

Psychological morbidity among emergency department doctors and nurses after the SARS outbreak

嚴重急性呼吸系統綜合症爆發後，急症室醫生與護士的心理病態

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Objective: To determine the psychological morbidity among emergency department (ED) doctors and nurses six months after the 2003 Severe Acute Respiratory Syndrome (SARS) outbreak. **Methods:** During the SARS outbreak from 13 March to 31 May 2003, the study ED was designated as Singapore's only screening centre for SARS and was closed to all other patients. A self-administered questionnaire survey was conducted in November 2003. Doctors and nurses of the study ED who had patient contact during the outbreak were included. Data collected were demographics and responses to (a) Impact of Event Scale (IES) and (b) General Health Questionnaire 28 (GHQ 28). Scores were assigned to the responses whereby an IES score $\geq 26/75$ or a GHQ 28 score $\geq 5/28$ was indicative of post-event and psychiatric morbidity respectively. **Results:** Thirty-eight out of 41 (92.7%) doctors and 58 out of 83 (69.9%) nurses responded. Fewer doctors reported post-event and psychiatric morbidity compared to nurses, with 5 (13.2%) doctors and 12 (20.7%) nurses scoring ≥ 26 on IES, 6 (15.8%) doctors and 12 (20.7%) nurses scoring ≥ 5 on GHQ 28. The doctors reported a median of 9.5 (range 0-47) on IES and 0 (range 0-11) on GHQ 28. The nurses reported a median of 15 (range 0-61) on IES and 1 (range 0-25) on GHQ 28. **Conclusions:** Six months after SARS, the rates of post-event and psychiatric morbidity were relatively low among the study ED doctors and nurses. The results might have underestimated actual morbidity as the study was conducted six months after the outbreak. (*Hong Kong j.emerg.med.* 2005;12:215-223)

目的：確定在 2003 年嚴重急性呼吸系統綜合症（非典型肺炎）爆發六個月後，急症室醫生及護士的心理病態。**方法：**於 2003 年 3 月 13 日至 5 月 31 日非典型肺炎爆發期間，是次研究之急症室成為新加坡指定唯一的非典型肺炎審查中心，不接受所有其他的病人。2003 年 11 月，進行一個自我執行的問卷調查。這研究包括急症室在爆發期間有接觸病人的醫生及護士，收集的數據為研究對象的統計數據及對「事件衝擊量度 (IES)」與「一般健康問卷 28 (GHQ 28)」的答覆計分。IES 計分 $\geq 26/75$ 或 GHQ 28 計分 $\geq 5/28$ 分別地標示事後及精神病態。**結果：**41 名醫生中有 38 人回覆 (92.7%)，83 名護士中有 58 名回覆 (69.9%)。醫生報告事後及精神病態比護士少，5 名醫生 (13.2%) 及 12 名護士 (20.7%) 在 IES 得分 ≥ 26 ，6 名醫生 (15.8%) 及 12 名護士 (20.7%) 在 GHQ 28 得分 ≥ 5 。醫生 IES 的中位數為 9.5 (範

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圖 1-47) 及 GHQ 28 的中位數為 0 (範圍 0-11), 護士 IES 的中位數為 15 (範圍 1-16) 及 GHQ 28 的中位數為 1 (範圍 0-25)。總結: 非典型肺炎爆發 6 個月後, 在研究的急症室醫生及護士的事後及精神病態率相對地低, 由於研究在爆發期 6 個月後進行, 所得的結果或低估了當時實際的病態。

Keywords: Health personnel, psychological stress, Severe Acute Respiratory Syndrome

關鍵詞: 醫護人員、心理壓力、嚴重急性呼吸系統綜合症

Introduction

Background

In Singapore, the Severe Acute Respiratory Syndrome (SARS) outbreak lasted 80 days from mid-March 2003 till 31 May 2003 when Singapore was removed from the World Health Organization (WHO) list of SARS affected areas.¹ During the outbreak, the Singapore Ministry of Health (MOH) adopted a national strategy to control the outbreak expediently by centralising all SARS cases at the study hospital and closing the hospital to all non-SARS patients to free up resources to care for SARS patients.² The decision to centralise all SARS cases in the study hospital and to close it to all non-SARS patients was unprecedented in the history of health care in Singapore.

