

Impact of SARS on Avian Influenza Preparedness in Healthcare Workers

D.K.P. Tam, S. Lee, S.S. Lee

Abstract

Background: SARS was an unprecedented outbreak which brought about 1,755 infections and 302 deaths in Hong Kong. The similarity of SARS and avian influenza prompted us to examine the relationship between SARS experience and preparedness on a potential avian influenza outbreak.

Methods: A self-administered questionnaire was delivered to nurses in Hong Kong to assess their attitude towards avian influenza; risk perception, and their relationships with previous level of exposure to SARS patients.

Results: Nine hundred and ninety-nine respondents were included in data analysis. About half of them perceived there would be an avian influenza outbreak in Hong Kong. The majority accepted a personal risk of infection in the course of their work (72.7%), and prepared to take care of patients infected with avian influenza (84.0%). Respondents were classified into two groups: high exposure (44.1%) and low exposure (55.9%) as defined by having worked in SARS ward or hospitals. High exposure nurses were less likely to avoid patients, less inclined to change their job if they were required to take care of infected patients, and had therefore a more positive attitude towards an impending avian influenza epidemic. About half of the nurses had frequent involuntary recalls of incidents relating to SARS, the frequency of which was positively correlated with knowing a person suffering from long-term complications of SARS.

Conclusion: Healthcare workers who had been actively involved in SARS work were more "positive" in responding to the impending avian influenza epidemic. Whether the level of preparedness can be sustained would need to be further explored.

care workers (HCWs), patients, and their household members [2]. The epidemic in Hong Kong started in early March 2003 which brought about 1,755 infections and 302 deaths. Four hundred and five patients were HCW [3].

The unprecedented SARS outbreak exposed the weaknesses of the coping strategies of the territory of Hong Kong towards public health crises, both on individual as well as community levels. In particular, frontline HCWs are believed to have been severely impacted [4–8]. They faced not only the increased physical and psychological stress from attending to SARS patients, but also their own risk of infection due to their close contacts with those infected. Acknowledging colleagues' infections and deaths caused tremendous emotional upsets. With the uncertainties about the illness and the course of the epidemic, some chose to be self-quarantined to ease their worries of spreading the virus to family members [4, 9]. While SARS has not returned after the last cases were reported in the same year, the threat of avian influenza was just beginning to be felt. It's of note that both SARS and avian influenza are respiratory tract infections with high mortality. As of February 2006, 34 avian influenza outbreaks have been detected in 14 provinces or regions in China [10]. The concern about human-to-human infection has again imposed threats to the society and the health care system.

Knowingly, past traumatic experiences could affect current coping strategies [11]. It would therefore be important to determine if the SARS experiences could

Infection 2007; 35: 320–325
DOI 10.1007/s15010-007-6353-z

Introduction

Severe Acute Respiratory Syndrome (SARS) was a major threat to global public health when outbreaks occurred in 2003. SARS was characterized by its extremely high infectivity [1], and the constant infection risk to health

D.K.P. Tam, S.S. Lee

Stanley Ho Centre for Emerging Infectious Diseases, The Chinese University of Hong Kong, Hong Kong, China

S. Lee

Dept. of Psychiatry, The Chinese University of Hong Kong, Hong Kong, China

S.S. Lee (corresponding author)

Stanley Ho Centre for Emerging Infectious Diseases, 2/F School of Public Health, The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, Hong Kong, China; Phone: (+852) 22528812, Fax: (+852) 26354977, e-mail: sslee@cuhk.edu.hk

Received: December 8, 2006 · Revision accepted: April 17, 2007

Published online: September 19, 2007

affect preparedness of the society against an impending avian influenza epidemic. As one of the hardest hit cities during the SARS outbreaks, Hong Kong is uniquely positioned to explore such relationship, especially as regards the perception and attitudes of frontline HCW. We hypothesize that the experiences from SARS would affect HCW's attitude and preparedness towards the impending epidemic. We focused our attention on nurses as the prototype frontline HCW who would be charged with responding to the outbreaks and be dealing with the public, the medical professionals, embassies, overseas citizens and health authorities, not unlike what happened during the SARS outbreak [12].

