

## Concerns, Perceived Impact and Preparedness in an Avian Influenza Pandemic – a Comparative Study between Healthcare Workers in Primary and Tertiary Care

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### Abstract

**Introduction:** With the potential threat of an avian influenza (AI) pandemic, healthcare workers (HCWs) are expected to play important roles, and they encounter significant stress levels from an expected increase in workload. We compared the concerns, perceived impact and preparedness for an AI pandemic between HCWs working in public primary care clinics and a tertiary healthcare setting. **Materials and Methods:** An anonymous, self-administered questionnaire was given to 2459 HCWs working at 18 public polyclinics (PCs) and a tertiary hospital (TH) in Singapore from March to June 2006. The questionnaire assessed work-related and non-work-related concerns, perceived impact on personal life and work as well as workplace preparedness. **Results:** We obtained responses from 986 PC and 873 TH HCWs (response rate: 74.6% and 76.7%). The majority in both groups were concerned about the high AI risk from their occupation (82.7%) and falling ill with AI (75.9%). 71.9% accepted the risk but 25.5% felt that they should not be looking after AI patients with 15.0% consider resigning. HCWs also felt that people would avoid them (63.5%) and their families (54.1%) during a pandemic. The majority expected an increased workload and to feel more stressed at work. For preparedness, 74.2% felt personally prepared and 83.7% felt that their workplaces were prepared for an outbreak. TH HCWs were more likely to be involved in infection-control activities but the perception of infection-control preparedness in both groups was high (>80.0%). **Conclusions:** HCWs in both public primary and tertiary healthcare settings felt prepared, personally and in their workplaces, for a pandemic. Their main concerns were risks of falling ill from exposure and the possibility of social ostracism of themselves and their families. Preparedness levels appeared high in the majority of HCWs. However, concerns of HCWs could affect their overall effectiveness in a pandemic and should be addressed by incorporating strategies to manage them in pandemic planning.

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**Key words:** Bird flu, Outbreak, Personnel, Singapore

### Introduction

The danger posed by emerging infectious diseases has become greater in the past few years with the World Health Organization (WHO) warning that the threat of an avian influenza (AI) pandemic is imminent.<sup>1</sup> Healthcare institutions are expected to be key players during a pandemic,<sup>2</sup> with healthcare workers (HCWs) at a high risk of exposure and infection.<sup>3</sup> During the last severe acute

respiratory syndrome (SARS) outbreak, HCWs suffered from significant stress, partly from an overstretched healthcare system.<sup>4,5</sup> This is expected to be a similar scenario should an AI pandemic occur in Singapore.

In Singapore, primary outpatient care is provided by public polyclinics (PCs), accounting for about 22% of visits, with private general practitioners providing the rest.<sup>6</sup> Tertiary level care is provided by tertiary hospitals, which

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have multidisciplinary acute inpatient and outpatient facilities. HCWs working in primary care could differ from those working in tertiary centres in their concerns, perceived impact and preparedness for a possible AI pandemic. Our study compared these domains between HCWs working in these 2 different types of healthcare settings.

## Materials and Methods

We surveyed 2459 HCWs working in all 18 PCs and a tertiary hospital (TH) in Singapore from March to June 2006. The polyclinics are primary-care outpatient clinics staffed by doctors, nurses and administrative staff. They are located throughout Singapore and provided subsidised medical care. The PC staff was given and answered the questionnaires at their respective clinics. For the TH, the respondents comprised of staff that underwent the hospital's ongoing respiratory protection programme [respirator and Powered Air Purifying Respirators (PAPR) fitting sessions] during the survey period. This group was chosen as a convenient, representative sample for our survey and they held various jobs in the TH. The survey was administered prior to them undergoing their routine fitting or refitting of their PAPR.

We used an anonymous, self-administered questionnaire developed from an earlier survey used in a study of concerns and preparedness for SARS among HCWs.<sup>7</sup> Participation was voluntary and ethics approval was provided by the Institutional Review Board of the institutions. Questionnaires were rejected if there were incomplete entries in at least 2 pages of the questionnaire or illegible entries. The questionnaire assessed the impact among the HCWs during a pandemic – work-related (8 items) and non-work-related (4 items) concerns, perceived impact on personal life and work (10 items) and preparedness at the workplace (16 items). These items were measured on a 6-point Likert scale for responses (strongly disagree, disagree, not sure but probably disagree, not sure but probably agree, agree and strongly agree).

