

Newcastle Disease Vaccine and Poultry Productivity Changes: Mayurbhanj, India

A GALVmed Monitoring and Evaluation Study



Executive summary

This study assesses data from one of the earlier GALVmed market development field projects where commercial Newcastle Disease (ND) vaccine supply chains were being introduced to serve smallholder customers. In addition to the ND vaccine; Fowl Pox (FP) vaccines, dewormers, and improved poultry husbandry practices (relating to feeding and housing) were also introduced to smallholders. The primary project focus, however, lay in ND vaccines since this was considered the primary constraint in smallholder poultry production and the primary market opportunity for the animal health industry.

The project commenced in 2013 in Mayurbhanj District, Odisha State, India. At this time GALVmed's market development team were initiating field projects where the main focus was ND vaccines but where the strategic context was wider as GALVmed sought to build a better market understanding of the basic smallholder market issues (e.g. to what extent will smallholders realise productivity gains through better animal health inputs?, to what extent will they pay the market price for these inputs?, to what extent will supply chain actors, such as vaccinators, realise sustainable economic returns from these products?).

The project, while pragmatically focused on market understanding, generated reasonable levels of data on poultry productivity before and after the initiation of the ND vaccine supply. Limited data was also collected on adoption (smallholders) and supply chain performance (primarily vaccinators). This study focuses on the analysis and interpretation of smallholder data collected via surveys that were rolled out prior to vaccine delivery (baseline) and after 16 months (endline). The main findings indicate:

- That poultry productivity increased significantly after the project intervention. Average household flock sizes increased from 15 to 33.5 and average household poultry income increased from Rs. 2,060.00 (USD 30.90) to Rs. 8,953.00 (USD 134.30).
- That while the above productivity increases are remarkably high, it is not clear which aspects of the project intervention (awareness campaigns, ND vaccine, FP vaccine, dewormers and improved husbandry practices) are driving the increases and to what extent. The perceived wisdom is that the control of a major disease, such as ND, results in substantial productivity gains, which are then substantially amplified as smallholders have the confidence to invest further in improved feeding, housing and other health products. While this seems a logical interpretation, Randomised Controlled Trials (RCTs) would be required to definitively demonstrate this.

- That adoption rates of the ND vaccine were estimated to increase from 19%, prior to commencement of the project, to 98% at the study endline. This is consistent with ND adoption rates observed elsewhere in similar projects and indicates their perceived value by smallholders as indispensable farming inputs. Very few agricultural inputs attain this level of adoption in the smallholder sector.

ND vaccine sales continued past the study endline, with vaccinators earning a monthly net income of approximately Rs. 3,700.00 (USD 55.50) from poultry vaccination and deworming up to the end of May 2017. While 3,885,004 doses of vaccine were sold over the life of the project, an additional 556,600 doses of ND vaccine were sold six months after external support to the project ended. This indicates a good economic incentive and a sustainable basis for this last link in the commercial supply chain of the ND vaccine.

The data generated through this study was foremostly aimed at building market understanding for GALVmed and the numerous partners engaging the smallholder animal health market. The data collected shows, for example, that it is reasonable to assume (given the substantial productivity returns) that the vast majority of poultry owning smallholders will pay the market price for a product such as ND vaccine. This can then inform market size and market penetration considerations. Such evidence and understanding is crucial to GALVmed in working towards its mission of developing effective market based animal health distribution networks that can provide smallholders with a portfolio of products to meet their livestock health needs.

It is also understood that the data emanating from this (and similar) studies may be of interest to researchers looking to undertake more rigorous impact assessments (e.g. using RCTs). In this regard, GALVmed's remit is not to undertake these rigorous and costly research studies but rather to use pragmatic approaches, which still yield good data and which can point to areas of potential interest for the research community.

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Background

This project expanded the commercial supply chain for smallholder animal health inputs in Mayurbhanj District, Odisha State in India. The intention of the project was to gain a wider understanding of the smallholder animal health sector, focusing on poultry and Newcastle Disease (ND) in particular.

Introduction

Smallholder poultry production plays an important, and often undervalued, role in supporting rural livelihoods in developing countries. With minimal time and financial investment required, poultry represent a valuable source of protein and cash income in times of need (GALVmed, 2015; Bessell et al., 2017).

An infectious, rapid-onset, and economically devastating viral disease, ND is one of the biggest causes of poultry loss worldwide. Outbreaks of velogenic ND can cause morbidity and mortality rates of up to 90%. In developing countries, the impact of ND on smallholder poultry is particularly significant (Ahuja & Sen, 2007; Yune & Abdela, 2017). Effective and inexpensive ND vaccines exist that are appropriate for use in rural settings, but, in many areas, a lack of resources and infrastructure for vaccine distribution and for vaccination services hampers the uptake of these products (Wong et al., 2017).

Where ND is not controlled, rural households typically do not consume poultry products, favouring keeping eggs to produce more chickens for sale. Households use this income to purchase staple foods and other, often less nutritious, food products (Wong et al., 2017). Some of the benefits of ND control include increased income, particularly for female-headed households, and increased consumption of poultry products in the household. Studies have also associated ND control with increased trust between community and government, doubling of household incomes, and improved nutrient intake (Aklilu et al., 2007; Alders et al., 2010; cited in Wong et al., 2017).

