Preventing zoonotic influenza H5N1 in human: pictorial versus literal health communication methods

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Summary
Outbreaks of avian influenza H5N1 occurred in Africa's poultry and 16 countries have reported human infections globally. Intensified human-animal interactions necessitate correct communication of health messages to reduce zoonotic infection. This work was done to determine differences between pictorial and literal health education communication. Cross-sectional survey using literal and pictorial questionnaires in live bird markets and poultry farms was carried out among respondents based on matching criteria. Responses were scored and analysed with probability of independence using Chi square test and pairwise correlation. The degree of knowledge of clinical signs in birds, affected species, communication means and biosecurity were good, that of the post-mortem signs was poor with increasing potentials of human exposure to virus-rich visceral tissues from slaughtered sick birds. Marked differences existed for the various items listed within each knowledge field, the odds of having correct responses from pictorial were better than with literal respondents. Risky practices were still practised in the LBMs despite the good degree of knowledge of hygiene and biosecurity. Knowledge and implementation does not always correlate and pictorial representation out surpasses literal method in communicating potential zoonotic H5N1 influenza A infection to the undiscerning public.

Introduction

Global food needs, current food insecurity, rapid urbanisation and the increasing human populations have fostered industrial agriculture (Graham *et al.* 2008, Keusch *et al.* 2009, Alexandratos and Bruinsma 2012) with increased human-animal interactions, animal density per unit space and animal disease occurrence. The surge of animal populations has accelerated the risk of zoonotic diseases (Herfst *et al.* 2012, Gebreyes *et al.* 2014). Such diseases have also been associated with wild and domestic animal populations due to intense human-animal interfaces (Cleaveland *et al.* 2001, Keesing *et al.* 2010). Because of this complicated but inseparable interplay between humans and animals, health policy plans and implementation cannot be carried out in isolation. Because humans are intricately involved in the implementation of animal health, the understanding of the behavioural and emotional well-being, knowledge, attitudes and perceptions of humans (stakeholders in the animal industry) is important to reduce the burden of diseases (Decker *et al.* 2010, Liverani *et al.* 2013).

Since 1997, the majority of human cases have been confirmed to be linked to direct or indirect contact with infected live birds in poultry farms or in live bird markets (Horimoto and Kawaoka 2001, Wan *et al.* 2011, Herfst *et al.* 2012, Bridges *et al.* 2002, Okoye *et al.* 2013, Okoye *et al.* 2014, Mounts *et al.* 1999, Nuttal *et al.* 2012). To date, no evidence of virus reassortment exists to confirm sustained human-human infection (Ungchusak *et al.* 2005, Kandun *et al.* 2006, Wang *et al.* 2008). However between 2003 and 2015, the overall case fatality rate (CFR) for A H5N1 human infections was 62.3% globally (Fasanmi *et al.* 2016).

Since the beginning of avian influenza H5N1 pandemics in poultry, communication has been intensified in Asia, Europe and African countries and calls for intense inter-sectoral communications have been made to reduce spread (Breiman *et al.* 2007). Many international organizations and donor agencies have been involved and millions of dollars have been spent in communication and targeted socio-behavioural change (OIE/FAO 2016, UNICEF 2007, AU-IBAR 2009).

To assess the effectiveness of any communication system, regular reviews of intended and unintended outcomes are necessary (UNICEF 2011, UNICEF 2012). For example, recent evidence has indicated that human influenza vaccine health messages may sometimes be viewed with scepticism due to miscommunication and only brief but balanced evidence-based transparent information may be useful for communication (UNICEF 2011, UNICEF 2012, Mowbray *et al.* 2016). To date, no empirical evaluation and review of highly pathogenic avian influenza (HPAI) H5N1 communication campaigns have been conducted as advocated (AU-IBAR 2009, FAO 2008). The authors carried out a survey among poultry farmers and live-bird marketers (LBMs) to assess whether avian influenza health-related messages are correctly communicated, and whether communications using pictures and words will produce an improvement in the passage of biosecurity and health messages.

Methods

Questionnaire design and testing

A literal questionnaire was designed to test subjects' syndromic clinical signs in birds, species affected, knowledge of post-mortem signs in opened carcasses, knowledge and preference for communication methods, knowledge of biosecurity to reduce infection in man and animal, and knowledge of risky practices at sales point, all serving as early warning measure to precautionary preventive health in humans. Pictorial translations of all questions were designed from the literal document. Pictures were used with permission or downloaded with appropriate citation for use in the pictorial questionnaire (Annex 1). Prior to the administration of questionnaire, relevant clinicians, pathologist and avian medicine professionals viewed and cleared the questions and associated pictures. Pretesting of the questionnaire was conducted among ten selected pre-degree non-veterinary, medical, biological or agricultural sciences' students to assess for clarity, similar meaning, and to check whether matching criteria was appropriate in the poultry farms and LBMs. It was believed that such students' knowledge cannot bias their responses (because they have not been exposed to curriculated veterinary sciences (2nd to 6th years) as was expected among the general populace.

