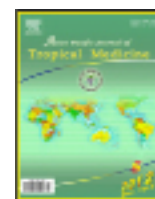


Contents lists available at [ScienceDirect](http://ScienceDirect)

## Asian Pacific Journal of Tropical Medicine

journal homepage: [www.elsevier.com/locate/apjtm](http://www.elsevier.com/locate/apjtm)

Document heading doi:

# Knowledge, attitudes and practices towards avian influenza A (H5N1) among Cambodian women: A cross-sectional study

Mav Khun<sup>1,2</sup>, Chantha Heng<sup>2</sup>, Md. Harun-Or-Rashid<sup>1\*</sup>, Hideki Kasuya<sup>3</sup>, Junichi Sakamoto<sup>1</sup>

<sup>1</sup>Young Leaders' Program in Healthcare Administration, Nagoya University Graduate School of Medicine, Nagoya, Japan

<sup>2</sup>Communicable Disease Control, Rapid Response Team, Kampot Provincial Health Department, Kampot Province, Cambodia

<sup>3</sup>Department of Surgery II, Nagoya University Graduate School of Medicine, Nagoya, Japan

## ARTICLE INFO

## Article history:

Received 10 March 2012

Received in revised form 15 May 2012

Accepted 15 July 2012

Available online 20 September 2012

## Keywords:

Highly pathogenic avian influenza

Knowledge

Attitudes

Practices

Kampot

Cambodia

## ABSTRACT

**Objective:** To measure highly pathogenic avian influenza (HPAI)-related knowledge, attitudes, and practices (KAPs) among Cambodian women. **Methods:** This cross-sectional study selected 246 married women aged between 18–55 years who had backyard poultry and lived at least one year in the areas of the survey through multi-stage cluster sampling. An average score of correct answers was generated to evaluate respondents' knowledge (Good/Poor), attitudes (Positive/Negative), and practices (Good/Bad). **Results:** We reported that about half of the respondents had good knowledge and good practices and four-fifth of them had positive attitudes towards HPAI. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated through a logistic regression model to explore contributing factors that raise their KAP levels. Most of the sources were significant in increasing knowledge of the respondent, like television (OR=1.6, 95% CI=1.0–2.7), radio (OR=2.5, 95% CI=1.3–4.9), leaflets/booklets (OR=2.1, 95% CI=1.2–3.9), school students (OR=18.4, 95% CI=2.4–142.9), village health volunteers (OR=4.5, 95% CI=2.2–10.9) etc. Factors such as television (OR=3.7, 95% CI=2.1–6.4), leaflets/booklets (OR=2.6, 95% CI=1.4–5.1), and public health staff (OR=2.2, 95% CI=1.2–4.1) had similar influence on practices. Although, we found similar effect on raising the attitudes of the responded, it was not significant. **Conclusions:** We report a satisfactory level of positive attitudes, and moderate level of knowledge and practices related to HPAI among Cambodian women. Raising KAPs through television, radio and other medias may be more efficient than using usual information, education and communication materials to prevent HPAI.

## 1. Introduction

Highly pathogenic avian influenza A (HPAI), also called avian flu or bird flu, is a highly contagious disease of birds caused by avian influenza (AI), a virus of subtype H5N1, occurred across Asia, Africa and Europe. It spreads through domesticated and wild birds, and transmitted from poultry to poultry and occasionally from poultry to humans, generally through close contact with infected birds and inhalation of dust or droplets containing the viruses. The disease is very fatal and causes death within 48 hours<sup>[1,2]</sup>. HPAI viruses are generally strong, and occasionally cause

illness or death, not only in humans but also in animals, such as cats, dogs, tigers that consume sick or dead birds infected by HPAI viruses<sup>[2–4]</sup>. Until March 2010, 486 cases of avian influenza A (H5N1) in human, resulting in 287 deaths [Case fatality rate (CFR)=59.05%], have been reported since 2003 with the first fatal case confirmed H5N1 positive in human in China<sup>[5,6]</sup>. Most of the cases were in the Southeast Asia, Indonesia, Vietnam, Thailand, China, Cambodia, and Hong Kong<sup>[6–9]</sup>.

Between February 2005 and April 2010, Cambodia had confronted 10 positive cases confirmed AI in human of which 8 already died with the CFR of 80%<sup>[10,11]</sup>. Four cases happened in one remote, rural area near Vietnam border, in Kampot province, the southern part of Cambodia. First case was detected in February 2, 2005. Ministry of Health of Cambodia in cooperation with World Health Organization (WHO) and other non-government organizations focused more on developing public health awareness to combat

\*Corresponding author: Md. Harun-Or-Rashid, Young Leaders' Program in Healthcare Administration, Nagoya University Graduate School of Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya 466-8550, Japan.

