Knowledge and concern about avian influenza among secondary school students in Taif, Saudi Arabia

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معارف ومخاوف طلاب المدارس الثانوية حول إنفلونزا الطيور في الطائف، بالمملكة العربية السعودية

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الخلاصة: تتناول هذه الدراسة معارف طلاب المدارس الثانوية في الطائف، بالمملكة العربية السعودية، بشأن إنفلونزا الطيور ومخاوفهم تجاهها. وقد تم توزيع استبيان يُستكمل ذاتياً لعيِّنة طبقية عشوائية، شملت 514 طالباً من ست مدارس ثانوية. وقد اتَّضح ارتباط نتائج المعارف ارتباطاً كبيراً بالمؤشِّرات الاجتماعية والاقتصادية. حيث ذكر نحو 70٪ تقريباً من المشاركين أن وسائل الإعلام (الإذاعة أو التلفزيون أو كليهما) كانت هي المصدر الأساسي لمعلوماتهم. وقد ذكر 65.4٪ من المشاركين بوجه عام، أنهم كانوا يتوقعون حدوث حالات إنفلونزا الطيور هذا العام في المملكة العربية السعودية. وكانت الطالبات أكثر قلقاً من الطلاب (70.9٪ مقابل 58.9٪). ويتَّضح في ضوء هذه النتائج أن هناك حاجة إلى تطبيق برامج فعَّالة للتوعية والتثقيف الصحي في المدارس، لتهيئة المجتمع للتعاطي مع هذه القضية الهامة.

ABSTRACT This study identified knowledge and concerns about avian influenza among secondary school students in Taif, Saudi Arabia. A stratified random sample of 514 students from 6 secondary schools was given a self-administered multiple-choice questionnaire. Knowledge scores were significantly related to socioeconomic indicators. Approximately 70% of the participants reported that media (TV and/or radio) was the source of their information. Overall, 65.4% of the participants said they expected there to be cases of avian influenza in Saudi Arabia this year. Females were more concerned than males (70.9% versus 58.9%). Effective school health education programmes should be implemented in order to prepare the community to deal with this important threat.

Connaissances et craintes au sujet de la grippe aviaire chez des élèves des écoles secondaires à Taif (Arabie saoudite)

RÉSUMÉ La présente étude a identifié les connaissances et craintes au sujet de la grippe aviaire chez des élèves des écoles secondaires à Taif (Arabie saoudite). Un questionnaire à choix multiples à remplir soi-même a été distribué dans un échantillon aléatoire stratifié de 514 élèves de 6 écoles secondaires. Les scores concernant les connaissances étaient significativement liés aux indicateurs socio-économiques. Environ 70 % des participants ont déclaré que les médias (TV et/ou radio) étaient la source de leurs informations. De manière générale, 65,4 % des participants s'attendaient à ce qu'il y ait des cas de grippe aviaire en Arabie saoudite dans l'année. Les filles étaient davantage préoccupées que les garçons (70,9 % contre 58,9 %). Des programmes efficaces d'éducation sanitaire en milieu scolaire devraient être mis en œuvre afin de préparer la communauté face à cette menace importante.

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Introduction

Avian influenza viruses of the type A strains occur naturally among wild birds [*1–3*], which carry the virus in their intestines but usually do not become symptomatic [*3*]. However, avian influenza is highly contagious among birds and can cause significant morbidity and mortality among domesticated birds, including chickens, ducks and turkeys [*1,4*]. Avian influenza viruses do not normally infect species other than birds and pigs [*3*]. The first documented case of infection in humans occurred in Hong Kong in 1997, when the H5N1 strain caused severe respiratory disease in 18 humans, of whom 6 died [*5*]. The infection of humans coincided with an epidemic of highly pathogenic avian influenza, caused by the same strain, in Hong Kong's poultry population [*2,5*]. Extensive investigation of that outbreak determined that close contact with live infected poultry was the source of human infection [*3,5*]. Studies at the genetic level further determined that the virus had been transmitted directly from birds to humans. Limited transmission to health care workers occurred, but did not cause severe disease [*5*].

