The Coverage Rate of Superior Native Chicken Vaccination and Factors Determining Farmers’ Decision in the Vaccination Program

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ABSTRACT: The Ministry of Agriculture distributed superior native chicken (KUB) through the BEKERJA program, which was followed by vaccination services as a determinant affecting chicken productivity. This study examined the coverage rate of chicken vaccination and the factors that influence farmers’ decision to vaccinate their chickens during the BEKERJA program in Indramayu District, West Java Province. Primary data were collected during vaccination, and secondary data on household characteristics were obtained from the Ministry of Social Affairs. Farmers from 1,549 impoverished households who vaccinated or did not vaccinate their chickens were chosen at random in three sub-districts, and monitoring was done from March to September 2019 during the vaccination program. Descriptive analysis was used to determine farmer characteristics and chicken vaccination coverage rate, while logistic regression analysis was used to determine factors influencing farmers’ decision to vaccinate their chickens. The coverage rate of chicken vaccination decreased from 88 percent in the first vaccination period to 63 percent in the sixth vaccination period. Farmers refused vaccination because of previous failures, increasing the mortality rate. Furthermore, the likelihood of implementing a chicken vaccination program was significantly higher (P<0.05) for households with a large number of chicken populations, livestock farming experience, and larger land size. However, the number of family members had a smaller effect (P<0.1), and respondents’ age and residence status did not affect vaccination decisions. As a result, a household's understanding of the importance of vaccination, and the required condition of chickens, must be considered for an effective vaccination strategy.

Keywords: Coverage-rate; Vaccination; Farmer’s Decision; Superior Native Chicken

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INTRODUCTIONS

Native chicken has a potency to be developed in Indonesia and many other low- and medium-income countries as a source of protein (Henuk & Bakti, 2018; Lindahl et al., 2019; Sofyan et al., 2019); source of income (Munawarah et al., 2021; Noferdiman et al., 2014); requires low investment (Alders et al., 2010; Lan Phuong et al., 2015); have a faster turn over (Lan Phuong et al., 2015; Wiedosari & Wahyuwardani, 2015); and has a potency for native chicken breeds conservation (Nataamijaya, 2010). Moreover, this native chicken production is also important in the economic development of the poorest (Hidayat, 2012; Munawarah et al., 2021; Nchinda et al., 2011; Padhi, 2016); where in Indonesia reached 24 million people in September 2019 and about 13.6 percent of them (3.4 million) lived in West Java (Badan Pusat Statistik, 2020).

The Indonesian government has launched the BEKERJA Program (Alleviate Poverty, Prosperous People program) with one of its main activity was the distribution of superior native chickens to stunted areas and impoverished community. This program aimed to reduce poverty and stunting rates as well as boost the income of impoverished people and the populations of superior native chickens in the community. This program has been conducted since 2018 based on Decree of the Ministry of Agriculture No 14 Year 2019 and the second amendment of the Decree No 31 Year 2019 concerning the Guidelines of BEKERJA Program dated 19 July 2019. Around 10 million superior native chickens were given throughout 10 provinces of Indonesia in 2018, while 20 million of those chickens were dispersed across 20 provinces in 2019. West Java was one province that received the chicken program, which was distributed to five districts in 2018 and 13 districts in 2019, one of which was Indramayu District. Indramayu District received not only superior native chickens but also superior ducks, as this location is the center of duck farming in West Java. The number of superior native chickens and superior ducks that have been distributed in Indramayu was 507,850 chickens and 50,150 ducks in 2018 for 11,160 households in four sub-districts, namely Tukdana, Kroya, Kandanghaur, and Gantar Sub-Districts. In 2019, the number of superior native chickens was distributed 409,450 chickens for 8,189 impoverished households throughout three sub-districts, namely Anjatan, Bongas, and Haurgeulis. As a component of the program, impoverished households also got support including chicken/duck feed, brooder and permanent pen, equipment (feed and water bins, heater lamp), training and supervision, as well as animal health services through providing free vaccination and medication for chickens.