In the emergency department (ED) of the study hospital, the macro decision by MOH brought about drastic changes in the work of the doctors and nurses. Overnight, the health care workers (HCW) of the study ED became the nation's front-liners in the battle against SARS, doing work and facing risks that were different from those of HCW in the rest of the hospital and in the ED of the other five public hospitals.

Importance

Studies published thus far reporting on the psychological impact of the SARS outbreak on HCW were cross-sectional, and included many different job categories of HCW e.g. doctors, nurses and ancillary workers.³⁻¹³ Four qualitative studies identified recurring themes common to HCW in Singapore and Toronto: fear of contagion, fear of infecting others, mortality concerns and death, stigmatisation and discrimination; uncertainty, disruption and frustration; conflict, balance and sense of duty to care for patients and sick colleagues.³⁻⁶

The quantitative studies conducted in Toronto, Hong Kong, Taiwan and Singapore used different instruments to measure stress and psychiatric morbidity in HCW. Using the General Health Questionnaire 12 (GHQ 12), Nickell et al reported a psychiatric morbidity rate of 29% amongst staff in a Toronto hospital.⁷ Using the Impact of Event Scale (IES), Maunder reported that 36% of 1,557 Toronto HCW had traumatic stress when a cut-off score of 20 on the IES was utilised.⁸ Chua et al reported that Hong Kong HCW who worked in SARS units and healthy controls had increased stress level as measured by the Perceived Stress Scale, but the stress level was equally increased.⁹ Poon et al used the State-Trait Anxiety Inventory to measure anxiety level among Hong Kong HCW who had contact with SARS patients and those without such contact.¹⁰ They reported increased anxiety level among those with contact, and workmen, health care assistants and nurses reported higher levels compared to other HCW.

From Taiwan, Chong et al used the Chinese Health Questionnaire and reported psychiatric morbidity among 75% of 1,257 HCW.¹¹ Two studies reported the psychological impact of SARS on Singapore HCW.¹²⁻¹³ Using the General Health Questionnaire 28 (GHQ 28) Chan and Huak reported psychiatric morbidity of 27% amongst 661 HCW in a non-SARS Singapore hospital in a survey two months after the outbreak.¹² In another study conducted around the same time, also using the GHQ 28, Sim et al reported a psychiatric morbidity of 20.6% and a post-traumatic morbidity of 9.4% on the Revised Version of Impact of Event Scale (IES-R) among 277 Singapore HCW from primary health care.¹³

Objectives of this investigation

To our knowledge, there has not been a report

examining the psychological effect of SARS on frontline ED HCW. As a result of doing screening work for the nation, HCW in the study ED were at risk of being stressed and distressed by the experience. Yet observations by top management and the psychological support services were that HCW in the ED were less stressed compared to HCW from the other frontline clinical areas in the study hospital. This study therefore aimed to determine the post-event and psychiatric morbidity among the doctors and nurses of the study ED six months after the SARS outbreak. This paper has a companion paper that examined the coping responses of the study subjects to the SARS outbreak.¹⁴

Materials and methods

Study design

A self-administered English questionnaire was distributed to the subjects in the first two weeks of November 2003. The subjects were instructed to respond to the statements in the questionnaire in relation to the SARS outbreak. During and immediately after the outbreak, there was a cessation or restriction of non-clinical activities e.g. research in the study hospital which led to this survey being conducted six months after the outbreak, instead of during or soon after the outbreak.

Setting

The study hospital is an urban acute general hospital providing care to persons aged 15 or older. Right up to the time of the outbreak, the ED of the study hospital was the busiest in Singapore and had an annual attendance of 131,127 in year 2002. Though Singapore was removed from the WHO list of SARS affected countries on 31 May 2003, it was only one month later, on 1 July 2003 that the study hospital re-opened its doors to all patients.