Of the 15 avian influenza virus subtypes, H5N1 is of particular concern for several reasons: it mutates rapidly and has a documented propensity to acquire genes from viruses infecting other animal species and its ability to cause severe disease and death in humans has now been documented [*6*]. Published information about the clinical course of human infection with H5N1 avian influenza is limited to studies of cases in the 1997 Hong Kong outbreak [*5,7,8*]. In that outbreak, patients developed symptoms of fever, sore throat, cough and, in several of the fatal cases, severe respiratory distress secondary to viral pneumonia [*6,8*]. Previously healthy adults and children, and some with chronic medical conditions, were affected [*6*].

Laboratory-confirmed human cases in the current outbreak, which began in Vietnam in December 2003, have been reported in Viet Nam, Thailand, Cambodia, Indonesia, China, Turkey, Iraq, Azerbaijan, Egypt and Djibouti. The World Health Organization (WHO) has officially recognized well over 200 cases [*9*] with a case-fatality rate of more than 50%. To date, sustained person-to-person transmission has not been recognized, although probable person-to-person spread was identified in Thailand involving transmission from an ill child to her mother and aunt [*10*] and several other familial clusters have been recognized [*11*].

WHO has taken several steps toward global pandemic influenza planning, including development of a pandemic plan in 1999 and an updated plan in 2005 [*12*].

Since avian influenza started to take the form of a pandemic among birds, many countries have been affected and there is some evidence of alarm and panic affecting the population in several countries [*4,6*]. However, the possibility of an influenza pandemic is a great public health concern, and for this reason our study set out to answer some important questions related to present knowledge and concerns about avian influenza in one city in Saudi Arabia.

The aim of the present study was to identify the levels of knowledge and concern about avian influenza among secondary school students using a self-administered multiple-choice questionnaire.

Methods

This study was conducted from December 2005 to February 2006 at Taif city, Saudi Arabia, as a cross-sectional survey. A rep-

resentative sample of secondary school students was chosen to screen for assessment of knowledge and concerns regarding avian influenza.

The research protocol was approved by the Research and Ethics Committee at Al-Hada Armed Forces Hospital and informed consent was obtained from all participants in the study.

Taif city is located at 1700–2500 meters above sea level in the western mountains of Saudi Arabia (Hejaz area) with a population of 885 474 according to the 2000 census [*13*].

Sample

There are 12 public and private secondary schools (7 for males and 5 for females) in Taif. A 2-stage stratified sample of 514 students from 6 out of 12 secondary schools in Taif was randomly selected for the study. The sample constituted approximately 15.7% of the secondary school population of 3267 students in all the secondary schools. In the first sampling stage, all 12 secondary schools were classified into 4 groups according to sex and socioeconomic level (categorized into male public, female public, male private and female private groups). Then, using the appropriate allocation method of sampling, 2 schools were randomly selected from the first 2 groups and 1 school was selected from the private schools (a total of 6 schools were selected). In the second sampling stage, 6 classes were selected randomly from each of the selected public schools and 3 classes from each of the private schools to represent the different grades (1 to 4). Thus, a total of 18 classes were included in the sample. Each class was considered to be a cluster, and all students in the selected classes constituted the target group of the present study.

Based upon a power analysis, a sample of 500 school students was needed for power > 0.90 to detect a moderate effect in multiple regression analysis at 5% level of significance [*14*].

Study tool

A self-administered multiple choice questionnaire in Arabic was created for the study, based on information from the World Health Organization [*2*] and Centers for Disease Control [*1*]. The questionnaire was subjected to a pilot trial on 50 students before it was distributed in its final form. Statistical analysis was used to validate the questionnaire. The questionnaire was found to be consistent, reliable and easy to read. The questionnaire contained 23 items, and included sociodemographic data, questions regarding knowledge, sources of information and concerns about avian influenza.