Vaccination is an important strategy in the development of the chicken industry to prevent and control disease outbreaks such as Newcastle Disease (ND), chronic respiratory disease (CRD), pullorum, and Avian Influenza (AI) which can infect humans (Campbell et al., 2019; Ismoyowati et al., 2022; Kencana et al., 2019; Musa et al., 2011; Pousga et al., 2018). Moreover, vaccination also impacts the productivity and survival rate of chickens (Bessell et al., 2020; Hugo et al., 2017; Knueppel et al., 2010); and makes chickens more viable for consumption and raising (Rasamoelina-Andriamanivo et al., 2014). Unvaccinated chickens have a high risk of dying (Harrison & Alders, 2010), for instance, high mortality of native chickens was found in Hulu Sungai Utara District, South Kalimantan due to ND and AI diseases (Suryana, 2017), and in Kebumen and Banyumas Districts due to AI (Ismoyowati et al., 2022). AI also has impacted the contribution of poultry business particularly to small farmers' income from 83.5 percent to 68.7 percent after AI infection, according to a study Ilham & Yusdja, (2010) in West Java, East Java, and Lampung. In addition, Annapragara et al. (2019) mentioned that a high coverage rate (more than 90 percent) will not stop the outbreaks unless followed by continued vaccination. This is due to the
short duration of effectiveness of vaccination, and the high levels of births and deaths in the chicken flocks.

Lack of response of farmers to the vaccination program held by government which can be seen by irregular chicken vaccination done by farmers, has negative impact on the success of the BEKERJA program. The reason for this is farmers often have a low understanding of the importance of chicken vaccination (Susilowati, 2011). Moreover, some farmers argue to do vaccination because the outbreak still happened even when the vaccination existed (Wiedosari & Wahyuwardani, 2015). Group farmers in Cicurug Subdistrict, Sukabumi, for instance, have initiated regular vaccination as well as improving chicken management to stop the chain transmission of AI, however, this effort is still limited at the district level (Basuno, 2008).

There have been several studies related to the coverage rate of vaccination programs in livestock, particularly in local chickens. However, fewer studies reported a coverage rate of vaccination for specific superior native chickens (Kampung Unggul Balitbangtan/KUB, invented by Indonesian Agency for Agricultural Research and Development (IAARD) as in this study, in which these chickens were distributed as a grant to farmers. While other studies reported farmers’ decision to vaccinate their livestock with their budget which might cost them, in this study government has also supported households with a free chicken vaccination program which the decision of households might be different. It is expected that all households will participate due to no cost from households. Thus, information about vaccination coverage is critical for determining the efficiency and effectiveness of a vaccination program, especially during the BEKERJA program. Low vaccination coverage of livestock is one of the major challenges to control diseases. Furthermore, relevant policymakers need this information to evaluate and develop a better vaccination strategy in the future. This paper aims to identify the vaccination coverage rate of superior native chickens and the factors influencing farmers’ decisions on chicken vaccination during the chicken distribution program in Indramayu District, West Java.

Since higher vaccine coverage can boost chicken productivity (Campbell et al., 2018), monitoring the coverage rate is crucial in the future to assist prioritize and tailor vaccination strategies.

**MATERIALS AND METHODS**

West Java Province had the fourth-largest population of native chicken (Direktorat Jenderal Peternakan dan Kesehatan Hewan, 2021) as well as the third-highest population of impoverished households in Indonesia (Badan Pusat Statistik, 2020). One district in West Java Province, namely Indramayu District was selected as the research location because it received chicken distribution through the BEKERJA program (Alleviate Poverty, prosperous people program) held by IAARD, Ministry of Agriculture from 2018 to 2019 and supported by the local government in this district. The district is located in the northern part of West Java Province between 107°51'-108°36' East Longitude and 6°15'-6°40' South Latitude. It has a total area of 2,090 square kilometers and a population of 1,871,149 in 2020.

There were 8,189 farmers from three sub-districts namely Anjatan, Hauregulis, and Bongas which were categorized into impoverished households’ farmers, involved in the BEKERJA Program by receiving 50 heads of superior native chicken “KUB” (invented by IAARD) per household. The criteria of impoverished households in this study were defined by Decree of Ministry of Social Affairs No 57 Year 2017 as households with an income of less than IDR 600,000; and additional criteria defined by (Badan Penelitian dan Pengembangan Pertanian, 2018) as being involved in agriculture activity and having space to build a chicken pen. Data population of chickens vaccinated were gathered during vaccination implementation, while the depletion of
chickens was recorded for four months since first rearing. Primary data were obtained from about 1,549 of those households, approximately 19 percent of the total population, who were selected using simple random sampling by computer. The respondents were interviewed using a structured questionnaire from March to December 2019 to assess their willingness to participate in the vaccination program, which included the number of chickens vaccinated. According to Gay & Diehl (1992), a larger sample size is more representative to generalize the results, and for descriptive studies, the sample size should be at least 10-20 percents of the overall population. Respondents in each sub-district were ordered as in the list of databases in Excel with choices being made from top to bottom. The proportion corresponded to the proportion of households in each subdistrict among the 8,189 households in the Indramayu District that received a chicken distribution. Secondary data was also acquired from the Ministry of Social Affairs (2017) regarding the characteristic of all impoverished households (8,189 farmers) that received chickens in Indramayu District, such as age, family members, house size (building and land), assets, occupation, and livestock experience. Some data such as age and family members, were verified in the field while others were not. For farming experience, there are no limiting criteria set by the government for households receiving chickens, so the approach taken here is not based on the amount of experience in farming, but whether they have farming experience or not.

