subgroup to be differentially impacted by the intervention suggests again the important role of outreach. ASHAs reported going to these communities for the first time, 'forced' as they were by the intervention design to screen videos in homes when women could not attend mothers' group meetings. It is possible that the ease of targeting these communities, which are defined by geographic boundaries, contributed to the estimated heightened effect (Table 11). However, the data we have cannot definitively estimate the relative contribution of this component.

We note that IMI aimed to directly target HTR communities as well, but IMI was implemented across the study setting and we still observed an increased gain in outcomes in intervention compared with control HTR communities over time. Seth and colleagues (2017) also measured a pro-equity effect of ASHA outreach, further reinforcing the importance of harnessing the potentially equity-enhancing effect of ASHAs.

Recommendation: District-level stakeholders should emphasize and strengthen ASHA engagement and outreach through improved motivation and supportive supervision. Such strategies should provide financial or nonfinancial incentives for reaching vulnerable or under-immunized children, and supportive supervision for tools such as due lists, to ensure that all families are reached.

7.4 Processes required for an improved intervention

A limitation of this cluster-randomized, controlled trial was that it did not sufficiently adjust the intervention or implementation strategies based on prospective process evaluation findings. Further analysis of these data could have identified aspects of the intervention or its implementation to refine or improve, including issues related to reaching men and vulnerable households, the salience and effectiveness of specific video messages, and issues related to ANM or ASHA performance. While we consider our intervention a multi-component intervention, it was likely not adequately refined to respond to existing and new barriers to vaccination.

Recommendation: Evaluation funders should consider funding novel evaluation approaches that enable continuous learning and improvement; trade-offs between flexibility and risk of bias should be based on the evidence and decision-making needs of decision makers.

7.5 Strengths and weaknesses of the evaluation design

This evaluation had limitations related to design and data collection. We designed a two-arm randomized, controlled trial; however, a factorial design could have helped to disaggregate the relative impact of each intervention component. While this evaluation aptly mixed quantitative and qualitative methods at endline and ultimately iterated the program theory, we wish we had stronger evidence on the effect of improved ASHA engagement, something that could have been measured if we had included an ASHA-only intervention or even collected more detailed monitoring data on ASHA-related inputs and outputs.

Data collected may be limited due to sampling biases, including from a change in the sampling procedure from baseline to endline. At baseline, we treated the ASHA register as the sampling frame, but having observed that ASHA registers excluded certain subpopulations, including HTR and scheduled castes, we performed a full household listing at endline of ASHA catchment areas. Table A2 in Online appendix G illustrates that certain subgroup characteristics differed between baseline and endline, but in divergent directions.

While we expected the revised sampling strategy would include a larger proportion of subgroups (for example, HTR, scheduled caste, Muslim) likely to be underrepresented in ASHA registers, Table A2 demonstrates that this hypothesis was not consistently borne out. While we surveyed more HTR households at endline, we surveyed fewer scheduled caste households at endline. We are unable to explain these inconsistencies and, because of the divergent directions of potential bias, cannot conclude definitively whether, and in which direction, our results may be biased.

Within the qualitative research, sampling bias exists based on the observation that most FGD respondents were also likely to attend mothers' group meetings; reaching the most vulnerable for these interviews was difficult.

These findings are likely generalizable to a range of settings, if transfer considers the TOC and intervention mechanisms, and how those are likely to change in a different context. For example, the ability to mobilize women to attend meetings will vary in different contexts; this version of the intervention is unlikely to work in urban settings but could work in other rural settings with strong community health worker cadres and existing women's groups.

Transfer to settings where access to vaccination is a greater constraint should include intervention components to improve access. Contexts in which mothers play a larger role in the decision to vaccinate may see even greater effects from Projecting Health. While this intervention's implementation benefited from technical assistance from international and local NGOs, we believe that it could be implemented by the public sector with a lighter external touch, or contracted out at relatively low cost to local nongovernmental partners.

In sum, complementary supply- and demand-side interventions are needed to continue improving rates of full vaccination in rural Uttar Pradesh, India. Future iterations of this work could include SBCC studies that include rapid testing of messaging and dissemination to households. Within health systems strengthening, further research is needed on interventions that can strengthen and extend the reach of community health workers.

7.6 Conclusions and recommendations

We evaluated the impact of a multi-component video intervention on vaccination coverage in rural Uttar Pradesh. The intervention package had a slightly positive but not statistically significant effect on FIC and other vaccination outcomes, and we estimate the cost of each additional FIC to be $5,524. The intervention had a statistically significant effect on FIC, vaccine timeliness and OPV dropout among children living in HTR communities, and on children receiving all vaccine doses on time among low-caste families, but the evaluation was not powered to detect a difference in these subgroups. These findings highlight the need for both supply- and demand-side interventions: the benefit of strengthening community health worker engagement and outreach, and the importance of localized knowledge of the social context in SBCC.