By the end of the outbreak, one ED nurse had suspected SARS¹⁵ while in the hospital, more than 40 HCW contracted the disease and one doctor and one nurse died from it.¹⁶ Within a few days of the declaration of outbreak in the hospital, the psychological medicine team and

counsellors responded with an open invitation to all staff, SARS victims and their family to avail themselves to the mental health support services that were being offered unconditionally, and proactively visited the frontline clinical areas.⁵

Selection of participants

The subjects were doctors and nurses of the study ED. Inclusion criteria were all ED doctors and nurses who had patient contact at any time during the 80 days of the outbreak and could comprehend and respond to the English questionnaire. Exclusion criteria were doctors and nurses who did not have any patient contact during the outbreak, doctors and nurses who could not comprehend the questionnaire and other HCW in the ED. All ED doctors and nurses were educated in English, and English was the language of written and verbal communication among doctors and nurses within the ED and hospital.

The hospital ethics committee approved this study and participation was voluntary. All the questionnaires were de-identified.

Study protocol

For the nurses, the purpose of the study and the use of the questionnaire were explained during the shift hand-over rounds over a 4-day period. Verbal reminders were made during the subsequent hand-over rounds. At the time of the survey, none of the nurses had resigned from the ED. The doctors were briefed during the monthly teaching round. For the residents who worked in the study ED during the outbreak and had since left the ED, the first author telephoned each of them to recruit them for the study. Two email reminders were sent to the doctors. Completed questionnaires were deposited into a designated box.

Methods of measurement

The first part of the questionnaire requested for demographic data, namely age, gender, nationality, race, marital status, religious affiliation, job experience and housing arrangement. Referring to the SARS outbreak, the second part asked the subjects to record their response to the English version of the following instruments: (a) Impact of Event Scale (IES)¹⁷ and

(b) General Health Questionnaire 28 (GHQ 28)¹⁸ which were used to measure post-event and psychiatric morbidity respectively. The IES and GHQ 28 had been used to study Singapore HCW who worked in two non-SARS health care settings during the outbreak.^{12,13}

The IES is a 15-item questionnaire that measures subjective stress related to a specific event which in this study referred to the SARS outbreak. Out of the 15 items, 7 examined for symptoms of intrusion i.e. unwanted memories of the event while the remaining 8 examined for symptoms of avoidance i.e. attempts to avoid reminders and numbing of emotional responsiveness. Based on the subject's response, each item was scored 0, 1, 3 or 5 giving a maximum score of 75 and a minimum of 0, whereby higher scores reflected higher impact. The threshold score for presence of post-event stress lies between 20 and 35.^{19,20} For this study, IES total score ≥ 26 was chosen as the threshold for post-event morbidity based on the recommendation by Corneil et al.²¹ The intrusive subscale has a maximum of 35 and the avoidance subscale has a maximum of 40.

The GHQ 28 had 28 items and detects minor psychiatric disorders in the community. In this study, GHQ 28 was used to assess the extent of post-SARS psychiatric morbidity among the subjects in terms of somatic symptoms, anxiety and insomnia, social dysfunction and depression. Based on the subject's response, each item was scored 0 or 1, with a maximum score of 28 and a minimum of 0. Psychiatric morbidity was defined as a score of ≥ 5 on GHQ 28 as recommended by Goldberg et al.¹⁸ The GHQ had been used on a general population study and a study of nurses in Singapore.^{22,23} After standardisation with data from the population census, the minor psychiatric morbidity rate in the Singapore general population was 16.6%, with differential rates of 17.4% for Chinese, 15.1% for Malays and 17.8% for Indians.²²

Primary data analysis

The data was managed and analysed with SPSS (version 11.0, SPSS Inc., Chicago). Where relevant, the means, standard deviations, medians and ranges of demographic data, IES and GHQ 28 were calculated. The scores of

total IES, intrusive subscale, avoidance subscale and GHQ 28 were managed as continuous variables. Multivariate linear regression was performed for these scores to assess if any demographic characteristics predicted morbidity. For the dichotomised scores i.e. IES < 26 and IES ≥ 26 , and GHQ 28 < 5 and GHQ 28 ≥ 5 , these were managed as categorical variables. Logistic regression analysis was performed on the dichotomised scores to determine whether there were any predictors indicative of psychiatric symptoms.

