

Introduction of Typhoid Conjugate Vaccine (TCV) in Nepal

ROLE OF THE VACCINATION CAMPAIGN IN IDENTIFYING AND REACHING ZERO-DOSE CHILDREN

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Gavi Zero-Dose Learning Hub (ZDLH)

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Contact Information

JSI Research & Training Institute, Inc.
2733 Crystal Drive
4th floor
Arlington, VA 22202
USA

ZDLH website: <https://zdlh.gavi.org/>

KEY LESSONS LEARNED

- TCV campaign identified ZD children and ensured catch-up on routine vaccination
- Team built multi-level stakeholder engagement into capacity building and coordination
- Systematic, independent concurrent monitoring by national and international monitors ensured the rigor and quality of the TCV campaign
- TCV campaign utilized learnings from past vaccination campaigns, including COVID-19 vaccine, for implementation and to identify ZD children
- Unique vaccination card and electronic app-based monitoring were innovations that helped to identify missed TCV and ZD children
- Exemplary teamwork and efficient use of human resources to brave challenges of terrain, mobility of population and climatic difficulties, despite budgetary constraints

1. COMMUNITIES MISSED BY ROUTINE VACCINATION ALSO EXPERIENCE HIGH BURDEN OF TYPHOID

Nepal is one of the highest burden countries for typhoid with an incidence rate of more than 100 cases per 100,000 population. Communities affected by typhoid fever in Nepal share many of the same correlates as zero-dose (ZD) and under immunized children and communities missed for vaccination. Introduction of the typhoid conjugate vaccine (TCV) in Nepal presented an opportunity to identify and reach ZD children during the vaccination introduction's catch-up campaign.

ZDⁱ and under immunized children are clustered in marginalized communities across Nepal. These populations tend to suffer from multiple social and economic deprivations, including inadequate access to safe water and sanitation, poor hygiene conditions, and limited use of the primary healthcare system, all of which favor the rapid spread of typhoid fever.^{1,2,3} Communities where ZD and under immunized children are located face a similar set of barriers. These circumstances provide the rationale for leveraging the TCV campaign to reach ZD children in Nepal and to further link them to the routine immunization system, with the ultimate goal of reaching full immunization. The catch-up campaign further justifies this approach by encompassing a wide age range of children, including those between 15 months and 15 years old. This ensures that a significant number of children can benefit from the TCV campaign and receive the necessary immunization.

EPIDEMIOLOGY OF TYPHOID IN NEPAL

Typhoid is a life-threatening, water-borne infectious disease caused primarily by *Salmonella enterica serovar Typhi* (S. Typhi). It is characterized by fever, malaise, anorexia, abdominal pain, and other gastrointestinal symptoms.⁴ Symptoms are often non-specific and clinically non-distinguishable from other febrile illnesses. Globally, an estimated 11 to 21 million cases of typhoid and 128,000 to 161,000 typhoid-related deaths occur every year.^{5,6} It is an important

ⁱ Gavi defines “zero-dose” as a child under 2 years old who has not received any dose of diphtheria, pertussis, tetanus vaccine (DPT).

“All these studies that have been conducted in Nepal...including administrative Health Management Information System (HMIS) data show typhoid burden is very high. So it was time Nepal introduced a typhoid vaccine in the national program, and appropriate typhoid vaccine was also available.”

—Key informant interview (KII) respondent

public health problem in many low- and middle-income countries, including Nepal.^{7,8,9} With its high incidence of typhoid, Kathmandu, the capital of Nepal, has been labeled the enteric fever capital of the world.^{10,11,12,13}

Epidemiological evidence shows that typhoid is the third-most common cause of food- and water-borne diseases and the fourth-most common reason for hospitalization in Nepal over the last three years.^{14,15,16} The 2019 Global Burden of Disease study estimated that there were at least 82,449 typhoid cases and 919 typhoid deaths in Nepal.¹⁷ A recent study conducted in Nepal found that the annual infection rate per 100,000 population was 764 among 0–4-year-olds, 6,713 among 5–9-year-olds, and 3,750 among 10- to 14-year-olds.¹⁵ Another study reported that the incidence of typhoid is 11 times higher in children under 15 years old when compared to other age groups.^{16,17,18} Evidence also showed that safe water, adequate sanitation, and hygiene combined with vaccination could lead to a considerable drop in the incidence of this disease. On the other hand, Nepal is also grappling with a significant burden of antimicrobial resistance due to the widespread misuse of antibiotics, inadequate healthcare systems, and poor infection control measures. Multiple studies in the country have highlighted the prevalent prescribing of multiple antibiotics without proper bacterial confirmation or susceptibility testing, leading to unnecessary antibiotic use. To combat the growing threat, vaccination against diseases like typhoid fever is crucial in preventing the transmission of resistant infections and reducing the reliance on antibiotics.^{19,20,21,22}

TYPHOID CONJUGATE VACCINE IN NEPAL

There are currently three safe and effective types of typhoid vaccines available globally: typhoid conjugate vaccines (TCVs), live attenuated Ty21a, and a Vi capsular polysaccharide vaccine (ViCPS).^{23,24} The latter two have been available since the early 1990s.²⁵ In 2017, WHO prequalified the first TCV and the Strategic Advisory Group of Experts (SAGE) recommended routine TCV vaccination for infants over 6 months of age in endemic settings, with children up to 15 years old targeted through catch-up campaigns.²⁶

Gavi then allocated over \$300 million of funding support for Gavi-eligible countries through the Typhoid Vaccine Acceleration Consortium.²⁷ TCV requires a single dose and is approved for children aged six months and older, allowing its inclusion in routine childhood immunization programs.^{25,28}

In 2017-18, TCV vaccination trials were conducted in Bangladesh, Malawi, and Nepal to generate evidence on the impact of a newly developed vaccine.²⁹ The

