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Barriers to Livestock Vaccine Use Among Rural Female Smallholder Farmers Of Nyagatare District in Rwanda

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Abstract

Women comprise the majority of small livestock keepers, but the productivity of their livestock is constrained by limited access to vaccines that could prevent and control animal diseases. This study examined the factors driving low adoption of vaccination against Newcastle disease (NCD) and Rift Valley fever (RVF) among smallholder women farmers of Nyagatare District in order to identify appropriate strategies that can lead to improved livestock production. Focus group discussions and key informant interviews were used to collect data on the level of women's participation in household decision making and their involvement at different levels along the vaccine value chain (VVC) for the NCD and RVF. Data were collected from 55 chicken and goat farmers—36 of which were women—as well as representatives of chicken farmer cooperatives, sector veterinarians, agroveter shop owners, and personnel from local NGOs working on livestock production and improvement. Our results reveal that women's ability to use livestock vaccines is constrained by cultural norms that limit their decisions over productive assets and income that they can use for buying vaccines. Women are also hindered by unavailability of livestock vaccines, lack of information and knowledge about livestock vaccination, and limited access to veterinary extension services. Our results highlight a need to organize gender training targeting men and women to change the attitudes, beliefs, and behaviors that affect women's ability to make independent decisions regarding the purchase and use of vaccines. Women also need training on livestock disease management through vaccination and easy access to veterinary services.

Keywords: Newcastle disease, Rift Valley fever, livestock vaccines, Rwanda, female smallholder farmer, gendered decision making

Obstacles à l'utilisation des vaccins pour le bétail des petites exploitantes rurales du district de Nyagatare au Rwanda

Résumé

Les femmes constituent la majorité des petits éleveurs, mais la productivité de leur bétail est limitée par un accès limité aux vaccins qui pourraient prévenir et contrôler les maladies animales. Cette étude a examiné les facteurs à l'origine de la faible adoption de la vaccination contre la maladie de Newcastle (ND) et la fièvre de la vallée du Rift (FVR) chez les petites agricultrices du district de Nyagatare afin d'identifier les stratégies appropriées pouvant conduire à une amélioration de la production animale. Des discussions de groupe et des entretiens avec des informateurs clés ont été utilisés pour collecter des données sur le niveau de participation des femmes à la prise de décision au sein du ménage et leur implication à différents niveaux de la chaîne de valeur des vaccins (CVV) pour la ND et la FVR. Des données ont été recueillies auprès de 55 éleveurs de poulets et de chèvres, dont 36 femmes, ainsi que de représentants de coopératives d'éleveurs de poulets, de

vétérinaires du secteur, de propriétaires de magasins agrovétérinaires et du personnel d'ONG locales travaillant sur la production et l'amélioration de l'élevage. Nos résultats révèlent que la capacité des femmes à utiliser des vaccins pour le bétail est entravée par des normes culturelles qui limitent leurs décisions concernant les actifs productifs et les revenus qu'elles peuvent utiliser pour acheter des vaccins. Les femmes sont également gênées par l'indisponibilité des vaccins pour le bétail, le manque d'informations et de connaissances sur la vaccination du bétail et l'accès limité aux services de vulgarisation vétérinaire. Nos résultats soulignent la nécessité d'organiser une formation sur le genre, ciblant les hommes et les femmes, dans le but de changer les attitudes, les croyances et les comportements qui affectent la capacité des femmes à prendre des décisions indépendantes concernant l'achat et l'utilisation des vaccins. Les femmes ont également besoin d'une formation sur la gestion des maladies du bétail par la vaccination et d'un accès facile aux services vétérinaires.

Mots-clés : maladie de Newcastle, fièvre de la Vallée du Rift, vaccins pour le bétail, Rwanda, petite exploitante, prise de décision selon le sexe

1.0 Introduction

Since the domestication of animals, women have been involved in livestock production systems that improve livelihoods (Bravo-Baumann, 2000; Food and Agriculture Organization of the United Nations, 2012; Rota et al., 2010). Women represent more than 70% of ~752 million poor people across the globe who earn their living from livestock production (FAO, 2012; Otte et al., 2012). Gender-disaggregated data demonstrate that women farmers are as interested in livestock keeping as men, but that women prefer small livestock such as chickens and goats (Acosta et al., 2019; Food and Agriculture Organization, 2009). In Rwanda, women are more likely to own chickens and goats compared to other livestock species (Gender Monitoring Office, 2017). This is because women have more control over the income and other products gained from rearing these species than they do from large livestock such as cattle, which tend to be exclusively controlled by men (Njuki & Mburu, 2013; Otte et al., 2012). Moreover, poultry and goat farming are attractive to women because they require lower start-up investment and maintenance expenses compared to larger livestock (Kingori et al., 2010, Njuki & Mburu, 2013). Thus, supporting successful and productive small livestock farming is a key entry point to elevate women's income and the livelihoods of their families (Otte et al., 2012).

Despite the economic importance attached to livestock production worldwide, small livestock kept by women and other marginalized rural farmers do not reach their maximum productive efficiency due in part to preventable diseases with high morbidity and mortality (Donadeu et al., 2019). In the Eastern Province of Rwanda, NCD—a highly contagious viral disease for which a vaccine exists—was the most fatal disease for poultry in the region (Mazimpaka et al., 2018). Rwandan farmers reported that their adherence to modern approaches of poultry disease management was low due to limited access to vaccines and other veterinary extension services (Mahoro et al., 2017). The majority of Rwandan farmers do not vaccinate their poultry against NCD, and they use indigenous knowledge, such as feeding green pepper, vein piercing, and defeathering, to treat disease amongst the flock (Mahoro et al., 2017 & Mazimpaka et al., 2018).

