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Impact on health care workers employed in high-risk areas during the Toronto SARS outbreak

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Abstract

Background: A number of publications focusing on health care workers (HCWs) during a severe acute respiratory syndrome (SARS) outbreak have suggested that HCWs experienced psychological distress, particularly increased levels of posttraumatic stress symptomatology (PTSS). Factors contributing to increased distress in HCWs working in high-risk areas treating patients with SARS have not been fully elucidated. The goal of this study was to quantify the psychological effects of working in a high-risk unit during the SARS outbreak. **Methods:** HCWs in a Toronto hospital who worked in high-risk areas completed a questionnaire regarding their attitude toward the SARS crisis along with the Impact of Event Scale—Revised, which screens for PTSS. The comparison group consisted of clinical units that had no contact with patients infected with SARS. **Results:** Factors that were identified to cause distress in the 248 respondent HCWs were the following: (a) perception of risk to themselves, (b) impact of the SARS crisis on their work life, (c) depressive affect, and (d) working in a high-risk unit. In addition, HCWs who cared for only one SARS patient in comparison to those caring for multiple SARS patients experienced more PTSS. **Conclusions:** As expected, HCWs who were working in high-risk units experienced greater distress. Contrary to expectations, HCWs who experienced greater contact with SARS patients while working in the high-risk units were less distressed. This suggests that HCW experience in treating patients infected with SARS may be a mediating factor that could be amenable to intervention in future outbreaks.
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Introduction

In early March 2003, the first case of severe acute respiratory syndrome (SARS) was reported in Toronto, Canada [1,2]. This major metropolitan city subsequently suffered the largest outbreak of SARS in North America. At the end of this outbreak, SARS had claimed 44 Canadian lives [3,4] and infected 251 people, of whom 108 (43%) were health care workers (HCWs) [4]. The fact that hospital-acquired infections accounted for the majority of infections worldwide during the SARS outbreak [5,6] was especially significant for HCWs working in the health care system during this period.

The SARS outbreak and the public health response substantially changed working conditions for HCWs in Toronto by requiring the implementation of extensive surveillance and infection control (IC) measures [7,8]. The new precautions physically distanced HCWs from their patients and colleagues [9]. HCWs were instructed to

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minimize their contact with each other at work and outside of the work environment, and socialization with other HCWs was discouraged. These changes extended outside of the work environment, where HCWs reported instances of stigmatization, which often included their family members [9].

In the early stages of the SARS outbreak, little was known about the etiology, modes of transmission, methods of containment, or natural history of this emerging infectious disease [1,10]. In the face of a number of unknowns, HCWs were required to care for their colleagues and other patients with the fear of contracting SARS themselves. HCWs became infected with SARS despite the institution of IC precautions [11–13].

The impact of working in this type of environment has been identified by a number of studies of HCWs from around the world as being stressful, if not traumatic [14–20]. Several variables [14–20] that could increase the likelihood that an HCW would experience distress while working during an outbreak were identified. These variables included (a) being a nurse [15], (b) working part-time [15], (c) experiencing health fear and social isolation [16], (d) being placed in quarantine [17], (e) lower self-efficacy [18], (f) lifestyle affected by the SARS outbreak [15], (g) one's ability to do one's job being affected by precautionary measures [15], and (h) personal vulnerability [19,20]. It is essential to try to identify factors in the health care environment that may be precipitants or modifiers of HCW distress so that HCWs can be provided with the most favorable working conditions possible in times of extreme stress. In order to address these stressors, several studies [15,16,20–22] postulated similar methods to decrease the concerns of HCWs: clear directives regarding IC measures, use of active coping and positive framing, obtaining support from colleagues and family, and the ability to provide feedback to and obtain support from management.

These studies [14,16,23] have assisted in identifying distress in the general HCW population during an outbreak; however, the experience of those working in high-risk units has not been previously reported. The goal of this study was to extract factors that determined the psychological effects of the Toronto SARS outbreak on those HCWs working in units, which were considered to be high risk for contracting SARS. It is relevant for future planning to be aware of a possible differential risk for HCW distress related to various levels of exposure to infected patients.