Tel/Fax: 81-52-744-2444

E-mail: mh\_rashid67@yahoo.com

HPAI<sup>[12]</sup>. Various activities, such as advocacy, workshops, and training of health staffs, community people, village health volunteers (VHVs), chiefs of villages, chiefs of communes, students of high schools, and junior high schools have been made in order to create awareness about HPAI, and to reduce exposure to the disease, particularly to stop endemic of HPAI in Cambodia. Information, education, and communication (IEC) materials, such as T-shirts, caps, posters, panoramas, leaflets, booklets, and calendars have been produced and distributed to Cambodian people not only in the affected areas, but also in other areas over the country. To harmonize avian and human influenza (AHI) materials, a Bird Flu IEC Committee was established in 2005, and then the AHI campaign started<sup>[13]</sup>. Moreover, the Communicable Disease Control Program initiated strategy to broadcast information necessary to prevent HPAI via mass media, like television (8 broadcasting a day for a month, once in 3 months), radio (10 times/2 minutes, 30 days/3 months), newspaper *etc.* Direct campaign by local staffs and villagers to the communities, especially during the main festival-days in every year also were conducted regularly.

From February 2005, the number of HPAI in human has spread in 5 provinces, such as Kampot, Kampong Cham, Kampong Speu, Prey Veng, and Kandal with 10 positive cases confirmed by Pasteur Institute of Cambodia located in Phnom Penh, Cambodia<sup>[12]</sup>. In addition, regular quarterly meetings have been conducted with local health workers in the communities around Kampot province in order to strengthen AI surveillance, and reporting health information system on infectious diseases.

According to the report of Cambodia Communities out of Crisis, 80.5% of Cambodians live in rural areas; 35% of the total population live with the income of \$ 0.45 per person per day, below the national poverty line of \$ 1 per person per day<sup>[14]</sup> and Cambodian's census in 2008 indicated that 47.2% of people over 25 years old were not primary completed and 13.4% were illiterate<sup>[15]</sup>. Rate of illiteracy was significantly higher among females than males. As there is no definitive treatment of HPAI and spread from poultry-to-poultry and poultry-to-human is common, it is crucial to raise awareness about HPAI among the most vulnerable population. Accordingly, we aimed to assess level of knowledge, attitudes, and practices (KAPs) among married women in Kampot province. As most of the household chores including handling of poultry are women-centered, it is crucial to assess and upgrade their level of KAPs regarding transmission, symptoms, treatment and prevention of HPAI. An effective strategy based on their level of KAP can efficiently help prevent HPAI among Cambodian population. Married women are particularly vulnerable and at high risk for severe complication of HPAI during inter-pandemic periods, in case of such pandemic due to emergence of HPAI viruses, because they take main responsibilities of housework such as raising poultry, food preparation, and taking care of their children<sup>[16]</sup>. Although published reports are available about HPAI-related KAPs, no such studies have ever reported on married women in Cambodia. Therefore, this study aimed at determining KAPs and its influential factors towards HPAI among Cambodian women. This baseline information about their awareness about HPAI could help policy makers and future researchers for effective planning and implementation.

## 2. Materials and methods

### 2.1. Study sites

The study was conducted in Kampot Operational District located in Kampot Province, Southern part of Cambodia, a typical area occupied by poor people of two different religions including Buddhism and Muslim. The study area located from 6 to 35 km to the Kampot town with population of 144 090 out of 585 110, the total population of Kampot province<sup>[15]</sup>.

### 2.2. Study population

Two hundred and forty-six married women aged 18–55 years were enrolled in this cross-sectional study. Women who were residing in the village for at least one year before the survey were included; because, they had the opportunity to attend in various activities that have been done so far and to obtain information on HPAI from it. Included women were involved in many household works which threatened them to be in contact with HPAI, such as house keeping, taking care of their children, cooking food for the family members, educating their children, raising poultry, selling poultry, cleaning outdoor, and indoor around their houses. Legally eligible age for marriage of women in Cambodia is 18 years, so 18 years were the lower limit<sup>[17]</sup>, and women aged over 55 years were the upper limit because this is the retiring age in Cambodia<sup>[18]</sup>. Women without having backyard poultry were also excluded from the study.

### 2.3. Survey methodologies

Trained health staff was responsible for collecting data with the help of the chiefs of the villages through face-to-face interview. Accordingly, both health staff and the village chiefs were trained about how to conduct the interview. Although, only the health staff were responsible for collecting data, the village chiefs were cooperating with them in identifying households and introducing the interviewers with them. Using a structured questionnaire, data was collected during November to December, 2009. Targeted sample of 300 eligible women were chosen through a multi-stage cluster sampling from the Kampot OD<sup>[19–22]</sup>. Initially, 5 communes were randomly chosen from 19 communes (of 21 communes in Kampot OD, 2 were excluded because they were located in the town). Fourteen villages were randomly selected from a total of 28 villages of the chosen communes. All the villages had similar number of eligible women and therefore, each village was treated as one Primary Sampling Unit (PSU). From each PSU, we selected 22 women systematically to get a total of 300 targeted women<sup>[23,24]</sup>. Only one woman was interviewed from each household. Lists of women were provided by the chief of each village. Because of their unwillingness to participate in the study, absence from home, we could interview 270 women. During data cleaning, 24 respondents were excluded because of incomplete information to make a final total of 246 women.

The questionnaire was developed with little modification of the previously published questionnaire<sup>[21, 22, 25, 26]</sup>. Some new additional questions were created by local team. The

questionnaire was designed in four sections: Section A contains demographic information; section B focuses on knowledge on AI which composed of 32 questions; Section C describes the prevention practices from HPAI which set with 20 questions, and Section D mentions on attitude related to HPAI which contains 11 questions[20,23,24,27].

