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PEOPLES' BEHAVIOR ON BIOSECURITY MEASURES FOR *HIGHLY PATHOGENIC AVIAN INFLUENZA* CONTROL IN BALI AND LOMBOK¹

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ABSTRACT

Cross sectional studies of live bird market in Bali and Lombok reveal that live bird movement along the supply chain came from various sources within the island such as villages, and sub-district traditional markets. From these markets, the birds are purchased by customers for different purposes such as consumption, ceremonies, religious festivals, and for another stock. The quantity of birds moving along the movement pathways tend to increase during Galungan and Kuningan in Bali, and Maulid and Hari Raya months in Lombok. This study confirms for positive behaviors of all parties involved in the live birds markets - want and tend to buy healthy birds, not to buy the sick birds. Transportation and management of birds at the markets reveal some behaviors that against such recommended biosecurity practices. Collectors and Vendors do not really separate the birds according to the bird species and sources, mixing the birds in a cage during the transportation and selling at the markets. Slaughter activity is another point in the live bird movement pathway where risk for AI transmission is identified. People that involve in bird slaughter apply minimal biosecurity requirements. They do not use hand gloves, mask, boots, clean cloths, and other clean equipments. The slaughter areas are also neglected for their good and better slaughter management. On the basis of these findings, there is a need to take strategic collective action to help all stakeholders along the supply chain comply with AI Control Strategies. Policy and non-policy approaches are needed in addressing issues that exist around the live bird movement in those high risky points!

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1. Introduction

Transboundary animal diseases (TAD) continue to exist and limit livestock production in south-east Asia and, by their ongoing presence in the region, pose a threat to Australian livestock industries. In addition, highly pathogenic avian influenza (HPAI) has caused human deaths in the region and is a significant international public health concern. Effective control of these highly infectious animal diseases requires coordinated implementation of targeted control activities across a region. Success in control of a TAD can be achieved, as demonstrated by foot-and-mouth disease (FMD) eradication in the Philippines, when there is adequate government and veterinary infrastructure to implement an appropriate set of control tools (such as vaccination, quarantine, biosecurity procedures).

Movement restriction or quarantine is an essential component of TAD control to prevent introduction of disease to uninfected areas. Once a control program has commenced in an endemic area, activities to prevent and/or minimise TAD reintroduction via infected animals and products are essential and may include movement restriction, surveillance of high risk movements, extension to support early detection and response, and testing or vaccination of introductions. Evidence of disease spread through movement of domestic animals and animal products is compelling for FMD and CSF, and is accumulating for HPAI. A recent investigation of transmission pathways for HPAI introduction into individual countries in the current global pandemic determined that poultry trade was the avenue for introduction to 9 Asian countries including Indonesia (Kilpatrick et al. 2006). This exemplifies the importance of movement restriction and targeted surveillance in the prevention and control of TAD.

In Indonesia the consequences of unrestricted animal movement are well demonstrated by CSF. This country was CSF-free until 1993 when pig movement led to CSF spread from Malaysia to Sumatra and then on to Java, Bali, Kalimantan, Sulawesi and Nusa Tenggara Timor (NTT) between 1994 and 1998 despite the implementation of vaccination programs (Hutabarat and Santhia, 2000). CSF is now endemic in Eastern Indonesia and causes substantial losses in terms of pig deaths and reproductive failure.

HPAI, now endemic in poultry in 29 of 33 provinces in Indonesia, provides another example of a disease that has spread quickly across the country since introduction in 2003. The entry and spread of HPAI, most likely via movement of infected poultry, appears to have been impeded little in this country by control programs focused on culling and vaccination. The consequences to date include 81 human cases, 63 of which were fatal, and an immense loss

for the poultry industry reported in 2004 to be 17 million birds by death due to HPAI or culling at an estimated cost of A\$1 billion (Hartono 2004). In contrast to the large outbreaks in Java and Bali, NTT has reported only a few suspect outbreaks. The prevention of HPAI incursion in NTT is the direct result of a provincial decree that permits entry only to day old chicks and eggs from specified high biosecurity farms in Surabaya. This is unequivocal evidence that policy to restrict animal and animal product movement based on qualitative risk assessment can successfully prevent regional HPAI incursion in Indonesia.

A *cross-sectional study* was carried out to determine trends in quantity, sources, destinations and management of chickens and ducks at selected markets in Bali and Lombok – and also to understand peoples' behaviours in regard to biosecurity measures to protect their folks. This paper presents the findings on peoples' knowledge and perceptions of AI, and biosecurity practices. On the basis of these information and data, the last section of the report presents a qualitative assessment of risk associated with chicken and duck movement.