Project background

GALVmed's market development activities in Africa and Asia comprise three types:

1. Small-scale pilot projects to test smallholder willingness and ability to pay market-related prices for animal health inputs and products.
2. Field projects, based on these pilots, to expand the commercial supply chain for smallholder animal health inputs and to demonstrate economic viability for smallholders, retailers, and vaccinators.
3. Larger market initiatives to generate positive cash flows and achieve subsequent growth and expansion through these profits, drawing commercial partners into the smallholder sector.

Map of project area Mayurbhanj District, Odisha



This field project represents the second type of initiative at a time when GALVmed was testing the commercial principle of whether smallholders would be willing to pay market-related prices for animal health inputs and whether, at scale, these inputs and products would realize sufficient productivity gains to ensure their sustained use. The field project focused on ND vaccines since this was considered the primary constraint in smallholder poultry production and the primary market opportunity for the animal health industry.

The field project built on a successful small-scale pilot project in Mayurbhanj District - one of the most economically backwards districts in Odisha State, India. An assessment of the pilot project showed a 50% increase in poultry production and a Rs. 5,133.00 (USD 76.99) increase per annum in smallholder income.

Reaching 44,855 smallholder households, from November 2013 to May 2017, the scaled field project had four key objectives: to establish a profit-based vaccine supply chain; to identify and train a cadre of community vaccinators; to improve smallholder awareness of the importance of poultry vaccination and deworming; and to improve smallholder poultry management practices (i.e. low cost feed supplements, construction of night shelters, use of low cost equipment, traditional natural hatching and brooding techniques).

Addressing the first objective, the project strengthened the animal health supply chain from the district supplier level through to the smallholder. Prior to the project, a commercial supply chain for the provision of vaccines to smallholders in rural areas did not exist. Retail stores at the district or block level did not regularly stock ND vaccines, nor were the vaccines available in appropriate dose sizes for smallholders.

The project worked with agents along the supply chain to improve the availability of high-quality vaccines and other products packaged in suitable doses. A partnership between GALVmed and Hester Biosciences made a thermotolerant vaccine available within the supply chain. By the end of the project, retailers at block- and intra-block level started to carry ND and Fowl Pox vaccines. Seven animal health stores, located in different marketplaces, also stocked and sold ND and other livestock vaccines.

The project trained 118 community vaccinators in smallholder poultry and goat vaccination (the latter in consultation with the local government veterinary department), deworming, first aid, entrepreneurship, improved poultry and goat husbandry and management practices, cold chain management, and provided community vaccinators with cooler boxes. In turn, community vaccinators engaged smallholders in deworming their poultry, adopting critical vaccines (ND and Fowl Pox), practicing better poultry management, and purchasing and using high-quality animal health products.

From the second year of the project, forty model villages¹ covering 1,821 smallholder households were provided intensive support. Smallholders in these villages were trained in improved poultry management practices and low-cost feed supplements. Low-cost night shelters were constructed using local resources and the field project supplied smallholders with poultry feeding and drinking equipment. Village-level awareness, vaccination, and deworming campaigns complemented community vaccinator efforts.

To enhance sustainability, the Government veterinary department was involved at all stages of the project. Project staff and community vaccinators attended monthly meetings at the animal husbandry department. Government veterinary surgeons participated in the community vaccinator training sessions and community vaccinators were linked to Government veterinary institutions at block (veterinary dispensary) and sub-block (livestock inspector centre) level.

By May 2017, 103 community vaccinators were in regular operation at a ratio of 1:435 smallholder households, each earning an average net income of Rs. 3,700.00 (USD 55.50) per month for vaccination and deworming services to smallholders. Approximately 3,885,004 doses of ND vaccine were sold over the life of the project. By November 2017 - six months past the withdrawal of external support to the project - an additional 566,600 doses of ND vaccine were sold, demonstrating the commercial viability of the vaccine in the field project area.

GALVmed Monitoring and Evaluation carried out a study to assess the poultry productivity changes associated with the scaled field project in Mayurbhanj. The study was implemented through questionnaire-based surveys that were rolled out prior to vaccine delivery (baseline) in May/June 2014 and after 16 months (endline) in October 2015. This study provides a snapshot of the project's initial uptake and effects on poultry productivity. Given that the project continued for another 19 months after the study endline, and that the sale of ND vaccines increased over this time, these effects are likely to have increased accordingly.

Study design

Questionnaire

The survey questionnaire (Appendix 1) comprised a mix of structured open and closed questions, which were tested and revised in a pilot study. Survey questions addressed flock size, consumption of poultry meat, productivity, husbandry practices, and use of vaccines and knowledge of poultry rearing. The questionnaire was written in English and translated into the local language. Each questionnaire took between 45 and 60 minutes to administer. A sample of survey forms were appraised by a supervisor during data collection. Following the completion of each survey, data was entered into a customised database.