TCV Nepal trial was an observer-blind, individually randomized, controlled trial to evaluate the efficacy of TCV in Lalitpur Metropolitan City in children aged 9 months to 16 years.^{28,30,31} Children were followed for 2 years post-vaccination through passive surveillance using blood culture-confirmation of typhoid fever.^{30,32} Results from the study showed 81.6% TCV efficacy against blood culture-confirmed typhoid fever after one year with similar results reported across other geographies and populations.^{33,34}

The National Immunization Program (NIP) in Nepal is a government-led initiative that aims to provide immunization services to all Nepali citizens, particularly children. The program is implemented by the Department of Health Services under the Ministry of Health and Population. Presently, the NIP in Nepal provides 13 vaccines to prevent various infectious diseases such as measles, polio, tetanus, diphtheria, hepatitis B, tuberculosis, etc. These routine immunization services are provided through the Expanded Program on Immunization (EPI), which determines the immunization schedule for children from birth to 15 months of age. The outreach services target hard-to-reach and underserved populations, such as those living in remote and mountainous areas.

In April 2022, the Government of Nepal launched TCV into the country's routine immunization program, with support from GAVI, the World Health Organization (WHO), and the United Nations International Children's Emergency Fund (UNICEF), and other partners. Nepal is the fourth Gavi-supported country to introduce TCV into its routine immunization program. Partnerships with volunteer stakeholders played an important role in TCV campaign implementation. Volunteers helped raise awareness, dispel myths, and suggest modifications to the campaign based on input from community members. This case study captures the TCV campaign in Nepal through the eyes of stakeholders at different levels of the health system and explores how the introduction of a new vaccine helped to identify under immunized children who were missing other routine vaccines such as the measles-rubella vaccine.

2. NEPAL INTRODUCES TCV VACCINE IN ROUTINE IMMUNIZATION

“...For the first time we had a national level campaign, throughout the country, that was in one phase. Earlier there was no other campaign that was conducted in one phase; it was in two or more phases.”

—KII respondent

In April 2022, Nepal launched a new vaccine campaign introducing TCV into the routine immunization program with support from Gavi, coupled with a catch-up campaign for all children up to 15 years of age

TCV INTRODUCTION IN NEPAL

The TCV campaign was implemented as a catch-up strategy prior to introducing TCV into the routine immunization program in Nepal. The campaign aimed to reach the country's estimated 7.7 million children aged 15 months to 14 years to rapidly build immunity against typhoid fever and significantly reduce the incidence of typhoid disease and its complications.³⁵ Keeping this broad goal in mind, the specific objectives of the campaign were:

1. To provide population immunity/protection through one dose of TCV to all children aged 15 months to 14 years;
2. To utilize the opportunity to strengthen and promote routine immunization and identify children who have missed full immunization, including measles-rubella;
3. To introduce TCV in the routine immunization schedule to be given at 15 months of age.

CAMPAIGN STRATEGY

Table 1 shows key information regarding the TCV vaccine and its use in Nepal. The following strategies were adopted to ensure an effective rollout of the TCV vaccine campaign in Nepal:

- Vaccination campaign in a single phase;
- Coordination, cooperation, and ownership by the federal, provincial, and local levels;
- Logistic management and capacity building of human resources;
- Information, education, and communication approaches, including social mobilization and school education;
- Strengthening of routine immunization and promotion of hygiene and sanitation through the campaign;
- Implementation of post-campaign vaccine coverage survey.

Table 1. Information regarding TCV campaign in Nepal

Vaccine name	Typhoid Conjugate Vaccine (TCV)
Production company	TYPHIEV (Biological E Ltd.), India
Site of vaccination	In routine immunization: At the age of 15 months, in the mid outer part of the left thigh. During campaign: For ages 15 to 23 months: inside the muscle of the mid outer part of the left thigh. For ages 2 to 15 years: inside the muscle of the mid outer part of the left arm.
Target population	15 months to 15 years age group
Dose of vaccine	One dose
Quantity of vaccine	0.5 ml
Cold chain	+2°C to 8°C Freeze sensitive
Resistance capacity	96.95%
Duration up to which the vaccine can be used after opening of the vial	In the campaign, the vaccine must be used within 6 hours in the vaccination center.

TOOLS USED

The TCV campaign adopted several approaches to strengthen routine immunization practices. The first is the campaign invitation card which provides the full immunization schedule on the reverse side (Figure 1). These cards were distributed to all households with children in the eligible age range. The second is a unique campaign vaccination card with two versions: one for children aged 15 to 24 months and the other for children aged 2 to 14 years. The card includes a counterfoil that was designed to be torn off and kept at the health facility for tracking children with missed doses. Health workers recorded children with missed doses in the counterfoil for follow up and completion of all recommended routine doses. Lastly, health workers at vaccination sessions provided counseling to caregivers of children under 24 months on the importance of routine immunization and, given the specific age group, assessed for measles-rubella vaccine status (provided at 15 months) along with other routine vaccines.

Figure 1. TCV Campaign invitation card



3. CAMPAIGN IMPLEMENTATION

“Without community participation, it would be impossible to have such an immunization campaign conducted in our context in Nepal.”

—KII respondent

The TCV campaign had multi-level commitment from the government of Nepal. It used a school-based approach with strong stakeholder engagement at the community level and visible external support from international agencies and neighboring country governments.

THE CAMPAIGN

The TCV campaign was conducted between 8 April - 1 May 2022 in all 77 districts across seven provinces of Nepal. The target population included 7,715,516 children aged 15 months – 15 years.³⁶ A range of stakeholders were involved, including government functionaries, international and UN agencies, female community health volunteers, and school teachers. Table 2 below captures some of the key logistics of the TCV campaign implementation.