Method

We employed a self-administered questionnaire to assess nurses' SARS experiences and their responses to the impending avian influenza outbreak. The questionnaire was in Chinese language as almost all frontline nurses in Hong Kong were local Chinese. It was developed after interviewing stakeholders and healthcare workers to determine the themes and range of possible responses for assessing SARS experiences. The questionnaire was field tested and then sent to the nurses via their postal addresses, through three nursing associations – the Hong Kong Nurses General Union; the Nurses Branch, and the Enrolled Nurses Branch, Hong Kong Chinese Civil Servants' Association. These associations serve as a forum for social gathering and networking. All nurses practicing in Hong Kong are eligible to apply for membership. Applications to the three associations are not mutually exclusive. Mailing was made just before the influenza seasons of 2006. The posted questionnaire was accompanied by an introductory letter to explain about study objectives and protection of anonymity, a self-addressed stamped envelop, and a small souvenir. Subjects who were not practicing as a nurse in 2003 were excluded. Ethical approval was obtained from ethics committee of The Chinese University of Hong Kong.

Questionnaire Design

The questionnaire was set to inquire the demographics, community hygienic practice, attitudes towards avian influenza and SARS experiences. For demographics, subjects were asked to provide their age, gender, and their years of services. They were asked to indicate their nursing practice (registered nurse/enrolled nurse), and how frequently did they contact patients. Community hygiene practice included hand washing, the use of separate set of chopsticks for picking food at meals, and the use of bleach to clean furniture. We also asked about the stocking of Tamiflu at home.

Perception of societal risk of avian influenza was assessed by six-point Likert scale, adapting the questionnaire by Imai et al. [13] for assessing SARS risk perception in healthcare workers in Japan. Questions included perceived chance of an avian influenza outbreak in Hong Kong, perceived control on avian influenza infection, and fear about the infection. Perception of personal risk in occupational settings included one's acceptance of risk, avoidance of patient, and possible job change as a result of risk of infection.

Four items were used to assess one's experiences in SARS, which included (1) work participation during SARS outbreak, (2) having friends or colleagues infected with SARS in 2003, (3) whether one's still suffering from long-term complications

after SARS; and (4) how frequently was there a recall of SARS in the last 6 months.

Statistical Analysis

Data analysis was performed using SPSS (version 13.0). Non-parametric Mann-Whitney *U* test was used on ordinal data analysis. Binary data was analyzed with odds ratio and logistic regression. Statistical significance was defined at $p < 0.05$.

Results

Characteristics of Respondents

A total of 2,929 questionnaires were sent off through over a 4-week period in January and February 2006. Eighty-one (2.77%) of those were undelivered due to incorrect postal addresses. As of 22 February 2006, 1,005 completed questionnaires were received. One of them was not included as the respondent was not practicing as a nurse in 2003 and 2006. Five other responses were discarded as the subjects had retired before 2003.

An estimated 10% of the recipients had enrolled in two of the associations listed above, and about 2% not in active practice, the response rate of the study could range from 35.29% to 39.75%.

Of the 999 returned questionnaires available for analysis, a majority were from female respondents (85.9%). Most of them were experienced nurses, with 11 or more years of services (84.3%). The age range followed normal distribution, with about half ageing between 36 and 45 (50.3%) (Table 1). About 80% of respondents claimed that they had frequent contacts with patients. No difference in characteristics between registered nurses and enrolled nurses was observed.

Infection Control and Risk Perception

At the time of the survey, less than 40% of respondents wore mask all the time during working hours. Half of them (53.0%) had been vaccinated against influenza before the questionnaire was administered, while 2.6% indicated they would receive their vaccination in the following months. Some 94% of our subjects reported that they washed their hands before getting off duty.

About half (50.4%) of the respondents perceived there would be an avian influenza outbreak in Hong Kong. A majority (72.7%) accepted a personal risk of avian influenza infection in the course of their work, and that most (84.0%) were in fact prepared to take care of patients infected with the avian influenza virus. Although they (72.0%) believed they had little control over the chance of contracting avian influenza, and were afraid of falling ill with the infection (69.4%), they would not consider a job change even if they (81.6%) were required to take care of patients with the infection.