Results

Thirty-eight out of 41 (92.7%) doctors and 58 out of 83 (69.9%) nurses returned the questionnaires. Two doctors and two nurses were excluded because they did not have patient contact. The doctors' mean age was 31.6 years (standard deviation SD 4.4) and for the nurses, the mean age was 32.1 years (SD 9.2). More than two-thirds (68.4%) of the respondents were Singaporeans, while 17.9% were Filipinos and the rest were from Malaysia, China and India. Half of the respondents (51%) professed to Christianity, 17.7% to Buddhism, 13.5% to no religion, 11.5% to Islam and 6.3% to Hinduism and other religion. The majority (89.6%) of respondents had more than two weeks of direct patient contact during the outbreak. Table 1 summarises the demographic characteristics.

Overall, 17.7% of ED HCW scored ≥ 26 on IES, indicative of post-event morbidity in relation to the SARS outbreak. A higher proportion of nurses reported post-event morbidity compared to the doctors. Figure 1 is a graphical representation of the IES scores reported by the respondents. Between the 2 subscales, nurses seemed to be experiencing more avoidance symptoms compared to intrusive symptoms. Table 2 summarises the IES and GHQ 28 scores.

Eighteen (18.8%) respondents scored ≥ 5 on the GHQ 28, indicative of psychiatric morbidity. Figure 2 is a graphical representation of the GHQ 28 scores reported by the respondents. Among the 65 Singaporeans comprising 54 Chinese, 8 Malays and 3 Indians, the overall rate of psychiatric morbidity was

Table 1. Demographic characteristics of emergency department doctors and nurses

Characteristic	Doctor (n=38)	Nurse (n=58)
Response rate	92.7%	69.9%
Male	65.8%	8.6%
Female	34.2%	91.4%
Mean age (years) [Standard deviation]	31.6 [4.4]	32.1 [9.2]
Median no. of years in current profession [Range]	6.0 [1-15]	6.5 [0-34]
Marital status		
Single	44.7%	63.8%
Married	55.3%	31.0%
Divorced/separated	0	5.2%
Nationality		
Singapore	70.3%	67.2%
Philippines	16.2%	19.0%
Malaysia	10.8%	5.2%
China, India	2.7%	8.6%
Religion		
Christianity	60.5%	44.8%
Buddhism	13.2%	20.7%
No religion	13.2%	13.8%
Islam	5.3%	15.5%
Hinduism, others	7.8%	5.2%

Table 2. Median scores on Impact of Event Scale (IES) and General Health Questionnaire 28 (GHQ 28) reported by respondents

Demographic categories	IES total [Inter-quartile range] (maximum 75)	Number with IES total score ≥ 26 (%)	IES Intrusive Subscale [Inter-quartile range] (maximum 35)	IES Avoidance Subscale [Inter-quartile range] (maximum 40)	GHQ 28 total [Inter-quartile range] (maximum 28)	Number with GHQ 28 score ≥ 5 (%)
Job category						
Doctor (n=38)	9.5 [4-16]	5 (13.2)	4 [2-7]	5 [1-10]	0 [0-0]	6 (15.8)
Nurse (n=58)	15 [5-24.5]	12 (20.7)	5 [1-11]	9 [3-15]	1 [0-3.5]	12 (20.7)
Gender						
Male (n=30)	12 [5-18]	3 (10.0)	5 [2-7]	6 [1-11]	0 [0-1]	5 (16.7)
Female (n=66)	11.5 [4-24]	14 (21.2)	4 [1-11]	8 [3-11]	0 [0-3]	13 (19.7)
Marital Status						
Married (n=39)	12 [3-28]	11 (28.2)	5 [1-9]	7 [1-18]	0 [0-2]	8 (20.5)
Single (n=54)	12 [5-21]	6 (11.1)	4 [2-7]	8 [3-13]	0 [0-3]	10 (18.5)
Divorced/ Separated (n=3)	6 [3-10]	0	0 [0-2]	6 [3-8]	3 [1.5-3.5]	0