We set each section with one correct answer for each question. Those who answered correctly were scored 1 and 0 was scored for the wrong answers. The total scores of correct answers for each respondent were split at the mean because they were normally distributed data. Accordingly, level of knowledge on HPAI was categorized into “good” and “poor”. If the correct answers were equal or more than the mean scores, the woman’s knowledge was considered “good”. If the correct answers were less than the mean, the woman’s knowledge was considered “poor”[20,22,27,28]. Attitude was considered “positive” for equal or more than mean score and “negative” for score less than the mean. Same techniques were applied to categorized practices of the respondents into “good” (equal or more than mean score) and “bad” (less than mean score)[20,25]. Questionnaire was translated into local language, validated and pre-tested before final interview[25,26,28,29].

#### 2.4. Statistical analyses

The data from the questionnaire were generated into the Statistical Package for the Social Sciences (SPSS Inc., version 17, Chicago, USA) for all statistic analyses. We presented categorical data, like religion, education, occupation, as number and percentages. Continuous data were presented as mean and standard deviation (SD) for normally distributed data and median (interquartile range, IQR) for non-normal data. Odds ratios (ORs) and the 95% confidence intervals (CIs) were estimated through a logistic regression model to reveal association between different factors like sources of information and levels KAPs. *P* value <0.05 was considered significant.

#### 2.5. Ethical clearance

This study was approved by the National Ethics Committee for Health Research of the Ministry of Health of Cambodia. Before obtaining oral consent, respondents were explained about the purpose, benefit, and possible harm of the study. Anonymity and confidentiality of their information was maintained. Moreover, all the respondents were given freedom not to participate or to withdraw them from the study at any time.

### 3. Results

Table 1 shows that among 246 eligible respondents, the median age (IQR) was 28.0 (24.0–34.0) years. Most of them (80.5%) were aged 18–35 years and 182 (74.0%) were Cambodian Buddhist. About 10.2% (25) were illiterate, 140 (56.9%) were educated at primary level and 71 (28.9%) were educated at secondary level. One hundred and forty-nine (60.6%) of them were living with family income less than 60 US dollars per month and the median of their monthly family income was \$50.0 (IQR=30.0–75.0). According to occupation,

75.2% of them were housewives, 22.8% were self employed, *i.e.*, they have own businesses at home; and only 2.0% were employed.

Table 2 indicates knowledge of the study population about HPAI relating to modes of transmission, symptoms, treatment and prevention. Only 28.0% respondents could correctly answer about the indirect mode of transmission of HPAI, and more than half of them knew that HPAI transmission by direct contact with sick or dead poultry is possible. Only 2.4% of the respondents had correct knowledge about human-to-human transmission of HPAI. Less than half (41.5%) of the respondents responded that HPAI can be transmitted from mosquito bite, 161 (65.4%) answered correctly that AI transmits from poultry to animals, such as cats, dogs, tigers, lions *etc.*

Respondents were asked about nine symptoms of HPAI in human to assess their knowledge. Only four symptoms of HPAI were commonly known by Cambodian people, such as fever (64.6%), cough (34.6%), breathlessness (23.2%) and muscle ache (23.6%) because these symptoms were mentioned in the IEC materials and were regularly broadcasted on television and radio. Others are described in the leaflets and booklets only. Most of them (*n*=234, 95.1%) told correctly that HPAI causes death within 48 hours from the onset of symptoms, 156 (63.4%) had the wrong impression that vaccine against HPAI is available in Cambodia and 141 (57.3%) had the right knowledge about availability of drugs for treatment HPAI.

Majority of the respondents (*n*=162, 65.9%) were aware that avoiding contact with sick or dead bird can prevent HPAI, and 166 (67.5%) felt hand washing, 229 (93.1%) said that wearing mask can prevent themselves from HPAI and only (15.9%) aware that avoiding cock fighting can prevent from HPAI.

Figure 1 shows multiple sources of information about HPAI. Radio was the first source that could provide knowledge on HPAI for the most people (78.9%), followed by television (49.2%).

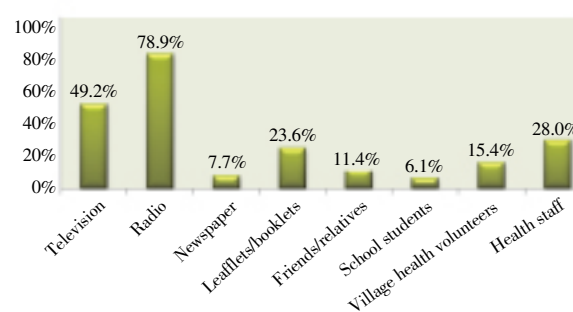


Figure 1. Different sources of information about HPAI.

While questioning about their attitudes on HPAI, 214 (87.0%) opined to meet public health staffs when they get sick, only 10 (4.1%) prefer to use public health services, and 91.5% favor to use private health services. When we asked them about their willingness to visit HPAI patients in the hospital, 49 (19.9%) answered “yes” and 240 (97.6%) were willing to see a medical doctor if they are suspected with HPAI infection (Table 3).