Table 2: Human resources and vaccination centers involved in the TCV Campaign

Number and Type of Human Resources and Vaccination Centers	
Vaccination centers	56,429
Vaccination staffs	10,000
Volunteers	112,858
AEFI management and Rapid Convenience Monitoring (RCM) staff	6,000
School health nurse or teacher as focal point	25,000
Teacher and student volunteers	50,000

Along with providing the TCV, each child's vaccination card was examined to determine whether or not they had received other routine immunizations, including the measles-rubella vaccine. Thus, efforts were established during the

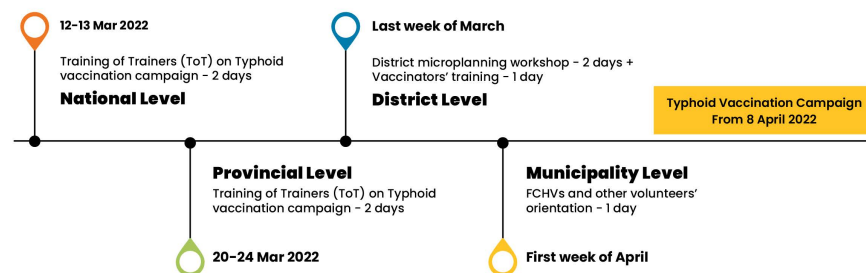
TCV campaign to identify ZD children and bring them up-to-date on their immunization status.

FROM INCEPTION TO IMPLEMENTATION: TCV CAMPAIGN PLANNING

In Nepal, the TCV Campaign followed a carefully planned cascade approach from the national to the local level (Figure 2). After planning meetings in early 2022, a two-day training of trainers (ToT) workshop on the vaccination campaign was held in March at the national level. The national level trainers then conducted ToT workshops at the provincial level, followed by three-day microplanning and vaccination training workshops in the districts.

Figure 2. Cascade training for the TCV campaign

Training plan of Typhoid vaccination campaign



During the microplanning stage for immunization, the villages/wards/residential areas of participants were mapped, the number of participants estimated, logistics requirements assessed, and plans put in place. The local volunteers were also provided with a one-day training session on executing community engagement initiatives for the TCV campaign. This training was focused on adapting societal norms, timing of activities, participant demographics, and other factors. Following the provincial and district coordination meetings as well as communication campaigns through visual, print, social and informal/folk media, the TCV campaign was launched on 7 April 2022 by the Honorable Prime Minister of Nepal. The Government of Nepal provided guidance on the systematic and effective implementation of the campaign with the preparation and release of operational guidelines by the Ministry of Health and Population.

TCV RAPID CONVENIENCE MONITORING

Door-to-door rapid convenience monitoring (RCM) during the TCV campaign in Nepal was used to identify and reach children who were missed by the initial vaccination campaign efforts and to increase coverage. In the campaign, RCM was conducted on all levels as follows:

- Chief of Health Facility/Supervisor (at all ward levels);
- Ward and local levels designated for supervision by the supervisors of the municipality and health office;
- Supervision of federal and provincial level and external independent monitors based on need.

KEY FEATURES OF THE TCV CAMPAIGN

Implementation of the campaign featured multi-level preparatory activities, broad support from the government for implementation, and RCM of TCV introduction. The multi-stakeholder participatory approach had well-defined roles and responsibilities for each partner. The Ministry of Health and Population spearheaded the TCV campaign with support from different stakeholders. Gavi worked closely with the government, providing technical, financial, and logistics support, including the provision of vaccines. The Immunization Preventable Disease Program of WHO Nepal (WHO-IPD) provided technical support including development of guidelines, support for training of trainers, and implementation, monitoring, and follow-up of the campaign. UNICEF, along with Gavi and the vaccine supply division of the government, supported the logistics of vaccine delivery and successfully distributed vaccines throughout the country. UNICEF also prepared Information, Education, and Communication (IEC) materials, including TCV campaign guidelines and invitation cards.

The preparatory activities included training and coordination meetings that cascaded from the national capital to districts and municipalities. These activities involved national, provincial, and grassroots functionaries as well as other partners and civil society. Civil society organizations such as the Red Cross Society and WaterAid also played a role before and during the immunization campaign.

“We had a kind of cascade effect; we had national level consultation with all major stakeholders; we invited provincial authorities, and they, in turn, went back to their province till they invited district level program manager and district program manager within...invited all the municipal level program managers,

elected political representatives. It was all a series of discussions, consultations and expressions of commitment so it was a massive exercise.” [Respondent KII4]

The school-based approach was a key feature of the TCV campaign. The Ministry of Education and all stakeholders in the education sector were engaged in the planning and implementation of the campaign.

“School teachers were very important in the vaccination campaign. Generally, people obey teachers, which helps to influence the community for vaccination.” [Respondent KII1]

Another key highlight was the involvement of international monitors during the campaign. The monitors were from WHO South East Asian Region Office (SEARO) countries; they observed the day-to-day implementation of the TCV campaign and provided feedback to improve it.

“We also had delegations from different SEARO countries... they also went on ground in different parts and they provided feedback based on their observations and were independent monitors that were deployed throughout the country. It was a collective effort and we had support of all the stakeholders; otherwise, the campaign would not be possible in the challenging environment that we had at the moment.” [Respondent KII4]

“The nationwide catch-up TCV campaign was conducted with 7.69 million children, and now the vaccine is available in routine immunization as well.”

—KII respondent

“The major agenda of the TCV campaign is also to reach zero-dose children.”

—KII respondent

4. OUTCOMES OF THE TCV CAMPAIGN

The TCV campaign reached over 7 million children across Nepal through its catch-up strategy, in addition to those reached through the post-campaign introduction of TCV into the routine immunization program. The campaign also provided concrete mechanisms for identifying and reaching ZD and under immunized children in Nepal.

