

**Mapping the Peste des Petits Ruminants (PPR)
Disease Vaccine Value Chain in Nepal: An
Intersectional Analysis to Increase Women's
Engagement and Benefit**

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Abbreviations

AFU	Agriculture and Forestry University
BMGF	Bill & Melinda Gates Foundation
CAHW	Community animal health worker
CBS	Central Bureau of Statistics
DLS	Department of Livestock Services
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussion
GAC	Global Affairs Canada
GESI	Gender Equality and Social Inclusion
GITA	Gendered intersectional transformative approach
GON	Government of Nepal
HCP	Host country partners
HDI	Human Development Index
HICAST	Himalayan College of Agricultural Science and Technology
IDRC	International Development Research Centre
JT	Junior technician
JTA	Junior technical assistant
KII	Key informant interview
MALD	Ministry of Agriculture and Livestock Development
MOLD	Ministry of Livestock Development
MOPE	Ministry of Population and Environment
LVVC	Livestock vaccine value chain
OHCHR	Office of the High Commissioner of Human Rights, United Nations
PPR	Peste des Petits Ruminants
VVC	Vaccine value chain
UF	University of Florida
UNDP	United Nations Development Programme

Introduction

In Nepal and other developing countries of Asia and Africa, the burden of treatable infectious diseases among livestock is high and access to animal health services and laboratories is challenging if not burdensome on the smallholder owners. Consequences of the Peste des Petits Ruminants (PPR) disease outbreaks are pressing issues, both globally and in Nepal. Lack of routine vaccination practices have contributed to the occurrence of outbreaks, while at the same time, underuse of vaccines through lack of access, affordability and availability also leads to death of goats and sheep. As part of the global effort to eradicate PPR disease in Nepal by 2030, the Government of Nepal (GON) has been actively supporting the production of the PPR vaccines and facilitating their delivery throughout the country.

This report presents the findings from the livestock vaccine value chain (LVVC) mapping activity conducted by the University of Florida (UF) researchers in collaboration with local partners and students from two agricultural universities in the country: The Agriculture and Forestry University (AFU) and the Himalayan College of Agriculture Science and Technology (HICAST).

Country Context

Nepal is a landlocked country in Asia between China and India. Agro-ecologically Nepal is divided into three topographical zones: mountain, hills, and Terai. The mountain region is 4000 meters or more above sea level with rugged topography that limits sparsely populated human inhabitation and economic activities. The Hills Region lies between 1000-4000 meters in altitude. Agriculture and livestock farming are predominant economic activities, yet it is a food deficit area. The Terai is a lowland tropical and subtropical belt stretching along the Nepal-India border. Agriculture and livestock farming are the bones of the Region which is home to approximately 50% of the population (Central Bureau of Statistics (CBS), 2012).

Nepal has a population of 28.09 million (World Bank, 2018). A high portion of youth work abroad and contribute to country's gross domestic product in the form of remittances. National gender ratio (males per 100 females) is about 94.2, however, men outnumber women in urban areas, while rural areas are dominated by women due to male outmigration for economic reasons. (CBS, 2012). Adult's literacy rate is at 56.6%. Female literacy is at 57.4%, while male's is about 75.1%. Rural areas are far behind and there are more women who can't read and write (Dhakal, 2018).

Nepal is one of the poorest countries in the world. In 2018, Nepal's Human Development Index (HDI) was 0.579 ranking Nepal in 147th position. A quarter of the population (25.2%) is below the poverty line, with the majority (45%) in rural areas (UNDP, 2019). Most of the rural population (80%) depends on agriculture as the main livelihood system, representing potential opportunities that could be enhanced to reduce rural poverty (MoLD, 2017). Livestock is an integral component of the agricultural system that provides smallholders cash income, improves dietary diversity, and increases agricultural productivity through draft power and manure. Goats are the most commonly owned form of livestock; 49.8% of all household keep goats, with average herd sizes of 3.3 animals per household (Heifer International, 2012). These figures obscure the importance of goats to poor

livestock keepers; in Nepal, goats are commonly referred to as the “poor person’s cow” and nearly every rural household keeps at least a small number of goats (Uprety, 2009). While buffalo is the largest contributor to the livestock gross domestic product, the value of goat production is growing, due to higher demand for goat meat in urban areas (Heifer International, 2012). However, a poorly functioning goat value chain compounded with limited access to animal health, including timely and in adequate supply of vaccines, has left poor livestock keepers, most of whom are women, unable to benefit. Rising demand for meat has been largely satisfied by increased imports from India rather than domestic production (Heifer International, 2012).

Other constraints affecting smallholder goat producers include lack of year-round access to nutritious feed, scarce extension, and poorly functioning output markets. Livestock vaccination rates against PPR have remained low (between 12-35%) despite the GON’s efforts to increase production of the vaccine, offering vaccines for free and through annual vaccination campaigns and empowering local communities to take leadership roles in deciding the use of scarce resources at the community level. About 47% of all livestock and poultry are raised in the Hills, 39% in Terai and 14% in the Mountain regions (MoLD, 2017).

Between 1971-2001, increased internal migration trends were from the Hills and Mountain zones to the Terai zone due to resettlement programs, availability of arable land and employment, and better facilities and services such as health, education, and transportation. Most migrants are men of whom 80% move in search of job opportunities; 70% of women move to follow their husbands (USAID, 2017). This situation exists when, for example, people from the hills and mountain areas move to the Terai area (MoPE, 2017).

Gender and Caste Dynamics

The Hindu hierarchical system practice exists and shapes societal structure in Nepal that systematically categorizes people on the bases of wealth, caste, gender, and class (OHCHR, 2012). There are four major caste groups which are categorized by occupation: Brahman as a priest, Kshatriya as warriors, Vaisya as merchants and Sudras as untouchables or service caste (Subedi, 2010). In the Nepalese development discourse, *Janajati* referred to ethnic people and *Dalit* referring to untouchable castes, both of which are two disadvantaged and marginalized groups where ethnic group and individuals’ identity are based on the geographical location, language used, and religious traditions and rituals (Gurung, 2005). Using the definition of a group of people from different language and ethnic groups that are religiously, culturally, socially, and economically oppressed, Gurung (2005) highlights that the source of oppression derives through from the ways in which people from different castes carry out their rituals. And even within castes there are differentiations; for instance, Dalit women are at a more disadvantaged position than Dalit men, which make them have, in practice, less access to economic sources in the community and less representation in the political and decision-making level of the State (OHCHR, 2012). The intersection of caste, ethnicity and socio-economic status are multiple and complex and may bring long lasting deprivations to the marginalized groups. In the study conducted by Stash & Hannum (2001), caste, ethnicity, and socioeconomic status influenced children’s education, particularly, in enrolling and finishing primary

school. The study explained that Tamang and other Bhotia (ethnic groups) and low castes possessed the lowest percentage of children enrolled because they live in a more impoverished, mountainous areas and/or have lower social status, while Newars (ethnic group) and high castes (Brahmin) had high rates of enrollment due to their residencies in the capital city and/or higher social status.

The livestock sector and its practices in rural areas are structured and embedded along with this socio-economic and ethnic differentiation system (Gurung et al., 2005) that shapes people's identity and thus, the scope of actions they can carry out. Gurung et al. (2005), however, extends this differentiation to gender aspects and makes special reference to the power dynamics between men and women in the livestock management. On one hand, there is a recognition of women's role for managing livestock and their possession of arrays of knowledge, skills, and capabilities. On the other hand, women still have limited control of the production system, which is situated in the men's domain (Gurung et al., 2005). That is, women's identity is recognized as representing key individuals that support food security systems, yet they lack access to resources, services, and the labor market.

