

# ANALYSIS OF POTENTIAL HEALTH AND ECONOMIC IMPACT OF LARGE AVIAN INFLUENZA EPIDEMICS IN INDONESIA

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## ABSTRACT

*The analysis of potential health and economic impacts from large epidemics on avian flu in Indonesia had been conducted using several sources including data from health, agriculture, tourism and transportation sectors. This analysis aimed to socialize the understanding on negative impacts and the size of burden if a large epidemic happened in Indonesia. It was estimated 43.2 million people will suffer from avian flu with a total deaths in the first two weeks at about 525,000 persons and 605,000 cases need hospitalized in the first 2 (two) months of epidemics. The cost needed for case managements reach 539.9 million US Dollars. In agriculture sector, the direct lost because of disease or stumping out of poultry reached 97.2 million US Dollars and the preventing cost using vaccines for poultry is 74.7 million US Dollars. In tourism sector, the losses reached 8.6 million Dollars and in transportation sector reached 1.7 milliard US Dollars just in the first two months. The negative impact will increase if the epidemic was in a long duration or the virus type is more virulent. So the government and community efforts to do promotion and preventive activities including preventing the virus transmission in poultry, to protect if the epidemic starts and to decrease the negative impacts for community health is important to manage the situation.*

**Key words:** economic, health, impacts, avian flu, large epidemics

## INTRODUCTION

As of December 2007, the Avian Influenza human cases has been found in 42 districts/cities located in 12 provinces of Indonesia (North Sumatra, Riau, South Sumatra, Lampung, Banten, Greater Jakarta, West Java, Central Java, East Java, South Sulawesi, West Sulawesi and Bali) with 115 confirmed cases and 94 deaths. Case Fatality Rate is still high, around 81.7%; that is higher than the experience of other Asian countries or global estimation (60,97%) ([www.litbang.depkes.go.id](http://www.litbang.depkes.go.id)).

Infected poultry flocks have been found in 27 of the Indonesia's 33 provinces. Cluster of cases have been found in 8 events, with the largest cluster found in Karo District, North Sumatra; where from 9 cases of Avian Influenza, 7 cases died.

The National Commission for Avian Influenza Pandemic Preparedness and Control, at the Coordinating Ministry of Social Welfare has issued the National Strategy for the Control of Avian Influenza, but the transformation of the strategy into actions in

the province/district/city in Indonesia is still needed ([www.komnasfbpi.go.id](http://www.komnasfbpi.go.id)).

The Ministry of Health has strengthened 44 referral hospitals for Avian Influenza, as well as 8 AI Laboratories in 8 provinces.

Any estimate of macroeconomic impact of Large Avian Influenza Epidemic is actually difficult, since many determinants and uncertainties around the timing, nature, severity of the epidemic; the country and community responses, the availability of vaccine and other medical technology to curb the situation. Avian Influenza has already caused significant economic damage, particularly in the agricultural sector (poultry production).

The general objective of the study is to estimate quantitatively the potential health and economic impact of large Avian Influenza epidemic in Indonesia.

The specific objectives are as follows:

1. to estimate the magnitude, spread and distribution of Avian Influenza in Indonesia in large epidemic situation

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2. to estimate the number of cases and deaths in the 2 months epidemic
3. to estimate the impact to the health sector, including to the health personnel and delivery of essential health services
4. to estimate the economic impact (in health and other sectors) of the epidemic from the macro perspective

## METHODS

The Avian Influenza cases during one episode of epidemic is estimated, this will include the magnitude, spread and distribution of Avian Influenza cases and deaths; using the current epidemiologic behavior and trends of the disease. Current capacity of the health sector and availability of essential drugs, including current anti viral drugs medical supplies and equipment in health facilities will be incorporated in the analysis; since this will contribute to the case management and Case Fatality Rate of the disease.

The significant macroeconomic impacts will include: reduced labor force and productivity due to illness/absenteeism and caring responsibilities, absenteeism of students (schools and Academies/Universities), breakdown in transportation and communication systems, banning of travel (national and international), breakdown of the tourism industries and poultry industries, increased absenteeism of workers, etc.