Another vaccine-preventable disease that impacts female farmers in Rwanda is RVF—a highly fatal viral disease of goats and cattle that also infects and causes disease in humans (Umuhoza et al., 2017). This disease, which was identified in 1931 in Kenya (Kariuki et al., 2019), was reported as an outbreak in Rwanda for the first time in the Eastern Province in 2018 (Ministry of Agriculture and Animal Resources [MINAGRI], 2019). However, prior to this report there were historical outbreaks that mimicked morbidity and mortality patterns common to RVF (MINAGRI, 2019) suggesting the disease has been present in Rwanda since at least 2012. The Law No. 54/2008 “Determining the prevention and fight against contagious diseases for domestic animals in Rwanda” stipulates that RVF vaccines are offered to all livestock species that can be infected without delay after identification of an epidemic (Republic of Rwanda, 2009). Prior to vaccination activity, veterinarians organize campaigns to educate farmers about RVF disease. However, men are more likely to attend these campaigns and to vaccinate their livestock compared to women (Smith et al., 2021). The provision of RVF education and vaccination services to goat farmers, who are mostly women, is inadequate because RVF vaccines are provided through government programs that are mostly attended by men who own or manage cattle (Mazimpaka et al., 2020). In the fiscal year 2018–2019, in which the first official RVF outbreak occurred, MINAGRI (2019) reported that 334,433 livestock were vaccinated against RVF but did not specify which livestock species were vaccinated. In 2019–2020 and 2020–2021, goats and other small ruminants were not included in the report of RVF vaccination, which documented that between 347,154 and 349,539 cattle were vaccinated each year, respectively, against RVF (MINAGRI, 2019, n.d.-a, n.d.-b). Cattle prioritization for RVF vaccination is due to their higher economic value in the Rwandan society (Mazimpaka et al., 2018).

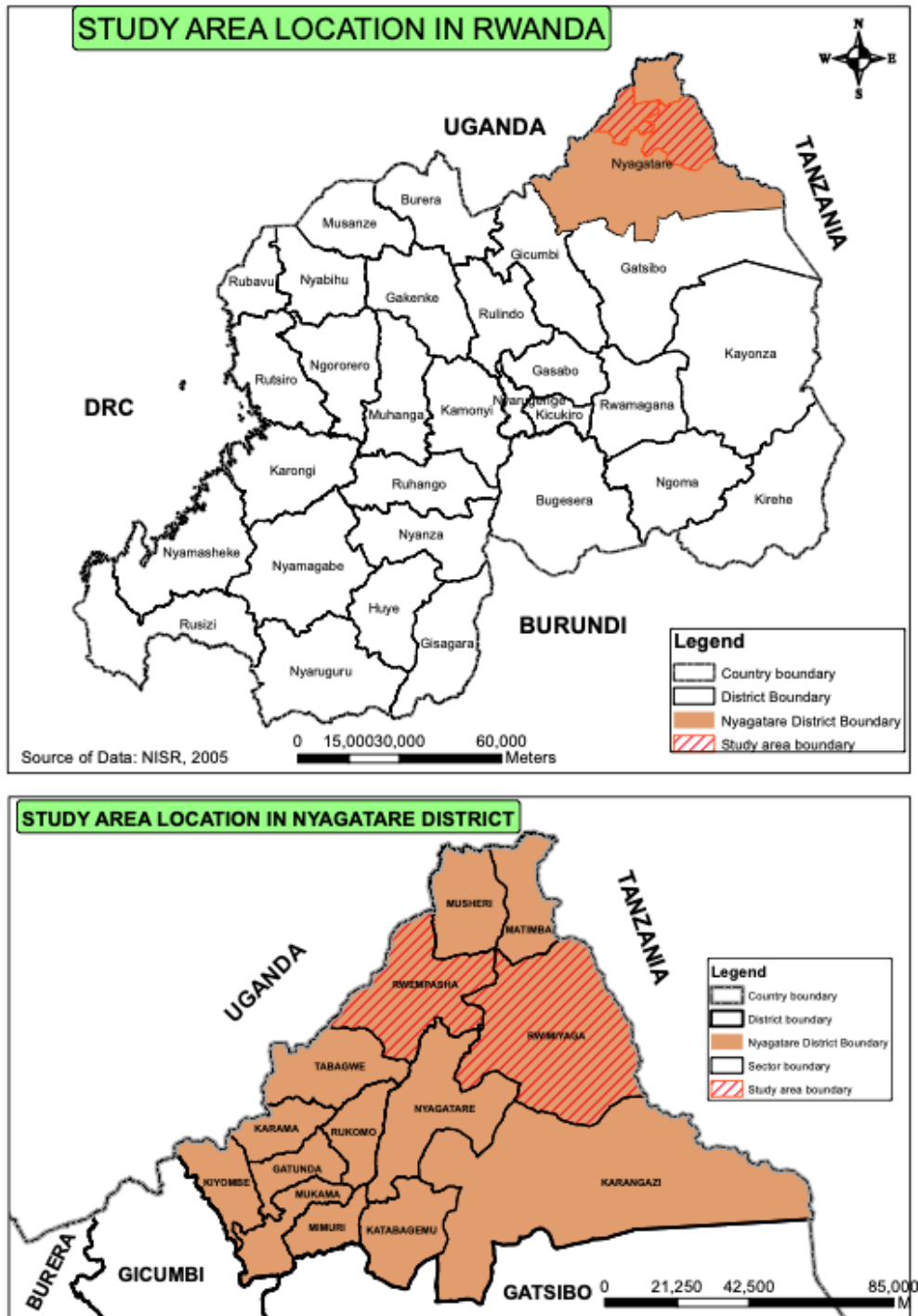
In addition to the challenge of limited access to RVF and NCD vaccines and limited knowledge on how to use them, findings from other African countries like Uganda and Kenya indicate that a woman’s decision to vaccinate livestock is a gendered and complex phenomenon that is influenced by cultural factors, including gender norms (Mutua et al., 2019). In some areas of Tanzania, particularly the Maasai communities, most of the valuable assets—such as land and livestock—belong to men through inheritance, which marginalizes women’s participation in household decision making (Price et al., 2018). Due to unequal power relations at the homestead, a woman’s willingness to vaccinate the family’s livestock in the Ibanda district of Uganda necessitated her husband’s permission (Mutua et al., 2019). The lack of penetration of the RVF and NCD vaccines to smallholder women, is a major gap in the Rwandan livestock vaccine supply chain, and if addressed, has the potential to empower women and communities through improving livestock production. This highlights a major knowledge gap in the ability to improve small livestock vaccine use in Rwanda: a gendered assessment of vaccine use including identification of barriers to their use. The Government of Rwanda aims to increase the productivity of key livestock value chains for dairy, beef, poultry, and pork production (Shapiro et al., 2017). To achieve this target, there is a need to modernize livestock disease management, including the use of vaccination, among producers of all genders.