2. Biosecurity Measures on Avian Influenza Control

Biosecurity means doing everything you can to protect your birds from disease. By practicing biosecurity you can keep your birds safe from germs by creating and using a biosecurity plan. In simple terms, biosecurity is informed common sense. Don't bring germs to your birds and don't bring your birds to germs. Germs are persistent, invisible killers that can survive in soil, droppings, and debris waiting to hitch a ride into your backyard and into your flock. Biosecurity practices don't have to be cumbersome (complicate) or expensive. In fact, a small tub, a gallon of bleach or disinfectant, and a brush will go a long way toward protecting your birds from "outside" disease. Your property needs to be a "safe" area and biosecurity practices are the barriers you can use to keep disease out. Infected flocks is always related to a breakdown of Biosecurity (birds, people, equipment, etc.)

In other words, biosecurity is the set of precautions taken by the bird owner to minimize the risk of infection (AI or otherwise) that comes from contact with visitors (avian, human, or equipment). Biosecurity- preventing the introduction of infectious agents into a flock. There are three types of methods:

- Control human traffic
- Control equipment (Avoid sharing with other bird owners, keep clean, etc.)
- Isolate birds from others (Keep wildlife out. Avoid mixing young and old birds, as they may be more or less susceptible to illness, and be carriers without showing signs)

The following three points could help to prevent AI from the flocks:

- **Look for Signs.** Watch for signs of disease or unexpected deaths among your birds.
- **Report Sick Birds.** *Don't wait!* Early detection can make a difference.
- **Practice Backyard Biosecurity.** Keep your birds free from disease. Restrict traffic on your property, and disinfect shoes, clothes and hands to prevent the possible spread of disease.

Biosecurity Tips: 6 Ways To Prevent Poultry Disease

1. Keep Your Distance

- Restrict access to your property and your birds. Consider fencing off the area where your birds are to form a barrier between “clean” and “dirty” areas. The clean area is the immediate area surrounding your birds, and the dirty or buffer area must be considered to be infected with germs, even if the birds appear healthy and disease free.
- Allow only people who take care of your birds to come into contact with them. Your caretakers should not attend bird shows or other events where birds are present. If visitors to your property want to see your birds, be sure they wash up first and clean their shoes. Better yet, keep clean boots for visitors to wear. If your visitors have birds of their own, **do not** let them near your birds at all.
- Game birds and migratory waterfowl should not have contact with your flock because they can carry germs and diseases. If your birds are outdoors, try to keep them in a screened area.

2. Keep It Clean

- You wouldn't think of tracking dirt and disease into your house, where it could infect your family. Don't do that to your birds either! Germs can be picked up on shoes and clothing and moved from one area to another. To keep your birds “germ-free,” keep a pair of shoes and a set of clothes to wear only around your birds. Many people keep these clean clothes in a covered pail at the entrance to their bird area. Or, clean and disinfect your shoes and launder your clothes before you check on or work with your birds.

- Scrubbing your shoes with a long-handled scrub brush and disinfectant will remove droppings, mud, or debris. Clothes should be washed in a washing machine with laundry detergent.
- Wash your hands thoroughly with soap, water, and a disinfectant before entering your bird area.
- Keep cages, food, and water clean on a daily basis. Clean and disinfect equipment that comes in contact with your birds or their droppings. That includes tools such as feed scoops, shovels, rakes, and brooms. All manure must be removed before disinfectant can work, so clean surfaces with soap and water first. Properly dispose of dead birds by burial or incineration or take them to a landfill. Check on local ordinances for acceptable disposal methods.

3. Don't Haul Disease Home

Car and truck tires, poultry cages, and equipment can all harbor “germs.” If you travel to a location where other birds are present, or even to the feed store, be sure to clean and disinfect these items before you return to your property. Car and truck tires, poultry cages, and equipment can all harbor “germs.”

4. Don't Borrow Disease From Your Neighbor

Do not share birds, garden equipment, tools, or poultry supplies with your neighbors or other bird owners

5. Know the Warning Signs of Infectious Bird Diseases

Eight common signs of AI are (1) Sudden death, (2) Diarrhea, (3) Decreased or complete loss of egg production; soft-shelled, misshapen eggs, (4) Sneezing, gasping for air, nasal discharge, coughing, (5) Lack of energy and appetite, (6) Swelling of tissues around eyes and in neck, (7) Purple discoloration of the wattles, combs, and legs, (8) Depression, muscular tremors, drooping wings, twisting of head and neck, incoordination, complete paralysis

6. Report Sick Birds

Do not wait to report unusual signs of disease or unexpected deaths among your birds.