Methods

HCWs in selected clinical units at a Toronto tertiary care health care institution, which treated patients with SARS, were asked to participate in the study. The assessment and care of patients who were suspected of having SARS or those diagnosed with SARS were limited to three specific hospital areas. These were "high-risk" units consisting of a special SARS unit, the intensive care unit (ICU), and the

emergency department (ED). HCWs from these high-risk units constituted the study group. Eight selected units that were not involved in either the assessment or management of patients with SARS agreed to participate as a comparison group. The eight comparison units included two oncology units, three general medicine units, one cardiology unit, one general surgery unit, and one multiorgan transplant surgery unit within the same hospital system. An e-mail was sent to each unit manager, informing them about the study and asking for their permission to distribute the questionnaires to employees on their units. All contacted nursing units agreed to participate. Blank questionnaires with sealed boxes for collection of responses were placed at various designated work areas in each participating unit between June 16, 2003, and July 9, 2003.

The self-report questionnaire consisted of a demographics section to identify respondents by age, gender, marital status, number of children, and the setting in which they lived. The questionnaire developed for this study contained 91 items in total, which were grouped into seven domains: (a) HCWs' perception of personal risk, (b) HCWs' perception of their risk to others (e.g., spouse/partner, family members, and friends), (c) confidence in IC measures, (d) confidence in information received regarding SARS, (e) impact on personal life, (f) impact on work life, and (g) depressive affect. These domains were chosen based on the available literature on stress in the workplace and the opinion of experts working and caring for SARS patients. A copy of the survey is available on request.

The responses to the multiple-choice questions were scored on a 6-point Likert scale from *strongly disagree* to *strongly agree*. These responses were dichotomized into positive and negative responses. The Impact of Event Scale—Revised (IES-R) was imbedded in the questionnaire. The IES-R [24] is a self-report scale, which assesses the prevalence of posttraumatic stress disorder (PTSD) symptoms based on *DSM-IV* diagnostic criteria. The IES-R has been found to be more sensitive to a more general construct of traumatic stress in those with lower symptom levels [25], such as those who might be experiencing posttraumatic stress symptomatology (PTSS) [26–30]. The response format of IES-R consists of a 5-point Likert scale from 0 to 4 and provides three subscores for PTSD criteria: avoidance, intrusion, and hyperarousal. In this study, for the purpose of detecting the presence of PTSS rather than diagnostic PTSD, we used a total score of 20 or greater as a cutoff of significant stress in the HCW population based on other published studies [31,32]. Ethics approval for the study was obtained from the University Health Networks Ethics Board.

Statistical analysis

SAS version 6.12 (SAS, Cary, NC, USA) was used to perform the statistical analysis for this study. The statistical analysis determined means, standard deviations, and frequencies. Frequency distributions were computed for

responses to individual survey questions. Differences between means from study groups were analyzed using *t* test and ANOVA. Univariate and multivariate logistic and linear regression analyses were conducted. A *P* value ≤.05 was considered significant.

Results

Demographics

A total of 248 HCWs (41.1%) from a possible 604 HCW respondents completed the questionnaire. The predominant group of respondents was nursing staff: 173 out of 248 respondents. There were 88 respondents (32%) out of a possible 275 respondents from the comparison "low-risk" units and 160 (48.6%) out of a possible 329 respondents from high-risk units. In the high-risk units, 55% (*n*=120) of HCWs in the ICU and 48% (*n*=24) of HCWs in the SARS unit responded, while the ED had the lowest response rate of

26.2% (*n*=16). The respondents were mainly female (86%) and young (mean age=36.9 years, S.D.=9.2), which reflects the general makeup of HCW (Table 1). The comparison and study groups were similar with respect to demographics. No differences in age, gender, marital status, number of children, living arrangements, or changes in living arrangements were seen among the four groups (SARS unit, ED, ICU, and comparison group).