Table 4 demonstrates practices of the respondents to prevent HPAI. It shows that 134 (54.5%) clean poultry cages every day, 144 (58.5%) collect manure from the cage every day, 95 (38.6%) keep new birds away from the old one more than two weeks, 220 (89.4%) sold sick birds to other people,

215 (87.4%) always cook dead birds for food, 184 (74.8%) of them always throw dead birds into the water or forest, 115 (46.7%) scatter manure in the field, 219 (89.0%) always used to wash eggs before cooking, 154 (62.6%) always cover their noses during removing feathers of poultry, and 230 (93.5%)

**Table 1**

Socio-demographic characteristics of the study population ( $n=246$ ).

	Characteristics	<i>n</i>	%
Age group (years)	18–35	198	80.5
	36–40	23	9.3
	41–45	13	5.3
	46–50	7	2.8
	51–55	5	2.0
Religion	Buddhist	182	74.0
	Muslim	64	26.0
Education	Illiterate	25	10.2
	Primary	140	56.9
	Secondary	71	28.9
	High school	8	3.3
Occupation	University	2	0.8
	Housewife or unemployed	185	75.2
	Self employed/home business	56	22.8
Monthly family income (US\$)	Employed	5	2.0
	<60	149	60.6
	≥60	97	39.4

**Table 2**

Knowledge of the study population about HPAI.

	Factors	Correct answers	
		<i>n</i>	%
Mode of transmission	HPAI can be transmitted through:		
	direct contact with sick or dead birds	145	58.9
	indirect contact <i>e.g.</i> , airborne	69	28.0
	eating raw egg	45	18.3
	animals infected with HPAI	161	65.4
	mosquito bite	102	41.5
	human to human	6	2.4
Symptoms of HPAI	Fever	159	64.6
	Cough	85	34.6
	Breathlessness	57	23.2
	Sore throat	36	14.6
	Muscle ache	58	23.6
	Eye sore	10	4.1
	Diarrhea	15	6.1
	Vomiting	10	4.1
Treatment and prevention of HPAI	Stomach ache	8	3.3
	Drugs available for curing HPAI	141	57.3
	Separate wards for AI patients is available in hospitals province	161	65.4
	HPAI can be treated by vaccine	221	89.8
	HPAI vaccine available in Cambodia	90	36.6
HPAI can be prevented by	HPAI may lead to death	234	95.1
	Avoiding contact with sick or dead birds	162	65.9
	Washing hands after handling sick or dead birds	166	67.5
	Aavoiding cock fighting	39	15.9
	Washing raw meat properly	57	23.2
	Staying away from poultry farm	104	42.3
	Cooking well	90	36.6
	Cleaning equipment after they were used	58	23.6
Wearing mask during exposure	229	93.1	

**Table 3**

Attitudes on HPAI.

Variables	Respondents with correct answers	
	<i>n</i>	%
Meet public health staff when get sick	214	87.0
Meet traditional healer when get sick	221	89.8
Take over-the-counter flu medication	223	90.7
Do nothing, just stay at home naturally during sickness	220	89.4
Prefer to use private services for treatment of HPAI	225	91.5
Prefer to use public services for treatment of HPAI	10	4.1
Do not hesitate to visit patients with HPAI	49	19.9
Prefer to take care of HPAI patients	218	88.6
See medical doctor when suspected with HPAI	240	97.6
See traditional physician when suspected of HPAI	241	98.0
Buy drugs from pharmacy for prevention of HPAI	240	97.6

**Table 4**

Practices of the respondents on HPAI.

Variables	Correct answers	
	<i>n</i>	%
Keep poultry with animals	176	71.5
Stay with poultry	176	71.5
Clean poultry cage every day	134	54.5
Always wash hand with soap after touching poultry	228	92.7
Clean outdoor and indoor every day	172	69.9
Collect manure of poultry every day	144	58.5
Keep new birds from the market with the old ones	206	83.7
Separate new birds from the old for < two weeks	92	37.4
Separate new birds from the old ones > two weeks	95	38.6
Always keep sick birds in the cage	130	52.8
Sell sick birds to the others	220	89.4
Cook dead birds for food	215	87.4
Slaughter dead birds and sell in the market	230	93.5
Burn/ burry dead birds	176	71.5
Throw dead birds away	184	74.8
Keep manure in the well	122	49.6
Scatter manure in the field	115	46.7
Always wash eggs before cooking	219	89.0
Always cover your nose when removing feathers of poultry	154	62.6
Always wash equipments after they are used	244	99.2

always slaughter dead birds and sell in the market.

Although majority of the subjects ( $n=196$ , 79.7%) ( $8.6\pm 4.0$ ) had positive attitude towards HPAI, only half of them had good knowledge ( $n=114$ , 46.3%) ( $8.6\pm 1.5$ ) and good practices ( $n=145$ , 58.9%) ( $14.0\pm 3.1$ ).