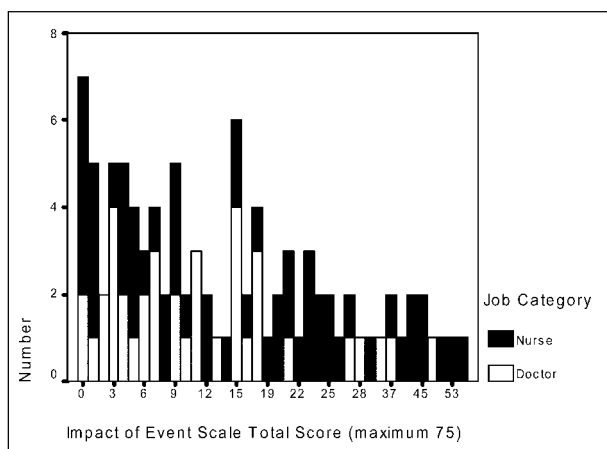


Figure 1. Impact of Event Scale total score reported by emergency department doctors and nurses.

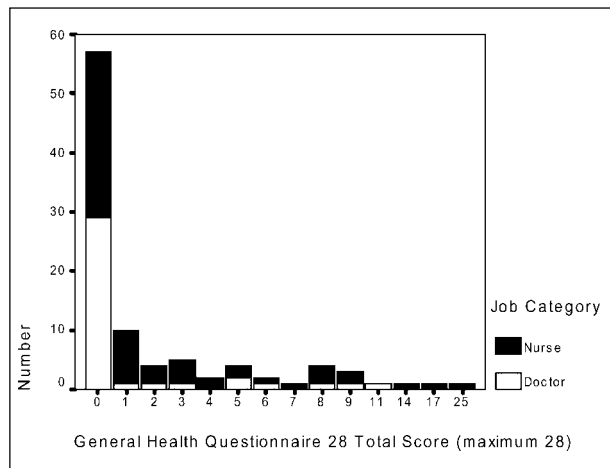


Figure 2. General Health Questionnaire 28 total score reported by emergency department doctors and nurses.

15.4%. This was comparable to the 16.6% for the general population reported by Fones et al.²² Nine (16.7%) of the Singaporean Chinese, none of the Malays and 1 of the 3 (33.3%) Indians scored ≥ 5 on the GHQ 28. The number of Singaporean Indians was too small for meaningful comparison to the general population rate but for the Chinese, this was comparable to the 17.4% reported by Fones et al.²²

Regression analysis did not reveal any demographic characteristic that predicted post-event or psychiatric morbidity among the respondents. When comparison was done between doctors and nurses, none of the demographic characteristic accounted for the higher morbidity among the nurses.

Discussion

Studies in the last two decades reported psychological distress rates between 25.2% and 51% among ED doctors²⁴⁻³⁰ of various seniority and 22% to 38.9% among emergency nurses.³¹⁻³⁴ These studies assessed the general stress level among ED HCW, rather than psychiatric morbidity in the aftermath of a major event. In June 2002, 9 months before the SARS outbreak, the mental health of doctors and nurses of the study ED was assessed using the GHQ 28 and Trauma Scale to measure post-traumatic stress disorder (unpublished data, Dr AO Chan, Psychological Medicine Department, Changi General Hospital, Singapore). The survey was general in nature and there was no specific event preceding the June 2002 survey. The response rate was 54.8% for doctors, who scored a median of 1 (minimum 0, maximum 20) on GHQ 28 and 36.1% for nurses, who scored a median of 2 (minimum 0, maximum 21). Among the respondents, 29.4% of 17 doctors and 33.3% of 24 nurses were found to have minor psychiatric disorder as defined by GHQ 28. Hence, in the 2002 survey, the general stress rates among our respondents were comparable to those reported in international studies,²⁴⁻³⁴ suggesting that the study ED is no more and no less stressful compared to other ED.