In this study, a working assumption of severe disruption lasting for 2 months in 2008 will be used.

Economic costs that need to be considered for each sector include direct costs for example in Agricultural Sector, losses of poultry due to the disease and to control measures (culling), with impacts extending not only to farmers, but also to upstream and downstream sectors, such as poultry traders, feed mills, breeding farms.

The effect of increased illness and mortality will influence the size and productivity of the country labor force. Business costs will increase due to workplace absenteeism, disruption of production processes and shifts to more costly procedures.

There are uncertainties about the timing, virulence (inherent lethality of the virus), coverage of epidemics and general characteristics of the future human influenza pandemic. Many experts argue that "Clinical, epidemiological, and laboratory evidence suggests

that a pandemic caused by the current H5N1 strain would be more likely to mimic the 1918 pandemic than those that occurred more recently. If we translate the associated rate of death to the current world population, it could cause 180 million to 360 million deaths globally" (Osterholm 2005).

## RESULTS

### Situational Analysis

Since 2003, outbreaks of Avian Influenza among poultry has been reported in 31 out of 33 provinces in Indonesia. Many farms as well as backyard flocks were affected with millions died. The increasing wide spread of AI is caused by the uncontrolled movement of infected birds and poultry products.

The costs for the government and the community are mostly related to the death of poultry from the disease itself, the culling of poultry to stem its spread, and the costs to the government of containing the epidemic in terms of equipment, materials, transport and personnel. FAO Survey in Indonesia indicates that more than 20 percent of permanent industrial and commercial farm workers lost their jobs.

The disease is of particular importance to Indonesia because the poultry industry is important to both the national and the local economy. Indonesia has an estimated standing population of 600 millions poultry, giving a population of approximately 1.5 billion each year. There are 80–85 million layers and over one billion broilers are produced annually. Sector 4, the village and backyard sector, is estimated to comprise some 300 millions poultry in 30 millions households. Sixty five percent of Indonesian poultry are in Java. Total investment in poultry is estimated to be US\$ 35 billion, with a turn-over of US\$ 30 billions per year. The majority of the production is sold through an estimated 13,000 conventional markets daily, while major abattoirs process only 20% (Ministry of Agriculture, 2007).

Assessment by WHO indicates that multiple factors contribute to human infection. The majority of cases have been associated with close contact to sick or dead chickens, although contamination of the environment and not only direct contact with birds may also be important factors ([www.who.int](http://www.who.int)).

Human cases of avian influenza infection continue to be detected in Indonesia. The human epidemic curve shows fluctuation in monthly incidence of the disease

without a clear trend or seasonal peak. The case profiles are similar to those in other countries, where the average age of infected people is approximately 20 years and the distribution of cases is relatively equal in males and females.

There are currently 33 districts/cities (out of 450 districts/cities) reporting confirmed human cases. At present, WHO states that there has been no sustained human to human transmission and the pandemic alert model remains at level three; that is "Human infections with a new subtype but no human to human spread, or at most rare instances of spread to a close contact".

### ESTIMATING THE MACROECONOMIC COSTS OF LARGE AVIAN INFLUENZA EPIDEMIC

The gross attack rate expresses the percentage of the population that is likely to become clinically ill. Influenza pandemics typically have a gross attack rate of 20–40% (Taubenberger 2005). It is estimated that in the case of Spanish Flu Pandemic in 1918, the mortality rate was between 2.5–5% of the population (Barry, 2005).

Exercise on estimating the number of cases and total deaths due to Avian Influenza in 2008 has been conducted using the following assumptions:

Gross Attack Rate : 20%  
Case Fatality Rate : 1.25%

The Gross Attack Rate expresses the percentage of the population that is likely to become clinically ill. The potential range is quite high. Typically influenza pandemics have a gross attack rate of 20–40% (Taubenberger 2005).