Disinfectants: Cleaning and disinfecting is one of the most important steps you can take in practicing backyard biosecurity.

3. Research Methods

Interviews and observation were used to gather data on formal movement of chickens and ducks through selected markets in Bali/Lombok at quarterly intervals. A total of 17 live bird markets were selected for the study.

At both sites (Bali and Lombok), these interviews were carried out in the form of informal, semi-structured questions (mix of open and closed questions) with traders, retailers and customers to build their trust and willingness to participate in the project (Minichiello, et al. 1995). When it is identified that customers or traders operate as a collective to market animals focus group interviews (Cameron, 2005) was also held to gain further understanding of livestock markets and movements. Observations at markets was conducted after gaining trust and confidence of traders and sellers in order to reduce levels of suspicion and mistrust (Babbie, 1998).

4. Research Findings from Cross Sectional Studies in Bali & Lombok

4.1. Respondents' knowledge and perception of avian influenza

Sources of AI knowledge

On the basis of round 1, 2 and 3 data collection, there are two main sources of AI knowledge for the vendors/collectors, **first**, *television program or news*, and **second**, from other people such as *their friends or* and from related official agents – Department of Livestock who came and informed them about AI. These agents also facilitated spraying of disinfectants at the markets, and according to the vendors, so far it was done once.

This study also reveals that other mass media such as *newspaper, books, magazine and poster* were not effective enough to disseminate AI information. As it is summarized in Table 1, almost 100 percent of the study respondents did not use them to know or learn about AI. Some respondents even do not know anything about AI (number 7 in the Table).

Table 1. Distribution of Respondents according "From Where They Learned about AI", 2009.

Learnt AI from	Round 1						Round 2					
	V	%	Co	%	Cu	%	V	%	Co	%	Cu	%
1. Television	35	83.3	31	91.2	33	97.1	30	77	26	96	26	81.3
2. Radio	0	0	0	0	2	5.9	1	3	4	15	4	12.5
3. Newspaper/books/magazines	0	0	0	0	11	32.4	0	0	0	0	1	3.1
4. Pamphlets/brochure	2	4.8	2	5.9	5	14.7	0	0	1	4	0	0
5. Posters	0	0	1	2.9	1	2.9	0	0	0	0	0	0
6. Other people (friends, field agents)	6	14.1	6	17.7	3	8.8	10	26	5	19	4	12.5
7. Other – specify (don't know)_____	3	7.1	3	8.8	1	2.9	2	5	1	4	5	15.6

Remarks: V: Vendor, Co: Collectors, Cu: Customer

Learnt AI from	Round 3					
	V	%	Co	%	Cu	%
1. Television	65	70	16	73	16	72.8
2. Radio	0	0	0	0	1	4.55
3. Newspaper/books/magazines	1	1	0	0	1	4.55
4. Pamphlets/brochure	0	0	1	5	0	0
5. Posters	0	0	0	0	0	0
6. Other people (friends, field agents)	18	19	7	32	0	0
7. Other – specify (don't know)_____	13	14	4	18	6	31.85

Remarks: V: Vendor, Co: Collectors, Cu: Customer

Respondents' knowledge and perceptions of AI

Based on data collected in round 1, 2 and 3, it was found that vendors and collectors do not really understand the more specific and detail characteristics or symptoms of AI. When they were asked about "how is AI introduced to the Live Bird Market", most respondents stated that AI was introduced through "infected poultry" (about 70 % vendors & collectors). The second possible ways for AI introduction to the live bird market perceived by the collectors and vendors contaminated cages, however, this proportion less than those who do not really know how AI is transmitted (Table 2).

Data presented in Table 2 reveal that high proportion of respondents (almost 30% vendors and collectors in Round 1; 44% vendors in Round 2; 48% vendors in Round 3) also provides "do not know responses" (presented as "Other" in the Table) in response to the AI introduction question. This low level of peoples' knowledge on AI could also be understood due to for example (1) no experience or never be infected by AI, and (2) lack of personal

approach in socialization of AI – or AI campaign. The respondents claimed that AI just happened to broiler and in Java.