Sampling

Sample size was calculated with a 95% confidence interval and significance level of 5%. The baseline comprised 421 smallholder households and the endline comprised 441 smallholder households. Using random stratified sampling, villages were selected from each lower administrative unit weighted by the number of households in the administrative unit. The same survey was used at baseline and endline. In households that agreed to participate in the study, the person responsible for looking after poultry was interviewed. In households that had no poultry, or were unwilling to participate in the survey, the next household was selected.

Data processing and statistical analysis

Data was collected on paper forms, before being manually entered into electronic format. Outliers were removed on a single-metric basis (rather than declaring entire records void). Subsequent analysis was completed using a combination of Microsoft Excel & R statistical software. Most comparative indicators were calculated using only the data provided in the surveys. Limited calculations required the use of external information for improving the context, understanding, and comparison possibilities (e.g. approximate value of poultry). Only where applicable, categorical responses were aggregated into broader topic areas – with care taken to avoid double counting.

¹As the baseline and endline study data came from a sample of all villages in the project area, it is likely that some of the respondents were in these model villages.

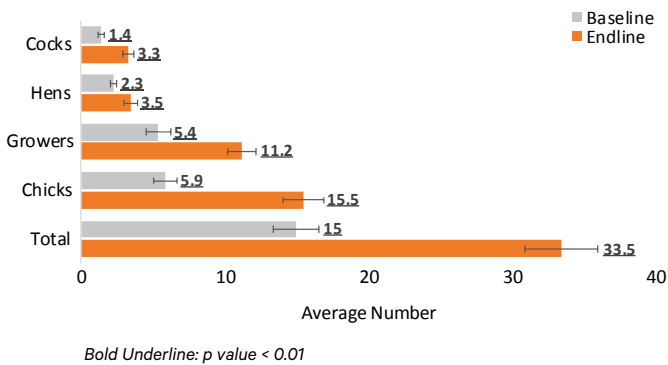
Findings

This section first reviews the findings from the major focus of the study - the effects of the project on smallholder productivity - and then turns to the minor focus of the study, which is on smallholder adoption.

Productivity

From baseline to endline, smallholder poultry flock sizes increased significantly. The increases were statistically significantly different for all categories of smallholder poultry – cocks, hens, growers, and chicks (Figure 1). The largest increases were seen in chicks (163% increase) and growers (107% increase). During the baseline, the average number of birds was 15 – comprising mature birds (25% – i.e. hens 16% and cocks 9%), growers (36%), and chicks (39%). After the project intervention, this number increased to 33.5 comprising mature birds (20% – i.e. hens 10% and cocks 10%), growers (34%), and chicks (46%). It is interesting to note that the number of chicks increased to nearly half of the flock and that the percentage of mature birds decreased from 25% to 20%.

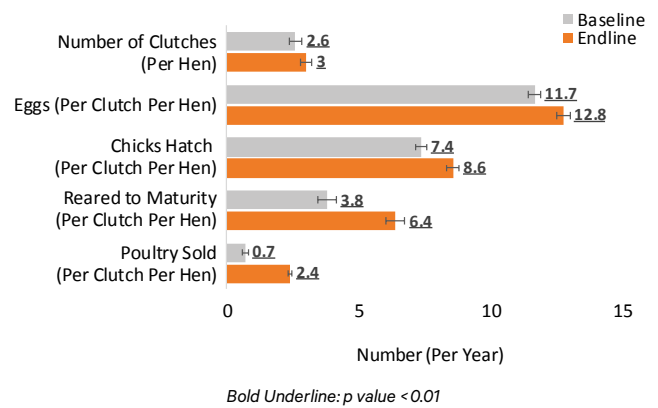
Figure 1. Average flock size at baseline and endline



One of the key expected outcomes of the project was that household income would increase as a result of smallholder poultry sales. This outcome was predicated on the assumption that reduced poultry morbidity and mortality would make more poultry available for sale. Mirroring the flock size increases in Figure 1, Figure 2 demonstrates that the number of poultry clutches, eggs, chicks, and birds reared to maturity, increased from baseline to endline. The 'laying productivity' of hens increased, demonstrated by the number of clutches per hen that improved from 2.6 to 3.0 per annum. Statistically significant increases were also seen in the number of eggs per clutch (up from 11.7 to 12.8 on average), the number of chicks hatched per clutch per hen (up from an average of 7.4 to 8.6), and the number of poultry raised to maturity (showing the biggest average increase from 3.8 to 6.4 poultry birds).