Recruitment of respondents

Twenty-five states and the Federal Capital Territory, Abuja, have reported previous or current outbreaks of avian influenza H5N1 in Nigeria and 11 states have never experienced or reported outbreaks. Following these outbreaks, repeated messages of avian influenza have been disseminated in poultry farms, live bird markets, town hall meetings, print and electronic media. For this survey, a total of 1,692 identified LBMs with a combined daily capacity of 198,700 birds were recruited as target population. Using the formula for sample size n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)], 314 respondents were needed for the survey. We interviewed 210 farmers and 140 poultry marketers (total = 350) from seven states in the southern part of Nigeria using face-to-face interviews. All respondents were matched by level of education (up to secondary versus post-secondary; 1:1.5), size of the farm (≤ 500, 501-2000 and ≥ 2001; 1:1) and volume of sale per day in the LBM (≤ 100 birds per day and ≥ 100 birds per day; 1:1). For purposes of classification and irrespective of the level of education, we classified "biomedically semi-literate" individuals as persons who may have had some years of formal education but not in the biomedical (veterinary, medical, biological and agricultural) field. Each respondent was only allowed to fill a pictorial or literal questionnaire and not both at any time during the study.

Data coding and statistics

Following the administration and retrieval of questionnaires from the farms and live bird markets, all data and information were entered into Microsoft Excel spreadsheet. Data were categorised, filtered and coded appropriately for ease of statistical analysis. All binary data were categorised as '0' for 'No' and '1' for 'Yes' responses. Knowledge score was accepted as correct (1) if the total score in a knowledge category was at least 75%, and incorrect (0) if the score is less than 75%. Using the Intercooled Stata v9.0 (StataCorp, Texas, USA), we test the probability of independence for categorical data using Pearson's Chi square test. The association between two variables and odds of correct responses were conducted and tested using the 2 × 2 table. Pairwise correlation analysis was used to correlate knowledge scores with pictorial representation. Other descriptive analyses were performed to summarise the respondents' inputs.

Results

The majority of the poultry farming and live-bird market respondents were older than 45 years (P < 0.001), and many have obtained post-secondary education. In addition, a greater proportion operated in the rural and peri-urban areas (P < 0.001, Table 1). The degrees of knowledge of clinical signs in birds, affected species, preference for communication, biosecurity to reduce infection in man and animal, and risky practices at sales points were good to very good but the degree of knowledge of post-mortem signs in opened carcasses was relatively poor (P < 0.001, Table I).

Specifically, significant difference exists between responses to pictorial and literal representations of the specific questions in each knowledge field. For the knowledge of clinical signs in birds, torticollis (twisting of neck, OR = 3.46, P < 0.001), malformed eggs (OR = 1.52, P < 0.001) and swollen head (OR = 3.27, P < 0.001) got a significantly higher number of correct responses in the pictorial respondents (Table II). There was no difference in the responses to depression (OR = 0.71, P = 0.48) and coloured shank (feet, OR = 1.24, P = 0.51). Whereas most respondents (literal and pictorial) were aware that chickens are affected by avian influenza H5N1 (OR = 1.00, P = 1.00), there were significantly more positive responses with regards to the other species of birds among pictorial respondents for ostrich infection (OR = 224) (Table II).

Although the knowledge of post-mortem signs was generally poor, they were significantly better (OR = 8.59 to 24.28, P < 0.001) among respondents who answered the pictorial questions (Table II). There was no difference in the preference and method of reporting outbreaks between respondents to pictorial and literal means. A great disparity was however observed between good knowledge of biosecurity measures and implementation in the farms and live bird markets (Table II). Finally, risky practices continue to exist in the LBMs through the sales of wild birds and other animals alongside farmed poultry. Pictorial representation was poorly correlated with post-secondary education but positively correlated with the knowledge of clinical signs (P < 0.001), species affected (P < 0.001) and post-mortem signs in opened carcasses (P < 0.001) (Table III).