Past Work Experience with SARS

One hundred and seventy-six (17.8%) and 266 (26.9%) of our respondents had worked in SARS wards or hospitals

	Total		SARS exposure				
	N	%	High		Low		
			N	%	N	%	
Nursing ^a	(Missing = 16)						
Registered nurses	782	79.6	365	85.3	410	75	OR = 1.94, 95% CI 1.39, 2.69
Enrolled nurses	201	20.4	63	14.7	137	25	
Gender	(Missing = 14)						
Male	139	14.1	55	12.8	83	15.2	OR = 0.81, 95% CI 0.56, 1.18
Female	846	85.9	376	87.2	462	84.8	
Age	(Missing = 4)						
25 or below	11	1.1	3	0.7	8	1.5	Mann-Whitney <i>U</i> test
26–35	206	20.7	120	27.5	82	14.9	<i>p</i> < 0.001
36–45	500	50.3	206	47.2	291	52.9	
46–55	243	24.4	97	22.2	144	26.2	
56 or above	35	3.5	10	2.3	25	4.5	
Nursing experiences	(Missing = 34)						
Less than 6 years	29	3.0	14	3.3	14	2.7	Mann-Whitney <i>U</i> test
6–11 years	122	12.6	65	15.4	55	10.3	<i>p</i> < 0.05
11–20 years	420	43.5	185	43.7	232	43.4	
More than 20 years	394	40.8	159	37.6	233	43.6	
Living	(Missing = 17)						
Alone	881	89.7	45	10.5	54	9.9	OR = 0.94, 95% CI 0.62, 1.43
With family/friends	101	10.3	384	89.5	490	90.1	
Contact with patients ^b	(Missing = 15)						
Frequent	770	78.3	384	88.1	386	70.4	Mann-Whitney <i>U</i> test
Normal	77	7.8	30	6.9	47	8.6	<i>p</i> < 0.001
Rare	72	7.3	16	3.7	56	10.2	
No contact	65	6.6	6	1.4	59	10.8	

^a Registered nurses completed 3 years' nursing training in a recognized training school or a degree or diploma in nursing or equivalent; enrolled nurses completed 2 years' nursing training under a hospital-based programme in a recognized training school; ^b Frequent contact: regular interaction; normal contact: direct contact is involved, but on an irregular basis; rare contact: infrequent contact

with SARS patients, respectively. Three hundred and twenty-one (32.4%) had not participated in any SARS related duties. Other respondents participated in SARS duties not directly related to patient care, for example, public education, infection control, and quarantine of Amoy Garden residents, where a major outbreak occurred. Four of the respondents were SARS survivors, and about half of the respondents (56.2%) had family members, friends or colleagues who contracted SARS. Nearly half (48%) had involuntary SARS recalls from time to time. One-third of these knew somebody who was still suffering from the long-term complications of SARS infection.

Respondents were classified into two groups according to their SARS exposure. High exposure group included nurses who had worked in SARS ward or hospitals with SARS patients (437, 44.1%). Respondents indirectly involved in SARS duties or non-SARS related duties were classified as low exposure group (554, 55.9%). Nurses in high exposure group were generally younger (Mann-Whitney *U*, *p* < 0.001) and less experienced (Mann-Whitney *U*, *p* < 0.05). A higher proportion of them were

registered nurses (OR = 1.94, *p* < 0.01), and tended to have frequent contact with patients in their current nursing practice (Mann-Whitney *U*, *p* < 0.001).

Impact of SARS Exposure

We compared attitudes towards avian influenza between high and low SARS exposure groups. High exposure nurses were less likely to avoid avian influenza patients (OR = 0.59, 95% CI 0.41, 0.84) and to change their job, if they were required to take care of them (OR = 0.67, 95% CI 0.48, 0.93). A significantly higher proportion of them, however, were afraid of contracting avian influenza infection (OR = 1.32, 95% CI 1.00, 1.74) (Table 2). Same analyses were performed to compare SARS ward group and non-SARS ward group. Nurses who worked inside SARS ward were less likely to change their job (OR = 1.62, 95% CI 1.02, 2.58). No other significant difference was found.