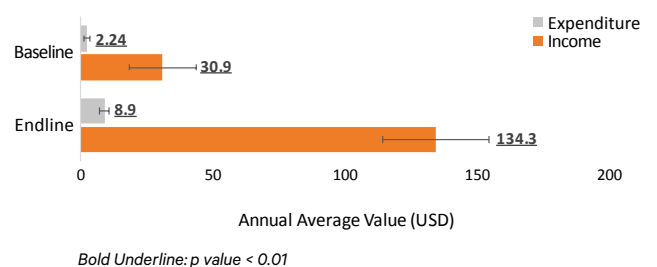
Correspondingly, there was a large and statistically significant increase in the sale of poultry from baseline to endline with smallholders selling 2.4 poultry per clutch, per hen, compared to only 0.7 poultry per clutch, per hen, at baseline. In both the baseline and endline surveys, poultry sales rather than egg sales were the main contributing source of income. The low volume of egg sales may be due to the fact that producers preferred to hatch the eggs to increase the size of their productive flocks (Wong et al., 2017) or a consequence of the improved income from poultry meat production. Another reason may be that there is not a well-developed market for 'second-hand' eggs – people may distrust the quality. In this analysis, egg sale volume did not contribute to the calculation of income from poultry.

Figure 2. Poultry productivity



Household income from poultry increased substantially relative to expenditure from baseline to endline (Figure 3). Overall, household expenditure on poultry increased almost fourfold from Rs. 149.33 (USD 2.24) to an average of Rs. 593.33 (USD 8.90) per annum. Smallholder income from poultry increased 335% from an average of Rs. 2,060.00 (USD 30.90) to an average of Rs. 8,953.00 (USD 134.30) per annum.

Figure 3. Poultry expenditure: poultry income

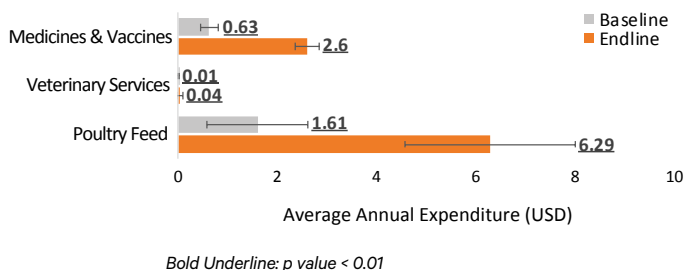


A key hypothesis was that smallholders with access to vaccinations and other animal health products, who were made aware of and were motivated to use these products, would increase their expenditure on poultry-related medicines and vaccines, veterinary services, and feed. Figure 4 demonstrates that spend on poultry-related animal health items increased over the life of the project. The increases in expenditure from baseline to endline were statistically significant for all sources – poultry feed, veterinary/professional services, and medicines and vaccines.

Expenditure on poultry-related medicines and vaccines saw the biggest increase of 313% from baseline to endline - from Rs. 42.00 (USD 0.63) to Rs. 173.33 (USD 2.60) - while expenditure on poultry feed increased by 291% from Rs. 107.33 (USD 1.61) to Rs. 419.33 (USD 6.29). Expenditure on veterinary/professional services also increased from an average of Rs. 0.67 (USD 0.01) to Rs. 2.67 (USD 0.04) on average per annum². The veterinary cost per smallholder was minimal in the baseline and endline, as most smallholders did not pay for veterinary services.

As in the baseline, at endline smallholders spent the most per annum on poultry feed followed by medicines and vaccines and then veterinary/professional services.

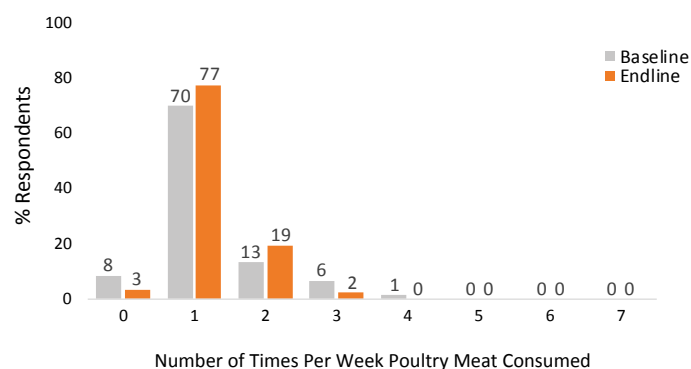
Figure 4. Expenditure on medicines and vaccines, veterinary services, and feed



One of the assumptions was that vaccine adoption would lead to a decrease in poultry morbidity and mortality which, in turn, would make more poultry available for offtake – either through gifting, selling or consumption. Poultry, as a source of protein, is important for improving rural household diets (Bruyn, 2015), which typically consist of starchy staples (Taruvunga, Muchenje, & Mushunje, 2013).

Figure 5 demonstrates a slight increase in poultry consumption over the life of the project, with a reduction in respondents eating no poultry meat (3% versus 8% at baseline), and more respondents eating poultry at least once or twice a week (7% and 6% more respondents, respectively). Interestingly, fewer respondents ate poultry more than three times a week at endline.