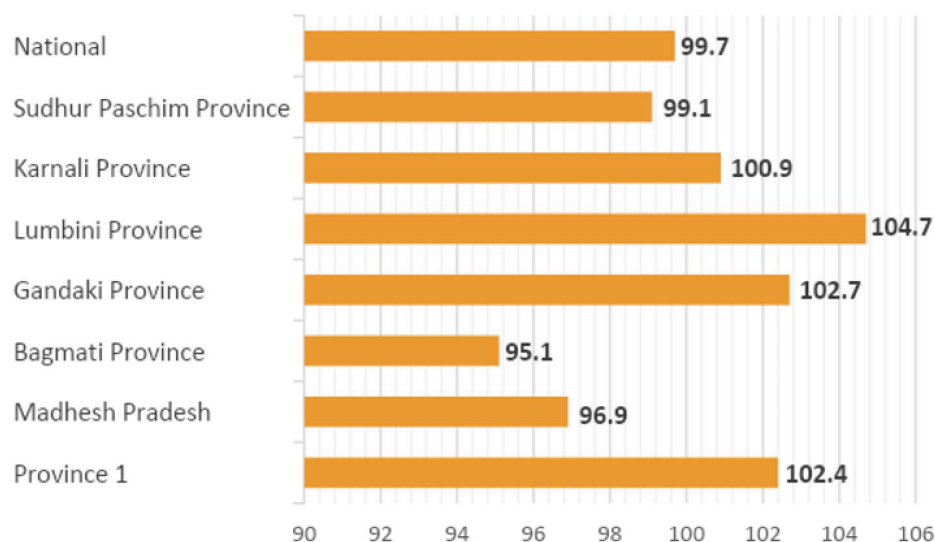
DISTRICT COVERAGE

Nepal is administratively divided into seven provinces and 77 districts. Interim results from RCM data collected during and after the campaign indicate the lowest TCV coverage in Rasuwa district (77.0%) and the highest in Surkhet district (120.0%). The latter coverage of over 100% was likely a result of an underestimated target population produced during microplanning. Kathmandu, Nepal’s capital, had an estimated coverage of 93.0%. Figure 3 displays the coverage estimates at national and provincial levels immediately following the

campaign.³⁶ A coverage survey (planned for the second quarter of 2023) will provide current vaccination coverage estimates which will be added to the next version of this case study.

“Irrespective of the high coverage rate of the TCV campaign, misleading data of an actual number of school students is one of the causes of not getting 100% coverage.” [Respondent KII3]

Figure 3. National and provincial coverage of TCV campaign in Nepal [26]



HOW THE TCV CAMPAIGN CONTRIBUTED TO IDENTIFYING AND REACHING ZD AND UNDER IMMUNIZED CHILDREN

TCV introduction was seen as an opportunity to reach ZD children, a population that respondents estimated had increased from 1% in 2016 to 4% after the COVID-19 pandemic. The TCV campaign had built-in mechanisms to look for and identify ZD children. Health staff and monitors were trained to identify ZD children during the preparatory phase of the campaign. The unique vaccination card used in the campaign had a section that captured information on routine immunization status. It helped to evaluate the measles-rubella vaccine status, along with other routine vaccines in children. To ensure comprehensive documentation, health workers recorded any missed doses on the counterfoil designated for health worker use. This information was intended to facilitate follow-ups and ensure the completion of all recommended doses during routine immunization. They were subsequently brought under catch-up service coverage after the campaign. The monitoring carried out was designed and conducted in a

manner that identified not only children who had not received TCV (15 months to 15 years) but also those who were ZD or had not received the second or third doses of the DPT vaccine or the second dose of the measles-rubella vaccine (given at 15 months).

TRAINING

The ongoing policy recommendation in Nepal was that children who missed vaccines could receive any missed doses until they reached two years of age. One of the major objectives of the TCV campaign was to identify ZD children, which was highlighted from the campaign's preparatory phase. Following a recommendation from the Nepali Government's Immunization Advisory Committee, the immunization policy was revised to allow children up to 5-years-old to receive missed vaccines from the Childhood Vaccination Schedule, supporting the TCV campaign's objective. During the preparatory phase of the TCV campaign, health workers received training to identify under immunized children, record any missed vaccines and counsel them to visit their designated health facility to receive missed vaccines after the campaign. The training on microplanning for the TCV campaign, which included mapping beneficiaries and resources, also highlighted strategies for identifying ZD children.

"We gave training to health workers and also in our immunization cards, we made it a point to focus on health workers. And whenever children come for immunization, please ask if they have received all their routine vaccines or not. If not, please record their details and immediately send them for administration of those vaccines that have been missed. So that was also good in a sense that it provides an additional window to those children that have been missed."