Traditional practices put women at a disadvantage. For example, *chhaupadi* is a practice that makes mother and infant stay in a cowshed during and, sometimes, after delivery (MoPE, 2017). Women get married at an earlier age than men, but also women with no education marry even earlier than women with higher education (USAID, 2017). At every level of education attended, men have a higher representation when compared to women (USAID, 2017). Girls' education is undeniably beneficial, yet it is not perceived as such by many parents, even if the education provided to women could increase family income (MoPE, 2017). When women have a job, they earn less than men because 52% of women's work is unpaid and 77% of men receive a salary in cash. Men are twice as likely as women to own a house and land – only 8% of women own land (Paudel et al., 2009). Lack of land ownership limits women's access to finance, technology, inputs, and government supports (FAO, 2019). Despite increased efforts to support women's participation in decision making, they have less voice on these processes, especially at the household level (USAID, 2017).

Gurung et al. (2005) reports that poorer smallholders have small animals such as goats, pigs, and poultry, while more affluent farmers raise large livestock such as cattle and buffalo. As such, the incidence of animal diseases (e.g., PPR) has a direct impact on the livelihoods of relatively poorer livestock-dependent communities, especially women living in these households (Libeau et al., 2014). Women are responsible for taking care of small ruminants (Paudel et al., 2009). Livestock-keeping provides women with an opportunity to contribute to the household's economy. The Agricultural Perspective Plan (APP) also emphasizes the livestock sector's role in enhancing rural women's participation in the agricultural labor force and development (Agricultural Project Services Centre, 1995). Yet, women have little voice in decision making in the production of livestock, for instance, in particular to access veterinary services and control over livestock business (Gurung et al., 2005). Women have less power over assets and control over the production; many agricultural projects perpetuate these power dynamics by favoring men (Quisumbing et al., 2015). Furthermore, access to fixed assets, finances, and property is limited for women (MoPE, 2017). GALVmed (2011) emphasizes the importance of women and marginalized groups in the success of livestock

vaccination. Thus, the formalization of women’s land ownership and their access to basic services in rural areas are recognized as national issues that remain to be fully addressed. In other words, improvements in PPR eradication could enhance women’s control over the production of small ruminants so they could, in turn, contribute to their families’ economic and nutrition status, as well as the education of their children (FAO, 2015).

Gender Equality and Social Inclusion (GESI) is a national-level framework to deliver equal rights, opportunities, and services to all the populations through not only formal institutional arrangements but also the recognition of informal setting where power relations have disadvantages for women, the poor, the vulnerable, and the excluded (GESI WG, 2017). Related to livestock keepers and the PPR value chain, the application of the GESI framework could provide a thorough and more inclusive lens to engage women livestock keepers in the value chain and the livestock sector. Furthermore, the GESI framework plays a key role in developing programs that are gender sensitive and alleviating gender, ethnic and caste-related disparities in the agricultural and livestock sector as illustrated in Figure 1 (FAO, 2019).

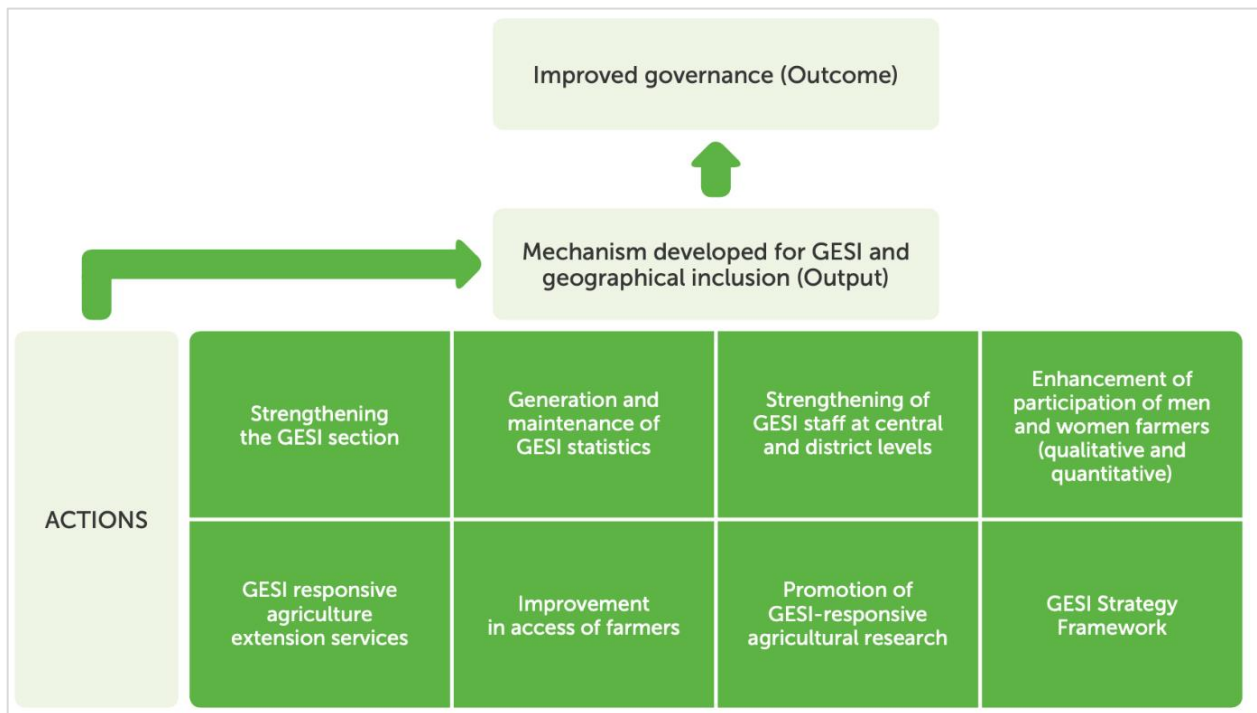


Figure 1. Conceptual framework for GESI mechanism in the Agriculture Development Strategy (Source: FAO, 2019)

Methodology

Research Objectives

The LVVC mapping study was designed to contribute to the understanding of how gender intersects with social markers, such as caste and ethnicity in relation to women’s access to the PPR vaccine, and how it influences the participation of women livestock keepers in the PPR vaccine value chain.

The primary research objective was to map the PPR vaccine distribution value chain with a focus on women's involvement in the nodes and links of the chain, and the related attitudes and perceptions of this involvement. The secondary objectives included: 1) to investigate how rural women and men perceived who is in charge of goat husbandry, 2) to identify vaccination practices characteristics of the research sites, 3) to investigate the barriers and opportunities the women and men livestock keepers faced in accessing the PPR vaccine, 4) to investigate the male and female concepts of empowerment, ownership and livelihoods related to livestock husbandry, vaccination practices, and vaccines, 5) to investigate the barriers and opportunities for women to become CAHWs or veterinary officers at upper nodes of the chain, and finally, 5) to investigate how community members perceived the colocation of animal and health information or services under the One Health umbrella.

Methods

The research design for the LVVC mapping employed a mixed methods approach, drawing on the expertise from gender studies, economics, animal sciences, veterinary medicine and extension in order to evaluate the gender and intersectional issues in the LVVC. Narayan (2005) states that “a mix of data collection tools provides a more reliable and complete picture of the phenomenon under study, as the tools balance out each other's weaknesses” (p. 25).