Descriptive statistics (average, percentage) were used to investigate the characteristics of impoverished households' farmers, land/asset ownership, mortality rate, and coverage rate, while the binary logistic regression modeling technique via SPSS software was used to investigate factors influencing farmers' decision to vaccinate their chickens. For households' characteristics, the maximum, minimum, and modus values were identified rather than standard errors. This is to simultaneously see whether the household receiving the chicken assistance meets the criteria set by the government. For example, poor families are characterized by small and poor residential areas and houses. The age is not limited but it is expected not to be too old so that it will have an impact on the ability to raise chickens. If the modus figures are still low, indicates that this program has been mostly for appropriate targets. Furthermore, the number of family members is important because it relates to the cost of living.

During the BEKERJA Program, mortality and coverage rates were analyzed. The mortality rate was calculated by dividing the total number of dead chickens by the total population, whereas the coverage rate was calculated by dividing the total number of vaccinated chickens by the total chicken population, as shown below:

\[
\text{Mortality rate} \, (\%) = \frac{\text{Number of died chickens (heads)}}{\text{Number of the chicken population (heads)}} \times 100\%
\]

\[
\text{Coverage rate} \, (\%) = \frac{\text{Number of vaccinated chickens (heads)}}{\text{Number of the chicken population (heads)}} \times 100\%
\]

A binary model was set up in this study to define \(Y=1\) for the condition in which the households decide to vaccinate their chickens; and \(Y=0\) for otherwise. It is assumed that \(X\) is a vector of explanatory variables and \(p\) is the probability that \(Y=1\), two probabilistic relationships, as asserted by (Wooldridge, 2012), can be considered, as follows:
\[
p(Y = 1) = \frac{e^{\beta x}}{1 + e^{\beta x}}
\]
\[
p(Y = 0) = 1 - \frac{e^{\beta x}}{1 + e^{\beta x}} = \frac{1}{1 + e^{\beta x}}
\]

Wooldridge, (2012) concluded that since Equation (2) is the lower response level, which is the probability that impoverished households did not vaccinate their chickens, this will be the probability to be modelled by the logistic procedure by convention. Both equations present the outcome of the logit transformation of the odds ratios, which can alternatively be represented as:

\[
\logit[\theta(x)] = \log\left[\frac{\theta(x)}{1-\theta(x)}\right] = \alpha + \beta_1X_1 + \beta_2X_2 + \cdots + \beta_kX_k
\]

and thus, allow its estimation as a linear model for which the following definitions apply: \(\theta\) = logit transformation of the odds ratio; \(\alpha\) = the intercept term of the model; \(\beta\) = the regression coefficient or slope of the individual explanatory variables modelled; and \(X_i\) = the explanatory or predictor variables. The logistic regression in this study can be specified as:

\[
Y_i = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \mu_k
\]

Where:
\(Y_i\) = the dependent variable defined as the decision to vaccinate chickens by impoverished households = 1 and 0 otherwise;
\(\alpha\) = constant and intercept of the equation;
\(X_1\) = households’ age;
\(X_2\) = dummy involved/had experience in livestock production as farmers, 1 = had experience and 0 = otherwise;
\(X_3\) = total family members (people);
\(X_4\) = number of chicken population (head);
\(X_5\) = size of land/area (m\(^2\));
\(X_6\) = dummy status of dwelling, 1 = own dwelling; 0 = others (rent, free-living)