A majority (94%) of our subjects washed their hands every time before getting off duty. In the community setting, 49.5% used a separate set of chopsticks to pick food at meals, a practice commonly observed in restau-

Attitude towards avian influenza	n	%	OR	95% CI
There will be an avian influenza outbreak in Hong Kong				
Low exposure to SARS	276	49.9	1.00	0.82–1.36
High exposure to SARS	224	51.3	1.06	
I accept the risk of getting avian influenza as part of my job				
Low exposure to SARS	404	73.1	1.00	0.74–1.31
High exposure to SARS	318	72.8	0.99	
I should not be looking after patients with avian influenza				
Low exposure to SARS	107	19.3	1.00	0.41–0.84
High exposure to SARS	54	12.4	0.59**	
I have little control over whether I get infected with avian influenza or not				
Low exposure to SARS	391	70.7	1.00	0.89–1.56
High exposure to SARS	323	73.9	1.17	
I am afraid of falling ill with avian influenza				
Low exposure to SARS	370	66.9	1.00	1.00–1.74
High exposure to SARS	318	72.8	1.32*	
I will look for another job or consider resigning because of the risk of avian influenza infection				
Low exposure to SARS	121	21.9	1.00	0.48–0.93
High exposure to SARS	69	15.8	0.67*	

N = 990, missing = 9; * p < 0.05, ** p < 0.01

rants during and after SARS. Slightly more than half (57.3%) used bleach to clean furniture at home. Correlating the community hygienic practices of nurses with different SARS exposure, while controlling for age, gender, contact with patients, and working experience, SARS exposure was significantly associated with hand washing behavior (OR = 3.40, 95% CI 1.64, 7.03).

SARS Recall

About half of our respondents (48.0%) had frequent or occasional involuntary SARS recalls (Table 3). Response from these subjects (frequent and occasional recall) were compared with the rest of the respondents (rare and no recall). Nurses experiencing frequent recalls were more likely to have known a person who had SARS (OR = 1.45, 95% CI 1.13, 1.87), or known somebody suffering from long-term complications arising from SARS (OR = 2.26, 95% CI 1.73, 2.96). These variables were entered into a logistic regression model, using SARS recall as the dependent variable. While controlling for age, gender, working experience, contact with patients, and SARS exposure, “knowing a person who was suffering from SARS long-term complications” was significantly associated with SARS recall (OR = 2.44, 95% CI 1.82, 3.28).

Nurses who had frequent SARS recall generally perceived a higher chance of avian influenza outbreak in Hong Kong (OR = 1.37, 95% CI 1.06, 1.75). They were more afraid of falling ill from the infection (OR = 1.71, 95% CI 1.30, 2.25) and more inclined to seek a job change, if they were required to take care of avian influenza patients (OR = 1.43, 95% CI 1.04, 1.96). Interestingly, they

were also more likely to stock Tamiflu at home (OR = 2.04, 95% CI 1.12, 3.74).

Discussion

This study aimed to examine previous traumatizing experiences on willingness to respond to future crisis. Our results suggested that nurses who had been actively involved in SARS work held a more “positive” attitude in responding to the impending avian Influenza outbreak. They were more willing to take care of their patients and to stand by their post despite the perceived risk of infection. We postulate that experience from SARS is unique

and has made positive impacts to frontline health care workers.

Our study suggested that nurses managed to build a strong sense of self-identity after the SARS outbreaks, and have been able to seek meaning from such experiences. They acquired knowledge on how to prepare for a new crisis in the future, and fostered constructive attitudes on providing the best care for patients [5, 9, 14]. Witnessing deaths and serious infections were sufficiently stressful. SARS was such an important life event for our nurses, and the unique yet painful experience had built up strengths and identity. As noted by Frinke [15], nurses developed posttraumatic stress disorder after serving in the Vietnam War during which they witnessed quite a number of deaths and injuries. The pain however did not stop them from taking care of their patients. They reframed the situation from a positive angle and were able to cope with new stress when the environment became disruptive. Similarly, nurses in our study reframed their SARS exposure as a unique experience, which has enabled them to get better prepared for an impending outbreak of avian influenza.