Fieldwork took place in 2019 and involved two phases of data collection. The first phase started early July until the beginning of August, while the second phase started mid-August until the end of October. The field teams in both phases were different. The first phase involved a UF graduate student (co-author of this paper) paired with a graduate student from HICAST, while the second phase involved two graduate students from AFU recruited additionally to work with the HICAST graduate student, the gender expert and the country coordinator. While the UF student had a social science background and experience working with rural communities in Indonesia, the Nepali students came from agricultural and veterinary sciences backgrounds with limited social science and qualitative interview experiences. Prior to data collection, the students were trained how to conduct qualitative interviews and discussions, prepare field or interview notes and transcribe recorded data. Logistical arrangements for both teams were made by the country coordinator. The fieldwork was supervised by the UF research team and the country coordinator.

Participants did not receive monetary compensation for their participation, only snacks and soft drinks were provided. The community-level livestock service providers (CAHWs, JTs or JTAs) of focus groups discussions (FGDs) were reimbursed for their transport because in most cases they traveled to a central location from rural municipalities or communities where they resided. The FGDs and individual interviews were recorded and transcribed from Nepali into English for data analysis. Some key informant interviews (KIIs) were completed in English, especially those at the national level, and some in Nepali, but all interview notes were prepared in English. Verbal informed consent was given by all participants following UF's Internal Review Board (IRB)-approved protocol.

Data collection instruments discussed below were adapted slightly to the local context in order to make them understandable to the local people. The mapping activity started with KIIs in Kathmandu, after which the field teams travelled to research sites to continue interviews with various actors from provincial, district and local levels. It should be noted that when possible a snowballing sampling was used to identify actors participating in the PPR vaccine distribution chain.

Focus Group Discussion

A total of 30 FGDs took place of which 26 were conducted with livestock keepers, disaggregated by sex, and four with community-level livestock service providers (mixed sexes and occupations, including CAHWs, JTs and JTAs). Organizing groups by sex was done to create a space for women to talk freely about gender-specific barriers and opportunities. The FGDs with livestock keepers included a range of topics, including participants' experiences with goat farming, access to vaccines and information about vaccines, experiences of past vaccinations, advantages and disadvantages of livestock vaccinations, barriers faced in accessing vaccines, and the perceptions of who had the greater barriers in accessing vaccinations in their communities. The livestock keeper FGDs also explored women's and men's perceptions about women's empowerment and disempowerment, who in the household was in charge of goat farming and decisions pertaining to vaccinations. Questions on the advantages and disadvantages of co-locating animal health with human health under the umbrella of One Health approach were also used in the context of Nepal to understand if there are country-specific variations that can be accounted for. The FGDs with CAHWs, JTs and JTAs investigated similar topics as livestock keepers' FGDs in addition to understanding the day-to-day responsibilities of the livestock service providers and their experience in working with communities and district or provincial level veterinary service providers during vaccination campaigns. In total, approximately 332 people were interviewed through FGDs.

Individual Interviews

A total of 30 individual interviews were completed with 12 male and 12 female livestock keepers, and the remaining three with female CAHWs, two with male CAHWs, and one with a male JTA. The interviews explored individual experiences with vaccination services and animal health in general. The interview protocol also included the basic demographic questions.

Key Informant Interviews

A total of 30 KIIs were completed encompassing key informants at the national (7), provincial (5), district (8) and local/rural municipality (6) levels. The KIIs primarily targeted the actors of the vaccine distribution chain, but also those who indirectly facilitated the vaccine production or distribution chains. These agencies included the Nepal Agricultural Research Council (2), Heifer International (1), USAID funded project working in the livestock sector (KISAN II; 1), a private vaccine producer from India – Hester Biosciences (1), and a CAHW training company in Nepal (1). The KIIs included 24 men and 6 women.

Data from FGDs, KIIs and individual interviews were de-identified in accordance with the guidelines of the UF IRB. The transcripts were analyzed using thematic analysis. The KII notes were used to expand the understanding or interpretation of findings from the mapping activity. Field data

was complemented with a review of available literature about gender and intersectional dimensions of the goat and PPR vaccine value chains in Nepal.

Study Setting

The study communities for the mapping activity were located in four provinces: Province 2, Province 3, Gandaki Pradesh (Province 4), and Province 5 (see Figure 2). Two of the provinces (Province 3 and Gandaki Pradesh) belong to the Hills agro-ecological zone, while Province 2 and 5, and Chitwan District of Province 3 are located in the Terai agro-ecological zone. As mentioned earlier, the national level data was collected in Kathmandu.



Figure 2. Location of research sites in Nepal (in white or red circles; source: Nepalbuzzpage)

These provinces were selected purposively, because they had large goat production areas and experienced PPR outbreaks in the past. Additionally, the UF team based the selection of research sites on the experience of another UF project, which was implementing a goat value chain research program in Nepal at the time of the UF project research idea inception and mapping work. Table 1 provides the names of research sites in selected provinces as well as the general information about the provinces.

Table 1: Research sites and general information about the province (Source: Nepalsbuzzpage)

Province	General information about the province	District	Rural Municipality	Communities/ Wards
Province 2	Capital: Janakpur Area: 9,661 sq km	Mahottari	Khayeramara	Jyoti Damarbhanjyang
Province 2	Population: Over 5 million Density: 559 people per sq km	Rautahat	Chandrapur Rangapur	Gadura

	Districts: 8 Mostly Terai agro-ecological zone			Rangapur (Gujara-2), Katani
Province 3	Capital: Hetauda Area: 20,300 sq km Population: Over 5.5 million	Nuwakot	Belkotgadi Bidhur	Ratmate Tupche, Bahundanda
Province 3	Density: 272 people per sq km Districts: 13 Mostly Hills agro-ecological zone (Chitwan district is in Terai)	Dhading	Dhunibesi Gogan Pani Nilkantha	Chhatreurali Gogan Pani Palpabhanjyang
Province 3		Chitwan	Shaktikhor	Chitwan
Gandaki Pradesh	Capital: Pokhara Area: 21,405 sq km Population: Over 2.4 million Density: 112 people per sq km Districts: 11 Mostly Hills agro-ecological zone	Kaski	Mjuri	Mjuri
Province 5	Capital: Butwal Area: 22,288 sq km	Palpa	Phek Ribdikot	Lalupate Phulbari tole, Somar
Province 5	Population: Over 4.9 million Density: 219 people per sq km Districts: 21 Mostly Terai agro-ecological zone	Banke	Nepalgunj Binauna Raptisonari-05	Apsara Binauna Ward 3, Baisa

Most rural areas selected for study had goat or producer cooperatives, of which some were formed with support from Heifer International. Because research sites were also organized by agro-ecological zoning, the rural areas shared many study characteristics. The Hills zone are comprised of mountainous terrain where it does not generally snow. The residents of Hills are primarily agro-pastoralists as they practice mixed systems by cultivating rice, wheat and potatoes while raising goats and poultry. Some residents have cattle and buffalo but in fewer numbers due to the mountainous terrain. The population density in the Hills is low and houses are scattered. An indigenous ethnic group (Newars) is the largest ethnicity occupying the Hills followed by smaller ethnic groups and different caste groups characteristic of Nepal. The Terai zone is a lowland region containing some smaller hill ranges. Most of the Terai lies along the Indian border; because of this, there is a large influence of Indian-infused Hindu culture on the local population. The caste system is more prominent in Terai. Nepali is taught in schools and often spoken in government offices; however, some local populations also use Maithali, Bhojpuri and Tharu languages. The Terai rural residents are also agro-pastoralists. They cultivate various agricultural crops as well as maintain goats, poultry, cattle and buffalo. The population density in Terai is high and houses are more concentrated around their ethnic or caste cohorts.