RESULTS AND DISCUSSION
The characteristic of farmers
In terms of age and number of family members, the characteristics of families that received native chicken through the BEKERJA Program did not differ among the three sub-districts in Indramayu Districts. The average age of a household was roughly 50 years old, with about four members in the family. (Table 1). This indicated that households are still in productive age and still able to keep chickens. Besides that, households 50 years old are mature enough to make decisions to receive government policies such as vaccination programs (Sofyan et al., 2019). The study by Baliyan & Masuku (2017) found that poultry farming in Botswana involved mostly young people aged 16-45 years old (58 percent), while the rest were people aged more than 46 years old, contradicting the result found in this study. Moreover, according to Table 1, the oldest respondents (aged 86-93 years old) have also been found in those three sub-districts. These respondents still had the opportunity of receiving chicken from the Government since they were impoverished, and they felt disposed to manage chickens with the assistance of other family members who lived in the same house.
Table 1. The characteristic of respondents who were involved in the chicken distribution program in three subdistricts in Indramayu District, West Java Province, 2019

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Anjatan</th>
<th>Haurgeulis</th>
<th>Bongas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>Ave 51.4</td>
<td>Ave 52.5</td>
<td>Ave 50.2</td>
</tr>
<tr>
<td></td>
<td>Min 17</td>
<td>Min 21</td>
<td>Min 21</td>
</tr>
<tr>
<td></td>
<td>Max 86</td>
<td>Max 87</td>
<td>Max 93</td>
</tr>
<tr>
<td></td>
<td>Modus 50</td>
<td>Modus 60</td>
<td>Modus 50</td>
</tr>
<tr>
<td>Family members (people)</td>
<td>Ave 3.5</td>
<td>Ave 3.9</td>
<td>Ave 3.4</td>
</tr>
<tr>
<td></td>
<td>Min 1</td>
<td>Min 1</td>
<td>Min 1</td>
</tr>
<tr>
<td></td>
<td>Max 13</td>
<td>Max 10</td>
<td>Max 10</td>
</tr>
<tr>
<td></td>
<td>Modus 4</td>
<td>Modus 4</td>
<td>Modus 3</td>
</tr>
<tr>
<td>Size of house (m²)</td>
<td>Ave 49.5</td>
<td>Ave 57.9</td>
<td>Ave 45.9</td>
</tr>
<tr>
<td></td>
<td>Min 4</td>
<td>Min 6</td>
<td>Min 4</td>
</tr>
<tr>
<td></td>
<td>Max 505</td>
<td>Max 404</td>
<td>Max 404</td>
</tr>
<tr>
<td></td>
<td>Modus 54</td>
<td>Modus 54</td>
<td>Modus 30</td>
</tr>
<tr>
<td>Size of area (m²)</td>
<td>Ave 315.8</td>
<td>Ave 473.7</td>
<td>Ave 301.1</td>
</tr>
<tr>
<td></td>
<td>Min 140</td>
<td>Min 140</td>
<td>Min 140</td>
</tr>
<tr>
<td></td>
<td>Modus 93</td>
<td>Modus 140</td>
<td>Modus 140</td>
</tr>
</tbody>
</table>

Ave= average

In addition, due to the chicken program being aimed at households, they have small land for houses which was about 301-473 m², however, those land including houses was mostly (more than 70 percent) owned by themselves (Table 2). In terms of occupation, households as a government target work mostly in the agricultural sector, both on farms with paid/unpaid labor and as agricultural workers, accounting for around 92 percent of those in Anjatan and Haurgeulis Sub-Districts and 99 percent of those in Bongas Sub-District (Table 2). Only the smallest percentage of households (less than 8 percent) had occupations in the non-farm sector. This indicated that the government-established program had an appropriate target for people in the agriculture sectors with lower incomes. Interestingly, only less than 6 percent of households in three areas have experience in livestock.

Table 2. The ownership of land and occupation of households involved in the chicken distribution program in three Sub-district, Indramayu District, West Java Province, 2019