Table 5 shows the contributions of different sources of information on the level of KAP of HPAI of the study population. Most of the sources were significant in increasing knowledge of the respondent, like television, radio, leaflets/booklets, school student, village health volunteers *etc.* Few factors did have similar influence on practices, such as television, leaflets/booklets, and public health staff. Unfortunately, we could not find any significant sources of information which may influence on changing their attitudes.

#### 4. Discussion

Recommendations and guideline developed by WHO in order to control and prevent outbreaks of HPAI have been used in Cambodia in response to the endemic threat due to poor knowledge, negative attitudes, and bad practices<sup>[30-32]</sup>. The main recommended measures used to apply the public health interventions are: 1) intensify collaboration between animal sector and public health sectors; 2) appropriate personal protective equipment (PPE) for medical workers; 3) effective disease surveillance for early detection and reporting of outbreaks; 4) food safety of poultry products; 5) control of movement of birds and products that may contain viruses; 6) risk communication; 7) rapid destruction of infected poultry and poultry at high risk of infection; and 8) proper use of vaccination<sup>[25,33,34]</sup>.

The results of our research illustrated that the knowledge



**Table 5**

Impact of different sources of information on knowledge, attitudes, and practices of HPAI.

Source of Information	Knowledge					Attitude					Practice				
	Good (%)	Poor (%)	OR <sup>†</sup>	95% CI <sup>‡</sup>	P value	Pos <sup>#</sup> (%)	Neg <sup>△</sup> (%)	OR	95% CI	P value	Good (%)	Bad (%)	OR	95% CI	P value
Television	55.3	43.9	1.6	1.0–2.7	0.070	82.6	76.8	1.4	0.7–2.6	0.297	62.1	30.7	3.7	2.1–6.4	<0.001
Radio	86.8	72.0	2.5	1.3–4.9	0.007	81.4	73.1	1.6	0.8–3.3	0.216	80.7	76.2	1.3	0.7–2.5	0.354
Newspaper	10.5	5.3	2.1	0.8–5.5	0.135	89.5	78.9	2.1	0.5–9.6	0.323	10.3	4.0	2.8	0.9–8.8	0.075
Leaflets/booklets	30.7	17.4	2.1	1.2–3.9	0.014	77.6	80.3	0.8	0.4–1.7	0.616	29.7	14.9	2.6	1.4–5.1	0.004
Friends/relatives	13.2	9.8	1.4	0.6–3.0	0.437	82.1	79.4	1.2	0.4–3.4	0.703	11.7	10.9	1.2	0.5–2.7	0.672
J–HSS <sup>##</sup>	12.3	0.8	18.4	2.4–142.9	0.009	80.0	79.7	0.9	0.2–3.5	0.903	8.3	3.0	2.8	0.8–10.2	0.127
VHVs <sup>*</sup>	25.4	6.8	4.5	2.2–10.9	<0.001	86.8	78.4	1.8	0.7–5.0	0.235	15.9	14.9	1.1	0.5–2.2	0.869
PHSs <sup>**</sup>	39.5	18.2	2.9	1.6–5.2	<0.001	81.2	79.1	1.1	0.5–2.2	0.809	33.8	19.8	2.2	1.2–4.1	0.011

<sup>†</sup>OR: Odds ratio, ORs were adjusted for age, educational status, and income of the respondents; <sup>‡</sup>CI: Confidence interval; <sup>#</sup>Positive; <sup>△</sup>Negative; <sup>##</sup>J–HSS: Junior high school and high school students; <sup>\*</sup>VHV: Village health volunteer; <sup>\*\*</sup>PHS: Public health staff; <sup>###</sup>Reference category is 'Poor' for knowledge, 'Bad' for practices, and 'Negative' for attitudes.

of the study population was moderate related to modes of transmission, symptoms, treatment and prevention of HPAI which is in agreement with the similar finding of a study conducted in Thailand among the high-risk population<sup>[35]</sup>. Nearly half of the respondents correctly answered that HPAI does not spread from mosquito to human. Surprisingly, almost of all the respondents mentioned incorrectly that HPAI can be transmitted from human to human. The low level of awareness of Cambodian women contradicts with the recently published studies in Italy and China which reported higher level of awareness on HPAI among their general population<sup>[19,24]</sup>. Low level of literacy among our women may be the striking factors behind these contradictions.

The study also showed that just over half of women had good practices. Almost similar level of practices were also reported in a study in Thailand among the high-risk people<sup>[35]</sup>. Lack of good practices on HPAI is one of the risk factors of contracting and spreading of HPAI. For people who always prepare sick or dead birds for consumption and have direct contact with sick or dead birds without PPEs, the proportion of infection from infected birds could be high<sup>[7,8, 19, 36]</sup>. People engage themselves in this risky practices specially during the national holidays, Chinese new year and special occasions, and they believe that since long time their seniors and neighbors could never get infected with HPAI by doing that<sup>[22]</sup>. This may also be strongly related to poor economic status and low literacy rate. A finding of a newly published study in China shows similarity with our results<sup>[24]</sup>.