Overall, the high-risk groups had a longer work experience (13.8±8.8 years; *P*=.04), as compared to the comparison group (11.3±9.3 years). Differences were observed between groups in their length of work experience (*P*=.03), where the post hoc analyses using Tukey's HSD for multiple comparisons showed differences between the ED group with 18.5±9.7 years of working experience and the comparison group who had less experience with 11.3±9.3 years. Fifty-six percent of HCWs from the high-risk unit had had daily contact with SARS patients. HCWs from the high-risk areas were more likely to have been in quarantine

Table 1
Demographic variables, living arrangements, and quarantine experience of 248 study HCWs in the overall high-risk and comparison units and in the individual high-risk units of the ICU, SARS unit, and the ED

	SARS unit	ICU	ED	Comparison units	*P* value (SARS unit vs. ICU vs. ED vs. comparison units)[a]	High-risk units	*P* value (high-risk units vs. comparison units)[b]
Age (years), mean±S.D.	35.1±8.9 (*n*=20)	37.5±8.6 (*n*=115)	41.7±9.0 (*n*=16)	35.7±9.2 (*n*=79)	.68	37.6±8.8 (*n*=151)	.13
Length of work experience (years), mean±S.D.	12.4±9.4 (*n*=23)	13.5±8.5 (*n*=118)	18.5±9.7 (*n*=16)	11.3±9.3 (*n*=82)	.03 *	13.8±8.8 (*n*=157)	.04 *
Gender	*n*=24	*n*=120	*n*=16	*n*=84		*n*=160	
Female, *n* (%)	23 (95.8)	98 (81.7)	13 (81.3)	75 (89.3)	.61	134 (83.8)	.24
Male, *n* (%)	1 (4.2)	22 (18.3)	3 (18.7)	9 (10.7)		26 (16.3)	
Marital status	*n*=24	*n*=118	*n*=16	*n*=84		*n*=158	
Single, *n* (%)	8 (33.3)	44 (37.3)	6 (37.5)	36 (42.9)		58 (36.7)	
Married, *n* (%)	13 (54.2)	56 (47.5)	7 (43.7)	41 (48.8)		76 (48.1)	
Common law, *n* (%)	2 (8.3)	9 (7.6)	1 (6.3)	4 (4.7)		12 (7.6)	
Divorced/Separated, *n* (%)	1 (4.2)	9 (7.6)	2 (12.5)	3 (3.6)	.90	12 (7.6)	.45
Number of children	*n*=22	*n*=118	*n*=16	*n*=84	.65	*n*=156	.60
None, *n* (%)	12 (54.5)	62 (52.5)	6 (37.5)	46 (54.8)		80 (51.3)	
≥1, *n* (%)	10 (45.5)	56 (47.5)	10 (62.5)	38 (45.2)		76 (48.7)	
Changed living arrangements	*n*=24	*n*=119	*n*=14	*n*=83		*n*=157	
Yes, *n* (%)	4 (16.7)	13 (10.9)	2 (14.3)	8 (9.6)	.79	19 (12.1)	.57
No, *n* (%)	20 (83.3)	106 (89.1)	12 (85.7)	75 (90.4)		138 (87.9)	
Living arrangement	*n*=24	*n*=119	*n*=16	*n*=85		*n*=159	
With family, *n* (%)	21 (87.5)	87 (73.1)	12 (75.0)	67 (78.8)		120 (75.5)	
With roommates, *n* (%)	1 (4.2)	12 (10.1)	2 (12.5)	6 (7.1)	.80	15 (9.4)	.79
Alone, *n* (%)	2 (8.3)	20 (16.8)	2 (12.5)	12 (14.1)		24 (15.1)	
Placed in quarantine	*n*=23	*n*=117	*n*=16	*n*=85		*n*=156	
Yes, *n* (%)	2 (8.7)	16 (13.7)	4 (25.0)	4 (4.7)	.052	22 (14.1)	.03 *
No, *n* (%)	21 (91.3)	101 (86.3)	12 (75.0)	81 (95.3)		134 (85.9)	

SARS unit denotes a specialized unit treating only SARS patients. Comparison units refer to units not treating or unlikely to be exposed to SARS patients. High-risk units consist of the ICU, ED, and the SARS unit.

[a] ANOVA between groups.