On the community level, our study generated similar results in hygienic practices as those obtained by Tam et al. [8]. Over 90% of our nurses washed their hands every time before getting off duties. Such practice was more likely to happen among nurses who had higher SARS exposure. Knowingly, handwashing plays an important role in maintaining good community hygiene. Nurses have frequent contacts with patients, and their hands are easily contaminated by transient bacteria [16]. Washing hands after work decreases the chance of

Table 3
Association of SARS recall with attitude towards avian influenza.

Attitude towards avian influenza	n	%	OR	95% CI
There will be an avian influenza outbreak in Hong Kong				
Rare SARS recall	243	46.8	1.00	1.06–1.75
Frequent SARS recall	262	54.6	1.37*	
I accept the risk of getting avian influenza as part of my job				
Rare SARS recall	383	73.8	1.00	0.69–1.20
Frequent SARS recall	345	71.9	0.91	
I should not be looking after patients with avian influenza				
Rare SARS recall	81	15.6	1.00	0.81–1.58
Frequent SARS recall	83	17.3	1.13	
I have little control over whether I get infected with avian influenza or not				
Rare SARS recall	361	69.6	1.00	0.99–1.74
Frequent SARS recall	360	75.0	1.31	
I am afraid of falling ill with avian influenza				
Rare SARS recall	332	64.0	1.00	1.30–2.25
Frequent SARS recall	361	75.2	1.71**	
I will look for another job or consider resigning because of the risk of avian influenza infection				
Rare SARS recall	85	16.4	1.00	1.04–1.96
Frequent SARS recall	105	21.9	1.43*	

N = 999, no missing; * p < 0.05, ** p < 0.01

bringing infectious agents to the public, which is beneficial to the community. This is, however, just one of the many practices in maintaining good community hygiene. The contribution of other practices in environmental hygiene would need to be explored before a conclusion can be arrived.

One special observation in our study was the phenomenon of frequent SARS recalls in a subset of our nurses. Having known a person suffering from long-term SARS complications was a predictor of such recall. It appears that nurses with frequent SARS recall were less prepared for the impending avian influenza outbreak. Nevertheless they perceived a higher chance of an avian influenza outbreak, were more afraid of the infection, and were more likely to change job due to the risk of infection. A higher proportion stocked Tamiflu at home as a preparatory measures compared to other respondents. Getting acquainted with a person suffering from long-term complications from SARS could have triggered one's memory of the incident. However, we were unable to identify any significant relationship between SARS recall and SARS exposure. It's possible that SARS recall was one negative consequence of SARS exposure rather than an objective index of having worked closely with SARS patients in wards or hospitals. Further study is in progress to identify the content of the recall, and assess the impacts of SARS exposure.

The generalizability of the observation made in this study is an important issue. While the respondents have come from three different nursing associations, their similar objectives and modes of operation as forum for

networking instead of technical training implies that extrapolation is possible. There were however problems relating to potential sampling bias. First of all, the application of self-administered questionnaire through mail could have led to a selection of just those who decided to return the questionnaire. In addition, the response people made in a self-reported questionnaire may not reflect their behaviors in real situation. Secondly, a majority of our respondents were actively practicing as nurses in healthcare settings. It is possible that we were unable to capture those who

had resigned after the SARS outbreak, which may have resulted from severe physical or psychological impacts. Moreover, SARS has remained a sensational issue and could have driven some potential subjects away. On the other hand, we lack a standardized instrument for measuring attitudes and risk perception of health care workers towards an impending avian influenza outbreak. The subject was to a large extent too hypothetical, and could never be validated unless an outbreak did eventually take place. We have adopted the statements used in Imai et al. [13] study, which were useful but may not be entirely applicable as their statements were originally designed to measure risk perception of health care workers as regards SARS in Singapore.