<table>
<thead>
<tr>
<th>No</th>
<th>Parameters</th>
<th>Number of respondents in</th>
<th>%</th>
<th>Number of respondents in</th>
<th>%</th>
<th>Number of respondents in</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Anjatan</td>
<td></td>
<td>Haurgeulis</td>
<td></td>
<td>Bongas</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Status of dwelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a Free- rent house</td>
<td>347</td>
<td>11.00</td>
<td>155</td>
<td>7.86</td>
<td>318</td>
<td>10.39</td>
</tr>
<tr>
<td></td>
<td>b Rent House</td>
<td>18</td>
<td>0.57</td>
<td>3</td>
<td>0.15</td>
<td>12</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>c Own house</td>
<td>2778</td>
<td>88.05</td>
<td>1815</td>
<td>91.99</td>
<td>2730</td>
<td>89.19</td>
</tr>
<tr>
<td></td>
<td>d Not available</td>
<td>12</td>
<td>0.38</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3155</td>
<td>100</td>
<td>1973</td>
<td>100</td>
<td>3061</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Occupation aspect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a Livestock</td>
<td>162</td>
<td>5.13</td>
<td>117</td>
<td>5.93</td>
<td>93</td>
<td>3.04</td>
</tr>
<tr>
<td></td>
<td>b Agriculture</td>
<td>2751</td>
<td>87.19</td>
<td>1705</td>
<td>86.42</td>
<td>2937</td>
<td>95.95</td>
</tr>
<tr>
<td></td>
<td>c Other</td>
<td>242</td>
<td>7.67</td>
<td>151</td>
<td>7.65</td>
<td>31</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3155</td>
<td>100</td>
<td>1973</td>
<td>100</td>
<td>3061</td>
<td>100</td>
</tr>
</tbody>
</table>

Stimulus and type of vaccines provided in the BEKERJA Program

Households involved in this program including those in Indramayu District received 50-day-old chickens; 250 kg of subsidized feed; subsidized pen; training in chicken management, and chicken health services such as vitamins, medication, and vaccination. The chicken provided is superior native chickens, known as KUB chicken (Kampung Unggul Balitbangtan) which were invented by IAARD, and can produce more eggs and reach slaughter weight faster than other native chickens (Hidayat et al., 2011; Suryana, 2017). The egg production is approximately 160-180 eggs per chicken each year, slaughter weight of 1,000-1,300 gram can be reached in 12
weeks; and the feed is sourced from a feed company that requires 17.5 percent of crude protein, 2,800 of metabolic energy and probiotics (Asyari et al., 2014). In terms of a pen, households received a package of the brooder for a 1-30 days-old chicken as well as IDR 500 thousand subsidies for building a permanent pen.

Financial aid was offered for building permanent chicken pens, so that the chickens could be cared for intensively, increasing biosecurity, and preventing disease spread. This is because native chickens are typically reared extensively with low biosecurity controls and restricted access to veterinarian inputs, increasing the risk of disease spreading. The chicken health services such as providing vitamins, medication, and vaccination are supervised by the Livestock Services Agency in that area.

In the areas, three types of vaccines were used: IBD, ND (through vaccination drops), and AI (by injection). The IBD vaccination was administered twice to the chickens, once at 7 days and once at 21 days; and AI was administered twice to chickens once at 14 days and once at 84 days. ND La Sota vaccine was given to chickens in 28 days followed by ND-IB in 70 days years old chickens. Type and time of vaccination are defined by both Livestock Services Agency (LSA) of Indramayu Districts and ICARD, as a coordinator of the program in the area) according to some cases that had been experienced in the area.

**The coverage rates of chicken vaccination during the BEKERJA Program**

According to data recorded during vaccination, it has been discovered that the coverage rate of chicken vaccination is decreasing in the study locations. (Figure 1). The number of chickens vaccinated at the first vaccination (vaccine IBD) was about 90 percent in Haurgeulis and Bongas Subdistricts, whereas it only reached 77 percent in Anjatan. The low coverage rate of IBD 1 vaccination in the Anjatan Subdistrict was caused by a week-delayed supply of IBD 1 vaccines due to Eid al-Fitr 2019. This delay in vaccine supplies caused vaccination in three out of the 11 villages in Anjatan, namely Anjatan Utara Village, Anjatan Baru Village, and Anjatan Village were not done appropriately because the chickens were past the vaccination age.

The insufficient number of vaccinators was also a factor in the lack of vaccination coverage in these three villages. Thus, this condition affected the vaccination coverage in Anjatan Subdistrict which was lower than the other two subdistricts. This implies that the technical factor is also important to be considered in reaching the success of the vaccination program. Islam et al. (2008) mentioned that the preparation and administration of vaccines were clues associated with the failure in vaccination. (Annapragada et al., 2019) also noticed that vaccination faces a challenge regarding the supply of cold chain as well as the availability of trained vaccinators.

In comparison to IBD 1 vaccination, the average coverage rate of IBD 2 vaccination (in 21 days) of the three subdistricts was higher (92.8% vs 88.2%), even though coverage rates in Bongas and Haurgeulis Subdistricts had declined slightly, reaching 94 and 87 percent, respectively. On the other hand, IBD 2 vaccination coverage in Anjatan Subdistricts reached 97.34 percent, which was higher than the prior IBD vaccination. Because there was no shortage of IBD 2 vaccines, all villages in Anjatan were vaccinated.