[b] *t* test for equality of means between high-risk and comparison units.

* *P*≤.05.

Table 2
Univariate logistic regression analysis of risk factors for PTSS using the IES-R

Dependent variable	β	S.E.	OR	95% CI	P value
Demographics					
Male gender	−0.67	0.40	0.51	0.2–1.1	.10
Age (years)	−0.01	0.02	0.99	0.96–1.02	.34
Experience (years)	−0.01	0.01	0.99	0.96–1.02	.49
Marital status (married/common law)	0.02	0.27	1.02	0.6–1.7	.95
Children	0.19	0.27	1.21	0.7–2.0	.48
Quarantine	0.95	0.44	2.59	1.1–6.1	.03
Number of SARS patients cared for					
0			1.0		
1	1.84	0.47	6.3	2.5–15.9	<.001*
≥2	0.96	0.33	2.6	1.4–5.0	<.001*
Unit					
Comparison unit			1.0		
SARS unit	0.88	0.48	2.4	0.9–6.2	.07
ICU	0.81	0.26	2.3	1.3–3.8	.003*
ED	0.80	0.41	2.2	1.0–5.0	.05*
High-risk units	1.15	0.03	3.2	1.8–5.7	<.001*
Domains of survey					
Perception of risk to self	0.90	0.15	2.5	1.8–3.3	<.001*
Perception of risk to others	0.54	0.11	1.7	1.4–2.2	<.001*
Confidence in IC measures	0.09	0.17	1.1	0.8–1.6	.59
Confidence in information	0.30	0.15	1.4	1.0–1.8	.04*
Impact on personal life	0.82	0.14	2.3	1.7–3.0	<.001*
Impact on work life	0.86	0.16	2.4	1.7–2.2	<.001*
Depressive affect	1.14	0.19	3.1	2.1–4.5	<.001*

The IES-R <20 and ≥20 is the dependent variable. The independent variables were gender, age, number of years of experience, marital status, children, quarantine, unit, number of patients attended (0, 1, or ≥2), perception of risk to self, perception of risk to others, belief in IC, belief in information, impact on personal life, impact on work life, and depressive affect.

   * $P \leq .05$.

because of unprotected contact with SARS patients than those working in the comparison units (P=.03).

Forty-nine percent of respondents felt underappreciated by their hospital coworkers, and 42% did not feel appreciated by the society at large for the nature of their work. Sixty percent of the respondents indicated that friends and neighbors avoided them, while 36% reported that people avoided their family members because of concerns of contracting SARS.

Factors that did not affect HCW psychological distress

The results of the univariate logistical regression presented in Table 2 indicate that IES-R scores (PTSS) are independent of gender, age, years of work experience, marital status, and number of children (0 vs. ≥1). Multi-variate logistical regression shows that perception of risk to others, confidence in IC measures, confidence in the information provided, and impact on personal life were not significant predictors of IES-R scores. Similarly, multivariate linear regression of IES-R avoidance, hyperarousal, and intrusion subscores was not impacted by HCW confidence in IC measures, confidence in the information provided, perception of risk to others, or perception of personal risk. The intrusion subscores were not affected further by the impact on personal life.

Factors that did affect HCW psychological distress

The clinical unit of work was a factor in HCW psychological distress. ANOVA of continuous IES-R scores by unit was significant at P<.001 (SARS unit: 22.05±19.3; ICU: 22.07±16.1; ED: 24.16±16.7; comparison units: 13.77±13.2; Table 1). Univariate logistical regression (Table 2) showed that taking care of only one patient with SARS was more stressful [odds ratio (OR)=6.3; 95% confidence interval (CI)=2.5–15.9] than taking care of

Table 3
Multivariate logistic regression analysis of risk factors for PTSS using the IES-R

Dependent variable	β	S.E.	OR	95% CI	P value
High-risk units	0.76	0.37	2.2	1.0–4.4	.04
One SARS patient cared for	1.27	0.50	3.5	1.3–9.5	.01
Perception of risk to self	0.67	0.19	2.0	1.4–2.8	<.001
Impact on work life	0.62	0.19	1.9	1.3–2.7	.001
Depressive affect	0.79	0.23	2.2	1.4–3.5	<.001

The dependent variable is the IES-R <20 and ≥20. Independent variables for the IES-R were determined using modified backward stepwise logistic regression. In this procedure, all variables significant in the univariate analysis were initially included in the model. Variables that did not remain significant were not included in subsequent analysis.

none or taking care of two or more patients with SARS (OR=2.6; 95% CI=1.4–5.0).