Results

The study results are generally organized into five sub-sections. The first, focuses on the actual mapping of the PPR vaccine value chain and relations at different nodes of the value chain, starting with the higher-level nodes (national, regional and district) followed by lower nodes (rural municipality and community). The second, focused on the exploration of gender and intersectional dynamics at the community level, encompassing both the livestock keepers and those who provide veterinary services to them. In addition, this section also covered related understandings of women's

roles and operationalization of empowerment. The third focuses on barriers to accessing vaccines, the fourth, on animal health practices, and finally, the fifth, on the roles of cooperatives in animal health services at the community level.

A total of 332 participants, 200 women and 132 men, participated in the FGDs. The majority of the participants had primary education. The men were either a migrant laborer on a holiday break or recently returned from foreign employment and started their own small businesses (mostly commercial goat farms). The JTs and JTAs in FGDs were the only ones who had formal education, while CAHWs completed a 35 day CAHW standardized curricula approved by GON. Their ages ranged between 20 to 65 years old, with an average age of 45 years. Male participants were of similar ages. The JTs and JTAs were generally older than CAHWs, especially female CAHWs.

Mapping of the Livestock Vaccine Value Chains in Nepal

The results presented in this section come primarily from KIIs and was corroborated from literature available within the Department of Livestock Services (DLS) and other sources. Findings from the focus groups and individual interviews with both livestock keepers and community-level animal health service providers provided additional insights.

In Nepal, the livestock VVCs are regulated by the national disease control programs. Such programs exist for PPR, Foot and Mouth Disease (FMD), Swine Fever, Newcastle Disease (NCD) and rabies. The LVVCs follow the same institutional setup, regulated by the Program's provisions, except the FMD vaccine, which is not locally produced but imported. International regulatory bodies, such as OIE and FAO play important roles in guiding animal health regulations within Nepal. Under the Ministry of Agriculture and Livestock Development (MALD), DLS oversees animal disease investigations and control, veterinary standards and drug regulation labs, as well as coordinates veterinary services through veterinary laboratories and vaccination programs to improve the livestock sector including expanding disease control services for livestock (GARP, 2015). The animal health service delivery systems layout focuses on animal-related resources including knowledge and skills that are found in an economic setting to provide services to both livestock keepers and animals (Mirajkar et al., 2011). The provision of services is designed to enhance the animal productivity by eliminating animal diseases which, in turn, contribute to the increased well-being of the farmers.

Figure 3 shows that the government channels vaccines when disease outbreaks occur to prevent the spread of the disease (GARP, 2015). The vaccine flow (one direction) denotes the flow of vaccine from the time it is produced to the time it is administered, and the information flow denotes the flow (two directional) of outbreak reporting and vaccine requests/delivery between different actors in the chain. Most vaccines (except FMD) are produced in the National Vaccine Production Laboratory. Vaccines regulated by the above described programs are considered public goods. The Animal Health Investigation and Control at the national level has been assigned to manage disease control, an important and challenging task in the livestock sector. Thakur (n.d.) lays out the established communication protocols regarding an outbreak or suspected cases in the community to the federal government (Figure 4).

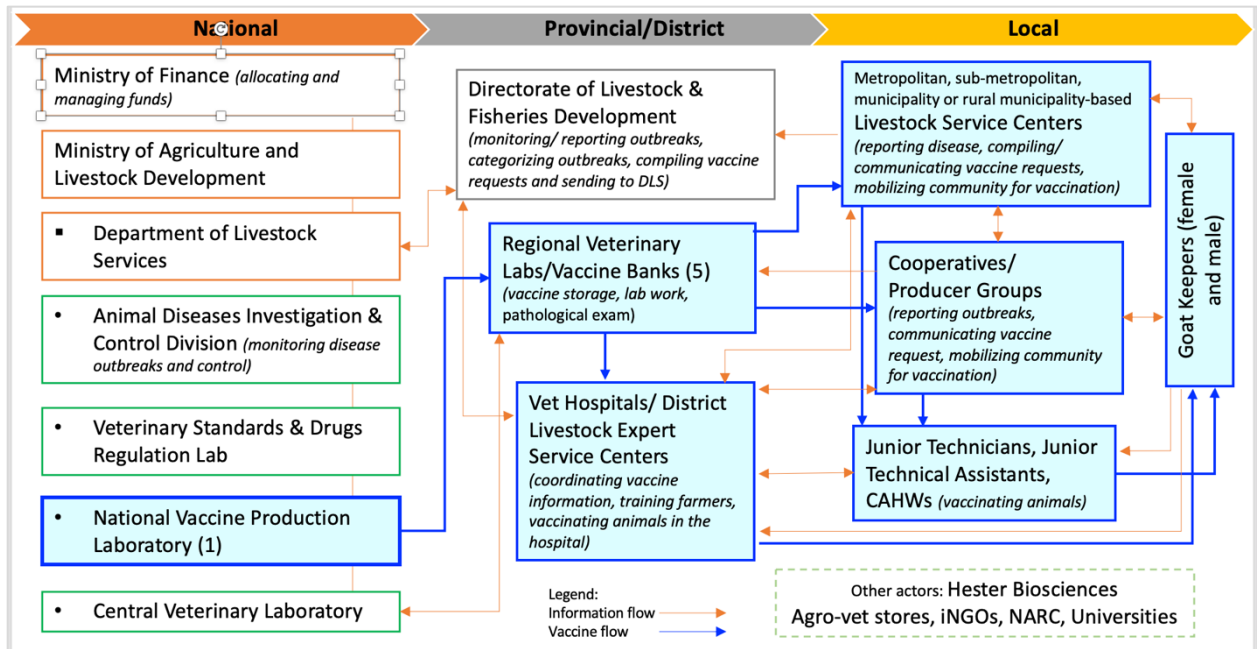


Figure 3. LVVC System in Nepal

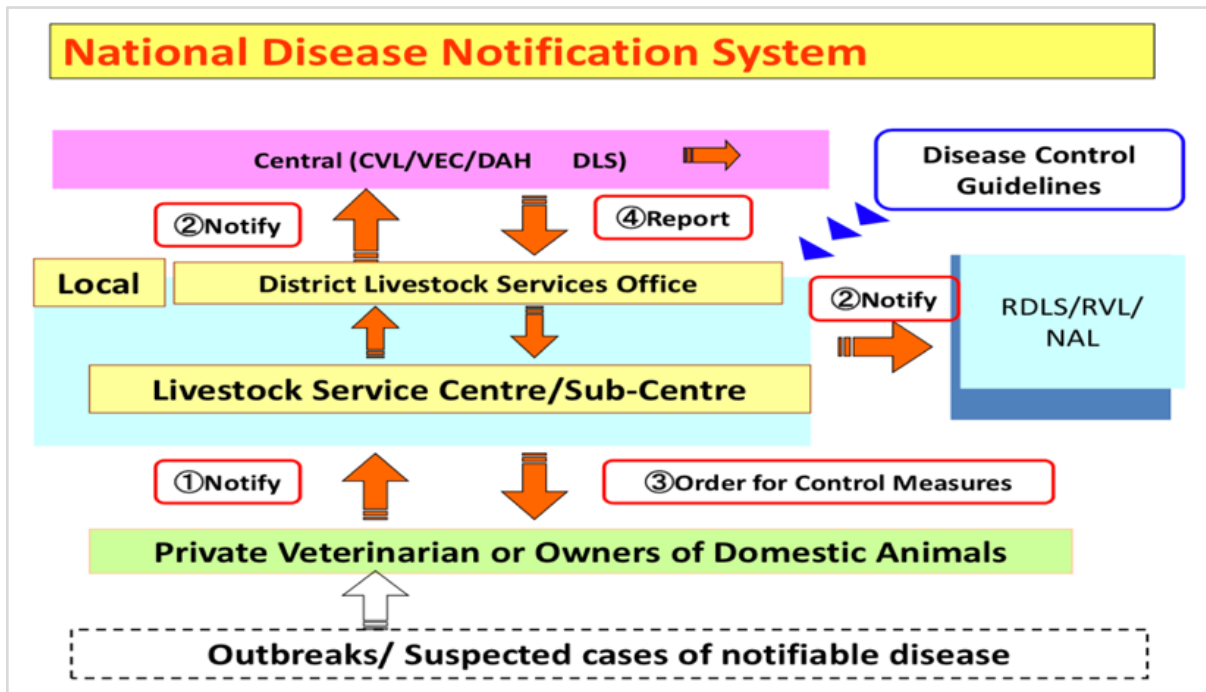


Figure 4. National disease notification system in Nepal (Thakur, n.d.)