2.0 Methodology

This study is part of a larger research project that conducts action research in Kenya, Uganda, and Rwanda to identify and analyze the barriers, opportunities, and

potential strategies for improving women small holder farmer’s entry and participation in the VVC—vaccine production, distribution, delivery, and use. In Rwanda, this project is implemented in Rwempasha and Rwimiyaga sectors of Nyagatare District, Eastern Province of Rwanda. Rwempasha Sector borders Uganda while Rwimiyaga Sector borders Tanzania (see Figure 1).

Figure 1. Map of Rwanda highlighting the Nyagatare district (top) and the Rwempasha and Rwmyaga sectors (bottom) where the study was conducted.



The most recent Rwandan population and housing census conducted by the National Institute of Statistics of Rwanda (NISR) in 2012 shows that Rwempasha has an area of 168 km² and a population of 20,512 (10,369 men; 10,143 women) while Rwimiyaga has an area of 309 km² and a population of 57,527 (28,804 men; 28,723 women) (NISR, n.d). The present study was not designed to produce results that are generalizable to the whole country, rather it collected in-depth information and employed focus group discussions (FGDs) to understand participants' experiences with and around the NCD and RVF vaccine value chain. Although the VVC describes the entire vaccine production chain from (a) regulation to production, (b) distribution, (c) delivery, and (d) use by the farmers (Acosta et al., 2019), the present study focused on end users of vaccines in order to assess the barriers faced by women farmers to accessing and using NCD and RVF vaccines. The present study is cross-sectional and qualitative in design and used a convenience sample of poultry and goat farmers selected for inclusion in 'SheVax+' based on the following criteria: poultry and/or goat farmers living in Rwempasha or Rwimiyaga sectors of Nyagatare District and other livestock production stakeholders, including: (a) representatives of poultry farmer cooperatives, (b) sector veterinarians, (c) agrovet shop owners, and (d) personnel from local organizations working on livestock production and improvement.

Two FDG tools were employed across both male and female smallholder farmers and stakeholders involved in the NCD or RVF vaccine value chain (see Table 1). Six FGDs with a total of 68 participants were conducted to generate the data for this analysis (see Table 1).

Table 1. *Focus Group Discussion Composition and Structure*

Focus group	Participants gender	Participant occupation	Data collection tool
FGD-1	12 women	Goat farmers	Women's decision making
FGD-1	9 women	Chicken farmers	Women's decision making
FGD-1	9 men	Goats and chicken farmers	Women's decision making
FGD-2	15 women	Goats and chicken farmers	VVC analysis
FGD-2	10 men	Goats and chicken farmers	VVC analysis
FGD-2	11 men, 2 women	VVC stakeholders from private and public institutions	VVC analysis

The first FGD structure (FGD-1) explored the level of women's participation in household decision making and was conceptually divided into three participatory activities. The first activity assessed gendered access to and control over the five types of capital as described in the Sustainable Livelihoods Approach (SLA): (a)

physical capital (basic infrastructure such as roads, markets, electricity); (b) human capital (knowledge, skills, good health); (c) social capital (including formal and informal networks, membership to cooperatives or groups); (d) natural capital (natural resources, namely land, water, forests, and fisheries); and (e) financial capital (including savings, credit, formal and informal employment, and trade) (Women and Economic Development Consortium, 2001). The SLA framework was used to illustrate and describe the gender gap that exists between men and women regarding access to and control over resources. ‘Access to’ a form of capital referred to a situation in which an individual can use the capital because it is available to them. ‘Control over’ capital referred to a situation in which an individual has ownership or decision-making power over the capital–asset. For example, a woman may have zero control over her ability to go to the market if she must get permission from her husband to do so every time. However, she does have access to the market, in that she can easily walk there, knows where it is, and how to navigate it, etc. The following steps were followed to collect data on gendered access to and control over the five forms of capital from the SLA framework:

1. Participants in a focus group were presented with two large sheets of paper, each with a pentagon drawn on the sheet to form the base of the radar diagrams. Five lines were drawn from the center of the pentagon to the perimeter, similar to the spokes on a bicycle wheel. Each line represented one of the five forms of capital. One of the sheets was labeled ACCESS to assets, and the other CONTROL over assets.
2. Participants were introduced to the five types of capital used in this study and then asked to list the components of each type of capital that they have in their community.
3. This was followed by discussion on the level of women’s access to or control over the five forms of capital. The focus group had to agree on and then mark on the lines of the radar diagram the percentage of resources in each category that they think women have ‘access to’ and ‘control over.’ The center of the diagram corresponds to 0% and the perimeter corresponds to 100%, thus participants select a percentage between 0–100%. For example, if they think that women have access to 70% of the financial resources, a mark should be placed at the 70% spot on the ‘financial capital’ line on the ACCESS map. If women have control over 20% of the financial resources, a mark should be placed at the 20% spot on the ‘financial capital’ line on the CONTROL map.
4. The marks placed on the lines representing the different forms of capital were joined to create the radar diagram for access to and control over capital (see Figure 2).
5. After completing the radar diagrams, participants were asked to discuss the differences between men and women’s access to and control over the five forms of capital.

The second activity sought to collect information on knowledge about the vaccination of goats and chickens through which participants were asked to differentiate between treating and vaccinating a livestock. It focused also on the gendered power dynamics regarding decisions to vaccinate these animals. This was accomplished by asking participants to explain if women vaccinate their chicken and goats, if they participate in the profession of veterinary extension services or if they

can make independent decisions to buy vaccines for their livestock. The third activity focused on identifying gender stereotypes and their functions as barriers to women's engagement in the VVC. For this activity, participants were asked to list the gender stereotypes in their community, especially—but not only—about livestock keeping, animal treatment, and vaccine use. They also discussed why these gender stereotypes are prevalent, how do they get enforced, how do they affect men's–women's ability to protect the health of their animals, and what can be done to overcome them so that women as well as men can protect their animals' health, and participate in the VVC. The participant population for FGD-1 was male and female chicken and goat farmers. Recruitment was achieved through local key informants such as community leaders and technicians who work with livestock. Key informants recommended villages where smallholder chicken and goat rearing is common, and three farming communities were selected for inclusion: Rwempasha, Karushuga, and Rutare. The sector veterinarians and agronomists provided a list of farmers in each community, and we randomly selected female and male farmers from the list to participate.