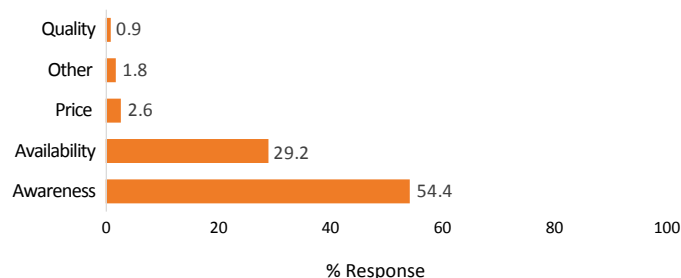
Figure 5. Critical protein intake through poultry consumption



Adoption

The study looked into the reasons smallholders did not vaccinate their poultry. A number of reasons were cited (Figure 6), chief among them the fact that smallholders were unaware of the advantages of vaccines - cited as the reason for non-vaccination 54.4% of the time. Other important reasons for non-vaccination included unavailability of vaccines or vaccinators (29.2% of responses). Vaccine price and quality were not major reasons for non-vaccination (only 3.5% of responses). By creating awareness around the benefits of vaccine adoption, strengthening the supply chain, and building a cadre of community vaccinators, the project responded directly to the barriers to vaccine adoption as identified through surveying smallholders in the project area.

Figure 6. Reasons for non-vaccination



There was a more than fivefold increase in adoption of the ND vaccine in the project area (Figure 7) coupled with a decrease in ND outbreaks (Figure 8) and a consistent increase in flock size over the life of the project. Per Figure 7, adoption of vaccines improved from only 19% adoption (79 smallholder households) in the baseline to 98% adoption (434 smallholder households) at endline.

²Many smallholders did not spend anything on veterinary fees, bringing the average down to a very small number.

Figure 7. Percentage of respondents adopting / not adopting ND vaccine

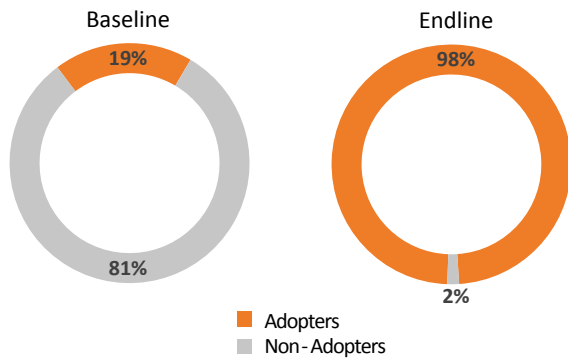
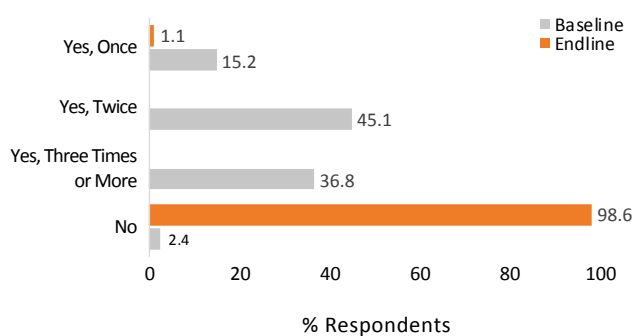


Figure 8. Newcastle Disease outbreaks



The project trained community vaccinators on low-cost poultry housing and feed management. In turn, community vaccinators cascaded this information to smallholders. Figure 9 suggests that the community vaccinators were successful in motivating a number of smallholders to construct poultry housing. Poultry house ownership increased from 15% at baseline to 42% at endline.

Figure 9. Poultry house ownership



Another key assumption was that ND and Fowl Pox vaccination would reduce the rates of poultry mortality in the project area. Figure 10 shows that almost all (98%) of respondents vaccinated their poultry against ND over the course of the project while approximately a third (35%) of respondents vaccinated against Fowl Pox. Correspondingly, the impact of ND was perceived to be far less at the end of the project relative to the start (Figure 11). ND was cited by 81.5% of smallholder respondents as a major disease responsible for poultry death in the baseline compared to only 1.4% at endline. Similarly, Fowl Pox was cited by 70.8% of respondents as a major disease responsible for poultry death at baseline compared to 20% at endline. Interestingly, other diseases causing poultry death increased from baseline to endline – cited as a major reason by 51.5% of smallholder respondents at the end of the project compared to only 1% at baseline. It is possible that lack of knowledge and awareness at the outset of the project contributed to misattribution of poultry death to ND, Fowl Pox and other poultry diseases (such as Avian Influenza) during the baseline. Altogether, the findings suggest that awareness campaigns were successful in improving smallholder knowledge and awareness of Fowl Pox and ND.

Figure 10. Diseases vaccinated against

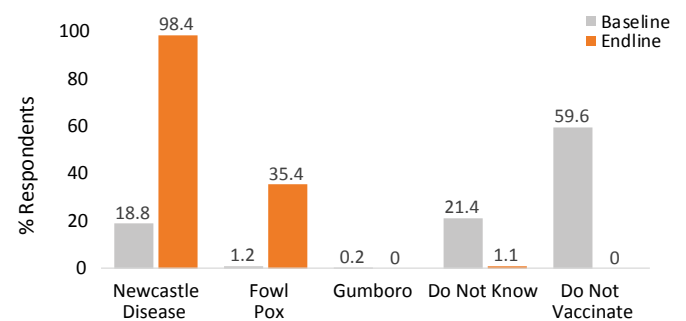
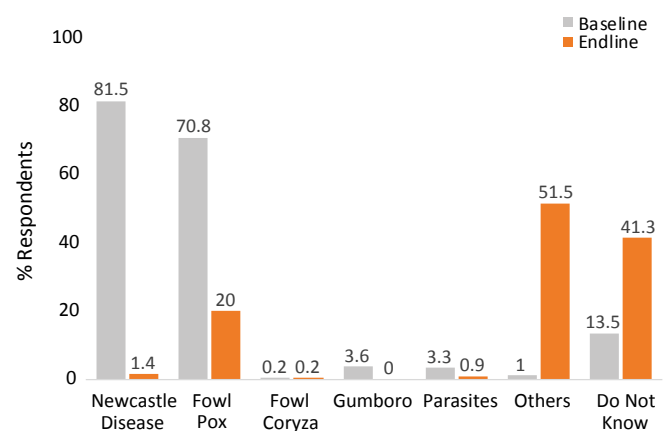