During statistical analyses, we dichotomised this scale into positive response (strongly agree, agree and probably agree) and negative response (strongly disagree, disagree and probably disagree). Chi-square analysis was used to compare proportions and logistic regression was used to adjust for all socio-demographic variables for all outcome variables. Significance level was set at  $P < 0.05$ . We analysed the data using SPSS Version 15.0 (SPSS Institute, Chicago, IL, USA).

## Results

### Response Rate and Characteristics of HCWs (Table 1)

One thousand and twenty-three out of 1321 PC HCWs returned the questionnaires but 37 had missing demographic

Table 1. Characteristics of Healthcare Workers (HCWs)

	PC n = 986 n (%)	TH n = 873 n (%)	Chi-square P value
Gender			
Male	136 (13.9)	129 (14.8)	0.596
Female	840 (86.1)	742 (85.2)	
Marital status			
Single	223 (22.8)	571 (65.5)	<0.001
Married	694 (71.0)	279 (32.0)	
Divorced/Separated	33 (3.4)	17 (1.9)	
Widowed	27 (2.8)	5 (0.6)	
Age group (y)			
< 19	2 (0.2)	21 (2.4)	<0.001
20-29	153 (15.5)	579 (66.3)	
30-39	234 (23.7)	150 (17.2)	
40-49	274 (27.8)	66 (7.6)	
50-59	268 (27.2)	43 (4.9)	
60-69	51 (5.2)	11 (1.3)	
≥70	4 (0.4)	3 (0.3)	
Mean (SD) (y)	42.8 (11.3)	29.1 (9.8)	
Ethnicity			
Chinese	631 (64.0)	478 (54.8)	<0.001
Malay	196 (19.9)	167 (19.1)	
Indian	129 (13.1)	115 (13.2)	
Others	30 (3.0)	113 (12.9)	
Job description			
Medical*	482 (48.9)	596 (68.3)	<0.001
Allied health†	40 (4.1)	109 (12.5)	
Administrative	464 (47.1)	168 (9.0)	
Staying with			
Family/Friends	923 (94.3)	638 (73.3)	<0.001
Alone	56 (5.7)	232 (26.7)	

PC: public polyclinic; TH: tertiary hospital

Numbers for each item may not add up to the total number of HCWs due to missing values.

\* Doctors and nursing staff

† Includes pharmacists, therapists, paramedics and medical social workers

data (valid responses: 986, response rate: 74.6%). Nine hundred and eight out of 1138 TH HCWs completed the questionnaire but 35 had missing demographic data (valid responses: 873, response rate: 76.7%)

Compared to those working in TH, PC HCWs were more likely to be Chinese, married and living with their families ( $P < 0.001$ ). PC HCWs (mean age, 42.8; SD, 11.3 years) were older than TH HCWs (mean age, 29.1; SD, 9.8 years). Medical staff (doctors/nurses) formed a greater proportion among the TH HCWs respondents compared to PC HCWs.