Discussion

We have shown evidence that communicating the health and disease prevention messages is dependent on using the appropriate means, and pictorial representations outperformed literal presentations in health information communication to generate the intended outcomes. Porter (Porter 2012, Porter 2013) has earlier highlighted the importance of using ethnographic details and images to communicate avian influenza information. The farming and livestock marketing populations were grossly semi-literate biomedically and appear to be aging with over 78% of the respondents older than 45 years; Mokoele and colleagues (Mokoele *et al.* 2014), have obtained similar findings in smallholder pig production in South Africa. Whether the aging trend of the formally educated individuals is a matter of increasing unemployment that forced

Table I. *Descriptive statistics of the respondents and knowledge scores.*

Variables	Categories (n)	Proportion ± SE (%)	*P*-value
Age	≤ 45 years (76)	21.7±2.2	< 0.001
	46-55 years (189)	54.0±2.7	
	> 55 years (85)	24.3±2.3	
Education level	Up to secondary (148)	42.3±2.6	< 0.001
	Higher than secondary (202)	57.7±2.6	
Location	Rural (206)	58.9±2.6	< 0.001
	Urban (144)	41.1±2.6	
Knowledge of clinical signs in birds	Yes (1173)	67.0±1.1	< 0.001
	No (577)	33.0±1.1	
Knowledge of affected species	Yes (1986)	81.1±0.8	< 0.001
	No (464)	18.9±0.8	
Knowledge of post-mortem signs in opened carcasses	Yes (522)	37.3±1.3	< 0.001
	No (878)	62.7±1.3	
Knowledge and preference for reporting outbreaks	Yes (1318)	75.3±1.0	< 0.001
	No (432)	24.7±1.0	
Knowledge of biosecurity to reduce infection in man and animal	Yes (1723)	82.0±0.8	< 0.001
	No (377)	18.0±0.8	
Knowledge of risky practices at sales point	Yes (591)	84.4±1.4	< 0.001
	No (109)	15.6±1.4	

humans into farming and poultry marketing apart from office-related employments is beyond the scope of this work. In addition, we observed that a greater proportion of respondents operated in the rural and peri-urban areas; we associated this observation with the fact that poultry farming, marketing and abattoir facilities are incompatible with the highly built-up urbanised areas due to the following reasons: (1) associated offensive odour that may emanate from improperly managed faecal waste, (2) other greenhouse gases like ammonia which are irritating and inimical to human health, and (3) increased possibility of contracting infectious or zoonotic diseases from poultry (Brautbar 1998, Snyder *et al.* 2003).

Although the positive score obtained in response to the questions on knowledge of biosecurity practice in the LBMs and poultry farms can be attributed

Table II. *Assessment of individual avian influenza health-related items using pictorial and literal responses. —cont'd*

			Categories of response variables		Pearson's χ²	OR (95% Conf. Interval)	*P*-value
			Literal	Pictorial			
Knowledge of clinical signs in birds	Torticollis	Yes	44	94	29.91	3.46 (2.20-5.43)	< 0.001
		No	131	81			
	Depression	Yes	167	164	0.50	0.71 (0.28-1.82)	0.48
		No	8	11			
	Malformed eggs	Yes	67	85	3.77	1.52 (1.00-2.33)	0.05
		No	108	90			
	Coloured shank	Yes	152	156	0.43	1.24 (0.65-2.37)	0.51
		No	23	19			
	Swollen head	Yes	101	143	23.87	3.27 (2.10-5.33)	< 0.001
		No	74	32			
Knowledge of affected species	Chicken	Yes	174	174	0.00	1 (0.06-16.12)	1.00
		No	1	1			
	Guinea fowl	Yes	137	170	28.87	9.43 (3.61-24.61)	< 0.001
		No	38	5			
	Duck	Yes	149	172	19.89	10.00 (2.97-33.72)	< 0.001
		No	26	3			
	Turkey	Yes	154	174	19.40	23.73 (3.16-178.47)	0.005
		No	21	1			
	Quail	Yes	100	166	68.23	13.83 (6.64-28.84)	< 0.001
		No	75	9			
	Pigeon	Yes	95	164	70.70	12.56 (6.37-24.76)	< 0.001
		No	80	11			
	Ostrich	Yes	5	152	249.60	224.70 (83.36-605.64)	< 0.001
		No	170	23			
Knowledge of post-mortem signs in opened carcasses	Ovary	Yes	8	51	37.69	8.59 (3.93-18.74)	< 0.001
		No	167	124			
	Intestine	Yes	49	154	129.31	18.86 (10.74-33.11)	< 0.001
		No	126	21			
	Trachea	Yes	28	137	136.23	18.93 (11.02-32.51)	< 0.001
		No	147	38			
	Heart, liver, spleen	Yes	7	88	94.79	24.28 (10.78-54.68)	< 0.001
		No	168	87			

continued

Table II. *Assessment of individual avian influenza health-related items using pictorial and literal responses. —cont'd*