The second FGD structure (FGD-2) used a gendered approach to conduct a stakeholder analysis of the vaccine value chain for NCD and RVF in Nyagatare district. Discussion and participatory mapping were used to generate a visual representation of the NCD and RVF vaccine value chain based on the experience and knowledge of the participant stakeholders. This group included (a) sector veterinarians; (b) leaders of cooperatives of chicken farmers; (c) private sector stakeholders—vaccine distributors, pharmacies, agrovet owners, and drug store owners; and (d) livestock feed distributors. The discussion was divided into three main activities: The first exercise aimed at identifying all stakeholders and actors in the distribution chain from producer to end user, including regulators, by drawing a map of the VVC actors for the NCD and RVF vaccine. The second exercise probed into the participation of women at each point along the VVC of NCD and RVF vaccines. The third exercise discussed the barriers to women's involvement at different levels along the VVC and possible entry points and solutions. However, all the information collected from FGD2 are not presented in this paper. Our paper focuses on end-users of vaccines in order to show barriers hindering women to vaccinate their livestock. As this paper was taken from a larger research project, further details on the VVC analysis will be presented in other papers.

FGD data was collected in Kinyarwanda using audio records, flip charts, and observer notes. Data analysis included regular reviews of all data to identify and triangulate key findings. Audio recordings were transcribed verbatim in Kinyarwanda and then translated into English for coding and analysis. Inductive coding of FGD transcripts were compared and contrasted and a comprehensive code book of 152 thematic codes was developed for further data summation and analysis.

2.1 Ethical Approval

Ethical approval for human subjects research was obtained locally in Rwanda (University of Rwanda, College of Agriculture, Animal Sciences & Veterinary Medicine, Office of the Director of Research & Innovation, [#027/19/DRIMay13,2019]) and through the Tufts University Social Behavioral & Educational Research Institutional Review Board (#1907033) prior to commencement of research activities. Community leaders and members were also sensitized prior to beginning any research.

3.0 Results

3.1 Gendered Dimensions of Household Decision Making Negatively Impacts Women's Adoption of Livestock Vaccines

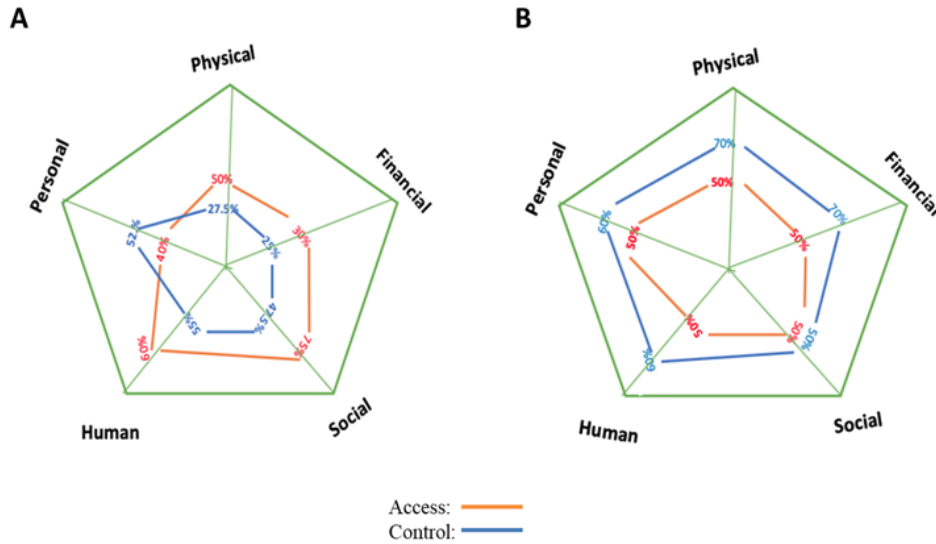
The study findings point out that Rwandan cultural norms and practices limit women's power over valuable assets that could help them to increase the productivity of small livestock. These include (a) limited access to and control over land, (b) women's concentration in small livestock activities, and (c) women's low status in decision-making surrounding household spending. In their respective focus group discussions, female and male farmers were asked to indicate women's access to and control over five types of capital from the SLA framework: physical, financial, social, human, and personal (Murray & Ferguson, 2001)

Women reported that they have less access to and control over almost all resources than men since their average score was below 50% (see Figure 2A). It was only in access to social (75%) and human (60%) capital that women reported having a good position (see Figure 2A). However, their increased access to these resources does not imply higher control. Regarding human capital, one woman said: "women have less control over human capital despite the skills and knowledge they have; they don't have freedom and are controlled by men" (female farmer, FGD-1). Although women reported that they have 50% access to physical assets, this response was based on the new land law that gives equal access to husbands and wives by registering family land in the names of both spouses—Law number 43/2013 (Republic of Rwanda, 2013). However, men have greater say on how to use the family land. One female participant asserted that a woman "may take land for cultivation without permission of a man" (female farmer, FGD-1). But her power over land ends in cultivating food crops for household consumption. This was supported by another woman who said that "my opinion is similar to what others said, if I have a banana tree, I can't decide to sell bananas without requesting the permission from my husband" (female farmer, FGD-1).

Findings from the men's FGD-1 (see Figure 2B) show that men gave women 50% in access to all assets and more than 50% in control over all assets. During the discussion that accompanied the activity, men were more likely to talk about the existing commitment from the government of promoting gender equality rather than the current practices in the community. When pressed for examples concerning access to and control over land, men revealed that the right of the woman to choose what to plant is subject to men's approval, affirming the women's perspective on their minimal access to and control over resources. One male participant said:

She can exert the rights because she is able to go and cultivate that land and she plants whatever she wants, isn't it? But, even if she is able to cultivate and plant whatever she wants...., her husband can wake up and stop her. It is the example that I take. This is to say that she has access to the land but she doesn't have decision making power over that land (male farmer, FGD-1).

Figure 2. Radar diagrams depicting women’s (A, FGD-1, 21 female farmers) and men’s (B, FGD-1, 9 male farmers) views on women’s access to (orange) and control over (blue) resources, expressed as a percentage, where the center of the diagram = 0% and the perimeter = 100%.