Table 2. Respondents' Knowledge on "How is AI Introduced into the Live Bird Market"

How AI introduce to LB Market	Round 1				Round 2				Round 3			
	V	%	Co	%	V	%	Co	%	V	%	Co	%
1. Infected poultry	27	64.3	28	82.4	22	56	25	93	47	51	17	77
2. Infected wild birds	0	0	2	5.9	0	0	4	15	1	1	0	0
3. Contaminated vehicles	0	0	0	0	0	0	0	0	0	0	0	0
4. Contaminated cages	9	21.4	9	26.5	1	3	8	30	0	0	2	9
5. Contaminated clothing/footwear	0	0	0	0	0	0	0	0	0	0	0	0
6. others (don't know)	12	28.6	9	26.5	17	44	2	7	45	48	4	18

Remarks: V: Vendor, Co: Collectors, Cu: Customer

How to prevent AI transmission

Consistent with the fact for lack of respondents' knowledge on AI, they (vendors, collectors and consumers) also provided limited responses to the questions on "how to prevent AI transmission at their respected markets". Most respondents pointed out actions such as cleaning cages (about 56 %), disposal sick and dead birds (26 %), cleaning stall area (21 %), and vaccination (17 %) – Table 48. On the other hand, most vendors and collectors neglecting the importance of separating birds according to their species and sources. They also put less favorable to the importance of cleaning vehicles. Observation on the vendors and collectors behaviors found in fact that they do not separate birds according the bird sources. For collectors with limited cages, mixing the birds such as chicken, duck, Muscovy is the common practices.

Table 3. Respondents' Knowledge on "How to Prevent AI Transmission at Their Market"

Necessary Actions to prevent AI at Market	Round 1				Round 2				Round 3			
	V	%	Co	%	V	%	Co	%	V	%	Co	%
1. Vaccinate birds	6	14.1	4	11.8	10	26	6	22	14	15	3	14
2. Clean cages	28	66.7	22	64.7	18	48	21	78	28	30	11	50
3. Clean stall area	8	19.1	10	29.4	4	10	10	37	6	6	5	23
4. Clean vehicles	0	0	1	2.9	0	0	1	4	5	5	6	27
5. Separate different bird species	2	4.8	4	11.8	2	5	4	15	6	6	2	9
6. Separate birds from different sources	1	2.4	0	0	0	0	0	0	2	2	0	0
7. Disposal of sick or dead birds	18	42.9	8	23.5	3	7	4	15	26	28	9	41
8. Other (do not know)_____	8	19.1	10	29.4	14	36	3	11	55	59	8	36

Remarks: V: Vendor, Co: Collectors, Cu: Customer

Willingness to report AI suspect

Two third of vendors and collectors expressed their negative attitudes toward AI prevention – Table 4. They said “No” to the questions of “*would you report for AI suspect?*” They are reluctant to report due to lack of information where to report, and they said that it is our own business (the risk belongs to them). Some of them said “no one responsible for the death birds except themselves” (so make no different even though they report the case). However, those who are willing to report, most of them prefer *to report to the head of kampong or sub-village*. Few of them would like to report to the local Livestock Office or the Department of Health.

Table 4. Respondents’ Willingness to Report AI Suspect.

Would you report for AI Suspect?	Round 1				Round 2				Round 3			
	V	%	Co	%	V	%	Co	%	V	%	Co	%
1. Yes	33	78.6	9	26.5	16	41	6	22	13	14	3	14
2. No	18	42.9	23	67.7	19	48	18	67	66	71	17	77
3. Possibly	1	2.4	2	5.9	3	7	3	11	14	15	2	9

This three round data collection highlights that vendors, collectors and consumers interviewed in this cross sectional studies expressed that they never involved in cock fighting competition. Data reveal that they did not have any fighting cock at home.

Evaluation of Practices in Relation to Highly Pathogenic Avian Influenza

On the basis of data collected from this cross sectional studies, a qualitative analysis was applied to identify the level of risk associated with live bird movement and marketing management practices. At it is summarized in Table 5, the study reveals that the existing patterns of movement and management practices are at a *high risk* for HPAI transmission. This high risk for AI transmission is identified along the supply chain, from the first transaction point (between producer and village collectors) to the last transaction point (between live bird vendors and customers), or from the village level to the market level.

This high level of risk for AI transmission is due to low level of people knowledge, negative attitudes and perceptions toward AI and the need for proper marketing and bird management practices. Almost all practices identified and observed along the supply chain are prone to *AI virus release* and *exposure* that lead to AI case and transmission to the healthy birds. The study found that none of vendors and collectors use hand gloves, mixing their birds in the same cages/stall, keeping sick birds at and around the healthy birds, leaving the dead bird wherever they like, mixing the sick bird and the healthy birds, selling the sick birds at a lower

price, and even slaughter the sick birds for selling and or their own consumption. All these practices are against biosecurity measures that recommended in controlling AI transmission.

Table 5. Gaps between Ideal, Knowledge and Practices – Identified Risk.