			Categories of response variables		Pearson's χ²	OR (95% Conf. Interval)	*P*-value
			Literal	Pictorial			
Knowledge and preference reporting outbreaks	Report by phone	Yes	160	163	0.36	1.27 (0.58-2.81)	0.55
		No	15	12			
	Community discussion	Yes	160	156	0.52	0.77 (0.38-1.57)	0.47
		No	15	19			
	I have reported	Yes	25	34	1.65	1.45 (0.82-2.55)	0.20
		No	150	141			
	State veterinary services	Yes	172	172	0.00	1 (0.20-5.02)	1.00
		No	3	3			
	Federal Department of Livestock (FLD)	Yes	130	146	4.39	1.74 (1.03-2.94)	0.04
		No	45	29			
Knowledge of biosecurity to reduce infection in man and animal	Footbath (know)	Yes	169	171	0.41	1.52 (0.42-5.46)	0.52
		No	6	4			
	Footbath (use)	Yes	118	135	4.12	1.63 (1.02-2.62)	0.04
		No	57	40			
	Hand wash (know)	Yes	175	173	2.01	-	-
		No	0	2			
	Hand wash (use)	Yes	170	172	0.51	1.69 (0.40-7.17)	0.48
		No	5	3			
	Vehicle spray (know)	Yes	153	157	0.45	1.25 (0.65-2.43)	0.50
		No	22	18			
	Vehicle spray (use)	Yes	53	77	7.05	1.81 (1.17-2.81)	0.008
		No	122	98			
Knowledge of risky practices at sales point	Wild bird, pigeon, egret	Yes	160	142	7.82	0.40 (0.21-0.77)	0.01
		No	15	33			
	Grass cutter, antelope	Yes	142	147	0.50	1.22 (0.70-2.12)	0.48
		No	33	28			

Table III. *Pairwise correlation analyses between pictorial representation and knowledge scores.*

	Pictorial representation	Education (post-secondary)	Knowledge of clinical signs in birds	Knowledge of affected species	Knowledge of post-mortem signs in opened carcasses	Knowledge of biosecurity to reduce infection in man and animal
Pictorial representation	1.000					
Education (post-secondary)	- 0.012	1.000				
Knowledge of clinical signs in birds	0.333*	0.068	1.000			
Knowledge of affected species	0.444*	-0.012	0.204*	1.000		
Knowledge of post-mortem signs in opened carcasses	0.567*	0.106*	0.450*	0.252*	1.000	
Knowledge of biosecurity to reduce infection in man and animal	0.017	0.113*	0.205*	0.123*	0.098	1.000

*P value ≤ 0.05

to lessons learnt from reinforced messages from previous outbreaks of HPAI H5N1 (2006-2008) (Pagani *et al.* 2008), good knowledge of biosecurity in the farms and live bird markets does not always correlate with implementation of biosecurity in facilities and the reinforcement of such messages using pictorial information may serve a more useful purpose.

The degree of knowledge of post-mortem lesions in tissues and organs of dead birds was very poor, probably due to the fact that previous training did not focus on making veterinarians out of farmers and marketers, however farmers live closely with these potentially infected birds and live bird sale are often accompanied by small to medium slaughter facilities (Fasina *et al.* 2016). In the course of slaughter and evisceration of such potentially infected poultry, humans are exposed to virus-rich visceral and respiratory organs (Reperant *et al.* 2012), and the risk of contracting infection is high. It becomes necessary to demonstrate such risks to these poultry stakeholders using video or pictorial representations.

Torticollis and swollen heads in birds have significantly higher odds of recognition in the pictorial representation but not depression and coloured shanks. These signs may be associated with low grade infection, low pathogenic avian influenza (LPAI) or confused with signs observed in other infections like Newcastle disease and Salmonellosis. Because the low pathogenic avian influenza viruses may sometimes mutate or undergo re-assortment to HPAI virus and infect humans (Peiris *et al.* 2007, Lee *et al.* 2016), we advocated for the development of panels of clinic-pathological signs in pictures for display at LBMs and farms to aid easier recognition of those signs and symptoms.

The awareness of HPAI H5N1 infection in chickens is very high among both the literal and pictorial respondents but most of the literal respondents found it difficult to accept that this virus may sometimes affect other species of birds. This lack of awareness predisposes these farmers and live bird markets to significant risk of infection as the adoption of precautionary measures around other species was likely to be poor (Neupane *et al.* 2012). Perhaps the display of coloured pictures that showed the clinical signs, symptoms pathology or biosecurity items (supplementary material) aided the outcomes of the pictorial respondents, and such positive reinforcement should also be encouraged in communicating health messages to the undiscerning public (Porter *et al.* 2013).