Based on our evaluation findings, we made the following recommendations:

- Implementers of SBCC interventions should use best practice to test and tailor messages, with a focus on addressing modifiable beliefs.
- Policymakers and partners who design interventions to increase vaccination coverage should consider how these interventions can more effectively target and reach other family members within the household who serve as decision makers (for example, male household heads, elder women).
- Fatehpur health district should adopt and implement best practice for refresher training and in-service training of ANMs based on identified competency gaps.
- State and district officials should identify barriers to ANM hiring and retention and address them through carefully implemented human resources for health strategies. This will ensure the availability of vaccine services, engendering trust in the health system.
- Districts should improve the design and implementation of ASHA training and supervision to ensure effective and consistent outreach to all families within their respective catchment areas.
- District-level stakeholders should emphasize and strengthen ASHA engagement and outreach through improved motivation and supportive supervision. Such strategies should provide financial or nonfinancial incentives for reaching vulnerable or under-immunized children, and supportive supervision for tools such as due lists, to ensure that all families are reached.
- Evaluation funders should consider funding novel evaluation approaches that enable continuous learning and improvement; trade-offs between flexibility and risk of bias should be based on the evidence and decision-making needs of decision makers.

Online appendixes

Online appendix A: Original theory of change

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-A-Original-theory-of-change.pdf

Online appendix B: Revised theory of change

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-B-Revised-theory-of-change.pdf

Online appendix C: Map of project area

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-C-Map-of-project-area.pdf

Online appendix D: Full list of villages

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-D-Full-list-of-villages.pdf

Online appendix E: Socioeconomic class calculation

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-E-Socioeconomic-class-calculation.pdf

Online appendix F: Household survey instruments

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-F-Household-survey-instruments.zip

Online appendix G: Full tables

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-G-Full-tables.pdf

Online appendix H: Listing maps

https://www.3ieimpact.org/sites/default/files/2020-06/TW10.1039-Online-Appendix-H-Listing-maps.pdf

Online appendix I: Household survey listing form

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-I-Household-survey-listing-form.zip

Online appendix J: Pre-analysis plan

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-J-Analysis-plan.zip

Online appendix K: Qualitative instruments

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-K-Qualitative-instruments.zip

Online appendix L: Qualitative field notes

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-L-Qualitative-field-notes.zip

Online appendix M: Qualitative codebooks

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-M-Qualitative-codebooks.zip

Online appendix N: Sample size and power calculation

https://www.3ieimpact.org/sites/default/files/TW10.1039-Online-Appendix-N-Sample-size-power-calculation.zip

References

Ajzen, I, 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), pp.179–211.

Bangure, D, Chirundu, D, Gombe, N Marufu, T, Mandozana, G, Tshimanga, M and Takundwa, L, 2015. Effectiveness of short message services reminder on childhood immunization programme in Kadoma, Zimbabwe – A randomized controlled trial, 2013. *BMC Public Health*, 15, article 137.

Britt, H, Hummelbrunner, R and Greene, J, 2017. *Causal Link Monitoring*. Available at: < https://www.betterevaluation.org/sites/default/files/CLM%20Brief_20170615_1528%20FINAL.pdf> [Accessed 15 September 2019].

Carter, BR and Hood, K, 2008. Balance algorithm for cluster randomized trials. *BMC Medical Research Methodology*, 8, article 65.

Chatterjee, S, Das, P, Ngam, A, Nandi, A, Brenzel, L, Ray, A, Haldar, P, Aggarwal, MK and Laxminarayan, R, 2018. Variation in cost and performance of routine immunisation service delivery in India. *BMJ Global Health*, 3, e000794.

Christen, P, 2006. *A comparison of personal name matching: Techniques and practical issues*. Canberra,: Australian National University.

Fatehpur District, 2020. *About District*. Available at: <https://fatehpur.nic.in/> [Accessed 1 July 2020].

Friberg, IK, Kinney, MV, Lawn, JE, Kerber, KJ, Odubanjo, MO, Bergh, A-M, Walker,N, Weissman, E, Chopra, M and Black, RE, 2010. Sub-Saharan Africa's mothers, newborns, and children: how many lives could be saved with targeted health interventions? *PLOS Medicine*, 7(6), e1000295.

Gavi, 2014. *Gavi strategy 2016–2020*. Geneva: Gavi, the Vaccine Alliance.