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The number of chicken vaccinated AI (in 14 days) was 85 percent in Anjatan, higher than those percentages in the other two subdistricts which were approximately 70 percent. This figure is higher than that reported by Susilowati (2011) which was approximately 73.1 percent in West Java and far higher than the coverage rate recorded in Bali, which was barely 60 percent. The highest covering rate in Anjatan can reduce chicken disease, therefore lowering mortality. This is also demonstrated by the fact that the proportion of chicken mortality in Anjatan was approximately 2.47 percent, which was lower than the other districts, which were approximately five percent (Figure 2). In contrast, the average coverage rate of the second AI vaccination in three subdistricts was only 62.7 percent, a considerable decline from the preceding period of AI vaccination (78.4%), with Anjatan having the lowest coverage rate (56.44%) compared to the other two subdistricts (Figure 2). This condition occurred as a result of (1) the sale of roosters (male chickens) that had already attained consumption weight (> 1 kg) at the age of 12 weeks when the second AI vaccination was administered, and (2) an increase in chicken death rate after vaccination.

Several factors contributed to the increased mortality rate of chickens after vaccination. First, due to the limited number of vaccinators available from the local Livestock Services Agency to catch up on the vaccination schedule, program assistants were trained on how to vaccinate. The Livestock Services Agency trained them before the vaccination program; however, this short training was insufficient to improve their knowledge, notably in selecting chickens that can be vaccinated. With this knowledge, many chickens injected were not in good condition (weak or stressed) before vaccination, and as a result, many chickens dead following vaccination. Islam et al. (2008) reported that the condition of chickens such as sick or stress led to the failure of Gumboro vaccination in the Dinajpur district of Bangladesh. Second, another factor that contributes to chicken mortality during vaccination is the timing, which is sometimes done in the afternoon and during hot hours due to unreachable distances, causing the chickens to become stressed and dead. Generally, vaccination should be administered early in the morning, or later if it is during dry season (Sharif & Ahmad, 2018). Third, improper storage temperature of the vaccine due to limited vaccine flasks distributed to vaccinators in the field. Freeze-dried vaccines require freezing conditions, but lyophilized vaccines can be stored at 4°C, and the low temperature may not be maintained.
correctly during transportation (Sharif & Ahmad, 2018).

Fesseha (2020) stated that a successful vaccination program is reliant on many factors, including vaccine handling, the quality and nature of the vaccine, the use of local antigens, the immunogenic response inside the chicken's body, and following the manufacturer's instructions. Meanwhile, Sharif & Ahmad (2018) identified two types of vaccine failure: antigen factor and host reaction. The following shortcomings in commercially available vaccines may result in vaccine failure: improper vaccine formulation, non-use of local antigens, improper storage temperature, direct sunlight exposure, use of expired vaccines, and virus mutation. In terms of host reaction, the following flaws cause poultry birds that have been vaccinated against diseases do not respond well to vaccinations, resulting in vaccine failure: stress on birds, concurrent disease, immunosuppressive diseases, immaturity of birds, and immaturity of poultry birds. Interaction with maternal antibodies, improper route of the administration in the birds' bodies, inadequate dosage, lack of booster dose, incorrect vaccination timing, and climatic conditions.

Figure 2. The mortality rates of chickens per week in three sub-districts in the Indramayu District

As mentioned previously, the past failure experience of vaccination also affected the number of chickens vaccinated for the second AI vaccination (84 days), as evidenced by the coverage rate of chicken vaccination dropped to 56 percent in Anjatan Subdistrict; and to 64 and 67 percent for Haurgeulis, and Bongas Subdistricts, respectively. The impact of this lower coverage rate of vaccination is that the mortality rate of chickens increased significantly from week 12 (Figure 2). This proves that vaccination is an important aspect that needs to be considered by households in developing chickens.

The coverage rate of ND remained steady for both ND (in 28 days) and ND-IB (in 70 days). This is because these types of vaccines are vaccination drops, which are easier to be done and less sensitive to the chicken than the injectable vaccine, such as the AI vaccine. In general, these IBD and ND vaccinations have a greater coverage rate compared to AI in Indramayu District. The same condition has also been found in West Java and Bali as reported by (Susilowati, 2011). Due to a lower coverage rate of AI, it is required to understand factors that determined farmers' decisions in vaccination programs particularly AI
vaccination. Therefore, the decision analysis of farmers was only focused on the decision to participate in AI vaccination.