Table 2. Concerns Regarding a Bird Flu Pandemic

Concerns (Agree)	PC n = 986 (%)	TH n = 873 (%)	Total n = 1879 (%)	Unadjusted OR	P value	Adjusted OR†	P value
<b>Work-related concerns</b>							
My job would put me at great exposure risk	832 (85.8)	687 (79.3)	1519 (82.7)	0.64 (0.50-0.81)	<0.001	0.51 (0.37-0.71)	<0.001
I am afraid of falling ill with bird flu	757 (78.4)	636 (73.2)	1393 (75.9)	0.75 (0.61-0.93)	0.100	0.73 (0.55-0.96)	0.024
I should not be looking after bird flu patients	217 (23.9)	222 (27.2)	439 (25.5)	1.19 (0.96-1.48)	0.119	1.34 (1.01-1.78)	0.044
The risk I am exposed to is not acceptable	279 (29.3)	230 (26.7)	509 (28.1)	0.88 (0.72-1.08)	0.214	0.97 (0.75-1.27)	0.836
I accept that risk of contracting bird flu is part of job	736 (76.1)	632 (73.1)	1368 (74.7)	0.85 (0.69-1.05)	0.134	0.79 (0.60-1.03)	0.083
Might look for another job because of risk	136 (14.0)	140 (16.1)	276 (15.0)	1.18 (0.91-1.52)	0.207	1.32 (0.95-1.84)	0.095
Acceptable if colleagues resign because of their fear	507 (52.2)	419 (48.8)	926 (50.6)	0.87 (0.73-1.05)	0.142	0.73 (0.57-0.93)	0.010
Confident employer would look after my needs if I fall ill with bird flu	890 (91.2)	772 (89.1)	1662 (90.2)	0.79 (0.58-1.08)	0.141	1.04 (0.69-1.56)	0.850
<b>Non-work concerns</b>							
People close to me would be at high risk of getting bird flu because of my job	735 (76.6)	598 (70.4)	1333 (73.7)	0.72 (0.59-0.89)	0.002	0.60 (0.46-0.79)	<0.001
I would be concerned for my:							
Spouse/partner	794 (95.5)	598 (96.6)	1392 (96.0)	1.33 (0.77-2.29)	0.308	1.41 (0.68-2.95)	0.358
Parents	832 (95.1)	738 (96.3)	1570 (95.7)	1.36 (0.84-2.22)	0.211	0.84 (0.45-1.59)	0.600
Children	749 (95.5)	429 (95.1)	1178 (95.4)	0.91 (0.53-1.57)	0.739	0.89 (0.43-1.84)	0.746
Close friends	854 (92.2)	779 (96.1)	1633 (94.0)	2.05 (1.34-3.15)	0.001	1.64 (0.94-2.85)	0.081
Work colleagues	899 (94.3)	815 (97.3)	1714 (95.7)	2.13 (1.30-3.50)	0.002	2.02 (1.04-3.94)	0.039
People close to me would be worried for my health	928 (95.2)	813 (96.3)	1741 (95.7)	1.33 (0.84-2.11)	0.228	1.06 (0.58-1.95)	0.847
People close to me would be worried as they may get infected by me	836 (85.7)	748 (86.2)	1584 (85.9)	1.04 (0.80-1.35)	0.790	1.12 (0.79-1.59)	0.517

OR: odds ratio; PC: public polyclinic; TH: tertiary hospital

Numbers for each item may not add up to the total number of HCWs due to missing values.

† Adjusted for age, sex, marital status, ethnicity and staying with other people

### Concerns (Table 2)

The majority of HCWs in both groups (82.7%) felt that their job puts them at high risk of exposure to AI and three-quarters were afraid of falling ill. However, only 25.5% felt that they should not be looking after AI patients and 15.0% would leave their current job in an outbreak. Three-quarters of respondents accepted the risk of contracting AI as “part of my job” but a similar proportion were also worried that people close to them would be at high risk. About half of all respondents felt it was acceptable if their colleagues

resigned due to fear. Less TH HCWs than PC HCWs believed that their job puts them at great risk of exposure to bird flu (85.8% vs 79.3%; OR, 0.51; 95% CI, 0.37 to 0.71) and that people close to them would be at high risk because of their occupations (76.6% vs 70.4%; OR, 0.60; 95% CI, 0.46 to 0.79).

### Perceived Impact During a Pandemic (Table 3)

Nearly two-thirds of respondents felt that people would avoid them due to their jobs and half felt that the same

Table 3. Perceived Impact on Personal Life and Work

Perceived impact (agree)	PC n = 986 (%)	TH n = 873 (%)	Total n = 1879 (%)	Unadjusted OR	P value	Adjusted OR†	P value
I would be afraid of telling my family about the risk I am exposed to	253 (25.9)	261 (30.2)	514 (27.9)	1.24 (1.01-1.51)	0.042	1.86 (1.29-2.66)	0.001
People would avoid me because of my job	645 (66.1)	523 (60.5)	1168 (63.5)	0.79 (0.65-0.95)	0.014	0.99 (0.50-1.95)	0.975
People would avoid my family members because of my job	528 (54.3)	425 (49.2)	953 (51.9)	0.82 (0.68-0.98)	0.030	1.26 (0.67-2.38)	0.480
I would avoid telling other people about the nature of my job	266 (27.4)	234 (27.2)	500 (27.3)	0.99 (0.81-1.22)	0.941	1.34 (0.89-2.01)	0.150
There would be inadequate staff at my workplace to handle the increased demand	594 (61.4)	468 (54.2)	1062 (58.0)	0.75 (0.62-0.90)	0.002	1.33 (0.83-2.13)	0.230
There would be more conflict amongst colleagues at work	372 (38.5)	331 (38.5)	703 (38.5)	1.00 (0.83-1.21)	0.993	1.17 (0.70-1.94)	0.558
I would feel more stressed at work	666 (68.8)	575 (66.6)	1241 (67.7)	0.90 (0.74-1.10)	0.304	0.87 (0.48-1.55)	0.630
I would have an increase in workload	789 (81.3)	653 (75.6)	1442 (78.6)	0.71 (0.57-0.89)	0.003	0.71 (0.53-0.90)	0.023
I would have to work overtime	812 (83.6)	639 (74.0)	1451 (79.1)	0.56 (0.44-0.70)	<0.001	0.57 (0.42-0.76)	<0.001
I would have to do work not normally done by me	787 (81.1)	640 (74.2)	1427 (77.8)	0.67 (0.54-0.84)	<0.001	0.84 (0.63-1.13)	0.250