The knowledge section comprised questions about the definition of avian influenza, its etiology, exact causative agent, method of transmission to humans, the likelihood of human infection compared with bird infection, means of prevention and control, and the countries affected by the current pandemic.

Concern questions asked respondents if the feared that they or any of their family members were at-risk of avian influenza, whether they expected cases of avian influenza in Saudi Arabia in the current year and what they would do if cases of infection were discovered in their area.

The responses of the participants to the 7 knowledge questions were scored 1 for a correct answer and 0 for an incorrect answer (scores ranged from 0 to 7, with a median of 4). A cut-off score was calculated based on the median value. Participants scoring at or above the median value of the total knowledge score were classified as having good knowledge, while those having a total knowledge score less than the median value

were considered as having poor knowledge.

Analysis

In non-parametric tests, the ranks of the data rather than their raw values were used to calculate the statistic. Data were ranked by ordering them from lowest to highest and assigning them, in order, the integer values from 1 to the sample size. Ties were resolved by assigning tied values the mean of the ranks they would have received if there were no ties. Accordingly, the mean rank score was calculated for each group by dividing the sum of the ranks by the sample size of that group.

Sociodemographic characteristics (age, sex, parental education, parental occupation, income and household crowding index) as well as the sources of information were treated as categorical variables. Comparison of the total knowledge score according to these categories was done using non-parametric statistical tests: the Mann-Whitney test for comparing scores of 2 sub-groups and the Kruskal-Wallis test for comparing scores between more than 2 sub-groups. The association between sociodemographic characteristics and concern about avian influenza was tested using the chi-squared test. A fixed logistic regression model was performed with the total knowledge score (good versus poor) as an outcome variable and sociodemographic data and source of information data as dependent variables. Odds ratios (OR) and 95% confidence intervals (CI) were calculated.

Analysis of data was done using *SPSS*, version 11.0 software.

Results

The mean age of the 514 participants was 17.0 years (SD = 1.4 years), the median age was 17 years and the minimum and maximum ages were 13 and 21 years respectively. Most participants were of Saudi Arabian nationality (74.9%). Among the respondents, 55.3% (n = 284) were females. Nearly half of the participants had university graduated fathers and secondary or university graduated mothers. The mothers of most respondents were not working (79.8%). Approximately 30% of participants had military fathers. The majority had "enough and save" income (74.1%) and a crowding index ≤ 1.5 persons/room (Table 1).

Table 1 also shows the knowledge about avian influenza. It shows the mean rank scores of different sociodemographic subgroups of the participants. Analysis of knowledge scores indicated that the mean rank of score was significantly higher among participants with higher maternal education level as compared with those with lower maternal educational level (Kruskal-Wallis χ^2 test = 7.74, P = 0.05), participants with civil and retired employee as opposed to military fathers (Kruskal-Wallis χ^2 test = 16.89, P = 0.001), and participants with higher income ("enough and save") compared with those with not enough income (Kruskal-Wallis χ^2 test = 8.81, P = 0.012). No statistical significant differences in the knowledge score were found between different sub-groups of age, sex, nationality, paternal education, maternal work and crowding index.

Regarding sources of information, approximately 70% of the participants reported that the broadcast media (TV and/or radio) was the source of their information regarding avian influenza (Table 2). There was a statistically significant association between the knowledge score and the source of information (P < 0.001). The highest knowledge scores were observed among participants who reported that their source of information were newspapers, followed by parents, the internet and the broadcast media.