Vaccines are transported down through the government veterinary system, which consist of three levels:

1. Directorate of Livestock and Fisheries Development (DLFD) within the provincial-level Ministry of Agriculture. It is charged to enforce and oversee all veterinary functions on behalf of the federal government. The senior veterinary officers within the DLFD are responsible to monitor and report outbreaks, categorizing outbreaks, compiling vaccine requests and sending those requests to the DLS.
2. The DLFD closely coordinates with the Regional Veterinary Laboratories (also known as vaccine banks) that store vaccine, carry out lab work and pathological exams, and participate in outbreak investigations. There are five regional labs serving several provinces at the same time, based on geographic location (for example, a lab in Pokhara serves Gandaki Pradesh as well as selected districts in Province 5).
3. The district-level Veterinary Hospitals are housed together with the District Livestock Expert Service Centers who coordinate vaccine information, train farmers, and vaccinate livestock in the hospital. Both the senior veterinary officers and senior livestock development officers have veterinary degrees from AFU. One of the key functions of these actors are to support the livestock service centers within the rural municipalities.
4. The Livestock Service Centers within the rural municipalities represent the public veterinary system at the community levels (rural municipalities encompass up to 10 communities or wards). The head of the Service Center is usually a trained livestock technical agent who maintains a roster of junior technical assistants (JTAs) or junior technicians (JTs). The primary responsibility of this agent is to report disease outbreaks, compile vaccine requests, and mobilize communities for vaccination campaigns when they are scheduled. The agent notifies the District Livestock Expert Service Center about the outbreak or suspected cases and the notification is passed on to the DLS through the DLFD. From there, the DLS makes a decision for the type of disease control measures to be applied. To continue the process, the DLS gives the order for the control measures back to the DLFD and at the community level at determination is made regarding specific variation(s) on how measures will be applied are defined considering the local characteristics of the outbreaks.

There are several important actors at the community levels nation-wide who provide veterinary services: CAHWs, as mid-level technicians including JTs or JTAs, and private veterinarians (Lamichhane and Shrestha, 2012). In places where veterinary services are available, livestock keepers choose to use the services based on their location as a function of the distance, livestock holding, ability to pay, and quality of services (Mirajkar et al., 2011). For example, the services from CAHWs are preferred by smallholders because they are readily available and more affordable. The commercial farmers prefer to use the services of the mid-level technicians or private veterinarians, who offer more services in comparison to CAHWs. It should be noted, that CAHWs are not generally allowed to vaccinate animals unless they complete a formal technical veterinary school that lasts at least 1.5 years. The standardized 35-day CAHW curricula covers the general topics of vaccinations but doesn't appear to provide practical training on how to administer vaccines.

However, recent trends in the field, confirmed by KIIs and FGDs, that some CAHWs participate in vaccinations in isolated and less developed areas.

There is also a diverse set of other actors in the LVVCs, including:

- The national agricultural research organization Nepal Agriculture Research Institute (NARC). The researchers from NARC in collaboration with universities (such as AFU) participate in outbreak investigation studies, socio-economic and biophysical research around animal health, and vaccine development.
- Hester Biosciences, a private vaccine producer from India with a branch in Nepal to produce NCD vaccine. Hester has a license to produce the PPR vaccine, but no vaccine production has occurred.
- International non-government organizations (NGOs) like the Heifer International. They do not directly participate in the public veterinary and vaccine flow systems but facilitate the creation of demand by raising awareness among livestock keepers and strengthening producer cooperatives. Heifer International is focused on livestock, including goats. Based on KII, for example, 400,000 goats in the Heifer's working areas are vaccinated every year. Heifer International also supports establishing goat cooperatives (led by women) that are acknowledged to have a critical role in bridging the gaps between the government and livestock keepers.
- Agro-vet stores – they sell some vaccines except PPR vaccines. Some stores were opened by JTs and JTAs in the past, while current regulations restrict opening stores in rural communities.

PPR Vaccine Value Chain

PPR is one of the disease the government of Nepal has committed to eradicate by 2030. The National Vaccine Production Laboratory in Tripureswor, Kathmandu started producing PPR vaccine in 2000. The only PPR vaccine available in Nepal is the Nigerian 75/1 strain. In 2019, the Laboratory produced 8 million doses of which 7 million were channeled through the public veterinary distribution system, 500,000 doses provided to the Regional Vaccine Lan as an outbreak reserve, and 500,000 doses were distributed through the private sector. The quota for commercial production of the vaccine will gradually grow to expedite the delivery of the PPR vaccine to large commercial goat farmers. The annual vaccination campaign for PPR takes place before the rainy season starts in June. PPR vaccine provided by the government is free (while the nominal cost per dose is 2.15 Nepali Rupee). The government pays vaccinators a vaccination service fee of 5-10 Nepali Rupees per vaccinated goats. Additional expenses incurred by vaccinators (due to Nepal's complex geographic terrain and poor transportation infrastructure) is covered by the individual livestock keepers. The vaccinators also receive a cool box and other supplies (needles, syringes and vaccine diluter) to carry vaccines and report back with the list of vaccinated goats and locations to receive the vaccination service fee.

Because PPR is endemic in Nepal, the government recommends vaccinating animals yearly. The distribution and administration of the PPR vaccine follows the public distribution model outlined

above (see Figure 2). The National Vaccine Production Laboratory is the only institution that officially produces PPR vaccines for the whole country. The Production lab transfers vaccines to five regional veterinary laboratories located in Pokhara, Janakpur, Biratnagar, Surkhet, and Dhangadhi. Those five cities are in five different provinces where the first three cities in the list are the capital city of the provinces. The five cities are also included in Nepal's development regions. The vaccines from these labs are disbursed to the veterinary hospitals at the district level but often directly to the rural municipality livestock service centers.

From there, vaccines go to vaccinators who launch their vaccination campaigns with the support of the goat cooperatives and CAHWs. The official vaccination campaigns for goats entails a calendar with specific dates and locations, called "vaccination points", where livestock keepers are expected to bring their animals for vaccination. If the communication channels work well, CAHWs and cooperatives convey this information in advance, so that livestock keepers can be organized to ensure their animals reach the nearest vaccination point. These points are usually located along the main roads, a community center or closer to a cluster of livestock keepers with larger herds. In rare cases, the JTs and JTAs may go from home to home to vaccinate goats but this was reported only by JTAs during an FGD.

Moreover, vaccinations outside the usual campaign periods are rare and costs more for livestock keepers, who need to pay higher service fees and often additional transport costs to bring their animals to the veterinary hospital.