Livestock is another asset where men and women have different levels of control. Results indicate that in Nyagatare District women prefer rearing chickens and goats while men have more interest in cattle. However, women’s involvement in chicken and goat rearing does not directly translate into higher control over these animals or the benefits they bring to the homestead. A female farmer explained this point clearly: “When a man and woman are at home, a woman can raise problem that needs money and to sell the chickens in order to obtain the money, but if a man doesn’t agree with, a woman can’t sell it” (female farmer, FGD-1). Other women revealed that the decisions about selling the goat of a man or a woman is based on a mutual agreement between them. One woman stated: “As an example, the man’s goat or even mine, I can’t take a decision to sell them, we can make a discussion for common understanding before taking the decision to sell the goat” (female farmer, FGD-1). But this last woman said that in the absence of a common agreement, the wife will be obliged to be humble and accept the man’s decision to avoid conflicts and quarrels in her family which can even result in being sent back to her father’s home.

As in other patriarchal societies, husbands are considered the family breadwinners and heads of household, implying male supremacy. The name of the husband is used to reference his family. The tradition extends beyond their death, as described by one man: “Even if a man dies, they still call the family in the name of the deceased, not in the name of the woman” (male farmer, FGD-1). The marginal position women are in regarding access to and control over resources is reinforced by gender stereotypes that are common within the community (see Table 2).

Table 2. Gender Stereotypes Recounted by Male and Female Farmers (FGD-1) That Affect Women's Participation in Household's Decision Making

Stereotypes Expressed by Male Farmers	Stereotypes Expressed by Female Farmers
<p>A woman is a visitor.</p> <p>A woman can only advise men, she cannot take a decision in the household.</p> <p>The saying: <i>Nta nkokokazi ibika hari isake</i> which means 'Hens do not crow where there is a rooster.'</p> <p>The saying: <i>Iyo amazi abaye make aharirwa infizi</i> which means 'When water is not enough, it is only given to the bull.'</p> <p>The saying: <i>Uruvuze umugore ruvuga umuhoro</i> which means that 'If it is the woman who speaks in the households, it results in bloodshed.'</p> <p>A man is the head of the household. When he dies, they still refer to his family in his name.</p> <p>A man who helps his wife in home activities (cooking, taking care of the children, etc.) is perceived as dominated by the woman, which is locally referred to as <i>inganzwa</i> meaning 'pushover.'</p> <p>If women have more money, they may become disrespectful to the men.</p>	<p>Taking care of children is primarily the function and responsibility of women.</p> <p>Women do not have physical strength to become good veterinarians.</p> <p>Girls are less intelligent than boys, they can't undertake scientific subjects.</p> <p>Girls have to get married as early as possible.</p> <p>A woman who is self-confident in making decisions within her household is called <i>Igishegabo</i> which means 'a virago.'</p> <p>The saying: <i>Nta nkokokazi ibika hari isake</i> which means 'Hens do not crow where there is a rooster.'</p> <p>The saying: <i>Uruvuze umugore ruvuga umuhoro</i> which means that 'If it is the woman who speaks in the households, it results in bloodshed.'</p> <p>The saying <i>Ibitekerezo bya kigore</i> which means that 'Women's ideas are weak.'</p>

There were both similarities and differences in the stereotypes that male and female participants reported. Most stereotypes mentioned by both men and women were negative towards women's participation in household decision making. For example, the following saying are common: *Uruvuze umugore ruvuga umuhoro*, which translates to English as 'when a woman speaks in the household, the result will be conflicts which can even lead to bloodshed' and *Nta nkokokazi ibika isake ihari*, which translates as 'there is no hen that can crow when there is a rooster' to indicate that a women's presence is ignored in the presence of men. In addition to stereotypes, phrases like *ibitekerezo bya kigore*, translated as 'women's ideas,' are

used to refer to nonsense, unclear or imperfect ideas even if the idea is a man's. Male farmers supported their superiority with bible arguments that God created men and women differently, and that their power, roles, and responsibilities were unequal from the creation of humankind. They also emphasized that even in the case of marriage, the woman joins the husband's home.

Our results demonstrate that women have also internalized these beliefs to the level of feeling that they cannot make any decisions. One female farmer shared, "...what I can add is that sometimes women don't know how to take a decision by themselves and instead wait for their husband, yet probably the decision is urgent" (FGD-1). Due to limited access to income, women depend on men's financial support and must request permission from their husbands for anything they want to do, including starting a business activity or travelling. One female and one male confirmed this by saying that:

The large part of the decision on the use of household income is reserved to men. If a woman goes to work she brings money at home, and me when I go to work and earn money,...I can decide to buy something and take the money without her presence...but whatever a woman wants, she asks a husband, even saved money, she says, darling, we want this and that. She can take money and use it but it is not as she wants. Unlike me, I can take it (male farmer, FGD-1).

If I do a job and earn 1000 Rwf and tell my husband that I need to solve a given problem using my money, he can allow me to use the money. You see the power to use my money comes after being allowed by my husband (female farmer, FGD-1).

One exception to the need to defer to men for decision making was mentioned in the context of a woman being left alone at home because the husband is traveling. One man described that his wife could make a decision during an emergency in the event that, for example, something happens while he is participating in the focus group and inform him later when he reaches home. He said: "...if I have something to do at home, it can't be stopped because I am not there, my wife does it, and if I arrive at home, I realize that it is already done without any problem (male farmer, FGD-1).

Moreover, female participants in two different FGD-1 discussions said that women cannot decide to buy vaccines without asking permission from their husbands. One of the women stated, "it is not possible for me to buy vaccine without asking my husband, I have to inform him so that he accepts or refuses" (female farmer, FGD-1). This point was supported by a male stakeholder who said that "...a chicken might get sick when the husband is not around and you find the chicken might die when the woman is waiting for the husband's permission" (male stakeholder, FGD-2).

3.2 Low Accessibility and Availability of Livestock Vaccines for Female Farmers Hinder Their Use

Access to the RVF vaccine, which is a government-controlled vaccine, occurs through the sector veterinarian. However, one farmer described the challenge

associated with accessing a veterinarian let alone the vaccine: “finding a sector veterinarian is not easy. You can find him after one week. You can even call him the whole month without reaching him due to his too much work” (male farmer, FGD-1). He went on to explain that even if you do reach the veterinarian, they do not always possess vaccines. Another farmer said that some goats were vaccinated against RVF when there was an outbreak in 2018, “for us when there was a general campaign for vaccination activity, veterinarians brought vaccines” (male farmer, FGD-1).