Table 1 **Avian influenza knowledge score for participants by sociodemographic data**

Variables	No.	% (*n* = 514)	Mean rank knowledge score	Significance[a]
Age (years)				
≤ 17	308	59.9	265.2	
> 17	206	40.1	246.0	***Z*** = 1.49; ***P*** = 0.137
Sex				
Males	230	44.7	247.3	
Females	284	55.3	265.8	***Z*** = 1.46; ***P*** = 0.144
Nationality				
Saudi Arabian	385	74.9	255.9	
Non-Saudi	129	25.1	262.3	***Z*** = 0.44; ***P*** = 0.659
Paternal education				
Illiterate or read & write	54	10.5	223.3	
Primary or intermediate	114	22.2	264.5	
Secondary	103	20.0	252.6	
University	243	47.3	263.9	χ^2 = 3.96; ***P*** = 0.266
Maternal education				
Illiterate or read & write	135	26.3	229.8	
Primary or intermediate	126	24.5	258.4	
Secondary	126	24.5	274.9	
University	127	24.7	268.9	χ^2 = 7.74; ***P*** = 0.052
Paternal occupation[b]				
Military	149	29.8	219.8	
Civil employee	176	35.0	278.4	
Civil worker	112	22.4	237.1	
Retired	64	12.8	272.4	χ^2 = 16.89; ***P*** = 0.001
Maternal work				
Working	104	20.2	262.3	
Not-working	404	79.8	252.5	***Z*** = 0.63; ***P*** = 0.528
Income[c]				
Enough and save	367	74.1	256.6	
Just enough	113	22.8	231.4	
Not enough	15	3.1	162.8	χ^2 = 8.81; ***P*** = 0.012
Crowding index[d]				
≤ 1.5	311	60.5	255.8	
>1.5	203	39.5	260.1	***Z*** = 0.34; ***P*** = 0.337

[a]Mann-Whitney or Kruskall-Wallis tests.
[b]Missing 13 responses; [c]Missing 19 responses.
[d]No. of persons per room.

Table 2 **Avian influenza knowledge score for participants by source of information**

Source	No.	%	Mean rank knowledge score
TV or radio	251	48.8	262.6
Newspapers	28	5.4	334.9
Internet	30	5.8	283.5
School	12	2.3	180.8
Parents	8	1.6	298.5
Friends	6	1.2	159.2
TV or radio and others	111	21.6	263.4
Other combinations	12	2.3	154.2
No definite source	56	10.9	213.8

χ^2 = 28.07; P < 0.001 (Kruskall-Wallis test).

Overall, 65.4% of the participants said they expected there to be cases of avian influenza in Saudi Arabia this year. Female participants were more concerned than males (70.9% versus 58.9%, $P < 0.001$) (Table 3). Similarly, the majority of the participants feared that they or a family member would get avian flu within the next 12 months (78.0%), with a higher percentage of females concerned than males (86.8% versus 67.5%, $P < 0.001$). If Saudi Arabia was to experience human cases of the avian influenza virus, there would be a major public reaction. If such cases were to occur in their area, more than half of the participants (53.4%) said that they would avoid travelling and attending public events, they would stay at home, take any useful drugs and avoid eating cooked birds. There was a statistically significant difference between males and females concerning their responses towards such an event ($P < 0.001$).

Table 4 shows the logistic regression analysis. The logistic regression model included age in years (≤ 17 versus > 17), sex (males versus females), nationality (Saudi versus non-Saudi), paternal education (illiterate or read and write versus primary or intermediate, secondary and university), maternal education (illiterate or read and write versus primary or intermediate, secondary and university), paternal occupation (military versus civil employee, civil worker and retired), maternal work (yes versus no), income ("enough and save" versus "just enough" and "not enough"), crowding index (≤ 1.5 versus > 1.5), and source of information (none versus 1, 2 and > 2).

Considering military paternal occupation as a reference category, participants with civil employee or retired fathers were at significant lower risk for having poor knowledge about avian influenza (OR: 0.47, 95% CI: 0.29–0.75 and OR: 0.42, 95% CI: 0.21–0.81 respectively). Regarding paternal education, participants with fathers of primary or intermediate education and of secondary education were at lower risk for having bad knowledge about avian influenza (OR: 0.34, 95% CI: 0.16–0.74 and OR: 0.44, 95% CI: 0.20–0.95 respectively). As opposed to participants having "enough and save" income, those having "just enough" or "not enough" income were at a 2-fold and 4-fold risk of having poor knowledge about avian influenza (OR: 2.06, 95% CI: 1.29–3.28 and OR: 3.93, 95% CI: 1.16–13.30 respectively) (Table 4).