Accessibility, availability, and affordability are important aspects that influence and reflect the functionality of the vaccine value chain. The National Vaccine Production Lab produces the PPR vaccine according to the instructions from the DLS. The DLS then sets their vaccination targets as part of a national plan based on three considerations: a) the total number of livestock; b) outbreak history; and c) livestock movement (where live animals move from one place to another by vehicle and/on foot). Through the vaccination programs, the DAFD works together with local government (rural municipalities) to deliver the vaccines to farmers. Vaccinators including JTAs and JTs, as well as community and village animal health workers, are expected to help vaccinate the goats. However, their work relies on the availability of vaccines relative to the demand, their feasibility to access the vaccines, and affordability of the vaccination services. While the PPR vaccine is free, the vaccination service costs between 5 to 50 Nepali Rupees per goat and not all livestock keepers can afford the expense, especially poor female smallholders and women from marginalized communities who lack control over household financial resources.

Gender and Intersectionality

This section explores PPR VVC constraints through the gendered and intersectional lens that exist at all nodes of the VVC: upper nodes and lower nodes. Some constraints operate differently according to the actors' positionality in the VVC, as well as what defines them as individuals, referring to the different experiences they have due to social markers (e.g., caste, ethnicity, age, wealth status, etc.). A growing body of literature in development studies is moving beyond comparing men and women through a binary lens (Nightingale, 2009; Carr and Thompson, 2014;

Tamim and Tariq, 2015; Pradhan, Meinzen-Dick, and Theis, 2019). Gender is considered not as “a stand-alone marker of social difference, but as a social category that gains meaning through its time- and place-specific interplay with other social markers or differences” (Carr and Thompson, 2014, p. 187). The purpose of applying the gendered and intersectional lens is to have a comprehensive understanding of how various social categories interact with gender and create barriers or opportunities for different people from the same sex within the VVC.

Higher Nodes of the Vaccine Value Chain

The main bottleneck at the higher nodes was related to the broken chain of command due to recent reorganization of the government administrative system from central to federal with subsequent decentralization of power to provincial, district, and various municipality levels, including rural municipalities. If in the past, the VVC included fewer actors, decentralization created more actors which resulted in confusion, a lack of coordination, weaker chains of command, and more red tape that hampers vaccine flow. Common issues are delays in orders, transport and distribution causes delays in the both vaccines distributed among the different actors, potentially reducing the vaccine’s effectiveness and raising concern among the livestock keepers about the benefits of vaccination. Most importantly, the vaccines often reach livestock keepers months after an outbreak or when vaccinations are due. The KII with DAFD also highlighted another issue. In the past, JTs and JTAs reported directly to the DAFD but not anymore. They now work for the rural municipality livestock service centers or invited through a roster maintained at the livestock service centers to participate in vaccination campaigns. The DAFD feared that this may worsen the efficacy of the vaccination programs because DAFD no longer supervises the field vaccinators nor attest their technical competence. This issue was also further expanded by JTs and JTAs who complained that the current system delays not only the delivery of the vaccines but also the payment for their vaccination services. Rural municipalities always experience monetary issues to provide quality/timely services. Additionally, they tend to do major activities closer to the election season in hopes to be re-elected.

Other areas highlighted by KIIs were the lack of women in the upper levels of the nodes. Fewer positions within the PPR VVC are occupied by women even under the government quota to increase women’s participation to 30%, but many women fall out of the system for several reasons: 1) they can’t pass the qualifying exam required of all public officers, and 2) lack of women friendly policies within government institutions (e.g., maternity leave, educational opportunities). The situation with caste representation at the government level is even worse. Officially, the Government of Nepal abolished the caste system and no one can be discriminated against according to their caste but social norms and expectations still remain strong. Educational and economic opportunities are unintendedly directed toward higher castes because they are better educated, aware of different opportunities available (e.g., scholarships), and supported with existing social and family networks. The representatives from lower caste miss out at each point and default to their disadvantaged positions of no voice and limited, if any, representation.

Community Level – Service Providers

At the community level, JTs, JTAs and CAHWs play an important role, connecting the livestock keepers within the community to livestock service centers, and the rest of the livestock vaccine value

chain. CAHWs trained under Heifer International tended to receive more trainings (e.g., improved husbandry practices, goat management) to better link communities to improved veterinary services and livestock management. Most CAHWs are men because of certain constraints: mountainous terrain, inferior infrastructure in rural areas that complicate the movement of women CAHWs from one location to another, early marriages that prevent young women from completing school, and household chores preventing women from exploring opportunities outside their homes. Literacy and numeracy are generally lower among women than men, further limiting their ability to attend technical schools. However, the feminization of agriculture and livestock in Nepal, as well as remittances from abroad help encourage more women to diversify their occupations and seek opportunities in veterinary services. Several women CAHWs said that they wanted to become CAHWs to move away from working in rice fields. The creation of women-led goat cooperatives is another positive trend that is jolting the social norms that women are born to look after their husbands and raise children.

Generally, the JT and JTA occupations are dominated by higher castes (Brahmin and Chhetri). This represents a huge barrier in accessing livestock keepers and households from lower castes. One, they do not speak the same language (Dalits speak different dialects of Nepali). Second, invisible discrimination traits expressed by higher castes (name, appearances (dress), posture) can generate more distrust among lower caste livestock keepers. Third, illiteracy is widespread among the lower castes and they miss out on many training programs offered in the communities. Fourth, many Dalits work as wage laborers. This creates a constraint for them when JTs/JTAs come to vaccinate goats at certain times when Dalits are not available. Finally, Dalits and other marginalized populations reside far from the centrally-mobilized vaccination points feeling less compelled to bring their fewer goats for vaccination. As a result, the use of traditional healers and witch-craft when animals get sick is common among Dalits.

Community Level – Livestock Keepers

Male and female livestock keepers are important actors at this level. Most men, remaining in communities, specialize in cattle and buffalo raising. Some run commercial goat farms (herds of more than 20 goats). Women's roles in livestock maintenance are diverse. For example, they collect fodder in the morning to feed their livestock, work on proper animal enclosures, and care for the sick and new-born animals. These activities make them feel attached to the livestock, especially to goats. Women take the lead in many initiatives and activities for livestock production, partly, because men migrate to cities or other countries in search for wage-based jobs. As a result, livestock has become a means for women to develop skills toward taking care of their livestock. Women tend to raise goats and participate in goat cooperatives.

Women's ownership of goats is heavily influenced by their relationships with their husbands. The closer the relationship (without in-laws interference), the more freedom a woman can exercise in decision making (Pradhan et al, 2019). Women in FGDs reported that they control earnings from goat sales. Women are first responders when animals are sick or becoming ill. As Nightingale (2011) argued, women like to display their strength by carrying heavy loads of firewood or fodder, taking

care of sick animals and performing other household chores that help them show their care for their families. Gender norms are more egalitarian among large ethnic groups such as Newar and Magar, and Dalit caste, especially in areas related to marriage choice, divorce, physical mobility, division of labor, and acceptability of women's wage labor (as demonstrated in studies by Acharya and Bennett, 1983; Pradhan, 2014). This is also supported by selected quotes from FGDs.

FGD with female livestock keepers: "In Magar community, women - yes, if women are given such responsibilities, there will be efficiency in economic, saving takes place and no haphazard expenses because women are economically disciplined."

FGD with female livestock keepers in Province 2 (Mahottari): "In the past men used to demand vaccines, now it is not a problem except in Madhesi. Women demand more than men while in the Madhesi community men demand more than women."