While the government tried its best to address RVF, it has never done any intervention to support vaccination of the poultry sector. The unavailability of NCD vaccines was also confirmed by the veterinary staff of Rwimayaga, who stated: “Yes we don’t have the NCD vaccines in our stock, probably we have RVF. For cooperatives that rear chickens, it’s a big challenge because NCD vaccines are rarely available in the agro-shops that are closer” (male stakeholder, FGD-2). The NCD vaccine can be sold in private agro-shops in Rwanda but the available options are in packages of 1,000 to 2,000 doses, which is not affordable for poor smallholder farmers who often have less than 100 chickens:

It is packaged in a big dose and after being opened for the 1st usage, it deteriorates rapidly; i.e., a farmer with 2,000 birds and another of 200 birds are given the same vaccine quantity hence it is more expensive for small farmers (male stakeholder, FGD-2).

Another factor linked to vaccine inaccessibility is lack of knowledge about animal vaccines. One woman said: “I don’t know them [vaccines] well but there are some that I know such as multivitamin and other that we mix with food [or] water” (female participant, FGD-1). Some women know that they must prevent diseases, but they use other approaches that they consider equivalent to vaccines, and these approaches are used largely because they do not have access to NCD vaccines in their area. One woman explained: “We know that it is preventing sickness, everyone who enters in the chicken coop whether for visiting or buying them, there is a place [similar to a foot bath] where he/she passes to avoid contaminating our chickens” (female farmer, FGD-1). Out of 24 female chicken farmers (nine from FGD-1 and 15 from FGD-2) who participated in the discussion about chicken vaccination, only one said that “I have heard that it exists [NCD vaccine] but we have never done it” (female farmer, FGD-2). However, all 19 male farmers (nine from FGD-1 and 10 from FGD-2) know that livestock vaccination is important as they are familiar with cattle vaccination programs. One of them said

In truth, there is a time when there was an outbreak in our village. All chicken died. If vaccines can reach us, it can help us since in this region we like keeping small livestock. It is what we were saying that preventing is better than treating

3.3 Gender Training, Field Visits, and Veterinary Extension Services Are Strategies to Improve Women’s Access to and Use of Livestock Vaccines

Participants were requested to think about ways to remove the barriers that hinder women in increasing livestock vaccination. Both female and male participants

across all FGD meetings requested gender training to increase the level of understanding of the concept of gender equality among community members. Male participants reported that when someone talks about gender equality in their community, they interpret it as a way of empowering women to disobey their husbands. One participant explained the common misunderstanding of the concept of gender equality in their community:

I am the leader of a village. I am used to solving conflicts between husbands and wives. They can disagree on something; then, the husband tells me: I talked to my wife and she replied saying that we are in a gender equality era! This can be a point of disagreement until they fight or beat each other. Then I explain to them that the meaning of the concept is not only equality but also complementarity (male farmer, FGD-2).

According to this community leader, gender equality is well understood when it refers to improving women's economic capacity to supplement men's contribution to the survival of the family. Gender training was considered by respondents as a good opportunity to break the culture of gender stereotypes and self-marginalization that impedes women from vaccinating their livestock. Women minimize themselves because they lack self-confidence, forget their potential, talents, and abilities. This lack of self-esteem was also supported by one man's statement: "Women and girls often minimize their capabilities; they say, this [task] is not ours". (male farmer, FGD-2).

Moreover, women's ability to successfully vaccinate their livestock is hampered by lack of knowledge about animal husbandry and vaccination. Female study participants did not understand the difference between treating (using medications) and preventing (using vaccination) infectious diseases. They expressed a need to be trained in animal husbandry and one of them stressed that "what I can say is that training in animal husbandry is important; it will help me to know well my poultry, the diseases affecting my animals and how to treat and prevent them" (female farmer, FGD-2). However, for this training to be successful, it should be coupled with field visits to help women to learn from the experience of other women who are doing well in animal husbandry. One male respondent illustrated this by saying "I am used to going to different places. The reason why the role of women in development is limited, they stay at home and can't get a chance to learn from others" (male farmer, FGD-2). In these conditions, field visits were identified as a powerful tool that could help women to become end users of vaccines. According to one male respondent: "field visits help face others' experiences and challenges yours" (male farmer, FGD-2).

Participants generated another idea to remove barriers to women's use of and benefit from livestock vaccination which is providing extension services that bring the vaccine closer to the woman smallholder farmer which shifts the major barrier of transportation to the village and maintenance of a cold chain from the women to the government or community. Participants suggested decentralization of veterinary services similar to other health services:

You see, in other health services, the health post is near the beneficiaries and it is easy to find medicines. For agriculture, there are agro-dealers who

sell fertilizers, they are near the population, they offer subsidized fertilizers and seeds, and you can find at least one in every cell. In this way, it would be an agent who deals with veterinary issues, who lives near livestock farmers (male stakeholder, FGD-2).

In addition to availability and accessibility, affordability of vaccines is an important consideration. Farmers are willing to pay the price of vaccines if someone brings them to the farm, as one respondent explained: “there is no problem if he brings vaccines” (male farmer, FGD-2). Another stakeholder endorsed this commitment of farmers to buy vaccines: “I think that farmers rear chickens to get better produce; therefore, if a vaccine is available and sufficient they can definitely buy the vaccine because they also buy other vaccines as well” (male stakeholder, FGD-2). The concern of availability and affordability of vaccines was also raised by private veterinarians and other distributors of vaccines in the stakeholder meeting who emphasized the need to produce small doses by manufacturers. One of them said:

...a farmer with 2,000 birds and another of 200 birds are given the same vaccine quantity, hence more expensive for small farmers. But I think if they [manufacturers] were to package small doses even us or SARURA [cooperative of chicken farmers] without a doubt we can buy and avail them to farmers with few chickens (male stakeholder, FGD-2).