Multivariate logistical regression (Table 3) indicates that working in a high-risk unit, attending only one SARS patient, perception of personal risk, impact on work life, and depressive affect contributed to the presence of PTSS. Multivariate linear regression calculations were performed on the continuous subscale scores of the IES-R for avoidance, intrusion, and hyperarousal. Depressive affect was impacted by symptoms of avoidance ($P<.001$), hyperarousal ($P<.001$), and intrusion ($P<.001$). The level of avoidance in subjects was positively associated with greater impact on personal life ($P=.006$), impact on work life ($P=.003$), and depressive affect ($P<.001$). The level of hyperarousal was similarly influenced by the perception of one's own risk ($P=.008$), impact on personal life ($P=.005$), impact on work life ($P<.001$), and depressive affect ($P<.001$). Intrusive symptoms were associated with taking care of only one patient with SARS, perception of one's own risk ($P<.001$), impact on work life ($P<.001$), and depressive affect ($P<.001$).

Discussion

This study quantifies the perception that caring for patients with SARS or those suspected of having SARS increased the incidence of traumatic stress in HCWs. We also identified that the level of contact (number of patients with SARS treated) has an important mediating effect on the degree of PTSS experienced. Data showed that caring for only one patient with SARS is significantly more stressful than caring for none or caring for two or more patients with SARS. In order to cope successfully when exposed to a stressful situation, an individual is required to assess his or her self-efficacy, which entails self-appraisal of his or her individual ability to cope with the stressful event [33–35]. The experience of HCWs who cared for several patients with SARS and were exposed on repeated occasions without being infected may have bolstered their confidence in their own ability to successfully use IC measures to manage their own risk and the risk to others. Effective coping, in this case, caring for patients with SARS, would not only have reduced the level of personal distress but may also have promoted a sense of personal efficacy to meet the ongoing requirements of a challenging task on a daily basis [36]. Other factors identified to moderate the level of PTSS in the HCW population in this study were (a) impact on work life, (b) perception of personal risk, and (c) depressive affect, which are similar to those identified by other studies of HCWs dealing with the SARS outbreak [14–16,18].

The Ontario provincial government SARS commission report [37] identifies that the swiftness of the outbreak, the risk to HCWs, the associated mortality within a short time frame, and the initial uncertainty of the exact causative agent all added to the fear and perception of personal risk to the HCW. Personal risk to the HCW was an identified stressor in our study population, but the stress may have been moderated by the confidence expressed by HCWs in the IC measures and the IC information they received. This confidence may have helped to mitigate the powerlessness and vulnerability originally experienced by HCWs in the early days of the SARS outbreak. Confidence in IC measures and information appeared to be a common finding among HCWs in other studies [14,38] and may have been a determining factor in assisting HCWs from various countries in dealing with the perceived personal risk while continuing to work in health care institutions.

The impact on work life became noticeable because of the mandated restrictions in HCW socialization in the hospital and requirements to utilize protective gear while in the hospital setting. Socialization with friends/colleagues, which is an important element of support in traumatic situations [39], was no longer available to the HCW staff. This isolation would have been intensified by the public fear of this new emerging infectious disease, which resulted in HCWs feeling stigmatized. Although the media portrayed HCWs positively and held them in great regard, our data support research [9,15] that found that HCWs felt stigmatized.