Females from marginalized communities look to local leaders during vaccination campaigns. If they vaccinate, then other livestock keepers also vaccinate:

Female FGD in Province 2 (Mahottari): "If the educated and leaders family vaccinate their livestock other farmers also accept vaccinations. If the educated farmers don't vaccinate other farmers reject vaccines. When the milk reduction is noticed they do not vaccinate the goats and livestock. Female are more interested, so, if women are convinced, they vaccinate."

When female livestock keepers' husbands are away (due to outmigration for wage-labor), they reach out to CAHWs, then if the services were not adequate, they consult with the livestock service centers or call JTs or JTAs. This and other examples shared in FGDs signify the critical role CAHWs play in the communities, which is important to promote and broaden by increasing the number of women CAHWs.

An "Empowered" versus "Disempowered" Woman

Empowerment must be defined in the local context and understanding how women themselves operationalize empowerment is as critically important as is how others (e.g., men) view empowerment (Kabeer, 2001; Leder, Clement, and Karki, 2018). The FGD participants were asked to explain what an "empowered" vs. "disempowered" woman was in their context. The different meanings they shared were shaped by personal life experiences, aspirations, and in the case of communities with goat cooperatives, by women's participation in the cooperatives. While in most cases, focus groups (men and women) and individual interviews indicated that men were the head of the household, were economically responsible for household well-being, and the household member responsible for paying for animal health, especially when it was related to commercial goat farms or buffalo raising, in instances, where women were members of the goat cooperative, goat-related decisions, including vaccinations, were handled by women. Women belonging to cooperatives did not experience problems defining what an "empowered" woman was and provided ample examples within their cultural settings:

FGD with female livestock keepers: “A woman who gets training, facilitates knowledge transfer to others, being independent... able to express thoughts, and maintain her family.”

FGD with female livestock keepers: “Those who can lead in the community are called empowered women... Men used to go to meetings some years back, but nowadays women have started to go to meetings and training programs. These women are capable of learning and transferring knowledge, so they are empowered. It is also a part of empowerment to keep ideas and thoughts in front of their husband and others in the community. The capacity to communicate with the outsiders is also an example of empowerment.”

In most cases, women operationalized empowerment with access to knowledge or training, leadership in the household and community, and, most importantly sharing their knowledge with others. This is an important consideration when project like ours is aimed to empower women through trainings and awareness raising about livestock vaccines.

On the other hand, most men associated “empowered women” with those who, first of all, take care of their households, emphasising what experience shows in other countries and society’s expectation of gender roles for women - a caregiver.

Various FGDs with male livestock keepers: “A woman who supports her husband, loves children, and cleans her home,” “a strong woman in all her work,” “runs household responsibilities,” “runs household chores,” “manages household affairs.”

Some men were supportive of women’s increased roles in goat production but desired their wives to consult them when making decisions. In communities, where the presence of the goat cooperative was strong, men were supportive of their wives making decisions alone in relation to goat production, including vaccinations. They considered their wives’ participation in goat cooperatives important to the family’s wellbeing.

Surprisingly, women and men operationalized a “disempowered” woman in similar manners:

Various FGDs with male and female livestock keepers: “scared to talk,” “those who are slackers,” “those who are reluctant to share their ideas and do not learn quickly,” “disobedient, lacking initiative, and illiterate women.”

During the FGDs with higher caste groups, it was difficult to tease out if a “disempowered” woman had any association with women from vulnerable groups. Only in one FGD, a “disempowered” woman who does not speak in public was associated with a Dalit woman, but caution is needed because this observation came from an FGD with higher caste women.

Barriers to Vaccination

FGDs with livestock keepers identified a long list of barriers to the PPR vaccinations. Common barriers identified by men and women were the unavailability of the vaccine when needed and in adequate quantity, and that getting vaccine was a lengthy process requiring regular check-ins with local veterinary services. The decentralization of the governance system, discussed earlier,

complicated the coordination of the vaccine supply between newly formed municipalities and rural municipalities, creating more chaos and confusion. Some participants claimed that if they requested the PPR vaccine in January they would not receive it until April or May, by then some goats would have died. Most communities with active goat cooperatives did not appear to have barriers in accessing vaccines in comparison to non-cooperative communities. Cooperatives leveraged networks within districts and provincial levels to get the needed quantities directly bypassing the livestock service centers. Moreover, non-member livestock keepers in the communities where cooperatives are active tend to benefit from cooperatives' efforts if their houses are physically close to the cooperative office.

Other barriers were associated with the scarcity of qualified and competent vaccinators, and willingness of those who are available to deliver quality services without additional incentives. Some livestock keepers feared the risk for disease transmission due to the use of the same needle or trusting vaccinators, especially if those represented a different ethnic or caste background and were young. The mistrust was prevalent among marginalized livestock keepers who usually received services from higher caste vaccinators. The FGD with CAHWs pointed to the perception higher caste livestock keepers have in their communities and how it influences whether livestock keepers use or do not use vaccines: "It takes some time to convince Brahmin and Chhetri [in the importance of vaccination] and once we feel that they believe [the vaccination] goes fast."

Women desired to see more female vaccinators, especially among JTs and JTAs, although they didn't feel uncomfortable in dealing with male vaccinators. One barrier most frequently mentioned was the distance to vaccination sites. This was shared by both the livestock keepers and vaccinators but for different reasons. While vaccinators found the geographic terrain and poor infrastructure to reaching communities difficult (this becomes a real barrier for female vaccinators to travel alone and to remote areas to service communities), the female livestock keepers cited the timing and location of vaccination as real issues, especially for those women who had three or less goats, or were too busy with competing household chores.

As stated earlier, while the actual PPR vaccine is free and the government pays each vaccinator between 5-10 Nepali Rupees per a vaccinated goat, the additional costs vaccinators incur (from travel, lack of logistical support) and the generalized poverty among livestock keepers is considered, then this combined set of factors appeared to represent a significant barrier for many households.

The lack of awareness about the vaccination campaigns (location, date, knowledge about vaccines) was persistent among households which were far from roads or were located at the edges of the communities. The cultural beliefs among these households were also strong. For example, Chepang livestock keepers believed that women shouldn't touch animals because animals could get infected.

FGDs with CAHWs, JTs and JTAs raised other barriers related to poor road infrastructure and inaccessible communities during the rainy season. Male JTs and JTAs raised issues of poor animal handling by women at vaccination sites, that the women lacked the physical strength. Some

vaccinators lacked proper cold chain support to visit remotely located households and therefore had to prioritize larger herds and those households close to roads.

In communities without goat cooperatives and households far from a goat cooperative if present in the community, there was confusion about the purpose of the vaccination; particularly confusing were treatments with vaccinations for disease prevention. This confusion was common among poorer households who have less than three goats and reside at the edges of the community or far from roads. This was also confirmed by CAHWs, JTs and JTAs. This also appeared to align with households who didn't attend trainings or didn't belong to cooperatives.

Some participants in FGDs had bad experiences whereby their goats aborted, or goats died after vaccination. Some livestock keepers preferred to seek services from a traditional healer, and families who have relied on traditional goat production tended to use traditional medicine instead of consulting a veterinarian or using vaccines. There is overall lack of understanding of the importance of vaccination among many vulnerable households, and according to key informants interviewed at higher nodes of the value chain, there should be more information sharing and training on the importance of vaccinations and on the difference between prevention and treatment.

Animal Disease Practices

Most women and men in FGDs could name the PPR disease, describe the general symptoms of the disease and explain the purpose of the vaccine. Generally speaking, there was no difference between women's and men's responses, and some associated vaccinated goats with healthy stock that gained weight in shorter times and received a better price in the market.