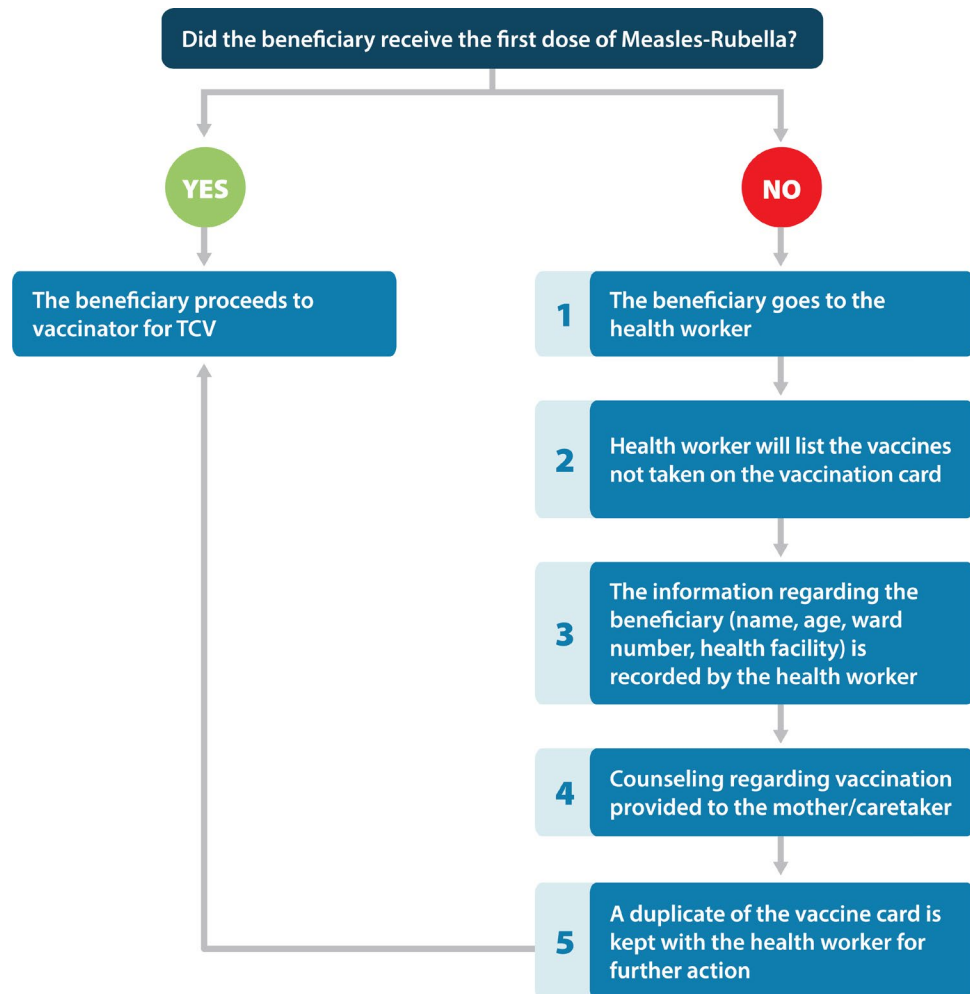
[Respondent KII4]

IMMUNIZATION CARD

The TCV immunization cards (Annex 1) had a unique design that played an important role in the identification and vaccination of ZD children during the campaign.³⁷ Two types of campaign vaccination cards were designed to cater to different age groups. One card was specifically created for children above 2 years old, while the other was intended for children aged 15 months to less than 24 months. The cards were given to the caregiver at the time of vaccination. Both cards included a detachable counterfoil, which was retained at the health facility for tracking and follow-ups on missed doses during routine vaccinations. During the vaccination sessions, health workers engaged in consultations with mothers or caregivers of children below 24 months of age, emphasizing the significance of routine immunization. They also evaluated the measles-rubella vaccine status, along with other routine vaccines. To ensure comprehensive documentation,

health workers recorded any missed doses on the counterfoil designated for health worker use. This information was intended to facilitate follow-ups and ensure the completion of all recommended doses during routine immunization. Figure 4 shows how the immunization card was used to identify ZD children.

Figure 4. Identification of zero dose children during TCV campaign



At the vaccination centers, children above the age of 5 were directed to the vaccinators to receive TCV. The caretakers of children up to 5 years were asked if they had received the first dose of measles-rubella vaccine and if the answer was 'Yes', it was marked on the immunization card. These children were then directed to the vaccinator for TCV.

If the answer to the screening question was 'No', the health workers recorded the child's missing vaccine status on the vaccination card along with identification

details, including their residential ward and health facility where they received routine services. Health workers then retained this duplicate section of the immunization card. Information regarding ZD children and children with missed doses of measles-rubella vaccine were compiled separately. The caretakers were provided with a copy of the card and given counseling on the importance of child immunization, after which they were directed to vaccinators for their TCV doses. After the campaign, the team further analyzed the data to separately list ZD children and children with missed doses and outreach was planned to vaccinate zero-dose children and children with missed doses. Following the conclusion of the campaign, the team conducted a comprehensive data analysis to identify two distinct groups: ZD children and children who missed their scheduled vaccine doses. Subsequently, efforts were made to administer vaccines to these groups either at healthcare facilities or within their own homes.

“To aid in the vaccination campaign, we created two types of cards for children under 23 months - one for the beneficiary and one for the institution. For identification, we ask the question, “Has your child received the Measles-Rubella vaccine at 15 months?” For children under 15 months, we ask, “Did you take two doses of Measles-Rubella?” For children under 5 years, the swayam sevak will ask if the child received two doses of MR and TCV at 15 months, and they will answer yes or no. Then, the swayam sevak will sign the card and give it to the vaccinator, who will ask, “Has your child received the vaccine?” For identification, the health worker will cross-check with the register, take one card, counsel the parents for vaccination, and provide all the necessary details. After the campaign, the health worker will identify the cards with a yes sign and place them in one bundle and do the same for those with a no sign. For children with a cross sign, they will make a list of their names, ages, and addresses in a predefined format. Then, in the health institution, they will cross-check with the register, verify and line-list all children for routine immunization for the next month, and send the list to the FCHV (Female Community Health Volunteer) to vaccinate these children.” [Respondent KII8]

MONITORING

Concurrent monitoring conducted alongside the TCV campaign helped identify children who had missed vaccine doses (mainly measles-rubella 1 or 2 but also DPT/Penta 3), including ZD children.

“While monitoring, it was discovered that approximately 8000 children had missed their vaccinations. Some had not received any doses, while others had dropped out after receiving a few doses, primarily for MR1, MR2, and JE. Some children had also missed doses of Penta and other vaccines. Around 200 children were zero dose children.” [Respondent KII8].

The monitoring phase of the TCV campaign also offered an important opportunity to identify and reach ZD and under immunized children. ZD children were mainly located in urban slums and remote areas with a higher concentration of underserved communities, including minority groups. They also resided in districts that share international borders with China and India. The ZD population was monitored during the TCV campaign, with special emphasis on marginalized populations.