Figure 11. Major diseases killing poultry



Conclusions

The results together indicate that the field project was successful in motivating smallholders to adopt and pay for vaccines that, in turn, decreased the effect of critical diseases and considerably increased poultry flock size. Other factors may have contributed to increased productivity but it is reasonable to assume that the large observed increase in uptake of ND vaccination had the biggest effect on the productivity of poultry producers. Enhanced levels and quality of animal feed, feed additives and improved production practices also played an augmenting role in the production process.

With an adoption rate of 98%, income gains of over 300%, and increases in household poultry consumption, the findings suggest that smallholder customers perceive ND vaccines as indispensable farming inputs. Through awareness raising campaigns and community vaccinator efforts, the project appears to have changed smallholder attitudes towards purchasing and adopting vaccines and other high quality animal health products. The increase in poultry meat consumption also suggests that smallholders are using part of their produce gains to feed their families as opposed to generating income alone.

Smallholders in the project area experienced significant poultry productivity improvements from the use of the ND vaccine and other animal health products. Statistically significant increases were seen in the number of clutches per hen per year, the number of eggs per clutch, the number of chicks hatched per clutch per hen, and the number of poultry raised to maturity. The gains are large enough to suggest that adoption of ND vaccines and other animal health products would likely persist after the cessation of the project and other awareness activities.

That smallholders made significant income gains, paid for vaccines, and paid the community vaccinator service fee for vaccinations - with community vaccinators earning an average net income of Rs. 3,700.00 (USD 55.00) per month - suggests that the project established a strong basis for sustainability and profitability over the long term. It is reasonable to assume that income will increase even further as flock size exponentially increases.

Whether key players in the vaccine supply chain (e.g. retailers and vaccinators) realised sufficient commercial returns to sustain their long-term business commitment remains to be seen. The fact that retailers at block and intra-block level started stocking ND and Fowl Pox vaccines is a step in the right direction. Likewise, that over half a million doses of ND vaccine were sold six months after external support to the project ended goes some way towards demonstrating the commercial viability for both retailers and vaccinators.

Overall, the project managed to influence the supply chain so that better quality products are available to smallholders in the correct vial sizes and with adequate cold chain management to safeguard vaccine efficacy. It also influenced the government veterinary department by including it in the project and involving departmental staff in community vaccinator training, ensuring that community vaccinators remain viable and successful in continuing vaccination programs for smallholder poultry in the project area.

Combined with findings from other field projects in Asia and Africa, the understanding gained through this field project has contributed significantly to GALVmed's progression towards larger scale market initiatives with commercial partners, such as vaccine manufacturers. It is these larger scale commercial initiatives, built upon the understanding gained through the smaller field projects, which will ultimately deliver GALVmed's vision of scale and economic sustainability in serving the animal health needs of smallholders.

Acknowledgements

This study is based on research funded in part by the Bill & Melinda Gates Foundation and with UK aid from the UK Government through GALVmed. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or the UK Government.

The project was delivered in partnership with Bhodal Milk Producers' Cooperative Society (BMPCS), India. The report was written by Katharine Tjasink from Khulisa Management Services <https://www.khulisa.com>.

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Appendix 1

Questionnaire

Target Group	Household
Enumerator	
Date	

Respondent's Data			
Surname		Name	
District			
Village			
Sub_village			
Address			
Mobile phone			
Email			

Social: Education

1.-Education of the respondent

- | | |
|---|---|
| <input type="radio"/> Illiterate | <input type="radio"/> High school |
| <input type="radio"/> Literate without formal schooling | <input type="radio"/> Diploma or Certificate Course |
| <input type="radio"/> Literate below Primary school | <input type="radio"/> Graduate |
| <input type="radio"/> Primary school | <input type="radio"/> Postgraduate or above |
| <input type="radio"/> Middle or Secondary school | |

2.-What is the most common source for poultry related information?

- | | |
|---|--|
| <input type="checkbox"/> Govt Veterinary/paraveterinary | <input type="checkbox"/> Dealers |
| <input type="checkbox"/> Private veterinary | <input type="checkbox"/> Community animal health workers |
| <input type="checkbox"/> State Agriculture University | <input type="checkbox"/> Vaccinators |
| <input type="checkbox"/> NGOs | <input type="checkbox"/> Other farmers, friends and/or relatives |
| <input type="checkbox"/> Cooperatives | <input type="checkbox"/> No information provider |

Social: Health

3.-How many times per week do you eat poultry in your meals?

|_____| Times per week eat poultry

-
- Multiple choice Unique choice Number

Economic: Economic structure

4.-Who takes care of the poultry?