Various FGDs with male and female livestock keepers: “[vaccines] increased the immunity power against diseases,” “vaccine prevents the PPR disease,” “I learned about vaccine from a recent training,” “animals also need care like people, so we need to vaccinate animals.”

However, some livestock keepers believed that if the goat was not infected with the PPR, then vaccination could potentially kill the goat. On other occasions, at the end of some FGDs, female livestock keepers would ask what the PPR disease was after learning that the FGD facilitator had a veterinary degree. Some male livestock keepers in FGDs acknowledge that they do not know what the PPR is and that their wives dealt with goat diseases. It is worth noting that these instances were common among households with returned migrant labourers and in communities with no cooperatives, signifying the role cooperatives could play in filling the knowledge gap about animal health and diseases.

The PPR vaccination in the communities is usually combined with deworming and other disease prophylactics. Goat cooperatives are proactive in organizing the animal health camps and combining those with vaccination campaigns when medicine and vaccines are provided without cost. The cooperatives were also efficient in mobilizing goat keepers and coordinating the process of vaccinations. Many livestock keepers believed that if goats were vaccinated on time this would prevent disease outbreaks.

The first line of access to animal health is almost always the CAHW if available in the community or the staff of the livestock service center (this may be a JT or JTA). Men and women noted that it is often the women in the household that care for the animals, and they are often the ones who first identify if an animal is sick. If a CAHW is not available, then either the female or male household member may seek help from the JTA or JT by phone. In areas with active cooperatives, they come forward as the first line of access and facilitating in getting appropriate help from a livestock service center. No one reported self-administration of the PPR vaccine, because even under a complex set-up of veterinary services, the PPR vaccination is tightly controlled by the government at all levels.

Both male and female livestock keepers believed that goats sacrificed during large Hindu holidays are not allowed the vaccination. People perceived goats injected with foreign materials as not sacred. This practice was characteristic of all castes.

Role of Cooperatives

Experience from other countries shows that cooperatives or producer groups facilitate the two-way flow of market and other information, including the vaccination information that benefit the members. The question about the role of cooperatives in animal health and vaccination campaigns was not directly probed, but in communities where cooperatives were present or active in vaccinations and animal health campaigns, both female and male livestock keepers would bring examples of a cooperative and its role in the PPR vaccination campaigns. The JTs and JTAs also preferred working through cooperatives who are responsible to organize logistical support for vaccinators and mobilize goat keepers to come to central locations. FGD participants, especially cooperative members, often cited that cooperatives helped raise awareness about animal diseases and offered regular trainings on improved goat husbandry practices.

Some cooperatives had electricity and refrigeration capacity to maintain vaccine cold storage. This was cited more in the Terai areas that appeared to be better equipped infrastructure-wise (better roads, access to electricity and running water), while some cooperatives in the Hills regions lacked basic infrastructure but are able to provide services to members.

Whether by a specific law to form a cooperative or for another reason (many cooperatives were created with the support from Heifer International), most members of the cooperatives were women. Men with commercial farms benefited by cooperatives as well but more through the association of their female household members who were cooperative members.

Limitations

This study has several limitations. One, the research coverage area was large, which made it difficult to concentrate more focus groups in one community to obtain saturated data. Second, some FGDs, especially with female livestock keepers, were large in size, 15-20 people participating, complicating group facilitation to stay focused or did not allow everyone to speak. This was outside the research team's control because when they asked for 7-8 women to participate, the community mobilizer would ask more women to come. Breaking down such large groups was not possible with the small research team. It was also impossible to schedule a sequential FGDs. Third, the research team tried

to invite the adult males of the same households to FGDs but the majority of the males were away due to their out-of-country employment. To mitigate this issue, the adult males from similar households were invited to participate. Fourth, despite several attempts to hold FGDs with lower caste smallholders or marginalized populations, they were not able to participate. Lower caste participants were invited to several FGDs, but they generally remained silent despite directing questions to them. Fifth, the field team were comprised from the Brahmin caste which may have contributed to the lack of responses from lower caste participants during the FGDs.

Conclusions

The national Strategy for PPR control has achieved considerable coverage for PPR although the current effort is driven more around PPR outbreak control rather than providing small ruminants with routine vaccinations to prevent disease occurrence. The strategy remains a government priority and every year the production level of vaccine increases incrementally.

The value chain of the PPR vaccine represents a complex interrelated nodes of different actors, interacting at different levels and relations. It begins from the production level where the national government regulates and produces vaccines. In the distributional channels, human and physical capital plays a key role including improved technologies to overcome poor infrastructure. Meanwhile, the ability of vaccine adoption by women farmers is crucial and requires additional resources and attention to highlight the role vaccines can play in the PPR eradication. In Nepal, an array of vaccine actors determines the effectiveness and efficiency of the chain; weak links affect the entire chain. Understanding the needs of each actor will enhance the effectiveness of the current distribution system that will have an impact on the success of future vaccination programs. That is help Nepal achieve a reduction of the PPR disease to 70-80% by 2030.

Availability and accessibility by the producers remain critical to the functioning of the PPR vaccine value chain, which is exacerbated by other important factors including technology, infrastructure, facilities, human resources, and socio-cultural aspects. Intersectionality and gender lenses help to understand the social and physical constructs that pose constraints, especially, for female livestock keepers and marginalized communities to more effectively participate in the value chain. At the same time, identifying the constraints could be a strategic way to develop interventions that are suitable for gender related - and locally-based contexts. Efforts to provide services for female smallholders will have a significant impact on the utilization of vaccines. For the implementation of the vaccination programs, hands-on information on the function and a better communication system on the provision of vaccines are both needed at the local level. The hands-on information will provide information on the importance of vaccination and a more effective communication system will help establish better coordination between the various actors and the end users. Thus, as women become well-informed, easier access to vaccinate their goats will accelerate their participation in the vaccination programs.

Although there is a perception that women's physical strength could hinder their work in the field, women veterinary technicians or CAHWs are important actors and have the capacity (knowledge

and skills) to highly contribute to the PPR vaccine value chain. As female livestock keepers are taking increased roles in taking care of goats due to male outmigration, bringing more women to the community-level animal health service levels will help address socio-cultural barriers in accessing services, information, and other economic benefits. On another spectrum, women's cooperatives play a critical role as "the front groups" for female livestock keepers. Like a gate, the goat cooperatives are the actor who would open, facilitate, and become the communicator and mediator between the farmers and the government.

Findings from the gendered and intersectional analysis suggest the following entry points for interventions that aim to improve the access to vaccines and ultimately lead more women to adopt vaccine use.

- Vaccine value chains should be designed with women, not for them. Therefore, it is important to involve women at every stage of the VVC design.
- Gendered intersectional analysis helps uncover hidden opportunities or unexpected insights in the VVC.
- Don't ask women to change to fit the system. Instead, find ways to change the system so that outcomes are truly inclusive and equal for all.
- Work with actors across all levels - through participatory stakeholder meetings - to identify ways in which existing resources could be more effectively leveraged given the complex interactions between gender, caste, ethnic and geographic characteristics.
- Offer training to all community-level livestock service providers (who are mostly men) in improving their gender awareness, employing effective communications to reach marginalized communities, and paying particularly attention to the needs of women who take care of small ruminants.
- Train CAHWs in a wide range of topics, to enhance their soft skills, including awareness about gender and intersectionality, business skills, communications and conflict management
- Increasing awareness among livestock keepers - through effective messaging, and community level activities - about the role and importance of vaccinating animals; and identifying through participatory mechanisms the solutions to overcome individual barriers to vaccination.

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