The very young and the old are at the greatest risk of mortality, however each Influenza outbreak is different and it is not possible to predict what groups will be most vulnerable.

In this exercise, the assumptions are that the attack rate and the risk of mortality are the same across the age groups and the epidemics are prevalent in all parts of Indonesia, lasting for about 2 months (8 weeks) for the first wave. The disease lasts for one year and is relatively well spread throughout the year.

Total number of Indonesian population in 2008 is 228,454,500 (BAPPENAS, BPS & UNFPA, 2005), with distribution by sex and age group as follows:

**Table 1.** Cumulative number of confirmed human cases and deaths of Avian Influenza (H5N1) reported to WHO globally, September 2007

Country	2003		2004		2005		2006		2007		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	0	0	0	0	0	0	8	5	0	0	8	5
Cambodia	0	0	0	0	4	4	2	2	1	1	7	7
China	1	1	0	0	8	5	13	8	3	2	25	16
Djibouti	0	0	0	0	0	0	1	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	20	5	38	15
Indonesia	0	0	0	0	20	13	55	45	31	27	106	85
Iraq	0	0	0	0	0	0	3	2	0	0	3	2
Lao PDR	0	0	0	0	0	0	0	0	2	2	2	2
Nigeria	0	0	0	0	0	0	0	0	1	1	1	1
Thailand	0	0	17	12	5	2	3	3	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	12	4
Viet Nam	3	3	29	20	61	19	0	0	7	4	100	46
<b>Total</b>	<b>4</b>	<b>4</b>	<b>46</b>	<b>32</b>	<b>98</b>	<b>43</b>	<b>115</b>	<b>79</b>	<b>65</b>	<b>42</b>	<b>328</b>	<b>200</b>

Source: WHO, September 22, 2007 - Total number of cases includes number of deaths.  
WHO reports only laboratory - confirmed cases

**Table 2.** Population by Sex and Age Group, Indonesia, 2008

Age Groups	Population		
	Male	Female	Total
0–4	10,514.200	10,119.200	20,633.400
5–14	20,743.600	20,055.500	40,799.100
15–44	57,817.700	58,427.900	116,245.600
45–59	16,809.300	16,078.300	32,887.600
60 +	8,513.400	9,375.400	17,888.800
Total	114,398.200	114,056.300	228,454.500

The total number of Avian Influenza cases in the population, if there is large epidemic in 2008, is estimated around 43,283,020; with details as follows:

**Table 3.** Estimated total number of Avian Influenza cases in the population by age group and sex, Indonesia 2008

Age Groups	No. of Cases		
	Male	Female	Total
0–4	2,055,460	1,982,360	1,982,360
5–14	4,267,260	4,127,360	8,394,620
15–44	10,993,340	11,125,500	22,118,840
45–59	2,855,880	2,683,840	5,539,720
60 +	1,511,780	1,680,240	3,192,020
Total	21,683,720	21,599,300	43,283,020

**Table 4.** Estimated number of deaths due to Avian Influenza in the population, by age group and sex, Indonesia 2008

Age Groups	No. of Deaths		
	Male	Female	Total
0–4	25,693	24,780	50,473
14 May	53,341	51,592	104,933
15–44	137,417	139,069	276,486
45–59	35,699	33,548	69,247
60 +	3,779	21,003	24,782
Total	255,928	269,991	525,919

Total number of deaths in the large epidemic of Avian Influenza that lasts for 8 weeks in 2008, will be 525,919 (Table 4).

Potential Years of Life Lost due to Premature Mortality, using the Indonesian Life Table, shows the potential loss of 14,848,590 productive years (Table 5).

**Table 5.** Potential Years of Life Lost due to Premature Mortality in Large epidemic of Avian Influenza, Indonesia 2008

Age Groups	Potential Years of Life Lost		
	Male	Female	Total
0–4	877,180	854,730	1,731,910
14 May	1,966,140	1,918,010	3,884,150
15–44	3,949,880	4,046,400	7,996,280
45–59	546,060	500,120	1,046,180
60 +	27,950	162,110	190,060
Total	7,367,210	7,481,380	14,848,590

Applying the income per capita in 2008 of about US \$1,300.00; it is estimated that the macroeconomic loss due to Avian Flu in Indonesia will be about 19.3 billion US Dollars.