Since no visitors to the hospital were allowed early in the SARS outbreak, HCWs took on a greater role in providing support and comfort to their patients. ICU HCWs are used to finding themselves caring for the dying patient. However, during the SARS outbreak, they found themselves to be the only ones at the bedside of patients who were dying of SARS. The patient's families were often quarantined or ill themselves and were unable or were not allowed to visit. These types of events would have placed a psychological burden on the HCW who would not have the opportunity, as in non-SARS times, to grieve with the patient's family and coworkers. The effect of a depressive affect on the level of distress experienced by HCWs is not surprising as it is known from previous epidemiological studies [39] that depressive disorders and PTSD are among the major psychiatric problems associated with disaster and traumatic events and will often co-occur. It has been postulated [40] that the combined effect of loss and threat may explain the frequent co-occurrence of PTSD and depression. In this case, the illness of coworkers with SARS was a loss to their colleagues, and the threat that they may also contract the SARS virus placed a heavy psychological burden on the individual HCW. Other studies [14–16,23] of HCWs during the SARS outbreak also found that large percentages experienced difficulties with depression, poor family relations, sleep problems, and somatic symptoms associated with depression.

A methodological limitation of the study is the response rate of the various units. The method of distribution of questionnaires based on ethical considerations did not allow for an accurate estimate of the number of HCWs who were possible respondents (the number of staff who actually saw

the questionnaire and decided not to participate). Response rates were based on using the full complement of staff who were assigned to the unit. This may have resulted in higher calculations of nonrespondent rates since the number of staff who would have come in contact with the survey would have been variable over the 3-week period that the study was carried out. Response rates of this study are comparable to other Canadian studies of SARS and HCW—47% in the study of Nickell et al. [15] and 23.3% in the study of Maunder et al. [16].

Survey responses from the high-risk units were higher than those from the low-risk comparison units. It is likely that HCWs who chose to participate differed in some respects from those who did not. HCWs in the high-risk units would be expected to be more acutely aware of the SARS experience and, thus, were likely to be more motivated to participate. Another determining factor may also have been the availability of staff time. Comparison units, which were low-risk units, had a smaller patient-to-staff ratio than the high-risk units, which usually had patient-to-staff ratios of 1:1 in the ICU and SARS unit. The number of HCWs available to be surveyed in the various high-risk units was variable, but it was scientifically necessary to include all designated high-risk units so that we would have a representative sample of this category of HCW. The ratio of possible respondents in the ICU versus the ED and SARS unit was approximately 5:1. The results need to be interpreted conservatively given the limitations of the number of respondents in the various categories.

The characteristics of the study population are considered to be similar to those of the population of the health care facility surveyed during the SARS outbreak. For example, nursing staff comprises 75% of frontline HCWs in this health care facility and 70% of the study population. Also, two studies [15,16] that were carried out in Toronto would suggest that our study sample is representative of other HCWs in Toronto since their findings are similar to those of our study, for example, having found increased distress to be associated with health fear and work stress. In contrast, our study also explored the exposure to SARS patients not only by self-report but also based on the information of each unit in which the HCW was working. The fact that HCWs in high-risk areas experienced more distress than those working in low-risk areas was not unexpected, but the finding that the greater number of patients cared for was associated with reduced PTSS needs to be further explored.

The seven-domain questionnaire, which was specifically designed for this study for assessing risk factors for psychological distress, was not standardized but has been used by several other groups [14,16]. No diagnostic interpretations of the IES-R or depressive affect data are made since results are self-report and no diagnostic interview was carried out. It may also be that the psychological distress experienced by the staff may be underestimated since the study was carried when the city of Toronto was at the tail end of the SARS outbreak.

Conclusions

This study suggests that the level of distress related to working in high-risk areas may be different from those in other hospital areas. Acknowledgment of this differential would be instrumental in implementing supportive work-force resources during an infectious disease outbreak. Efforts to address the level of distress in these areas may need to be centered on providing HCWs with ways to enhance their self-efficacy in dealing with high-risk situations such as SARS. A greater experience with SARS patients appeared to mitigate distress level. Using a buddy system (pairing an experienced HCW with a less experienced HCW) may help to transfer skills and address the social isolation brought about by changes in the work environment. This may be further enhanced by providing opportunities for HCWs to exchange and address concerns, share strategies that have been helpful, normalize feelings related to stressful situations, and discuss maladaptive responses. Involvement of occupational health experts [37] would help minimize the negative effects on work life and address the sense of helplessness that leads to a depressive affect [41]. Implementing systems for communication between HCWs and administration, health care facilities, and government [37], as well as preparation and planning for an outbreak, may help HCWs to reframe disease outbreaks so that they have a better sense of self-efficacy and control of the situation.