"We monitored almost ten thousand children through our independent monitoring system, and whenever we find zero-dose children for any of the routine vaccines we provide them to the respective health facility to vaccinate those children, so there is also a routine activity for these children zero-doses." [Respondent KII3]

"Our main challenges are reaching out to school children, those in slum and difficult-to-reach areas. To cover them, local leaders, city health volunteers, as well as female community health workers micro plan and mobilized the community and cover all those marginalized areas." [Responded KII6]

Grassroot health workers believed that the TCV campaign was an important pathway to reach ZD children. The TCV campaign made people aware of the need for vaccination, which in turn helped the cause of vaccinating ZD children.

"Now we don't have zero doses in Lalitpur, for accepting that new [TCV] vaccine, all are covered by our health facility." [Responded KII6]

Several stakeholders also acknowledged that they learned from the experiences of COVID-19 and measles-rubella vaccination campaigns in 2020-21, which benefited the planning and implementation of the TCV campaign and also helped in the identification of ZD children. Certain religious affiliations were also found to be associated with ZD status, which health workers addressed by mobilizing and sensitizing relevant community and opinion leaders.

"[In cases] where most children (zero dose and missed doses) belonged to a specific community like the Muslim community, we provided counseling to the community leader, maulana, and teacher." [Respondent KII8]

5. FACILITATORS, BARRIERS AND LESSONS LEARNED

CHALLENGES OF TCV INTRODUCTION

Among the challenges respondents mentioned was the timely release of funding to districts. Additionally, most respondents emphasized that organizing a national-level campaign during school vacations was challenging. Stakeholders highlighted the challenges of coordinating and conducting a campaign on a national scale in addition to the difficulties of managing logistics, training, and mobilization across the entire country. Furthermore, municipal elections were ongoing at that time, making implementation of the campaign more challenging and forcing districts to shorten the duration of the campaign.

“It was difficult to find suppliers for IEC material during that phase as most suppliers were busy printing voter lists and ballot paper.” [Respondent KII4]

In the mountainous regions, there were challenges such as snowfall, landslides, and remote, scattered villages. Another major difficulty in reaching eligible children was migration, as families tend to migrate from higher to lower altitudes or to and from neighboring countries. Estimating their number and following up on their immunization status was challenging and led to some inconsistencies between the calculated estimates and the numbers on the ground.

FACILITATORS FOR TCV INTRODUCTION

The spread of information about the TCV campaign exceeded expectations, with the cooperation of all stakeholders including media and civil society. Interview respondents cited the high level of political commitment, stakeholder engagement and advocacy, and community participation as the main facilitators of this success.

“The TCV campaign had very high-level advocacy, high-level endorsement, and actually TCV vaccination campaign was also launched by honorable President of Nepal, so high level advocacy was there, so I think all of these factors including support by the partners at the national and subnational level contributed for the success of the campaign.” [Respondent KII4]

Some respondents mentioned that traditionally, Nepal has a history of successful community uptake of vaccines. Routine immunization coverage is high and vaccines are widely accepted by communities in Nepal. The country has introduced many new vaccines in the past, which set a positive stage for the

introduction of TCV. The experience of planning and implementing the COVID-19 vaccination campaign also offered lessons for the TCV introduction.

“Since there are stakeholders who were already in different parts of the country in COVID-19 campaign, that experience and their resources on the ground also helped us.” [Respondent KII4]

Past successful immunization campaigns gave stakeholders some confidence that high vaccination coverage could be attained, even in a short period of time. Prior to the TCV campaign background analysis, the team conducted a disease burden analysis to understand coverage gaps. The Nepal team focused on information regarding previous campaigns and challenges. Based on the results, an orientation was provided to school teachers, nurses, vulnerable groups, and female community health volunteers.

Topography and programmatic challenges were addressed locally, on a case-by-case basis. Where electronic or mass media was not available, the team identified community volunteers who linked community members to the healthcare delivery system and played an instrumental role in the smooth implementation of the campaign.

“We do have different traditional announcers like chaukidar who have a traditional role to give a message. We used them, we trained them to provide immunization messages. Basically, they are the villagers; where there is no television, no means of communication, they were the main source of information.” [Respondent KII1]

Immunization invitation cards were provided to the community, which made them feel valued.

“They feel that the government has given importance to them by providing invitation cards for the very special occasion.” [Respondent KII2]

Multilevel involvement during the TCV campaign was another example of a best practice. Three levels of government—federal, local and community—took part in the campaign. In order to gain their involvement, provincial-level supervisors, municipal-level program managers, and elected political representatives were invited to attend a national-level consultation with all major stakeholders. The consultation included a series of discussions and consultations and requested an expression of commitment to make this massive campaign a success. Additionally, the TCV campaign made efficient use of the health workforce.

Health workers were provided flexibility in their approaches and schedules to carry out the campaign according to their local contexts and needs.

“We had given them very strict terms and limited budget with no flexibility on their part to, if necessary, recruit more health workers and add more immunization sites. Similarly in some places, it was snowing so they decided it was not possible to conduct on that day, but somehow, after few days we do it, and there were instances, I believe health workers, because they were not in subsequent number, so adjacent municipality when they completed theirs, they moved to adjacent municipality to support campaigns.” [Respondent KII4]

INNOVATION

A key innovation during the TCV campaign was the use of an application-based system for monitoring 46,000 children in 75 districts during the RCM phase. For this purpose, the WHO developed an app-based electronic monitoring system which could be used by both android and iOS platforms. This was used by the 230 independent monitors deployed throughout the country, the surveillance officers who supervised them, and 10 international monitors. This system was also used in a subset of children ages 15 months to 5 years to determine if they were ZD children or had missed the measles-rubella vaccine. However, the app-based monitoring was done by the WHO while the routine RCM was carried out using a pen and paper by government functionaries concurrently with the TCV campaign. Both monitoring exercises were planned and conducted in communication with each other so that there was no duplication.