Linked to the factor of cockfighting, only 16% of the study population was aware that HPAI contaminated from cockfighting. Cockfighting is a very popular game in Cambodia which takes place every year during summer. Although we don't have data of cockfighting gamblers in hand, but based on our observation, we noticed that most of the men join in this game, and they could highly get HPAI virus from their fighting cocks. A previous published study demonstrated that transmission of HPAI to human

occur through inhalation of infectious droplets and direct contact by handling fighting cocks and playing with poultry, especially playing with asymptomatic infected ducks<sup>[37,38,39]</sup>.

This survey demonstrated that the main sources for information of HPAI were radio and television. Almost the same result was found in China and Taif, Saudi Arabia<sup>[24,40]</sup>. However, the level of information that the respondents learnt from the radio was higher than the previous study; but lower from television<sup>[29]</sup>. People who watched television, the level of good knowledge, good practice, and positive attitude were higher than those who did not watch television. Similar findings from surveys performed in China and Italy shows television was found to be the most effective way to disseminate information on HPAI, but newspaper indicated a controversy to our results<sup>[24,25,35]</sup>. Unlike the finding among Nigerian people, about 74% of them reported that newspaper was one of the major sources of information on HPAI<sup>[41]</sup>. Mainly because of low literacy and poor economy, very few women have the scope to read newspaper. People always feel comfortable and trustful while they exchange their views face-to-face with health staff. Thereby, they can clarify their confusions after cross-checking with those staff. In addition, our study shows that leaflets and health staff could spread information better comparing to the others published materials<sup>[24,25,42]</sup>. This contradiction may be rooted in the difference of literacy and development stage from those countries.

Our finding shows, a quarter of the respondents know about HPAI transmission by indirect way, meaning to say by air borne or conjunctive deposition of large infectious droplets<sup>[7,42]</sup>. And the spreading of HPAI maybe highly caused by handling infected poultry without using PPEs, preparation of infected poultry for consumption, living with poultry or domestic animals, like cats, dogs, and hygiene of hand washing and using water containing HPAI viruses<sup>[43,44]</sup>.

Although Cambodian women have moderate level of knowledge and practices, they hold a satisfactory level of positive attitudes which was almost similar with the reports

in Indonesia and China<sup>[24,33]</sup>; however, study done in Italy (2008) shown higher level of knowledge among them<sup>[25]</sup>. Because of stronger influence of mass media, like television, radio, communication with health staff, Cambodian women enhance their attitude towards positivity in a greater pace than they do so for knowledge and practices. If the KAP of rural Cambodians continues to be limited, a highly pathogenic mutant HPAI could possibly spread between humans in the future.

To make ongoing awareness creation program more efficient, modification is necessary with greater emphasis on most effective means, like television, radio, and through health staff. Satisfactory level of KAPs obtained through such effective strategy could protect Cambodians from a fatal outbreak of HPAI.

The study confronted several limitations which is worthy of mention. First, we did this study in only one district of Cambodia. Second, we addressed only married female respondents who may not be representative of the Cambodian population. Third, our sample size was small which might be a threat for external validity of the result. Despite all these limitations, we believe our findings may provide a valuable source of information for the policy makers and future researchers.

This study reports a moderate level of knowledge and practices, a satisfactory level of attitudes among Cambodian women on HPAI. Television, radio, leaflets/booklets, VHV's etc had contributed in a differential manner on KAP. KAP on AI may be increased if emphasis on the significant contributors like television, radio etc can be strengthened, instead of relying on usual IEC materials. Future researches are encouraged on finding appropriate means to sustain and upgrade the existing positive attitudes among the population towards HPAI.

### Conflict of interest statement

We declare that we have no competing interest.

### Acknowledgements

The authors wish to express their sincere gratitude to the staff of the Young Leaders' Program, Nagoya University Graduate School of Medicine. This work was supported in part by a non profit organization "Epidemiological and Clinical Research Information Network". Our heartfelt thanks to the staff of Kampot Provincial Health Department for their generous assistance during data collection. Our sincere gratitude to all the respondents including their family members for their kind co-operation and responses.