#### ESTIMATING THE IMPACT OF LARGE AVIAN INFLUENZA EPIDEMIC TO THE HEALTH SECTOR

With the assumption that access of communities to the modern health care facilities/health personnel for out-patient services in all over Indonesia is 70% it is estimated that the total number of out-patient visitors will be 30,298,114. If each patient comes two times, it will become 60,596,228 visits.

Current policy of government for supporting the H5N1 out patient treatment per case: for diagnosis Rp.10,000, medical examination Rp.11,000–Rp. 22,000; Laboratory examination Rp. 27.000, Radiology examination Rp.48.000, and only small patients have additional budget for drugs with high variation (average Rp. 16,330,-). Budget reimbursement for out patient is about Rp. 54,900.00,- per case, consists of cost of medical examination, laboratory, radiology and drugs. Only 27% from all out patient had laboratory (average cost of Rp. 54,000.00 per case) and radiology (average cost of Rp. 96,000.00 per case) for diagnostic purposes.

With the estimated government price of Rp. 54,900.00 (US \$6.10,-) per case to be reimbursed,

the total minimum budget should be provided for reimbursement by the government will be in the amount of 3.33 trillion rupiahs or 396.6 million US Dollars (US \$ 396,636,990.08,-). If there are additional costs for drugs, laboratory and radiology examinations; the total costs may become five to six times, and this difference will be burdened to the patients.

Assuming that 2% of cases with access to outpatient services will be hospitalized, about 605,962 cases will be hospitalized in 2 months of epidemic.

Applying the average cost of in-patient services of Rp. 8,019,209 per case per episode (average cost in Jakarta Public General Hospitals), that includes medical examinations, specialist consultation, nursing care, drugs, medical consumables, laboratory and radiological examination; the total costs of hospitalization will be in the amount of 4.85 trillion rupiahs or equal to 539.9 million US Dollars (US \$539,926,213.00) for 2 months of epidemic.

## ESTIMATING THE ECONOMIC IMPACT TO OTHER SECTORS

### 1. Impact to the Agricultural Sector

In 2003 and early 2004, it is estimated that about 16.2 million of poultry were stamped out in control efforts and some more died due to the disease. This figure excludes those lost from backyard farms for which no accurate estimates are available.

The estimated total Poultry population in Indonesia in 2008 is 1,400,743,038 (Chickens: 1,366,130,981 and Ducks: 34,612,057).

Poultry systems in Indonesia affected by Avian Influenza are as follows:

- Industrial : 3.5% of poultry, export and national Consumption (49,026,006)
- Large Commercial : 21.2% of poultry (296,957,524)
- Small Commercial : 11.8% of poultry (165,287,678)
- Backyard : 63.4% of poultry (888,07,086)

Assuming that about 5 % of total poultry population will die during epidemic due to the disease or culling actions, the total number will be 70,037,152. If the average price for a chicken is Rp. 12,500,-; the total direct cost of the disease is 875.4 billion rupiahs or equal to 97.2 million US Dollars.

Includes in the direct costs is the prevention costs to avoid further loss, such as vaccination efforts (vaccine and operational costs). The price of per dose of vaccine is between Rp. 240.00 to Rp. 385.00. A chicken should receive on average 4 vaccinations, or Rp. 960.00 to Rp. 1,540.00 per chicken. With the assumption that only 50 % of poultry population (700,371,519) will be vaccinated, with the unit cost of Rp. 960.00,-; the estimated total cost will be in the amount of 672 billion rupiahs (74.7 million US Dollars).

The actual indirect costs will include loss of opportunity costs due to the shut-down of poultry industries, lost of employment, decreased production of poultry meat industries, decreased poultry traders, feed mills, and breeding farms. These were not estimated in the study.