“We had also developed an app-based system for monitoring the campaign. The same app-based system is a customized system and it can be used by anyone, in fact it can be used by other countries because it is customizable.” [Respondent KII3]

Another noteworthy practice was the use of information and resources previously used for the COVID-19 vaccination campaign. Stakeholders acknowledged that their learning from COVID-19 work benefited the TCV campaign as well as identification of ZD children. Nepal had performed very well, ranking highest in coverage out of the ninety countries who participated in the COVAXIN campaign. During the COVID-19 vaccination drive, the government of Nepal built partnerships with multiple sectors including the Education Department, NGOs, and community-based organizations, which helped in the implementation and monitoring of the TCV campaign and identification of ZD children.

“We have done school-based COVID-19 vaccination for 12-17 years adolescent age group. So already have interaction with the education sector, with schools

both at national and at subnational level, so that was very helpful because the majority of the implementation of TCV campaign was done through schools, so that experience was already there.” [Respondent KII3]

LESSONS LEARNED FROM THE TCV CAMPAIGN

Based on feedback from key informants in this case study, the main lessons learned related to the importance of the TCV campaign for identification and reach of ZD children are:

- Political commitment and engagement of country stakeholders across, within, and outside of the health sector and across the multiple levels of the health system (federal, provincial, district, and community) are essential to implementing a successful national vaccination campaign.
- During the TCV campaign, the targeting of ZD children was an explicit objective that was taken into consideration from the onset and throughout the planning and implementation of the campaign. Related actions included the revision of the immunization policy to administer missed doses to children up to the age of 5 and the training of health workers and monitors to identify ZD children.
- The vaccine card was not only designed in a way that allowed ZD children to be easily identified, but was paired with a mechanism to connect families of ZD children to their respective health facilities for follow-up visits to receive missed vaccines.
- Monitors were specifically trained to identify ZD children during their post-campaign efforts, with special attention to marginalized communities including those in urban slums, remote areas, and areas with high concentrations of minority groups. This work was facilitated by the innovative app-based system for monitoring.

For more background information on this case study, see Annex 2 for the case study methodology and Annex 3 for in-depth interview guidelines.

ANNEX 1

TCV Campaign vaccination card (15 to < 24 months)

नेपाल सरकार
स्वास्थ्य तथा जनसंख्या मन्त्रालय
स्वास्थ्य सेवा विभाग
परिवार कल्याण महाशाखा

टाइफाइड खोप अभियान २०७८/७९
(अभिभावकको प्रति)

खोप कार्ड
(१५ महिना - २३ महिना)

नाम: उमेर: महिना

खोपको ब्याच/लट नम्बर: लगाएको मिति: स्वास्थ्यकर्मीको हस्ताक्षर:

नियमित खोपको अनुगमन (४ कुनै बक्समा टिक ☒ चिन्ह लगाउने)

८ महिनामा दादुरा रुबेलाको पहिलो मात्रा: १५ महिनामा दादुरा रुबेलाको दोस्रो मात्रा:

लिएको ☐ नलिएको ☐ लिएको ☐ नलिएको ☐

सबै बालबालिकालाई नियमित खोप तालिका अनुसार १५ महिना सम्म सबै खोप लगाऔं ।

यो कार्ड सुरक्षित राखौं ।

राष्ट्रिय खोप-तालिका

घटक/लेट	कुल उमेरमा	कुल खोप
१	जन्मले तिरिकै	भि. डि. जी.
२	६ हप्तामा	रीटा पोलियो एक अर्ध भि.जी. डि. डि. जी. डि. डि. टी. रोप की रोज
३	१० हप्तामा	रीटा पोलियो डि. डि. जी. डि. डि. टी. रोप की रोज
४	१४ हप्तामा	पोलियो एक अर्ध भि.जी. डि. डि. टी. रोप की रोज
५	९ महिनामा	भि. डि. जी. दादुरा रुबेला
६	१२ महिनामा	जवाबिज इन्फेक्चसिबल
७	१५ महिनामा	दादुरा रुबेला टाइफाइड

खोप लगाएता पनि सधैं सरसफाईका सबै व्यवहारहरूको पालना गर्नु ।

Gavi | unicef | World Health Organization | नेपाल सरकार स्वास्थ्य तथा जनसंख्या मन्त्रालय स्वास्थ्य सेवा विभाग परिवार कल्याण महाशाखा

TCV Campaign vaccination card counterfoil (15 to < 24 months)

नेपाल सरकार
स्वास्थ्य तथा जनसंख्या मन्त्रालय
स्वास्थ्य सेवा विभाग
परिवार कल्याण महाशाखा

टाइफाइड खोप अभियान २०७८/७९
(स्वास्थ्य सम्बाको प्रति)

खोप कार्ड
(१५ महिना - २३ महिना)

नाम: उमेर: महिना

आमा/बुवाको नाम:

सम्पर्क नम्बर:

स्थानिय तह: वडा नं.:

खोपको ब्याच/लट नम्बर: लगाएको मिति: स्वास्थ्यकर्मीको हस्ताक्षर:

नियमित खोपको अनुगमन (४ कुनै बक्समा टिक ☒ चिन्ह लगाउने)

८ महिनामा दादुरा रुबेलाको पहिलो मात्रा: १५ महिनामा दादुरा रुबेलाको दोस्रो मात्रा:

लिएको ☐ नलिएको ☐ लिएको ☐ नलिएको ☐

सबै बालबालिकालाई नियमित खोप तालिका अनुसार १५ महिना सम्म सबै खोप लगाऔं ।

नियमित खोप तालिका अनुसार छुट खोप र दिइएको मिति ।

छुटेको खोप	मात्रा	लगाइएको मिति

ANNEX 2

CASE STUDY METHODOLOGY

The present study documents the experiences and perspectives of key stakeholders regarding the introduction campaign of the typhoid conjugate vaccine and attempts to identify its role in reaching zero-dose children in Nepal.