OR: odds ratio; PC: public polyclinic; TH: tertiary hospital

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† Adjusted for age, sex, marital status, ethnicity and staying with other people

would happen for their family members during a pandemic. PC HCWs were more likely to feel that there would be inadequate staff to handle any expected increase in demand for manpower. They were also more likely than TH HCWs to believe that they would be faced with increased workload and would need to work overtime.

#### Preparedness (Table 4)

The overall prevalence of perceived preparedness in both groups was high. Almost three-quarters of HCWs felt personally prepared while 83.7% felt that their institutions were prepared. The majority in both groups had received training for infection control (88.5%), knew about the outbreak preparedness plan (87.6%) and had been informed of the plan (77.5%). More than 80% felt that they had received adequate personal protective equipment (PPE) training and had someone to turn to if they were unsure about PPE usage.

TH HCWs were more aware of the presence of an infection control committee and staff, received training for infection control and influenza vaccination and were aware of their clinic preparedness plan. They were also more likely to feel that their workplace was prepared (87.3% vs 80.5%; OR, 2.58; 95% CI, 1.84 to 3.60) compared with PC HCWs.

#### Discussion

Our study assessed the concerns, perceived impact and preparedness of a possible AI pandemic between 2 different groups of HCWs – in an outpatient primary care setting and in a tertiary hospital with both inpatient and outpatient clinics. The majority of HCWs surveyed were willing to provide medical care during an AI pandemic and accepted the risk of contracting AI as part of their job of being health professionals. This finding was similar in other studies,<sup>8-10</sup> which showed different categories of HCWs expressing a professional obligation to provide medical care should an AI pandemic occur. In contrast, a study of public HCWs in the US reported that almost half were unlikely to report to work during an influenza pandemic.<sup>11</sup> The reasons mentioned for this could be due to fear of exposure and spreading the illness to family members. Our study revealed that the majority of HCWs also felt that their occupation puts them at a higher risk of exposure to AI and to falling ill. Most also expressed the worry that their family members were at high risk of contracting AI. These are potentially important considerations of HCWs regarding an outbreak and could affect their willingness to work in a pandemic.

The past experience of HCWs with SARS in 2003 could be a useful lesson in the planning for any future AI