3.4 The Benefits of Increased Participation of Women in Livestock Vaccination Activity

A discussion about using vaccines for improving the productivity of small livestock helped women who have never used vaccines in livestock farming to think about the benefits that they can gain from vaccinating their chickens and goats. They talked about increased productivity and income which may lead to their personal development: “outputs will grow, and we shall then develop” (female farmer, FGD-2). Women hope to improve their financial independence “If my child was waiting for his father to buy him clothes or me to wait from him for my clothes, I shall be able to buy them” (female farmer, FGD-2) and increase their status in society “what will show that we have got vaccines for our animals, if I was used to get cloth by begging from others, people will see that I am able to buy myself a cloth with my own money” (female farmer, FGD-2). Women also mentioned many other benefits like the possibility of scaling up chicken and goat rearing activities and starting or expanding other businesses: “After stopping sudden deaths in my chicken and expanding this business, I can expand to a commercial business” (female farmer, FGD-2).

Women’s views on the benefits associated with the adoption of livestock vaccination were not limited to their own benefits, but extended to their children and the whole family: “The things that will explain that I have made a progress, I will enroll my children in a school; I will pay our contribution for mutual health insurance on time and I will easily provide food for my family” (female farmer, FGD-2). The benefits will expand from their family to other community members: “We used to experience sudden death in our poultry but if this death stops, we will freely give chickens to our neighbors” (female farmer, FGD-2). Another woman added the benefit of

knowledge sharing to help others: “The first thing I will do is to care for my animals, to treat them and to inform the veterinarian to come so that he can treat them. After that, I’ll sensitize those who are like me in order to care for their animals” (female farmer, FGD-2).

Male participants stressed that having women who can deliver veterinary services including livestock vaccination can be beneficial for the whole community. One male participant compared the benefits of having a woman who is active in the veterinary profession in a village to those of a community health worker for humans by saying: “so, as people are used to go to health advisor when they get sick, we can say our veterinarian is there, let’s go to see her” (male farmer, FGD-2). Male respondents went beyond training in livestock vaccination and talked about the possibility of educating girls and women in veterinary sciences in general with the justification that this approach could decrease the cases of sudden death of their livestock. One respondent explained:

Imagine how much money we lost! If only there was one girl who studied veterinary medicine, she could have saved half of our animals which died. But actually, we look for the one who can treat them, and we don’t find any! Our main loss come from where? Not having educated children (male farmer, FGD-2).

The importance of educating women in veterinary sciences was described by another male respondent as an opportunity for them to get jobs and contribute income to the household. He said, “she could look for a job. If the husband has also a job like being motorcyclist or bicyclist and the wife performs a veterinary job, they can put together their salaries to improve the wellbeing of their families” (male farmer, FGD-2). They supported this idea with the Kinyarwanda saying “*ukurusha umugore akurusha urugo,*” which translates to English as “a man who has a better wife than yours also has a better family” (male farmer, FGD-2). The benefit of allowing women to get a job, increase income, and improve the welfare of her family was extended to highlight the potential benefit for community development by another respondent who said: “It is very good, and even when she improves her standards of living, she develops her native region, starting by brothers and sisters, nuclear family, extended family, the community and further” (Male farmer, FGD-2).

4.0 Discussion

Our study reveals that the barriers to women’s adoption of vaccines for their livestock stem in large part from the socio-cultural norms, beliefs, and practices that marginalize women in their access to and control over valuable assets including land, livestock, and household income. Although Rwandan Law number 43/2013 of 16/06/2013 (Republic of Rwanda, 2013) governing land introduced equal rights to land for legally married wives and husbands, decisions related to making money from land are still managed by men, limiting a woman’s ability to economically benefit from her land as an asset. This challenge of limited decision making over assets by Rwandan women was reported by USAID in 2015 when they documented that food crops and small animals such as chickens and goats belong to women while cash crops and cows are managed by men (USAID, 2015). Although female participants of this study confirmed that they are more involved in rearing

chickens and goats compared to cattle, they said that they have limited control over income gained from these species.

Women's limited power in decision making extends beyond income from land and their livestock to all household expenditures. Rwandan society is still governed by patriarchal ideologies and traditional norms which consider women as 'second-class citizens' who have to depend on husbands, whereas men have authority over household cash and assets (Abbott & Malunda, 2016).

This dynamic was also observed among Tanzanian, Ugandan, and Kenyan smallholder farmers (Akite et al., 2018, Mutua et al., 2019, Price et al., 2018). The study findings noted that the patriarchal norms of Rwandan society reinforce male supremacy in all avenues of decision making and promote negative beliefs that women are weak and that men are better at making decisions. Female respondents of this study said that they obey these norms to avoid quarrels and conflicts within their families. The strong influence of patriarchal norms on decision making in Rwanda was also reported in another study that noted that women of the Northern province still believe that they remain subordinates in household decision making, as the final decision is made by the head of the household, who is usually always a man (Bayisenge et al., 2015). Thus, women's limited control over income and household decisions in Rwanda is a socio-cultural barrier that blocks their access to vaccines for their chickens and goats. This was also identified as a key barrier that hindered uptake of RGV vaccine by women in Kenya and Uganda (Mutua et al., 2019). In Ghana, it was reported that men often serve as the head of household and make decisions about purchasing vaccines, and that allocation of household income was not determined by how much each spouse contributed to the family pool, but on gendered power relations (Martey et al., 2012). It was also found that men do not value the vaccination of chickens and goats that belong to women because they focus on cattle, which are more valuable (Martey et al., 2012). These collective findings illustrate how patriarchal norms reduce women's decision-making power, which is not unique to one country or culture.

In Rwanda, RGV vaccines for goats are controlled by sector veterinarians and are only distributed after an outbreak has been confirmed. There was a government vaccination program in 2018–2019 to vaccinate goats against RGV, but the owners were not told what the vaccine was for, and vaccines have not been available since. The lack of access to vaccines is worse for chicken farmers. In Nyagatare, there has never been a widespread vaccination campaign targeting poultry. Although NCD vaccines for poultry are sold in private agroveter shops, this study revealed two important factors that hinder their adoption by poor women: lack of knowledge about NCD and lack of small packages of NCD vaccines. Small scale farmers prefer small vials because they are affordable and avoid waste (Donadeu et al., 2019). Big doses of NCD vaccines were also identified as a key challenge to vaccine uptake in Tanzania (Campbell et al., 2018). Removing this challenge, for instance by scaling up chicken farming or by organizing sharing of NCD vaccine doses among neighbors, can increase vaccine demand and adoption (Campbell et al., 2018). Vaccines sold in Rwanda are manufactured and imported from international companies that produce big doses in response to the demand for large scale livestock production in developed countries. Policy makers need to create an enabling environment that will attract local investments to produce NCD vaccine doses that respond to the special needs of small-scale livestock farmers, including the women of Nyagatare District. Production of small doses of NCD vaccines was a successful

strategy to support sustainable vaccine adoption by female and male farmers in Malawi, Mozambique, and Tanzania (Bagnol et al., 2013). Since implementing the local production of NCD vaccines can take years, the Government of Rwanda could adopt an intermediate solution of importing small doses of NCD vaccines from Kenya Veterinary Vaccines Production Institute, which produces flacons of 200 doses, or other similar vaccine producers.