### 2. Impact to the Tourism Sector

Indirect impact to the Tourism Sector is due to the decreased income of the sector due to the epidemic. These are closely related to the estimated expenditures and consumption of the foreign and domestic tourist in Indonesia.

These can be grouped into 10 components, namely:

- a. hotel & accommodation
- b. restaurant
- c. transport
- d. travel bureau & tour operator
- e. tourist guide
- f. socio-cultural, recreation and entertainment services
- g. other services
- h. souvenirs
- i. health and beauty service
- j. non-food product
- k. agricultural product.

The decreased number of foreign tourists and their related expenditures was experienced in 2006, due to SARS Issue, Earth-quake and Tsunami, Travel Warning, etc.

Projected expenditures of tourists for 2008, by applying the trend in 2006–2007 are as follow:

It is estimated that the domestic tourists will spend 81,469.99 million rupiahs and foreign tourists will spend 73,385.81 million rupiahs in 2008.

The total loss of income in tourism sector due to a large epidemic of AI is estimated in the amount of

**Table 6.** Expenditures of tourists (in million rupiahs) for 2006, 2007 and projected for 2008, by Type of Expenditure and Type of Tourist, Indonesia 2008

Type of Expenditure	2006		2007		2008	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
Hotel and accommodation	4,860.86	17,657.40	4,954.44	19,225.27	5,049.83	20,932.36
Restaurant	14,244.65	9,298.86	14,555.27	10,615.79	14,872.67	12,119.23
Domestic transport	31,051.17	3,151.00	31,747.79	3,343.04	32,460.04	3,546.78
Travel bureau, tour operator	603.41	4,589.00	767.32	4,589.00	975.76	4,589.00
Socio-cultural Services, recreation & entertainment	1,702.96	2,988.60	1,989.70	3,312.34	2,324.72	3,671.15
Other services	6,186.51	3,910.42	6,188.54	6,573.25	6,190.58	11,049.37
Souvenirs	2,997.73	4,408.17	3,069.28	5,887.94	3,142.55	7,864.45
Health & beauty services	19	504.37	19.95	549.09	20.95	597.77
Non food industry product	12,139.58	5,240.40	12,632.92	6,152.53	13,146.31	7,223.42
Agricultural Product	3,034.90	1,285.75	3,158.24	1,518.04	3,286.59	1,792.30
Total	76,840.77	53,033.98	79,083.47	61,766.29	81,469.99	73,385.81

**Table 7.** Projected total decrease (in million rupiahs) by 50% of tourist expenditures due to large epidemic of Avian Influenza, Indonesia 2008

Type of Expenditure	Domestic	Foreign	Total
Hotel and accommodation	2,524.91	10,466.18	12,991.09
Restaurant	7,436.33	6,059.61	13,495.94
Transport	16,230.02	1,773.39	18,003.41
Travel bureau, tour operator	487.88	2,294.50	2,782.38
Socio-cultural Services, recreation & entertainment	1,162.36	1,835.57	2,997.93
Other services	3,095.29	5,524.68	8,619.97
Souvenirs	1,571.27	3,932.22	5,503.49
Health & beauty services	10.47	298.88	309.35
Non food industry product	6,573.15	3,611.71	10,184.86
Agricultural Product	1,643.29	896.15	2,539.44
Total Loss	40,734.99	36,692.90	77,427.89

77,427.89 million rupiahs (8.6 million US Dollars), with the largest expenditures for transport, restaurant and hotel accommodation.

### 3. Impact to Transportation Sector

The projected loss of PDP (Transportation Sector) by type of transport in 2008, with the assumption of 50% loss is projected as follows.

Impact to transportation sector in two months epidemic of AI is estimated a total loss of Rp 15.380 billions (1.7 billion US Dollars), with the largest impact

contributed by the land transport (57%), followed by Supporting services (16%) and air transport (14%).