Gavi, 2018. *Gavi Full Country Evaluations: 2017–2018 dissemination report, cross-country*. Seattle: PATH.

Gram, L, Skordis-Worrall, J, Manandhar, DS, Strachan, D, Morrison, J, Saville, N, Osrin, D, Tumbahangphe, KM, Costello, A and Heys, M, 2018. The long-term impact of community mobilisation through participatory women's groups on women's agency in the household: a follow-up study to the Makwanpur trial. *PLOS ONE*, 13(5), e0197426.

Gurnani, V, Haldar, P, Aggarwal, MK, Das, MK, Chauhan, A, Murray, J, Arora, NK, Jhalani, M and Sudan, P, 2018. Improving vaccination coverage in India: lessons from Intensified Mission Indradhanush, a cross-sectoral systems strengthening strategy. *BMJ*, 363, k4782.

Hargreaves, M, 2014. *Rapid evaluation approaches for complex initiatives – White paper*. Cambridge, MA: Mathematica Policy Research.

Hayes, RJ and Bennett, S, 1999. Simple sample size calculation for cluster-randomized trials. *International Journal of Epidemiology*, 28(2), pp.319–326.

Hekler, EB, Klasnja, P, Riley, WT, Buman, MP, Huberty, J, Rivera, DE and Martin, CA, 2016. Agile science: creating useful products for behavior change in the real world. *Translational Behavioral Medicine*, 6(2), pp.317–328.

Hutchinson, P, Lance, P, Guilkey, DK, Shahjahan, M, Haque, S, 2006. Measuring the cost-effectiveness of a national health communication program in rural Bangladesh. *Journal of Health Communication*, 11(suppl 2), pp.91–121.

Jacobson Vann, JC, Jacobson, RM, Coyne-Beasley, T, Asafu-Adjei, JK and Szilagyi, PG, 2018. Patient reminder and recall interventions to improve immunization rates. *Cochrane Database of Systematic Reviews*, 1, CD003941.

Jayachandran, S, 2014. *The roots of gender inequality in developing countries*. Cambridge, MA: National Bureau of Economic Research.

Kruk, ME, Gage, AD, Joseph, NT, Danaei, G, García-Saisó, S, Salomon, JA, 2018. Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries. *The Lancet*, 392(10160), pp.2203–2212.

Levin, C, 2018. *Methods for data collection and analysis: Costing methods in global health*. Available at: <http://dcp-3.org/resources/methods-data-collection-and-analysis-costing-methods-global-health> [Accessed 15 September 2019].

Megiddo, I, Colson, AR, Nandi, A, Chatterjee, S, Prinjad, S, Kherae, A, Laxminarayan, R, 2014. Analysis of the Universal Immunization Programme and introduction of a rotavirus vaccine in India with IndiaSim. *Vaccine*, 32(Suppl 1), pp.A151–A161.

Ministry of Health and Family Welfare, 2015. *Ministry of Health and Family Welfare launches Mission Indradhanush*. [press release] Delhi, India: Ministry of Health and Family Welfare.

Mirelman, A, Osawa, S and Grewal, S, 2014. The economic and social benefits of childhood vaccinations in BRICS. *Bulletin of the World Health Organization*, 92, pp.454–456.

National Health Mission, n.d. *Village Health Sanitation & Nutrition Committee*. Available at: <https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225> [Accessed 13 December 2019].

National Health Systems Resource Centre, 2012. *Uttar Pradesh: Public health workforce – Issues and challenges*. Delhi: National Health Systems Resource Centre.

National Health Systems Resource Centre, n.d. *Recommendations for enhancing skills & service delivery of healthcare workers (Draft)*. Delhi: National Health Systems Resource Centre.

Obi-Jeff, C, Nwaononiwu, E, Nuhu, N, Irechukwu, K, Mahmud, S, Bamiduro, T, Nwangwu, C, Ibiye Bello-Malabu, J, Sabah Rakhshani, N and Wonodi, C, 2019. *Improving vaccination initiation and completion via vaccine indicator and reminder bands: a formative study in Nigeria*, 3ie Formative Evaluation Report. New Delhi, India: International Initiative for Impact Evaluation (3ie).

Office of the Registrar General and Census Commissioner, 2011. *District census hand book*. Delhi: Government of India, Ministry of Home Affairs.

Office of the Registrar General and Census Commissioner, 2013. *Annual health survey (2012–13) fact sheet: Uttar Pradesh*. Delhi: Government of India, Ministry of Home Affairs.

Osamor, PE and Grady, C, 2016. Women's autonomy in health care decision-making in developing countries: a synthesis of the literature. *International Journal of Women's Health*, 8, pp.191–202.