Discussion

Just as the threat of an influenza pandemic is finally being taken seriously by governments around the world, a small but increasing number of scientists are questioning how great the danger really is [*15*]. It is useful to know how the public is responding in the face of contradictory messages

Table 3 **Comparison between males and females regarding their concern about infection with avian influenza**

Item	Males		Females		Total		Significance
	No.	%	No.	%	No.	%	
Do you expect cases of avian flu in Saudi Arabia this year?							$\chi^2 = 33.68$; ***P*** < 0.001
Yes, between migratory birds	48	21.4	26	9.7	74	15.0	
Yes, between domestic birds	14	6.3	14	5.2	28	5.7	
Yes, between humans	10	4.5	28	10.4	38	7.7	
Yes, between birds and humans at the same time	60	26.8	122	45.5	182	37.0	
No, don't expect	92	41.1	78	29.1	170	34.6	
Do you feel fear that you or any of your family members will be affected by avian flu?							$\chi^2 = 49.3$; ***P*** < 0.001
Yes	60	26.3	151	55.5	211	42.2	
Sometimes	94	41.2	85	31.3	179	35.8	
Not at all	74	32.5	36	13.2	110	22.0	
What you will do, if cases of infection are found in your area?							$\chi^2 = 42.58$; ***P*** < 0.001
Avoid travelling and transportation	26	11.5	4	1.5	30	6.0	
Avoid attendance of public events	6	2.7	0	0.0	6	1.2	
Won't leave the house	10	4.4	2	0.7	12	2.4	
Take any useful drugs	26	11.5	36	13.3	62	12.5	
Won't eat cooked birds at all	40	17.7	81	30.0	121	24.4	
All of the above	118	52.2	147	54.4	265	53.4	

from experts. To the best of our knowledge, this is the first trial to assess knowledge of avian influenza among school students in the Eastern Mediterranean Region. No previously validated questionnaire was found, which necessitated the creation of a tool for the assessment in this study.

Our results showed that there was no statistical significant difference in knowledge between participants regarding age, sex or nationality; however, knowledge scores were significantly higher among participants with higher maternal education level. The logistic regression model, taking good and bad knowledge among students as an outcome measure, showed that participants with low to moderate paternal educational level (primary or intermediate and secondary) were at lower risk of having poor knowledge compared with those with low educational level (illiterate or just able to read and write). This is in agreement with several studies that have assessed fathers' educational level and its impact on knowledge, attitudes and practice regarding different health topics [*16,17*].

Regarding paternal occupation, our results showed that the children of profes-

Table 4 **Predictors of poor knowledge about avian influenza among participants: multivariate logistic regression analysis**

Characteristic	Total knowledge score[a]				Adjusted OR	95% CI
	Good (*n* = 260)		Poor (*n* = 164)			
Paternal occupation						
Military (***n*** = 149)[b]	66	44.3	36	55.7	1.0	
Civilian professional (***n*** = 176)	104	59.1	50	40.9	0.47	0.29–0.75**
Civilian worker (***n*** = 112)	47	42.0	49	58.0	0.87	0.52–1.48
Retired (***n*** = 64)	40	62.5	24	37.5	0.42	0.21–0.81**
Paternal education						
Illiterate or read and write (***n*** = 54)[b]	18	33.3	26	66.7	1.0	
Primary or intermediate (***n*** = 114)	64	56.1	24	43.9	0.34	0.16–0.74**
Secondary (***n*** = 103)	54	52.4	22	47.6	0.44	0.20–0.95**
University (***n*** = 243)	124	51.0	54	49.0	0.62	0.30–1.29
Income						
Enough and save (***n*** = 367)[b]	206	56.1	161	43.9	1.0	
Just enough (***n*** = 113)	48	42.5	65	57.5	2.06	1.29–3.28**
Not enough (***n*** = 15)	4	26.7	11	73.3	3.93	1.16–13.30**

[a]Based on median cut-off value; [b]Reference category.
OR = odds ratio; CI = confidence interval.
****P < 0.05.***

sional workers and retired people had better knowledge scores than the children of military personnel. This may be explained by the greater time that professional civilians or retirees spend with their children compared with military employees who may be away from home more often; comparable results have been reported by others [*17*].