This study highlights three strategies that could help women to adopt NCD and RVF vaccines. The first strategy is to organize gender training for both men and women to change the attitudes, beliefs, and behaviors that affect women's ability to make independent decisions for the purchase and use of vaccines. Gender training will help to reduce gender inequality in control over income and promote efficient utilization of the benefits from local chicken (Akite et al., 2018). Gender training will also help women to stop the culture of self-marginalization and boost their level of confidence in household decision making. The second strategy is to train women in livestock farming and give them opportunities for field visits to learn best practices in other locations. At the homestead, women don't have access to information about new techniques, improved breeds, or animal disease control (Alexander et al., 2004). Female livestock keepers in this study believe that training in livestock practices will help them to improve the health and the productivity of their small livestock through increased access to appropriate knowledge and better management skills. Poor and low-educated women need appropriate information about different causes of diseases, disease prevention and control since their historical marginalization in livestock management interventions is known as a main cause of increased mortality of their livestock (Alders et al., 2010).

The third strategy is to bring veterinary and livestock extension services closer to animal keepers. There are no shops that sell veterinary products, such as vaccines, in the rural areas of Rwempasha and Rwimiyaga sectors, and farmers who need to buy vaccines or medicines must travel up to 24 km to purchase them in Nyagatare city. However, the NCD vaccines are not available in veterinary shops in Nyagatare since the shop owners and traders of veterinary products prefer selling livestock medicines that are frequently used by farmers. The limited demand for NCD vaccines for poultry is in part due to lack of knowledge that backyard chickens can be vaccinated. However, after learning about NCD vaccination for poultry in the FGD, participants said that they would buy and use NCD vaccines for their poultry if they were available and affordable. To respond to this demand, veterinary suppliers in Nyagatare need to add NCD vaccines to their inventory. To facilitate the process of accessing NCD vaccines in remote areas, research participants proposed the idea of reactivating the system of community animal health workers (CAHW). The strategy of expanding the provision of animal health services through the CAHW model was initiated by the Rwandan Agricultural Board in 2010, but the main focus was on cattle. Reorganization of CAHWs requires integrating women lead farmers in chicken and goat rearing by equipping them with necessary skills and logistics to provide veterinary services for small ruminants and poultry in their villages, as community health workers do for humans. CAHWs are known to play a vital role in disease control in Malawi, Mozambique, and Tanzania by carrying out vaccination campaigns or provision of basic animal health services including NCD vaccines (Bagnol et al., 2013; *Vétérinaires Sans Frontières International*, 2018). CAHWs are trained in good husbandry practices and basic animal health care to optimize animal production (*Vétérinaires Sans Frontières International*, 2018). For successful adoption of the CAHW model in the supply of NCD vaccines in

Nyagatare district, CAHWs could create a cooperative that organizes and documents vaccination campaigns and that prepares a vaccine calendar with farmers. CAHWs could buy NCD vaccines from agroveter shops in Nyagatare and sell them to farmers in rural communities. However, for the sustainability of their services, CAHWs must receive a price that covers the cost of vaccines and vaccination activity, including transportation costs (Bagnol et al., 2013).

Women in this study believed that increased vaccine uptake could help them prevent diseases that kill their animals, and thereby improve productivity, a strategy which has been shown to result in improved economic and food benefits from livestock among smallholder farmers in Tanzania (Campbell et al., 2019). They also believed that increased vaccine adoption could result in increased income and consequential financial independence, a benefit that has been noted among other female smallholder farmers (Alders et al., 2010). Controlling chicken diseases together with upgrading women's skills in chicken rearing were found to increase chicken productivity and food security among households in resource-poor areas (Wong et al., 2017). Women also articulated the benefit of scaling up their livestock from subsistence to commercial activities and investing income gained from livestock into new businesses, a practice commonly observed among smallholder poultry keepers in Bangladesh (Alders, 2004). Once their chickens and goats are more productive, women believe they will be able to support their colleagues to start chicken rearing through the system of free donation. This is known as '*kuziturirana*' or 'rotating scheme' which is borrowed from cattle keepers, where a poor family receives a cow free of charge. When the cow calves, the calf is given to the neighbor who keeps it and gives the next calf to the next neighbor (<https://rwandapedia.rw/hgs/girinka/how-it-works>).

5.0 Conclusion

Rwandan women have high interest in rearing chickens, goats, and other small livestock species due to numerous benefits attached to these animals. They are less demanding in terms of start-up capital and keep-up expenditures compared to cattle. They are more productive and can help to fight against poverty and malnutrition in poor households. However, the productivity of women's livestock is constrained by diseases that are preventable through vaccination. This study assessed the challenges hindering women of Nyagatare district to use vaccines against NCD and RFV for improving the productivity of their livestock. Results demonstrate that women face cultural norms and practices that limit their access to and control over land, livestock, and other productive assets that yield income to buy livestock vaccines, and that women have a lower status in household decision making compared to men, requiring their husband's permission to buy and administer vaccines to their livestock. Women's abilities to use livestock vaccines are also constrained by their unavailability. There is a shortage of agroveter shops near women's homes, and a lack of knowledge about livestock vaccines. Community stakeholders and farmers of both genders agree that increasing access to and use of livestock vaccines by women requires organized gender training targeting men and women to change the attitudes, beliefs and behaviors that affect women's ability to make independent decisions regarding the purchase and use of vaccines. Women would benefit from training on small livestock disease management and from more accessible veterinary services. Taken together, our results highlight a need to invest in both behavioral change at the level of the community and infrastructure change at the level of service provision

and delivery to increase women's agency, their participation in vaccination, and to improve production for the benefit of the entire family.

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