Oyo-Ita, A, Wiysonge, CS, Oringanje, C, Nwachukwu, CE, Oduwole, O and Meremikwu, MM, 2016. Interventions for improving coverage of childhood immunisation in low- and middle-income countries. *Cochrane Database of Systematic Reviews*, 7, CD008145.

PATH, 2017. *Projecting Health baseline evaluation: A report to 3ie*. Seattle: PATH.

Phillips, DE, Dieleman, JL, Lim, SS and Shearer, J, 2017. Determinants of effective vaccine coverage in low and middle-income countries: a systematic review and interpretive synthesis. *BMC Health Services Research*, 17, article 681.

Powell-Jackson, T, Fabbri, C, Dutt, V, Tougher, S and Singh, K, 2018. Effect and cost-effectiveness of educating mothers about childhood DPT vaccination on immunisation uptake, knowledge, and perceptions in Uttar Pradesh, India: a randomised controlled trial. *PLOS Medicine*, 15(3), e1002519.

Quilici, S, Smith, R and Signorelli, C, 2015. Role of vaccination in economic growth. *Journal of Market Access & Health Policy*, 3, article 27044.

Rémy, V, Largeron, N, Quilici, S and Carroll, S, 2015. The economic value of vaccination: why prevention is wealth. *Journal of Market Access & Health Policy*, 3, article 29204.

Scott, K, Javadi, D and Gergen, J, 2014. *India's Auxiliary Nurse-Midwife, Anganwadi Worker, Accredited Social Health Activist, Multipurpose Worker, and Lady Health Visitor Programs*. Available at: <https://www.chwcentral.org/blog/indias-auxiliary-nurse-midwife-anganwadi-worker-accredited-social-health-activist-multipurpose> [Accessed 13 December 2019].

Seth, A, Tomar, S, Singh, K, Chandurkar, D, Chakraverty, A, Dey, A, Das, AK, Hay, K, Saggurti, N, Boyce, S, Raj, A and Silverman, JG , 2017. Differential effects of community health worker visits across social and economic groups in Uttar Pradesh, India: a link between social inequities and health disparities. *International Journal for Equity in Health*, 16(1), article 46.

Seward, N, Neuman, M, Colbourn, T, Osrin, D, Lewycka, S, Azad, K, Costello, A, Das, S, Fottrell, E, Kuddus, A, Manandhar, D, Nair, N, Nambiar, B, Shah More, N, Phiri, T, Tripathy, P and Prost, A, 2017. Effects of women's groups practising participatory learning and action on preventive and care-seeking behaviours to reduce neonatal mortality: a meta-analysis of cluster-randomised trials. *PLOS Medicine*, 14(19), e1002467.

Shea, B, Andersson, N and Henry, D, 2009. Increasing the demand for childhood vaccination in developing countries: a systematic review. *BMC International Health and Human Rights*, 9(Suppl 1), p. S5.

State Innovations in Family Planning Services Project Agency, n.d. *Moving towards excellence: Capacitating ASHA Sanginis for supportive supervision and performance improvement*. Available at: <https://www.sifpsa.org/moving-toward-excellence.php> [Accessed 13 December 2019].

UNICEF, 2009. *National factsheet: Coverage evaluation survey, 2009 [India]*. New York: UNICEF.

UNICEF, 2013. *Multiple Indicator Cluster Surveys (MICS). Manual for mapping and household listing.* New York: UNICEF.

Valente, TW, Watkins, SC, Jato, MN, van der Straten, A, Tsitsol, LP, 1997. Social network associations with contraceptive use among Cameroonian women in voluntary associations. *Social Science and Medicine*, 45(5), pp.677–687.

Ved, R, Scott, K, Gupta, G, Ummer, O, Singh, S, Srivastava, A and George, AS, 2019. How are gender inequalities facing India's one million ASHAs being addressed? Policy origins and adaptations for the world's largest all-female community health worker programme. *Human Resources for Health*, 17(1), article 3.

WikiVillage, 2019a. Airaya block. [online] Available at: <https://www.wikivillage.in/block/uttar-pradesh/fatehpur/airaya> [Accessed 13 December 2019].

WikiVillage, 2019b. Hathgaon block. [online] Available at: <https://www.wikivillage.in/block/uttar-pradesh/fatehpur/hathgaon> [Accessed 13 December 2019].

World Health Organization (WHO), 2013. *Global vaccine action plan 2011–2020*. Geneva: WHO.

World Health Organization (WHO), 2014. *Global immunization data*. Geneva: WHO.

World Health Organization (WHO), 2016. *State of inequality: Childhood immunization*. Geneva: WHO.

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