### DISCUSSIONS

The Indonesian government will have to deal with an uncertain policy environment while responding to the public health emergency and economic disruption.

History shows that a large Influenza epidemic may cause a large number of illness and deaths, sufficient to temporarily paralyze public services

**Table 8.** Projected loss of PDB (in current price) by type of transport (in billion rupiahs), Indonesia 2008

Type of Transport	GDP 2008	Monthly average	Period of epidemic (month)	Total loss (50%)
Transport	184,569.69	15,380.81	2	15,380.81
Reilway	1,535.94	127.99	2	127.99
Roads	104,936.60	8,744.72	2	8,744.72
See	20,545.23	1,712.10	2	1,712.10
Rivers, lake, ferry	5,801.88	483.49	2	483.49
Air	25,151.20	2,095.93	2	2,095.93
Transportation support	30,242.96	2,520.25	2	2,520.25

and economic productivity. Another effect will be increased absenteeism in all sectors of the labor force, with capacity temporarily reduced in essential public services as health care, law enforcement, transportation, utilities and telecommunications.

On the demand side, an epidemic will affect consumer confidence, change consumption and social patterns. It will also affect investor confidence that might have long term consequences to the economy. On the supply side, it will affect the availability of labor, as the disease may cause many workers to stay at home during epidemic.

Healthy people may stay away from work voluntarily, because of fear of infection, or because of breakdowns in transport systems or bans on travel. Parents may need to stay home to care for children even if they themselves are not sick.

An epidemic will increase the number of poor families as well as inequality, if poor families are more affected. Many families will never recover their income due to lost of family members and loss of assets to pay health care costs. The policy response of governments in various level may minimize the health and economic impact of the epidemic.

The possible overreaction of people in the form of preventive actions, due to lack of accurate, transparent and timely information; may worsen the situation and affect the economic activity. Given the spread of AI through droplet transmission, people tried to minimize face to face interactions. This will cause a severe demand shock for services factors, such as tourism, mass transportation, shopping centres, retail sales, cinemas, hotels and restaurants.

Economic costs will also increase due to workplace absenteeism, disruption of production processes and shifts to more costly procedures

The study estimates the negative effect of the AI large epidemic for two months period. If the epidemic last longer or the outbreak recurs several times in a year, the consequences could be significantly worse. In that situation, appropriate public policy will play a key role in determining the economic outcome.

## CONCLUSIONS

The study on POTENTIAL HEALTH AND ECONOMIC IMPACT OF LARGE AVIAN INFLUENZA EPIDEMIC IN INDONESIA shows that about 43,283,020 people will be affected. The estimated deaths in two week epidemic may reach 525,919. Potential Years of Life Lost due to the epidemic will be 14,848,590 and will cause macro-economic loss of 19.3 billion US Dollars. About 605,962 cases will be hospitalized in 2 months of epidemic with the total costs of 539.9 million US Dollars.

For Agricultural Sector, the direct economic loss during epidemic due to the disease or culling actions is estimated 97.2 million US Dollars. Costs for poultry vaccination efforts (vaccine and operational costs) will be in the amount of 74.7 million US Dollars.

In Tourism Sector, an economic loss is estimated about 8.6 million US Dollars and in Transportation Sector will be about 1.7 billion US Dollars for one episode (2 months) of large AI epidemic.

Avian Influenza creates a major challenge to the Indonesian development. The purpose of the study is to provide some understanding of the magnitude and impacts of a large epidemic. The consequences will be worse if the epidemic lasts longer or the virus is more virulent. Appropriate major public policy will play a key role in determining the outcome of the event. Efforts of the government to prevent the start

of a large epidemic, to contain the epidemic once it has begun and to mitigate its harmful effects on the health of the population will become important in curbing the situation.

Besides, preventing transmission among animals, including enhanced surveillance, diagnosis, bio-security measures, culling and vaccination of poultry as suggested by Food and Agriculture Organization (FAO) and World Organization for Animal Health (OIE) should be seriously implemented.

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