SARS was an unprecedented outbreak, the impacts of which would continue to be a subject of public health debates. Our results showed that SARS could have indirectly made the society better prepared for an impending outbreak. However if SARS had not struck us, it's not known if the society could have the same level of preparedness towards the impending outbreak. If efficient human-to-human avian influenza transmission does not occur, it's again speculative if the level of preparedness can be sustained. The relationship between preparedness and impacts on the future epidemic would need to be examined, and would not be possible unless avian influenza really strikes us.

Acknowledgments

This project is funded by the Hong Kong Mood Disorders Center, The Chinese University of Hong Kong. The authors

would like to thank the executive committee of the three nursing associations who helped in subject recruitment and mailing of the questionnaire pack. Professor David Koh of Department of Community, Occupational and Family Medicine of the National University of Singapore is thanked for granting us permission to use the questionnaires originally designed for assessing attitudes towards SARS.

References

- Meltzer MI: Multiple contact dates and SARS incubation periods. *Emerg Infect Dis* 2004; 10: 207–209.
- Chan LY, Wong JT, Li PK, Lui SF, Fung H, Sung J: Risk of transmission of severe acute respiratory syndrome to household contacts by infected health care workers and patients. *Am J Med* 2004; 116: 559–560.
- Leung GM, Hedley AJ, Ho LM, Chau P, Wong IO, Thach TQ, Ghani AC, Donnelly CA, Fraser C, Riley S, Ferguson NM, Anderson RM, Tsang T, Leung PY, Wong V, Chan JC, Tsui E, Lo SV, Lam TH: The epidemiology of severe acute respiratory syndrome in the 2003 Hong Kong epidemic: an analysis of all 1755 patients. *Ann Intern Med* 2004; 141: 662–673.
- Chan SS, Leung GM, Tiwari AF, Salili F, Leung SS, Wong DC, Wong AS, Lai AS, Lam TH: The impact of work-related risk on nurses during the SARS outbreak in Hong Kong. *Fam Community Health* 2005; 28: 274–287.
- Mok E, Chung BP, Chung JW, Wong TK: An exploratory study of nurses suffering from severe acute respiratory syndrome (SARS). *Int J Nurs Pract* 2005; 11: 150–160.
- Poon E, Liu KS, Cheong DL, Lee CK, Yam LY, Tang WN: Impact of severe respiratory syndrome on anxiety levels of front-line health care workers. *Hong Kong Med J* 2004; 10: 325–330.
- Shaw K: The 2003 SARS outbreak and its impact on infection control practices. *Public Health* 2006; 120: 8–14.
- Tam CW, Pang EP, Lam LC, Chiu HF: Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. *Psychol Med* 2004; 34: 1197–1204.
- Lau PY, Chan CW: SARS (severe acute respiratory syndrome): reflective practice of a nurse manager. *J Clin Nurs* 2005; 14: 28–34.
- WHO: Prevention and control of avian influenza in humans in China: achieving the national objectives of the WHO Global Influenza Preparedness Plan. *Wkly Epidemiol Rec* 2006; 81: 108–113.
- Peres J, Mercante J, Nasello AG: Psychological dynamics affecting traumatic memories: implications in psychotherapy. *Psychol Psychother* 2005; 78: 431–447.
- Ho G, Parker J: Avian influenza: risk, preparedness and the roles of public health nurses in Hong Kong. *Nurs Inq* 2006; 13: 2–6.
- Imai T, Takahashi K, Hasegawa N, Lim MK, Koh D: SARS risk perceptions in healthcare workers, Japan. *Emerg Infect Dis* 2005; 11: 404–410.
- Chung BP, Wong TK, Suen ES, Chung JW: SARS: caring for patients in Hong Kong. *J Clin Nurs* 2005; 14: 510–517.
- Finke L: The bond and burden of caring. *J Child Adolesc Psychiatr Nurs* 2006; 19: 1–2.
- Bursey S, Hardy C, Gregson R: Handwashing. *Prof Nurse* 2001; 16: 1417–1419.