The SARS outbreak brought about many changes in the study ED, many of which were implemented over extremely short time intervals. Changes were frequent, sometimes daily or hourly, with little time for consultation with ground staff or consensus seeking.¹⁵ Casual conversation between the authors and the ED HCW revealed stressors that were similar to those experienced by HCW from Toronto, Hong Kong, Taiwan and other Singapore HCW.³⁻¹³ In addition to these stressors, the study ED was subjected to extremely intense media coverage because of its designation as Singapore's "SARS-central".¹⁶ Another stressor that some HCW felt was the pressure and embarrassment of being lauded as "heroes", of being greeted thus by strangers during the outpouring of accolades and encouragement from the nation.^{16,35} During the six months of normalisation of services after the outbreak, changes were still happening in the study ED,

including gradual stepping down of infection control measures, permanent division of patient clinical areas into two, changes in work flow for HCW, re-organisation of visitor traffic, resumption of consensus-seeking mode of decision making, and building up of patient attendance to pre-SARS level.

It is therefore interesting to note that six months after the SARS outbreak, given all the above stressors and changes, post-event and psychiatric morbidity among our ED HCW was relatively low. The reported rates for minor psychiatric illness on the GHQ 28 were lower than the pre-SARS baseline data and several explanations were possible. Firstly, the composition of the ED doctors and nurses had changed since 2002 with turnover of residents and expansion of the nursing manpower. Secondly, the response rates were much lower in the 2002 survey compared to the present study. Thirdly, perhaps most importantly, working through and surviving the SARS outbreak might have changed the perceptions of HCW in the study ED such that previous stressors paled in comparison to the stress of the outbreak. The questionnaire did not ask the respondents to compare their emotions pre-SARS and post-SARS. Hence, the authors could only speculate that the SARS outbreak was such a life-defining event for the respondents that their perceptions of stress changed drastically.

Compared to the other SARS-related studies,⁷⁻¹³ the ED HCW post-event and psychiatric morbidity rates were low. Possible explanations include firstly the difference in timing of the surveys. Most of the other studies were conducted within two months after the start of the outbreak while this study was conducted six months after the end of the outbreak. It is recognised that psychological impact tended to decrease over time after the traumatic event.¹⁹ Secondly, HCW in the other studies had to care for the usual load of patients in addition to maintaining vigilance for an extended period of time to identify and isolate SARS patients quickly.¹² Two additional points should be raised: (a) though empirical observation was supportive of the protective effect of N95 masks and personal protective equipment, the scientific evidence affirming the protective effect had yet to be validated or

published when the other surveys were conducted, and (b) Singapore was still on the WHO "hot zone" list. By November 2003, our respondents knew for sure that personal protective equipment was effective, and WHO had already declared Singapore and the world to be SARS-free.

In summary, six months after SARS, the rates of post-event and psychiatric morbidity were relatively low among the study ED doctors and nurses, at 17.7% on IES and 18.8% on GHQ 28. The trend was for nurses to report higher morbidity rates compared to the doctors. The results might have underestimated actual morbidity as the study was conducted six months after the outbreak.

Limitations

Several limitations to this study need to be addressed. During and immediately after the outbreak, the authors did not have the resources to collect data on post-event and psychiatric morbidity when the situation was likely to be most stressful. The results in this study therefore might have underestimated the actual morbidity as the study was conducted six months after the outbreak.

Due to language problem in understanding the questions in the 8-page questionnaire, the porters and housekeeping staff were not included in the study. Their ability to read English was at elementary school level or lower and their primary language of verbal communication was either Chinese dialects, Malay or Tamil. The porters had patient contact and the housekeeping staff had contact with contaminated linen and biological waste, hence the study might have yielded interesting results from these HCW if the language barrier could be surmounted without compromising the validity of the instruments. Health care workers who did not have patient contact were also excluded, namely the clerical and administrative staff. Though they had extremely low risk of infection, it was conceivable that they were distressed by the fear and uncertainty during the outbreak, which this study did not address.