One of the central variables of interest in our study was a measure of family income based on monthly income. Our results showed that a higher knowledge score was significantly associated with high family income. The logistic regression model also showed that having just enough or not enough income carry a higher risk of having poor knowledge about avian influenza compared with families who have enough and can save from their monthly income. An association between family income and knowledge score would be expected. Similar findings were also reported by Muhajarine et al., who discussed community and family characteristics, income dynamics and child health outcomes [*18*].

Health issues constitute a large part of the information in today's media. Already in 1990 in the United States of America (USA), at least one quarter of all articles in daily newspapers were in some way health-related [*19*]. In local USA television news broadcasts, health stories constituted the fifth most common topic. On Dutch television most information containing health and illness was found in television commercials [*20*]. Another study of commercials on USA television in 1998 showed that more than 17 commercials per hour contained health information [*21*]. This agrees with our results regarding sources of information, which showed that there was a statistical significant association between knowledge score and source of information ($P < 0.001$) and the highest scores were observed among participants who reported that their sources of information were newspapers, parents,

internet and media respectively. However, although schools are an important place for acquiring knowledge in general and health knowledge in particular, school was one of the lowest scoring sources of knowledge among these students.

Comparing our results to those obtained from a sample of the American populations [*22*], there were some similarities and some differences. More than half of Americans (57%) reported concern about the potential spread of avian influenza in the USA compared with 65% of our sample in Saudi Arabia. In contrast, the majority of our participants (78%) were currently concerned about the susceptibility of themselves or one of their family members to avian influenza compared with 21% among Americans. This could be attributed to the greater exposure of the American population to public health information messages compared with the population in our Region. Meanwhile, public reactions to the hypothetical situation of human cases of avian influenza were similar. One of the interesting findings regarding concerns was the statistically significant difference between males and females. Females were more concerned about the spread of infection, the possibility of catching the infection and the response to a hypothetical threat. The cause of this greater concern among females is as yet unknown, but hypotheses include the influence of female gonadal hormones and psychological changes that accompany puberty, including changes in social role to a parenting role [*23,24*].

The role of health education in the modern world is increasingly important. The goal of health education is to provide the individual with the information, skills and motivation necessary to make intelligent decisions concerning lifestyle and personal health behaviour. Health education in schools is crucial for promoting the health of young people and contributing to the overall health of the public. We also recommend the development of a validated and reliable tool for measuring knowledge, attitudes and concern regarding avian influenza as an example of a population health threat.

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Behind the global numbers: the real costs of research for health

Despite new knowledge and technologies that health research has created and which have led to improvements in average life expectancy and health status over the past century, there is still an enormous mismatch between how research resources are used and the burden of diseases affecting less developed countries. Since its foundation in 1998, the Global Forum has been tracking flows of funding for health research. The latest figures, published in 2004 but based on 2001 data, gave an annual total of approximately US$ 106 billion.

Monitoring financial flows for health research: behind the global numbers, a study published by the Global Forum, looks at some of the elements making up that global total. Where exactly does the money come from? Public or private sector in low-, middle- and high-income countries? How much does each source provide, where does the money go and how well are the allocations aligned with health research priorities at global and local levels? How to ensure that attention is paid to people in developing countries.

Monitoring financial flows for health research is available from Global Forum for Health Research, 1–5 route des Morillons, PO Box 2100,1211 Geneva 2, Switzerland. Telephone: (41) 22 791 4260; Fax: (41) 22 791 4394. It is also available free online from: http://www.globalforumhealth.org.