Feedback from HCWs as to the factors that play a role in determining the level of psychological stress is the first step in identifying potential areas for intervention in the future. Further follow-up of HCW resilience and personal/work requirements needs to be done to empower HCWs to deal with any future outbreaks.

Acknowledgments

References

[1] Poutanen SM, Low DE, Henry B, Finkelstein S, Rose D, Green K, et al, for the National Microbiology Laboratory, Canada, and the Canadian Severe Acute Respiratory Syndrome Study Team. Identification of severe acute respiratory syndrome in Canada. N Engl J Med 2003;348:1995–2005.

[2] Booth M, Matukas LM, Tomlinson GA, Rachlis AR, Rose DB, Dwosh HA, et al. Clinical features and short-term outcomes of 144 patients with SARS in the Greater Toronto Area. JAMA 2003;289:2801–9.

[3] Public Health Agency of Canada, SARS (severe acute respiratory syndrome) outbreak period, http://www.phac-aspc.gc.ca/sars/sars.html#numbers.

[4] Muller MP, Richardson SE, McGeer A, Dresser L, Raboud J, Mazzulli T, et al. Early diagnosis of SARS: lessons from the Toronto SARS outbreak. Eur J Clin Microbiol Infect Dis 2006;25:230–7.

[5] Ofner-Agostini M, Gravel D, McDonald LC, Lem M, Sarwal S, McGeer A, et al. Cluster of cases of severe acute respiratory syndrome among Toronto healthcare workers after implementation of infection

control precautions: a case series. Infect Control Hosp Epidemiol 2006;27:473–8.

[6] World Health Organization. WHO issues consensus document on the epidemiology of SARS. Wkly Epidemiol Rec 2003;78:373–5.

[7] Caputo KM, Byrick R, Chapman MG, Orser BJ, Orser BA. Intubation of SARS patients: infection and perspectives of healthcare workers. Can J Anaesth 2006;53:122–9.

[8] Muller MP, McGeer A. Febrile respiratory illness in the intensive care unit setting: an infection control perspective. Curr Opin Crit Care 2006;12:37–42.

[9] Hall LM, Angus J, Peter E, O'Brien-Pallas L, Wynn F, Donner G. Media portrayal of nurses' perspectives and concerns in the SARS crisis in Toronto. J Nurs Scholarsh 2003;35:211–6.

[10] Lee N, Hui D, Wu A, Chan P, Cameron P, Joynt GM, et al. A major outbreak of severe acute respiratory syndrome in Hong Kong. N Engl J Med 2003;348:1986–94.

[11] Loeb M, McGeer A, Henry B, Ofner M, Rose D, Hlywka T, et al. SARS among critical care nurses, Toronto. Emerg Infect Dis 2004;10: 251–5.

[12] Christian MD, Loutfy M, McDonald LC, Martinez KF, Ofner M, Wong T, et al. Possible SARS coronavirus transmission during cardiopul-monary resuscitation. Emerg Infect Dis 2004;10:287–93.

[13] Varia M, Wilson S, Sarwal S, McGeer A, Gournis E, Galanis E, et al. Investigation of a nosocomial outbreak of severe acute respiratory syndrome (SARS) in Toronto, Canada. CMAJ 2003;169:285–92.

[14] Koh D, Lim MK, Chia SE, Ko SM, Qian F, Ng V, et al. Risk perception and impact of severe acute respiratory syndrome (SARS) on work and personal lives of healthcare workers in Singapore: what can we learn? Med Care 2005;43:676–82.

[15] 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;170:793–8.

[16] Maunder RG, Lancee WJ, Rourke S, Hunter JJ, Goldbloom D, Balderson K, et al. Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other hospital workers in Toronto. Psychosom Med 2004;66:938–42.