- | | |
|---|---|
| <input type="checkbox"/> Adult male (s) | <input type="checkbox"/> Young girls in the house |
| <input type="checkbox"/> Adult female (s) | <input type="checkbox"/> Young boys in the house |

5.-Who buys the poultry feed?

- | | |
|---|--|
| <input type="checkbox"/> Adult male (s) | <input type="checkbox"/> Young boys in the house |
| <input type="checkbox"/> Adult female (s) | <input type="checkbox"/> Do not buy feed |
| <input type="checkbox"/> Young girls in the house | |

6.-Who is responsible for buying the medicines for the poultry?

- | | |
|---|--|
| <input type="checkbox"/> Adult male (s) | <input type="checkbox"/> Young boys in the house |
| <input type="checkbox"/> Adult female (s) | <input type="checkbox"/> Do not buy medicines |
| <input type="checkbox"/> Young girls in the house | |

7.-Who primarily makes the decision about selling the poultry?

- | | |
|--|---|
| <input type="radio"/> Adult male (s) | <input type="radio"/> Young boys in the house |
| <input type="radio"/> Adult female (s) | <input type="radio"/> Joint decision |
| <input type="radio"/> Young girls in the house | <input type="radio"/> Do not sell poultry |

8.-Who primarily decides the use of poultry income?

- Adult male (s)
- Adult female (s)
- No poultry income

Economic: Poultry production

9.-Do you have poultry house?

- Yes
- No

10.-What do you do if your poultry falls ill?

- | | |
|--|--|
| <input type="checkbox"/> Treat with traditional / home remedies | <input type="checkbox"/> Poultry traders |
| <input type="checkbox"/> Seek help from neighbors | <input type="checkbox"/> Community animal health workers |
| <input type="checkbox"/> Call local paravet or Livestock Inspector | <input type="checkbox"/> Consume |
| <input type="checkbox"/> Call the government veterinary | <input type="checkbox"/> Do nothing |
| <input type="checkbox"/> Get medicines from the medicine stores | <input type="checkbox"/> Sell immediately |
| <input type="checkbox"/> Private veterinary | |

11.-What are the main causes of poultry losses?

- | | |
|--|---------------------------------|
| <input type="checkbox"/> Infectious diseases | <input type="checkbox"/> Theft |
| <input type="checkbox"/> Parasites | <input type="checkbox"/> Others |
| <input type="checkbox"/> Predators | |

12.-What are the major diseases that are killing your poultry?

- | | |
|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> Newcastle | <input type="checkbox"/> Gumboro |
| <input type="checkbox"/> Parasites | <input type="checkbox"/> Do not know |
| <input type="checkbox"/> Fowl pox | <input type="checkbox"/> Others |
| <input type="checkbox"/> Fowl coryza | |

13.-What are the major symptoms when the poultry is sick?

- | | |
|---|--|
| <input type="checkbox"/> Gasping | <input type="checkbox"/> White diarrhea |
| <input type="checkbox"/> Coughing | <input type="checkbox"/> Brownish/Bloody diarrhea |
| <input type="checkbox"/> Sneezing | <input type="checkbox"/> Yellow diarrhea |
| <input type="checkbox"/> Twisted necks | <input type="checkbox"/> Brownish black spots |
| <input type="checkbox"/> Circling | <input type="checkbox"/> Sudden death |
| <input type="checkbox"/> Complete paralysis | <input type="checkbox"/> Swelling of eyes and head |
| <input type="checkbox"/> High mortality | <input type="checkbox"/> Others |
| <input type="checkbox"/> Green diarrhea | |

14.-What do you do with the dead poultry?

- | | |
|---|---|
| <input type="checkbox"/> Eat them at home | <input type="checkbox"/> Bury in the ground |
| <input type="checkbox"/> Throw away in some open area | <input type="checkbox"/> Sell |
| <input type="checkbox"/> Throw away in some pond or river | <input type="checkbox"/> Other |

15.-For which diseases do you vaccinate your poultry?

- | | |
|--|---|
| <input type="checkbox"/> Newcastle Disease | <input type="checkbox"/> Gumboro |
| <input type="checkbox"/> Fowlpox | <input type="checkbox"/> Do not know |
| <input type="checkbox"/> Fowl coryza | <input type="checkbox"/> Do not vaccinate |

16.-Who administers the Newcastle disease vaccines?