Keeping this broad aim in mind, the case study specific objectives included:

- To gather information on the introduction of the TCV campaign from stakeholders' experiences and perspectives;
- To understand the impact of TCV immunization campaign in reaching zero-dose children in the country;
- To explore facilitators and challenges of the TCV introduction with regard to addressing inequities and enhancing vaccination coverage;
- To document best practices during the TCV campaign with particular reference to reaching zero-dose children.

STUDY DESIGN

To achieve the specific objectives, a qualitative case study and narrative review approach was used, where a case study means an in-depth exploration of the topic with a pre-defined population within a specific geographic area. This study adopted a qualitative approach to explore key stakeholders' perspectives and experiences on the TCV campaign in Nepal.

STUDY PARTICIPANTS

We carried out eight in-depth interviews with purposively selected key informants in Nepal. Study participants were stakeholders who were actively engaged in the TCV immunization campaign, as well as representatives of the Government and international partners. The key informants interviewed are from the Government of Nepal, the World Health Organization (WHO), and the United Nations International Children's Emergency Fund (UNICEF). We also interviewed stakeholders representing district officials and health workers who actively participated in the TCV campaign.

TOOLS USED

The selected stakeholders were interviewed using a semi-structured in-depth interview guide (see Annex 3), which was developed by IIHMR-Delhi based on literature reviews to answer research questions. The guide sought information on essential socio-demographic characteristics, role, and responsibilities of the stakeholders, information regarding implementation experience, monitoring procedures, and experiences in reaching zero-dose children. Information was gathered on the facilitators and barriers faced by stakeholders during the TCV campaign in terms of achieving coverage and addressing various inequities. Information was also collected on best practices to inform details about equity, coverage, scalability, and sustainability. The pre-tested, open-ended, semi-structured interview guide was used to elicit information from the respondents. However, the probes and discussion points varied according to the stakeholder and their role in the campaign.

The stakeholders also provided available documentation (English and/or local language) including scheme guidelines, protocols, infographics, and fact sheets with the study team for secondary data analysis. In addition, Medline, Web of Science, and Scopus databases were searched for information from 2012 to 10 February 2023 regarding TCV epidemiology, trials, efficiency, cost effectiveness, and public perspectives in Nepal. A total of 97 articles in English were identified, of which 19 were included in this study, after excluding duplicates.^{4,6,7,8,9,10,13,14,15,16,19,23,25,24,29,30,31,32,33}

RECRUITMENT

Following consultation with JSI, Gavi, and the Senior Country Manager for Nepal, a list of potential study participants was generated. The initial list included seven key informants, including international partners and Government officials representing a range of organizational affiliations and socio-demographic variations.

All the individuals on the list were approached for participation and informed about the purpose of the study over email. After obtaining consent, the IIHMR-Delhi team communicated with the respondents to finalize a mutually convenient time for interviews. The in-depth interviews were conducted remotely using the Zoom online platform.

The first round of interviews comprised four key informants: two affiliated with international partners and two officials from the Ministry of Health. The second round of interviews included programme managers from district level and health workers who actively participated in the campaign.

DATA ANALYSIS

All in-depth interviews in the first round of data collection were conducted during February 2023. The interviews were conducted after obtaining informed consent from participants, including permission for audio and video recording. All interviews were conducted in English and subsequently transcribed for analysis. The interview transcripts were analyzed using thematic analysis based on the Braun & Clarke (2006) method.³⁸ The first step of the analysis was reading and re-reading the transcripts to get a rich overview of the diversity of the information collected. Next, the team reviewed and coded the transcripts. The transcripts underwent multiple readings and note taking of information related to objectives which were then transformed into categories and themes through discussions amongst the study team. To improve inter-rater reliability, team members reviewed selected transcripts independently to check for bias and alternative interpretations of the data. Discrepancies were discussed until a consensus was reached. At the end of this step, the codes were organized into broader themes in relation to the research question. Results and data saturation were discussed after review of all the themes.

ETHICAL CONSIDERATIONS

The ethical clearance for the study was obtained from the JSI Ethics Committee. The respondents were administered an Informed Consent form that explained the details of the study, nature of questions, time needed for interview, assurance on confidentiality of data, voluntary participation, and implications of the study. Consent for the video recording during online data collection was separately recorded. Collected data will be stored confidentially and used strictly for the purpose of this study; recordings will be destroyed after the conclusion of the study.

ANNEX 3

In-depth Interview Guideline

KEY QUESTIONS

A	INTRODUCTION
1	Designation, Experience – general and specific, years of service
B	SPECIFIC EXPERIENCE REGARDING IMMUNIZATION PROGRAMME
2	What vaccines do people regularly get here in Nepal? Why was TCV introduced? <i>Probe around:</i> TCV
3	What were your main roles and responsibilities in the TCV campaign? <i>Probe around:</i> role and responsibility before (preparatory phase), during (implementation) and after (monitoring) the campaign, the focused risk factors intervention
4	Modalities of the TCV campaign – preparatory, implementation and monitoring phases – who was involved, where how? <i>Probe around:</i> school-based programme; urban vs. rural areas?
5	What, if any, mechanisms are there for informing the health facility about the beneficiary lists? What are the steps taken to ensure that no child was missed?
6	How did the community respond to the campaign? (Interest, participation) <i>Probe around:</i> communities' perception about TCV
7	What are the experiences of the community members about the services during the vaccination campaign? <i>Probe around:</i> Interactions with the health professionals – information, explanation, service delivery, counselling, AEFI etc.
8	What were the sources of information (to different stakeholders) about the TCV? <i>Probe around:</i> Internet; health care workers (who?); friends/family; schools
9	Who would normally be the one deciding whether a child should be vaccinated or not? <i>Probe around:</i> Family/friends, parents, family doctor

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JSI Research & Training Institute, Inc.
2733 Crystal Drive
4th floor
Arlington, VA 22202
USA

For more information, visit zdlh.gavi.org.