[17] Bai Y, Ling CC, Lin CY, Chen JY, Chue CM, Chou P. Survey of stress reactions among health care workers involved with the SARS outbreak. Psychiatr Serv 2004;55:1055–7.

[18] Ho SM, Kowng-Lo RS, Mak CW, Wong JS. Fear of severe acute respiratory syndrome (SARS) among health care workers. Consult Clin Psychol 2005;73:344–9.

[19] Tam CWC, Pang EPF, Lam LCW, Chiu HFK. Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. Psychol Med 2004;34: 1197–204.

[20] Wong TW, Yau JKY, Chan CLW, Kwong RSY, Ho SMY, Lau CC, Lau FL, Lit CH. The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. Eur J Emerg Med 2005;12:13–8.

[21] Chan AOM, 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 2004;54:190–6.

[22] Chua SE, Cheung V, Cheung C, Cheung C, McAlonan GM, Wong JWS, et al. Psychological effects of the SARS outbreak in Hong Kong on high-risk health care workers. Can J Psychiatry 2004;49:391–3.

[23] Chen CS, Wu HY, Yang P, Yen CF. Psychological distress of nurses in Taiwan who worked during the outbreak of SARS. Psychiatr Serv 2005;56:76–9.

[24] Weiss D, Marmar C. The Impact of Event Scale—Revised. In: Wilson J, Keane T, editors. Assessing psychological trauma and PTSD. New York: Guilford, 1997. pp. 399–41.

[25] Creamer M, Bell R, Failla S. Psychometric properties of the Impact of Event Scale—Revised. Behav Res Ther 2003;41:1489–96.

[26] Ford JD, Campbell KA, Storzbach D, Binder LM, Anger WK, Rohlman DS. Posttraumatic stress symptomatology is associated with unexplained illness attributed to Persian Gulf War military service. Psychosom Med 2001;63:842–9.

[27] Beaton R, Murphy S, Johnson C, Pike K, Corneil W. Coping responses and posttraumatic stress symptomatology in urban fire service personnel. J Trauma Stress 1999;12:293–308.

[28] Lai TJ, Chang CM, Connor KM, Lee LC, Davidson JR. Full and partial PTSD among earthquake survivors in rural Taiwan. J Psychiatr Res 2004;38:313–22.

[29] Stein MB, Walker JR, Hazen AL, Forde DR. Full and partial posttraumatic stress disorder: findings from a community survey. Am J Psychiatry 1997;154:1114–9.

[30] Marshall RD, Olfson M, Hellman F, Blanco C, Guardino M, Struening EL. Comorbidity, impairment, and suicidality in subthreshold PTSD. Am J Psychiatry 2001;158:1467–73.

[31] Hawryluck L, Gold WL, Robinson S, Pogorski S, Galea S, Styra R. SARS control and psychological effects of quarantine, Toronto, Canada. Emerg Infect Dis 2004;10:1206–12.

[32] Feinstein A, Owen J, Blair N. A hazardous profession: war, journalists and psychopathology. Am J Psychol 2002;159:1570–5.

[33] Folkman S, Laxarus RS, Gruen RJ, DeLongis A. Appraisal, coping, health status, and psychological symptoms. J Pers Soc Psychol 1986;50:571–9.

[34] Schwarzer R. Self-efficacy: thought control of action. Washington, DC: Taylor & Francis, 1992.

[35] Bandura A. Social foundations of thought and action: a social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall, 1985.

[36] Pearlin LI, Schooler C. The structure of coping. J Health Soc Behav 1978;19:2–21.

[37] The SARS Commission Report, vol. 1, 2, 3, 4, and 5 http://www.sarscommission.ca, 2006.

[38] 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.

[39] Yehuda R. Post-traumatic stress disorder. N Engl J Med 2002;346: 108–14.

[40] Nortje CR, Moller CB, Andre AT. Judgment of risk in traumatized and nontraumatized emergency medical service personnel. Psychol Rep 2004;95:1119–28.

[41] Bibring E. The mechanisms of depression. In: Greenacre P, editor. Affective disorders. New York: International Press, 1953. pp. 19–26.