Ideal biosecurity	Knowledge, attitudes & perceptions	Practices (vendor, collector & customer)
Provide clean or disposable coveralls, head covers, and plastic boots or boots that can be cleaned and disinfected	Lack of knowledge on AI signs, AI transmission, actions to prevent AI release and exposure, and proper management practices during the transportation, at the markets and slaughter points	No head cover, no gloves, no boots
Do not share equipment or vehicles with other farms	Lack of knowledge on proper actions to prevent AI release and exposure during transportation, and at the slaughter point	Equipments, vehicles, stall/pens & cages were shared Mixing birds (even the sick birds with healthy birds)
Change disinfectant foot baths daily. Place foot baths at outside entries to poultry house(s) and egg room(s)	Lack of knowledge on AI transmission, actions to prevent AI release and exposure, and proper management practices	No particular disinfectant used at all points along the supply chain
Reduce traffic coming onto your premises	Lack of knowledge on AI signs, AI transmission, actions to prevent AI release and exposure, and proper management practices during the transportation, at the markets and slaughter points	Birds moving from one market to another as the vendors and collectors moving from one market to another to buy and sell birds
Dispose of dead birds safely (incineration, burial, composting, rendering). Never pile dead birds outside of a building or spread them on fields	Lack of knowledge on AI signs, AI transmission, actions to prevent AI release and exposure, and proper management practices during the transportation, at the markets and slaughter points Negative perceptions on sick birds – no problem to slaughter and eat sick birds	Draw dead birds every where
Report any increased illness or mortality to your company	Limited knowledge on AI risk management, lack of awareness to help prevent AI transmission and out-break	Not and reluctant to report to formal agencies

However, there are several positive points that promising for less likely of AI transmission as the vendors and collectors tend and eager to *buy healthy birds*, have a *good knowledge and skills* in identifying the difference between *healthy* and *sick birds* as they always observe and check the birds they are buying and collecting. The study confirmed that vendors and collectors know the healthy birds from observing the bird's performance such as by looking at and examining the birds' comb, feather, nose, mouth, wings, feces, and buttock.

5. Conclusions & Recommendations

Cross sectional studies of live bird market in Bali and Lombok reveal that live bird movement along the supply chain came from various sources within the island such as villages, sub-district traditional markets. The birds originally from backyard farmers, collected by small or village level collectors then bring into sub-district and district level live bird markets. From these markets, sub-districts and district level markets, the birds are purchased by customers for different purposes such as consumption (households, and restaurants), ceremonies and offering in certain religious festivals, and for another stock of the other farmers.

In line to the dynamic of peoples' live and activities during the year, the quantity of birds moving along the movement pathways also fluctuated during the year. This study found that the numbers of birds tend to increase during certain time and months of the year such as Galungan and Kuningan in Bali, and Fasting and Hari Raya months in Lombok (for the Muslim communities).

This study also confirms for positive behaviors of all parties involved in the live birds markets. Vendors, Collectors, and Customers are all want and tend to buy healthy birds. They examine birds' physical performance to ensure that the birds are healthy, and once they are convinced, then they make a decision to buy it. On the other hand, another common practice is that they would not buy the sick birds. At this points (decision points for ownership change), the behavior is positive to support better risk management and control for AI transmission. After this point in the movement pathway, some issues of concerns are identified.

Transportation and management of birds at the markets reveal some behaviors that against such recommended biosecurity measures. Collectors as well as Vendors do not really separate the birds according to the bird species and sources. The birds are mixing in a cage during the transportation and even at the selling point at the markets. Birds are also moving from one market to other as mobile Vendors and Collectors are also moving from one market to another market during the week to buy and sell the birds.

Slaughter activity is another point in the live bird movement pathway where risk for AI transmission is identified. People that involve in bird slaughter apply minimal requirements to do their job. They do not use hand gloves, mask, boots, clean cloths, and other clean equipments. Moreover, the slaughter areas are also neglected for their good and better slaughter management. In short, the way how they behave and manage their birds, stalls and slaughter areas are at a risky situation for AI transmission as they are not comply with FAO

recommendations (AI Management and Protocol recommended by the Indonesian Government) to protect birds from AI.

All those behaviors and practices have been associated with the peoples' lack of knowledge on AI, negative attitudes and perceptions of poultry diseases such as AI. Vendors and Collectors perceived that "slaughtering and eating sick birds would not be a problem for as they have done for generation". On the basis of these findings, there is a need to take strategic collective action to help all stakeholders along the supply chain comply with AI Control Strategies. Policy and non-policy approaches are needed in addressing issues that exist around the live bird movement in those high risky points!

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