### References

- [1] Liao QY, Lam WW, Dang VT, Jiang CQ, Udomprasertgul V, Fielding R. What causes H5N1 avian influenza? Lay perceptions of H5N1 aetiology in South East and East Asia. *J Public Health (Oxf)* 2009; **31**(4): 573–581.
- [2] Doyle ME, Schultz–Cherry S, Robach M, Weiss R. Destruction of H5N1 avian influenza virus in meat and poultry products. 2007. [Online] Available from: [http://fri.wisc.edu/briefs/FRI\\_Brief\\_H5N1\\_Avian\\_Influenza\\_8\\_07.pdf](http://fri.wisc.edu/briefs/FRI_Brief_H5N1_Avian_Influenza_8_07.pdf). [Accessed on May 10, 2010].
- [3] Thorson A, Petzold M, Nguyen TK, Ekdahl K. Is exposure to sick or dead poultry associated with flulike illness?: a population-based study from a rural area in Vietnam with outbreaks of highly pathogenic avian influenza. *Arch Intern Med* 2006; **166**(1): 119–123.
- [4] Vong S, Ly S, Van Kerkhove MD, Achenbach J, Holl D, Buchy P, et al. Risk factors associated with subclinical human infection with avian influenza A (H5N1) virus–Cambodia, 2006. *J Infect Dis* 2009; **199**(12): 1744–1752.
- [5] Epidemiology of WHO–confirmed human cases of avian influenza A(H5N1) infection. *Wkly Epidemiol Rec* 2006; **81**(26): 249–257.
- [6] Duan L, Bahl J, Smith GJ, Wang J, Vijaykrishna D, Zhang LJ, et al. The development and genetic diversity of H5N1 influenza virus in China, 1996–2006. *Virology* 2008; **380**(2): 243–254.
- [7] Dinh PN, Long HT, Tien NT, Hien NT, Mai le TQ, Phong le H, et al. Risk factors for human infection with avian influenza A H5N1, Vietnam, 2004. *Emerg Infect Dis* 2006; **12**(12): 1841–1847.
- [8] Mounts AW, Kwong H, Izurieta HS, Ho Y, Au T, Lee M, et al. Case–control study of risk factors for avian influenza A (H5N1) disease, Hong Kong, 1997. *J Infect Dis* 1999; **180**(2): 505–508.
- [9] World Health Organisation (WHO). Cumulative Number of confirmed human cases of avian influenza A/(H5N1) reported to WHO. 2010. [Online] Available from: [http://www.who.int/csr/disease/avian\\_influenza/country/cases\\_table\\_2010\\_03\\_04/en/index.html](http://www.who.int/csr/disease/avian_influenza/country/cases_table_2010_03_04/en/index.html). [Accessed on May 6, 2010].
- [10] Chotpitayasunondh T, Ungchusak K, Hanshaoworakul W, Chunsuthiwat S, Sawanpanyalert P, Kijphati R, et al. Human disease from influenza A (H5N1), Thailand, 2004. *Emerg Infect Dis* 2005; **11**(2): 201–209.
- [11] Communicable Disease Control Department. Pandemic (H1N1) in Cambodia: Situation updates 2010. [Online] Available from: <http://www.cdcmoh.gov.kh/>. [Accessed on April 30, 2010].
- [12] World Health Organisation (WHO). H5N1 avian influenza: Timeline of major events. 2007. [Online] Available from: [http://www.who.int/csr/disease/avian\\_influenza/Timeline\\_07\\_may\\_30.pdf](http://www.who.int/csr/disease/avian_influenza/Timeline_07_may_30.pdf). [Accessed on May 13, 2010].
- [13] GPAI Avian and Human Influenza Control and Preparedness Emergency Project. Indigenous Peoples Planning Framework, Phnom Penh, Cambodia. 2008.
- [14] Cambodian Communities out of Crisis: Facts and figures about Cambodia. [Online]. Available from: <http://www.cambcomm.org.uk/ff.html>. [Accessed on June 15, 2010].
- [15] National Institute of Statistics. General population census of Cambodia 2008. [Online]. Available from: <http://celade.cepal.org/khmnis/census/khm2008/>. [Accessed on May 15, 2010].