Table 4. Preparedness for a Bird Flu Pandemic

Statement (agree)	PC n = 986 (%)	TH n = 873 (%)	Total n = 1879 (%)	Unadjusted OR	P value	Adjusted OR†	P value
There is an infection control committee in my clinic	794 (82.3)	816 (94.7)	1610 (88.1)	3.82 (2.72-5.38)	<0.001	5.58 (3.65-8.54)	<0.001
I have received training for infection control at my clinic	836 (86.0)	785 (91.3)	1621 (88.5)	1.70 (1.26-2.29)	<0.001	1.86 (1.27-2.74)	0.002
I have been recommended by my clinic to receive flu vaccination	901 (92.5)	826 (95.3)	1727 (93.8)	1.63 (1.10-2.42)	0.014	3.00 (1.81-5.00)	<0.001
There is infection control staff in my clinic	839 (86.4)	836 (96.6)	1675 (91.2)	4.55 (3.00-6.85)	<0.001	4.74 (2.88-7.82)	<0.001
My clinic has a preparedness plan for a bird flu outbreak	811 (83.4)	800 (92.4)	1611 (87.6)	2.40 (1.78-3.26)	<0.001	2.86 (2.00-4.19)	<0.001
My clinic has informed me of their bird flu outbreak preparedness plan	706 (72.8)	716 (82.7)	1422 (77.5)	1.78 (1.42-2.24)	<0.001	2.24 (1.67-3.00)	<0.001
My clinic is prepared for a bird flu outbreak	780 (80.5)	757 (87.3)	1537 (83.7)	1.67 (1.29-2.15)	<0.001	2.58 (1.84-3.60)	<0.001
I am personally prepared for a bird flu outbreak	716 (73.7)	647 (74.6)	1363 (74.2)	1.05 (0.85-1.29)	0.665	1.57 (1.19-2.06)	0.001
<b>In the past 6 months</b>							
I have attended infection control training sessions	705 (72.5)	675 (77.9)	1380 (75.0)	1.34 (1.08-1.65)	0.008	1.34 (1.02-1.76)	0.039
I have participated in infection control audits	615 (63.5)	550 (63.5)	1165 (63.5)	1.00 (0.83-1.21)	0.985	1.01 (0.79-1.30)	0.939
I have attended infection control related meetings	583 (60.1)	517 (59.7)	1100 (59.9)	0.98 (0.82-1.18)	0.860	1.03 (0.81-1.31)	0.805
I have received flu vaccination	701 (72.0)	721 (83.3)	1422 (77.3)	1.93 (1.54-2.42)	<0.001	2.12 (1.59-2.84)	<0.001
Bought anti-bird flu medication	26 (2.7)	50 (5.8)	76 (4.2)	2.26 (1.39-3.66)	0.001	2.29 (1.26-4.16)	0.007
Bought masks	197 (20.4)	99 (11.5)	296 (16.2)	0.51 (0.39-0.66)	<0.001	0.60 (0.43-0.83)	0.002
Received adequate personal protective equipment training	806 (82.9)	712 (82.8)	1518 (82.9)	0.99 (0.78-1.26)	0.941	0.73 (0.53-1.00)	0.053
Have someone to turn to if unsure of use of personal protective equipment	880 (90.4)	781 (90.8)	1661 (90.6)	1.04 (0.76-1.43)	0.785	0.94 (0.63-1.39)	0.744

OR: odds ratio; PC: public polyclinic; TH: tertiary hospital

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† Adjusted for age, sex, marital status, ethnicity and staying with other people.

pandemic. More than 40% of all SARS infections in Singapore occurred among HCWs.<sup>12</sup> SARS-related deaths among HCWs who were exposed and infected occupationally contributed to the fears of HCWs contracting potentially fatal infectious diseases.<sup>13</sup> Danger to personal health was again found to be one of the most prevalent fears among HCWs who experienced significant psychological stress during SARS.<sup>14</sup> Our study probably reflected the same concerns that were similar among HCWs during the last SARS epidemic. Another concern expressed among HCWs was that of social ostracism for both themselves and

their family. Again, this could have arisen from the experience of HCWs during the SARS epidemic when there were reports of discrimination against HCWs in uniform.<sup>14,15</sup>

Our study highlights the contradiction between how HCWs might feel about their “duty to care” for their patients and their personal duty to themselves and their families. Some have described this “duty to care” as failing to consider the other competing obligations of HCWs.<sup>16</sup> These are issues which could potentially affect the level of commitment of HCWs during a pandemic and should be



addressed in any national influenza preparedness plan.<sup>17</sup> Another interesting finding was that more than half felt it acceptable if their colleagues resigned out of fear. The personal responsibility they felt as HCWs did not seem to extend to their colleagues leaving the profession. Personal choice appeared to be important in this aspect. HCWs in our survey might feel that they do not want to judge their colleagues when they themselves might have to make similarly difficult choices – to continue treating patients or passing the responsibilities to others. Other surveys of HCWs have found that some do agree that it is professionally acceptable for them to abandon their workplace in order to protect themselves and for their families.<sup>10</sup>

One positive finding was that the majority of HCWs we surveyed were confident that their employers were taking care of their medical needs. We believe that this is an important factor in supporting HCWs and could partly be due to the positive care shown by employers to HCWs who contracted SARS in the last outbreak.

TH HCWs appeared to be involved in infection control activities and also appeared to be more informed about their workplace preparedness plan. They were more likely to have received influenza vaccinations than PC HCWs. However, our study showed that infection-control activities were already high in both groups of HCWs. Such activities included infection-control training sessions, having an outbreak preparedness plan and training in the use of PPE. This could explain why a high proportion of both groups indicated that their institutions and they themselves were prepared for an AI pandemic. In contrast, a report by Cole on UK doctors showed that about two-thirds felt that their healthcare system would have problems coping with a pandemic.<sup>18</sup> As the majority of HCWs in our study reported feeling at increased risk for contracting AI, providing adequate protective measures could provide a measure of reassurance. Activities that impart knowledge and skills could help HCWs feel better prepared and maintain staff morale and possibly staffing levels during a pandemic.