Conclusion

We did not observe differences between the two methods of reporting outbreaks; hence we call for a complimentary use of both methods. Due to the fact that risky practises continue unabated in the LBMs and farms, continued surveillance and regular re-training of all stakeholders are important to reduce the burden of zoonotic influenza in humans. Education was negatively correlated with pictorial representation but the knowledge of post-mortem signs, clinical signs and species affected were positively correlated with pictures. We concluded that semi-literate individuals will benefit more from picture-oriented messages rather than literal ones and advocate the adoption of such practices by government extension and communication officers. To ensure that the intended outcomes of public health and preventive messages are achieved, it is important to evaluate and pre-test communication methods to determine their suitability.

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Annex 1

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Figure 1. *Pictorial questionnaire. —cont'd*

1

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YUNIBESITHI YA PRETORIA

QUESTIONNAIRE

Can you describe avian influenza H5N1 briefly? ________________________________

____

____

____

Which disease resembles the disease?

____

____

Q1 What are the clinical signs and symptoms you have observed in avian influenza?

	Yes	No
Torticollis		
Depression		
Malformed eggs		
Blue to red coloured shank/feet		
Swollen head		

Q2 Do you know the species affected by this disease? (List)

1	
2	
3	
4	
5	
6	
7	

continued

Annex 1

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Figure 1. *Pictorial questionnaire. —cont'd*

2

Q3 If you cut open any of the dead birds, can you describe what the intestine and other visceral resemble?

	Describe
Ovary (egg organ or reproductive organs)	
Intestine	
Trachea (windpipe)	
Heart, liver and spleen	

Q4. How do you like to communicate the message of avian influenza to the government?

Items		Yes	No
By Telephone			
By Community discussion with government			
Have you ever reported avian influenza outbreak			
Which are the Departments/agencies responsible for surveillance and reporting	(State Vet. Services)		
	FLD&PCS (Federal)		

Q5. Which biosecurity measures do you know or practice in your farm or LBM?

	Items		Yes	No
1	Footbath	Know		
		Use		
2	Hand wash with antiseptics	Know		
		Use		
3	Vehicular sprayer	Know		
		Use		
Do you see these animals in LBM or around the poultry farms?				
4	Wild birds, pigeon, egrets			
5	Grass cutter, antelope			

Thank you for your help

continued

Annex 1

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Figure 1. *Pictorial questionnaire. —cont'd*

3

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QUESTIONNAIRE

Can you describe avian influenza H5N1 briefly? ______________________________

____

____

____

Which disease resembles the disease?

____

____

continued

Annex 1

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Figure 1. *Pictorial questionnaire. —cont'd*

4

Q1 What are the clinical signs and symptoms you have observed in avian influenza?

	Yes	No
		
		
		
		
		

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continued

Annex 1

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Figure 1. *Pictorial questionnaire. —cont'd*

5

Q2 Do you know the species affected by this disease? (See picture list)

Picture	Yes	No
		
		
		
		
		
		
		

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continued

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Figure 1. *Pictorial questionnaire. —cont'd*

6

Q3 If you cut open any of the dead birds, can you describe what the intestine and other visceral resemble?

Picture	Yes	No
		
		
		
		

continued

Annex 1

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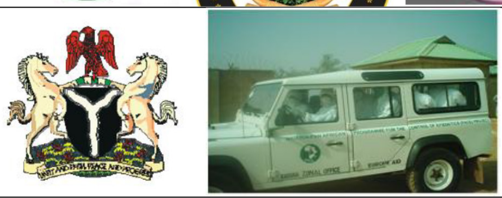
Figure 1. *Pictorial questionnaire. —cont'd*

7

Q4. How do you like to communicate the message of avian influenza to the government (Federal or State agency)?

Pictures	Yes	No
		
		
		

Have you ever reported avian influenza outbreak?	YES	NO

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continued

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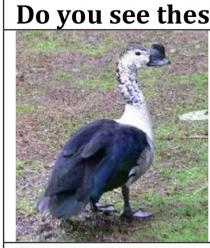
Figure 1. *Pictorial questionnaire. —cont'd*

8

Q 5. Which of these biosecurity measures do you know or practice to prevent avian influenza?

Pictures	Variable	Yes	No
	Know		
	Use		
 	Know		
	Use		
	Know		
	Use		
Do you see these animals for sale in the live bird market or around the farm?			
  			
 			

Thank you for your help