- [16]Rasmussen SA, Jamieson DJ, Bresee JS. Pandemic influenza and pregnant women. *Emerg Infect Dis* 2008; **14**(1): 95–100.
- [17]National Assembly of the State of Cambodia. Law on the marriage and family.1989. [Online]. Available from: [http://www.gocambodia.com/laws/law\\_marriage.asp](http://www.gocambodia.com/laws/law_marriage.asp). [Accessed on May 25, 2010].
- [18]Kingdom of Cambodia. Law on the general status of civil servants of the Kingdom of Cambodia (1994) 1994. [Online] Available from: [http://cambodia.ohchr.org/klc\\_pages/klc\\_section03.htm](http://cambodia.ohchr.org/klc_pages/klc_section03.htm). [Accessed on May 30, 2010].
- [19]Abbate R, Di Giuseppe G, Marinelli P, Angelillo IF. Knowledge, attitudes, and practices of avian influenza, poultry workers, Italy. *Emerg Infect Dis* 2006; **12**(11): 1762–1765.
- [20]Effendi R. *Factors related to regular utilization of antenatal care service among postpartum mothers in Pasar rebo general hospital, Jakarta*. Indonesia Bangkok: Mahidol Univeristy; 2009.
- [21]Van Kerkhove MD, Ly S, Guitian J, Holl D, San S, Mangtani P, et al. Changes in poultry handling behavior and poultry mortality reporting among rural Cambodians in areas affected by HPAI/H5N1. *PLoS One* 2009; **4** (7): e6466.
- [22]Van Kerkhove MD, Ly S, Holl D, Guitian J, Mangtani P, Ghani AC, et al. Frequency and patterns of contact with domestic poultry and potential risk of H5N1 transmission to humans living in rural Cambodia. *Influenza Other Respi Viruses* 2008; **2**(5): 155–163.
- [23]Nalongsack S, Yoshida Y, Morita S, Sosouphanh K, Sakamoto J. Knowledge, attitude and practice regarding dengue among people in Pakse, Laos. *Nagoya J Med Sci* 2009; **71**(1–2): 29–37.
- [24]Xiang N, Shi Y, Wu J, Zhang S, Ye M, Peng Z, et al. Knowledge, attitudes and practices (KAP) relating to avian influenza in urban and rural areas of China. *BMC Infect Dis* 2010; **10**: 34.
- [25]Di Giuseppe G, Abbate R, Albano L, Marinelli P, Angelillo IF. A survey of knowledge, attitudes and practices towards avian influenza in an adult population of Italy. *BMC Infect Dis* 2008; **8**: 36.
- [26]Ly S, Van Kerkhove MD, Holl D, Froehlich Y, Vong S. Interaction between humans and poultry, rural Cambodia. *Emerg Infect Dis* 2007; **13**(1): 130–132.
- [27]Panagakou SG, Theodoridou MN, Papaevangelou V, Papastergiou P, Syrogiannopoulos GA, Goutziana GP, et al. Development and assessment of a questionnaire for a descriptive cross-sectional study concerning parents' knowledge, attitudes and practises in antibiotic use in Greece. *BMC Infect Dis* 2009; **9**: 52.
- [28]Barenes H, Martinez-Aussel B, Vongphrachanh P, Strobe M. Avian influenza risk perceptions, Laos. *Emerg Infect Dis* 2007; **13**(7): 1126–1128.
- [29]Leslie T, Billaud J, Mofleh J, Mustafa L, Yingst S. Knowledge, attitudes, and practices regarding avian influenza (H5N1), Afghanistan. *Emerg Infect Dis* 2008; **14**(9): 1459–1461.
- [30]World Health Organisation. WHO global influenza preparedness plan. *The role of WHO and recommendations for national measures before and during pandemics*. Switzerland: World Health Organization; 2005. [Online] Available from: [http://www.who.int/csr/resources/publications/influenza/WHO\\_CDS\\_CSR\\_GIP\\_2005\\_5.pdf](http://www.who.int/csr/resources/publications/influenza/WHO_CDS_CSR_GIP_2005_5.pdf).
- [31]World Health Organization. WHO recommendations relating to travellers coming from and going to countries experiencing outbreaks of highly pathogenic H5N1 avian influenza. 2005. [Online] Available from: [http://www.who.int/csr/disease/avian\\_influenza/travel2005\\_11\\_3/en/index.html](http://www.who.int/csr/disease/avian_influenza/travel2005_11_3/en/index.html). [Accessed on May 13, 2010].
- [32]World Health Organization. Public health interventions for prevention and control of avian influenza. *A manual for improving biosecurity in the food supply chain: focusing on live animal markets*. New Delhi: Regional office for South-East Asia; 2006.
- [33]Agoes R, Masia S. Epidemiology of avian influenza in Indonesia. Why is West Java having the highest endemicity? *Proc ASEAN Congr Trop Med Parasitol* 2008; **3**: 38–42.
- [34]World Health Organization. Prevention of foodborne disease: Five keys to safer food. 2009. [Online] Available from: <http://www.who.int/foodsafety/consumer/5keys/en/>. [Accessed on May 13, 2009].
- [35]Maton T, Butraporn P, Kaewkangwal J, Fungladda W. Avian influenza protection knowledge, awareness, and behaviors in a high-risk population in Suphan Buri Province, Thailand. *Southeast Asian J Trop Med Public Health* 2007; **38**(3): 560–568.
- [36]Zhou L, Liao Q, Dong L, Huai Y, Bai T, Xiang N, et al. Risk factors for human illness with avian influenza A (H5N1) virus infection in China. *J Infect Dis* 2009; **199**(12): 1726–1734.
- [37]Beigel JH, Farrar J, Han AM, Hayden FG, Hyer R, de Jong MD, et al. Avian influenza A (H5N1) infection in humans. *N Engl J Med* 2005; **353**(13): 1374–1385.
- [38]Afzal F, Saeed A, Sharif MA, Ayub N, Hassan S. Pathogenicity of avian influenza virus H5N1 2007 isolates from Pakistan. *Asian Pac J Trop Biomed* 2012; **2**(Suppl 1): 380–382.
- [39]Liem NT, Lim W. Lack of H5N1 avian influenza transmission to hospital employees, Hanoi, 2004. *Emerg Infect Dis* 2005; **11**(2): 210–215.
- [40]Al-Shehri AS, Abdel-Fattah M, Hifnawy T. Knowledge and concern about avian influenza among secondary school students in Taif, Saudi Arabia. *East Mediterr Health J* 2006; **12**(Suppl 2): S178–S188.
- [41]Fatiregun AA, Saani MM. Knowledge, attitudes and compliance of poultry workers with preventive measures for avian influenza in Lagelu, Oyo State, Nigeria. *J Infect Dev Ctries* 2008; **2**(2): 130–134.
- [42]Bridges CB, Kuehnert MJ, Hall CB. Transmission of influenza: implications for control in health care settings. *Clin Infect Dis* 2003; **37**(8): 1094–1101.
- [43]Luby SP, Agboatwalla M, Feikin DR, Painter J, Billhimer W, Altaf A, et al. Effect of handwashing on child health: a randomised controlled trial. *Lancet* 2005; **366**(9481): 225–233.
- [44]Shortridge KF, Zhou NN, Guan Y, Gao P, Ito T, Kawaoka Y, et al. Characterization of avian H5N1 influenza viruses from poultry in Hong Kong. *Virology* 1998; **252**(2): 331–342.