- | | |
|---|--|
| <input type="checkbox"/> Govt. paravet or Livestock Inspector | <input type="checkbox"/> NGO service providers |
| <input type="checkbox"/> Govt. Veterinary doctor | <input type="checkbox"/> Farmer themselves |
| <input type="checkbox"/> Private veterinary doctor | <input type="checkbox"/> Do not vaccinated |
| <input type="checkbox"/> Community animal health worker | |

17.-If not vaccinating poultry please provide reasons

- | | |
|--|---|
| <input type="checkbox"/> Vaccines not available | <input type="checkbox"/> Poor quality of vaccines |
| <input type="checkbox"/> Not aware of advantages of vaccines | <input type="checkbox"/> Cost of the vaccine is high |
| <input type="checkbox"/> Not aware of time and use of vaccines | <input type="checkbox"/> No delivery of veterinary services at the doorstep |
| <input type="checkbox"/> Does not affect productivity | <input type="checkbox"/> Pack size |
| <input type="checkbox"/> Vaccinators not available | <input type="checkbox"/> Other |

18.-Did you have a Newcastle disease outbreak in the last 12 month?

- | | |
|----------------------------------|--|
| <input type="radio"/> Yes, once | <input type="radio"/> Yes, three times or more |
| <input type="radio"/> Yes, twice | <input type="radio"/> No |

Economic: Lili Lite General

19.-Number of goat that you have in the house

| _____ | Goat

20.-Number of sheep that you have in the house

| _____ | Sheep

21.-Number of pigs that you have in the house

| _____ | Pigs

22.-How much money do you spend in poultry feed per month?

| _____ | Local currency per month

23.-Value of the medicines or vaccines bought for poultry during the last 12 months

| _____ | Local currency

24.-Veterinary or other professional fees paid for poultry during the last 12 months

| _____ | Local currency

25.-If you have a specific poultry house, which is the estimated value of the poultry house

| _____ | Local currency

26.-Cost of repair and maintenance in the poultry house during the last 12 months

| _____ | Local currency

Economic: Lili Lite Chickens

27.-Number of male Cocks that you have in the household

| _____ | Cocks

28.-Number of hens that you keep in the household

| _____ | Hens

29.-Number of poultry growers that you keep in the household

| _____ | Growers

30.-Number of chicks that you keep in the household

| _____ | Chicks

31.-Number of clutches per hen per year

| _____ | Number of hen clutches per year

32.-Number of chicken eggs consumed or gifted per clutch

| _____ | Chicken eggs per clutch

33.-Number of chicken eggs sold per clutch

|_____| Chicken eggs per clutch

34.-Number of chicken eggs put to hatch per clutch

|_____| Chicken eggs per clutch

35.-Number of chicken chicks hatch per clutch

|_____| Chicks per clutch

36.-Number of chicken chicks reared to maturity per clutch

|_____| Chicks per clutch

37.-Number of poultry sold per clutch

|_____| Chickens sold per clutch

38.-Number of poultry bought for replacement during the last 12 months

|_____| Poultry

Economic: Lili Lite Guinea Fowl

39.-Number of male Guinea fowl that you have in the household

|_____| Guinea Fowl

40.-Number of female Guinea fowl that you keep in the household

|_____| Guinea Fowl

41.-Number of Guinea fowl growers that you keep in the household

|_____| Guinea Fowl Growers

42.-Number of Guinea fowl chicks that you keep in the household

|_____| Chicks

43.-Number of clutches per Guinea fowl per year

|_____| Guinea Fowl clutches per year

44.-Number of Guinea fowl eggs consumed or gifted per clutch

|_____| Guinea Fowl eggs per clutch

45.-Number of Guinea fowl eggs sold per clutch

|_____| Guinea Fowl eggs per clutch

46.-Number of Guinea fowl eggs put to hatch per clutch

|_____| Guinea Fowl eggs per clutch

47.-Number of chicks Guinea fowl hatch per clutch

|_____| Guinea Fowl per clutch

48.-Number of Guinea fowl chicks reared to maturity per clutch

| _____ | Guinea Fowl per clutch

49.-Number of Guinea fowl sold per clutch

| _____ | Guinea Fowl sold per clutch

50.-Number of Guinea fowl bought for replacement during the last 12 months

| _____ | Guinea Fowl

Economic: Lili Lite Ducks

51.-Number of male ducks that you have in the household

| _____ | Ducks

52.-Number of female ducks that you keep in the household

| _____ | Ducks

53.-Number of ducks growers that you keep in the household

| _____ | Ducks Growers

54.-Number of ducks chicks that you keep in the household

| _____ | Chicks

55.-Number of ducks produced monthly

| _____ | Ducks per month

56.-Number of ducks consumed or gifted per month

| _____ | Ducks per month

57.-Number of ducks bought for replacement during the last 12 months

| _____ | Ducks

Economic: Lili Lite Turkeys

58.-Number of male turkeys that you have in the household

| _____ | Turkeys

59.-Number of female turkeys that you keep in the household

| _____ | Turkeys

60.-Number of turkeys growers that you keep in the household

| _____ | Turkeys Growers

61.-Number of turkeys chicks that you keep in the household

| _____ | Chicks

62.-Number of turkeys produced monthly

| _____ | Turkeys per month

63.-Number of turkeys consumed or gifted per month

| _____ | Turkeys per month

64.-Number of turkeys bought for replacement during the last 12 months

| _____ | Turkeys



Protecting Livestock – Improving Human Lives