Factors determining households' Decision on chicken vaccination

According to the logistic analysis, several factors that significantly affect the decision of households in vaccinating chicken were the number of chicken population, experience in livestock production, size of land/area, and the number of family members, whereas the status of dwelling, and age of farmers had no significant effect on farmers' decision in vaccination program (Table 3). Study by Susilowati (2011), education has significantly no effect to layer farmers' decisions in vaccination programs in West Java. For that reason, in this study, this parameter was excluded from the model. From the logistic analysis, the value of Nagelkerke R square was about 0.364 indicating that the independent variables included in this model as a whole are able 36.4% to explain factors considered in the decision of households in chicken vaccination, even though there are still other parameters (63.4%) outside this model impact on the farmers’ decision. However, the model is claimed to be fit or it can predict the value of its observation since it has Hosmer and Lemehow’s Goodness of Fit Test value of more than 5% (or about P=0.236). A P>0.05, indicates that the hypothesis that the model is not well-fitted can be rejected, in short, the acceptance of the model can be supported by the test (Hilbe, 2015).

Table 3. The output of logistic regression analysis for factors determining the decision of chicken vaccination in Indramayu District

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Odds ratio</th>
<th>Pr &gt; Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-5.879</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Farmers’ age</td>
<td>0.000</td>
<td>1.000</td>
<td>0.984</td>
</tr>
<tr>
<td>Experience in livestock</td>
<td>0.743</td>
<td>2.101</td>
<td>0.011***</td>
</tr>
<tr>
<td>Number of family members</td>
<td>-0.092</td>
<td>0.912</td>
<td>0.064*</td>
</tr>
<tr>
<td>The chicken population</td>
<td>0.165</td>
<td>1.179</td>
<td>0.000***</td>
</tr>
<tr>
<td>Size of land/area</td>
<td>0.007</td>
<td>1.007</td>
<td>0.038**</td>
</tr>
<tr>
<td>Status of dwelling</td>
<td>-0.254</td>
<td>0.776</td>
<td>0.349</td>
</tr>
</tbody>
</table>

*less significant with confidence level 90% (P<0.1); **significant with confidence level 95% (P<0.05); and ***very significant with confidence level 99% (P<0.01)

The chicken population

The number of herds owned by households has a significant positive correlation (P=0.000; P<0.05) in affecting the participation of farmers in the vaccination program. The obvious explanation for this is that farmers will consider losses in this business if there is an outbreak. Then, as the number of chicken populations increases, the probability of conducting vaccination increases 1.179 times (see odds ratio). This was also confirmed by (de Bruyn et al., 2017), that to protect the assets or large flocks of chickens, farmers will participate in the vaccination program. In addition, households consider that the outbreak of disease will be faster in the high density of chickens, thus chickens need to be vaccinated.

Experience in livestock production

The experience of households in livestock production has the expected positive sign and influences significantly (P=0.011; P<0.05) the decision to vaccinate chicken. More experienced households in livestock tend to have good farm management skills (Baliyan & Masuku, 2017), including an understanding of the importance of animals’ health, particularly chicken vaccination. Kamalasari et al., (2019) reported that good previous experience in keeping animals increased the decision to vaccination due to farmers considering the importance of animal health through vaccination. The probability of vaccinating is twice greater for farmers who have more than many years of experience compared to farmers who have no livestock

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farming experience. In addition, households who are involved in livestock also interact with staff of LSA at least one time a year. More access to LSA staff enhances the adoption of intervention (Ochieng et al., 2012) due to these staff provide more information regarding chicken vaccination and the risk of not vaccinating animals (Kamalasari et al., 2019).

**Size of land/area**

The size of land/area owned by households also give a positive effect on their decision on chicken vaccination. Households with larger areas generally have a higher willingness to adopt innovation including vaccination programs due to better social economic conditions (South, 1968). Moreover, respondents with larger areas usually are located close to public areas/roads, and more people can access the land, as a result, this can increase the risk to be infected by a disease, and this affects the decision of households in the vaccination program. The high risk of an area that is close to a public area increases the decision to vaccinate reported (Susilowati, 2011). The probability of vaccinating increases by 1.007 times for farmers as the size of a land area increases.

**Total family members**

The number of family members also correlates but with a negative sign and is less significant to the decision to vaccinate chickens (P=0.064; P<0.01). It is assumed that more family members, and more living costs family, so households require to be more concerned about their chicken production to reach better income by following a vaccination program that can increase chicken productivity. However, this study found differently that with more family members, the probability to be involved in a vaccination program was low. As the number of family members increases, the probability of conducting vaccination decreases by 0.912 times.