The WHO has highlighted the importance of preparedness plans in reducing the impact of outbreaks<sup>19</sup> and many countries have developed and published their national pandemic influenza plans.<sup>20</sup> The Ministry of Health has also developed an Influenza Pandemic Readiness and Response Plan documenting the medical and public health responses to an AI outbreak.<sup>2</sup> The plan describes healthcare institutions as key during a pandemic, with provisions made to protect HCWs through infection control measures, personal protection practices and anti-viral medications. This is in line with the strategy recommended by the WHO<sup>19</sup> to ensure adequate support for front-line HCWs. Other strategies recommended include measures such as access to prevention and treatment for HCWs, information

and teaching of control measures and provision of medications or vaccines.

During emergency situations, HCWs would face conditions leading to physical and mental exhaustion. This was reflected in the concerns expressed by HCWs in our study about falling ill, dealing with increased stress and workload. Psychosocial support for HCWs and measures to manage the psychological impact of a pandemic would be crucial in the planning process for a pandemic.<sup>3</sup> These could take the form of counselling, incentives to boost morale and maintain service levels, education, provision of PPE and environmental controls. All this would be crucial to maintaining the integrity of the healthcare system during a pandemic.

There are several limitations to our study. There was a lack of qualitative design such as a focus group discussion when we designed the questionnaire. Our cross-sectional survey with self-administered questionnaires has its limitations such as recall, framing and rating bias. The TH sample population consisted of staff who participated in the hospital's ongoing respiratory protection programme during the survey period. This could result in selection bias and may not be a representative sample of all TH staff.

## Conclusion

Our study showed that the majority of HCWs in our survey felt prepared for an AI pandemic – both personally and at their workplaces. Even though TH HCWs appeared to have a higher level of participation in infection control activities, both groups reported high levels of preparedness. The majority were concerned about their risk of exposure to illness due to their job and also falling ill from exposure. Other concerns were the possibility of social ostracism of themselves and their families. The concerns and perceived impact from our study could potentially be factors affecting the overall effectiveness of HCWs during a pandemic. Measures to enhance protection for HCWs, to minimise the psychological impact and possible social ostracism should be addressed in the planning stage prior to any pandemic.

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Risk Perception and Worries among Health Care Workers in the COVID-19 Pandemic: Findings from an Italian Survey. by. Mariangela Valentina Puci. This study evaluated worries, risk perception and psychological aspects of HCWs during the first COVID-19 pandemic peak in Italy, in the period between February and May 2020. Results describe the extent of HCWs concerns about the COVID-19 pandemic (more than half of the HCWs reported being highly worried about this scenario) and offer noticeable insights on rising concerns among the occupational categories involved—albeit to a different extent—about the management of this international health crisis. Concerns, perceived impact and preparedness in an avian influenza pandemic—a comparative study between healthcare workers in primary and tertiary care. *Ann Acad Med Singapore*. 2008 Feb;37(2):96-102. Wong TY, Koh GC, Cheong SK, Sundram M, Koh K, Chia SE, et al. A cross-sectional study of primary-care physicians in Singapore on their concerns and preparedness for an avian influenza outbreak. *Ann Acad Med Singapore*. 2008 Jun;37(6):458-64. 136 Communicable Diseases Surveillance in Singapore 2011 Yang KS, Fong YT, Koh D, Lim MK. High coverage of influenza vaccination among healthcare workers can be achieved during heightened awareness of impending threat. *Ann Acad Med Singapore*. 2007 Jun;36(6):384-7. Concerns, perceived impact and preparedness in an avian influenza pandemic—a comparative study between healthcare workers in primary and tertiary care. @article{Wong2008ConcernsPI, title={Concerns, perceived impact and preparedness in an avian influenza pandemic—a comparative study between healthcare workers in primary and tertiary care.}, author={T. Wong and G. Koh and S. K. Cheong and H. Lee and Y. Fong and M. Sundram and Kelvin Koh and S. Chia and D. Koh}, journal={Annals of. We compared the concerns, perceived impact and preparedness for an AI pandemic between HCWs working in public primary care clinics and a tertiary healthcare setting.