To minimise fatigue, respondents were not asked to describe or list the specific aspects of the outbreak that were stressful. Even though they were exposed to similar risks of infection, doctors and nurses had different roles and tasks that would impact their perception of stress. Hence the chance to gather valuable information to prepare for future outbreaks was missed when major stressors were not identified. Information on prior psychiatric illness, counselling and use of psychiatric medications was not requested during the survey. Morbidity might have been underestimated if some of the HCW were undergoing counselling or using psychiatric medications. The response rate of 69.9% among the nurses, though good by most standards, was lower than that among the doctors. Due to the anonymous nature of the survey, the authors could only speculate if the nurses' lower response rate was a reflection of avoidance behaviour.

Acknowledgements

The authors would like to thank the doctors and nurses of the study Emergency Department for their help with this study, and Dr AO Chan for the use of the 2002 survey data.

References

1. World Health Organization. Update 70 - Singapore removed from list of areas with local SARS transmission [cited 2003 Jun 28]. Available from: http://www.who.int/csr/don/2003_05_30a/en/.
2. Ministry of Health, Singapore. Enhanced precautionary measures to break SARS transmission, March 22, 2003 - press release [cited 2003 Apr 4]. Available from: <http://app.moh.gov.sg/new/new02.asp>.
3. Maunder R, Hunter J, Vincent L, Bennett J, Peladeau N, Leszcz M, et al. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *CMAJ* 2003;168(10):1245-51.
4. Robertson E, Hershenfield K, Grace SL, Stewart DE. The psychosocial effects of being quarantined following exposure to SARS: a qualitative study of Toronto health care workers. *Can J Psychiatry* 2004;49(6):403-7.
5. Khee KS, Lee LB, Chai OT, Loong CK, Ming CW, Kheng TH. The psychological impact of SARS on health care providers. *Crit Care Shock* 2004;7(2):99-106.
6. Straus SE, Wilson K, Rambaldini G, Rath D, Lin Y, Gold WL, et al. Severe acute respiratory syndrome and its impact on professionalism: qualitative study of physicians' behaviour during an emerging healthcare crisis [cited 2004 Oct 24]. Available from: <http://bmj.com/cgi/content/full/329/7457/83>.
7. Nickell LA, Crighton EJ, Tracy CS, Al-Enazy H, Bolaji Y, Hanjrah S, et al. Psychosocial effects of SARS on hospital staff: survey of a large tertiary care institution. *CMAJ* 2004;170(5):793-8.
8. Maunder R. The experience of the 2003 SARS outbreak as a traumatic stress among frontline healthcare workers in Toronto: lessons learned. *Philos Trans R Soc Lond B Biol Sci* 2004;359(1447):1117-25.
9. Chua SE, Cheung V, Cheung C, McAlonan GM, Wong JW, Cheung EP, et al. Psychological effects of the SARS outbreak in Hong Kong on high-risk health care workers. *Can J Psychiatry* 2004;49(6):391-3.
10. 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(5):325-30.
11. Chong MY, Wang WC, Hsieh WC, Lee CY, Chiu NM, Yeh WC, et al. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br J Psychiatry* 2004;185:127-33.
12. Chan AO, Huak CY. Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore. *Occup Med (Lond)* 2004;54(3):190-6.
13. Sim K, Chong PN, Chan YH, Soon WS. Severe acute respiratory syndrome-related psychiatric and posttraumatic morbidities and coping responses in medical staff within a primary health care setting in Singapore. *J Clin Psychiatry* 2004;65(8):1120-7.
14. Phua DH, Tang HK, Tham KY. Coping responses of emergency physicians and nurses to the 2003 severe acute respiratory syndrome outbreak. *Acad Emerg Med* 2005;12(4):322-8.
15. Tham KY. An emergency department response to severe acute respiratory syndrome: a prototype response to bioterrorism. *Ann Emerg Med* 2004;43(1):6-14.
16. Ng WC. The Silent War: 1 March - 31 May 2003. Singapore: Tan Tock Seng Hospital; 2004:223-5.
17. Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. *Psychosom Med* 1979;41(3):209-18.
18. Goldberg DP, Williams P. A user's guide to the General Health Questionnaire. Windsor: NFER-Nelson; 1988.
19. Horowitz MJ, Wilner N, Alvarez W. Impact of Event Scale. In: Task Force for the Handbook of Psychiatric Measures. Handbook of psychiatric measures, 1st ed. Washington DC: American Psychiatric Publishing Group; 2000:579-81.
20. Neal LA, Busuttill W, Rollins J, Herepath R, Strike P, Turnbull G. Convergent validity of measures of post-traumatic stress disorder in a mixed military and civilian population. *J Trauma Stress* 1994;7(3):447-55.
21. Corneil W, Beaton R, Murphy S, Johnson C, Pike K. Exposure to traumatic incidents and prevalence of post-