Households with more family members likely tend to invest all members in keeping chickens both in chicken handling and environment sanitation, so it can reduce the risk of disease exposure, as a result, a chicken vaccination program become not necessary for households. A study by Prasetyo et al. (2017) has also found that several internal factors such as family members were not significant to influence the adoption level of innovation of the farmers' group of Lembah Meru in Jember District. Moreover, the increasing number of family members does not enhance the probability to participate in vaccination because the decision-maker is usually inspired by the head of the household (Baliyan & Masuku, 2017).

**Status of dwelling**

The status of farmers' dwellings had a negative sign (P=0.349; P>0.1) and not significantly influencing the decision to vaccinate chickens. Households who do not have their own house could be categorized into impoverished households that have a lower income. Campbell et al. (2019) indicated that high-income households enhanced the adoption of chicken vaccination due to an increase in the willingness to pay for the vaccine. However, in this study, lower-income farmers have a higher probability to be involved in chicken vaccination due to the program was a free government program.

**Households’ age**

The age of households is not significantly affecting the decision of farmers in chicken vaccination. This variable was also not significant in the study by Susilowati, (2011). Even, productive households with an average age of 50-52 years old (Table 1) are more mature to decide to participate in the vaccination program, but this study confirms that age has no impact on the vaccination program. Dewi et al. (2015) indicated that age does not affect decision-makers.

**Improved strategy in the vaccination program**

The attitudes of households in the research area were low toward the vaccination program even though at the first vaccination the coverage rate was higher (Figure 1), indicated by a decreased
percentage of coverage rate during six times vaccination, particularly for AI. Whereas, before the BEKERJA program started and assisted chicken was distributed, respondents were given an explanation regarding chicken farming management, including the vaccine programs that would be provided. As a result, the mortality rate started growing from particularly week 12. Households likely have a bad experience regarding their past vaccination or other households which made them resistant to the program (Figure 3). Marsh et al. (2016) indicated that when obtaining better information related to vaccines from other farmers, will increase the adoption of vaccination, likewise. Moreover, previous successful vaccination also significantly affected the willingness to pay for vaccination (Campbell et al., 2019).

![Figure 3. The reason farmers do not vaccinate the chickens](image)

It is suggested an effort to provide better information about the benefits of vaccination as well as how the vaccination should be done to each household. Lindahl et al. (2019) confirmed that knowledge is an important factor in affecting the attitude of households in Kenya and Tanzania towards vaccination. Moreover, households need to understand the required condition of chickens such as healthy chickens, etc. before vaccination to prevent chicken mortality. Vaccination for sick or stressed chickens will lead to the failure of vaccination (Islam et al., 2008).

During vaccination, vaccinators from LSA were helped by village assistances who were recruited to monitor chickens growth in this BEKERJA Program. Even if they received training related to vaccination, they cannot absorb the knowledge, so then they might not check the chicken's condition before vaccination. Only 42 percent of households reported that the chickens were sick. In this case, training about animal health is needed for village assistance and the households. Moreover, the other important strategy that needs to be considered is vaccine handling management which is important to anticipate vaccine damage due to a longer distance between households that need more time to reach the places.

**CONCLUSION**

The vaccination program has successfully implemented in Indramayu District during BEKERJA Program, indicated by a high to moderate coverage rate of chicken vaccination which on average reached about 90.3 percent for IBD and ND and 70.6 percent for AI. The number of chickens population, households’ experience as well as the size of land/area has significantly influenced farmers’ decision on chicken vaccination, while the number of family members has a lesser...
effect on vaccination. In addition, the age of households and status of dwelling is not significantly affected the decision of farmers in vaccination participation. It is recommended for the government through LSA to provide and promote good information related to the importance of vaccination as well as chicken health to households to increase the coverage rate, besides technical logistic aspects such as vaccine preparation and handling.

REFERENCES


Knueppel, D., Cardona, C., Msoffe, P., Demment, M., & Kaiser, L. (2010). Impact of Vaccination against Chicken Newcastle Disease on Food Intake and Food Security in Rural


Description and analysis of the poultry trading network in the Lake Alaotra region, Madagascar: Implications for the surveillance and control of Newcastle disease. Acta Tropica, 135, 10–18. https://doi.org/10.1016/j.actatropica.2014.03.008