- traumatic stress symptomatology in urban firefighters in two countries. *J Occup Health Psychol* 1999;4(2):131-41.
22. Fones CS, Kua EH, Ng TP, Ko SM. Studying the mental health of a nation: a preliminary report on a population survey in Singapore. *Singapore Med J* 1998;39(6):251-5.
 23. Boey KW, Chan KB, Ko YC, Goh LG, Lim GC. Work stress and psychological well-being among the nursing profession in Singapore. *Singapore Med J* 1997;38(6):256-60.
 24. McPherson S, Hale R, Richardson P, Obholzer A. Stress and coping in accident and emergency senior house officers. *Emerg Med J* 2003;20(3):230-1.
 25. Burbeck R, Coomber S, Robinson SM, Todd C. Occupational stress in consultants in accident and emergency medicine: a national survey of levels of stress at work. *Emerg Med J* 2002;19(3):234-8.
 26. Williams S, Dale J, Glucksman E, Wellesley A. Senior house officers' work related stressors, psychological distress, and confidence in performing clinical tasks in accident and emergency: a questionnaire study. *BMJ* 1997;314(7082):713-8.
 27. Gallery ME, Whitley TW, Klonis LK, Anzinger RK, Revicki DA. A study of occupational stress and depression among emergency physicians. *Ann Emerg Med* 1992;21(1):58-64.
 28. Whitley TW, Allison EJ Jr, Gallery ME, Cockington RA, Gaudry P, Heyworth J, et al. Work-related stress and depression among practicing emergency physicians: an international study. *Ann Emerg Med* 1994;23(5):1068-71.
 29. Whitley TW, Allison EJ Jr, Gallery ME, Heyworth J, Cockington RA, Gaudry P, et al. Work-related stress and depression among physicians pursuing postgraduate training in emergency medicine: an international study. *Ann Emerg Med* 1991;20(9):992-6.
 30. Doan-Wiggins L, Zun L, Cooper MA, Meyers DL, Chen EH. Practice satisfaction, occupational stress, and attrition of emergency physicians. Wellness Task Force, Illinois College of Emergency Physicians. *Acad Emerg Med* 1995;2(6):556-63.
 31. Laposa JM, Alden LE, Fullerton LM. Work stress and posttraumatic stress disorder in ED nurses/personnel. *J Emerg Nurs* 2003;29(1):23-8.
 32. Helps S. Experiences of stress in accident and emergency nurses. *Accid Emerg Nurs* 1997;5(1):48-53.
 33. Hawley MP. Sources of stress for emergency nurses in four urban Canadian emergency departments. *J Emerg Nurs* 1992;18(3):211-6.
 34. Keller KL. The management of stress and prevention of burnout in emergency nurses. *J Emerg Nurs* 1990;16(2):90-5.
 35. The Straits Times Interactive, Singapore. TTSH staff win accolade for their work [cited 2004 Jun 23]. Available from: http://straitstimes.asai1.com.sg/html/webspecial/sars/0105_13.html.