

Stress and Psychological Distress Among SARS Survivors 1 Year After the Outbreak

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Objective: Our study examined the stress level and psychological distress of severe acute respiratory syndrome (SARS) survivors 1 year after the outbreak.

Method: During the SARS outbreak in 2003, we used the 10-item Perceived Stress Scale (PSS-10) to assess SARS survivors treated in 2 major hospitals (non-health care workers, $n = 49$; health care workers, $n = 30$). We invited SARS survivors from the same hospitals (non-health care workers, $n = 63$; health care workers, $n = 33$) to complete the PSS-10 again in 2004. At that time, they were also asked to complete the General Health Questionnaire (GHQ-12) and measures of depression, anxiety, and posttraumatic symptoms. PSS-10 scores were also obtained from matched community control subjects during the outbreak ($n = 145$) and again in 2004 ($n = 112$).

Results: SARS survivors had higher stress levels during the outbreak, compared with control subjects (PSS-10 scores = 19.8 and 17.9, respectively; $P < 0.01$), and this persisted 1 year later (PSS-10 scores = 19.9 and 17.3, respectively; $P < 0.01$) without signs of decrease. In 2004, SARS survivors also showed worrying levels of depression, anxiety, and posttraumatic symptoms. An alarming proportion (64%) scored above the GHQ-12 cut-off that suggests psychiatric morbidity. During the outbreak, health care worker SARS survivors had stress levels similar to those of non-health care workers, but health care workers showed significantly higher stress levels in 2004 (PSS-10 score = 22.8, compared with PSS-10 score = 18.4; $P < 0.05$) and had higher depression, anxiety, posttraumatic symptoms, and GHQ-12 scores.

Conclusions: One year after the outbreak, SARS survivors still had elevated stress levels and worrying levels of psychological distress. The situation of health care worker SARS survivors is particularly worrying. The long-term psychological implications of infectious diseases should not be ignored. Mental health services could play an important role in rehabilitation.

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Clinical Implications

- Stress levels of SARS survivors remained persistently elevated and higher than those of community control subjects 1 year after the SARS outbreak.
- SARS survivors had worrying levels of psychological distress 1 year after the outbreak, with more than one-half scoring above the GHQ-12 cut-off that suggests psychiatric morbidity.
- One year after the outbreak, health care worker SARS survivors had higher levels of stress and psychological distress than non-health care worker SARS survivors.

Limitations

- Data were obtained by self-report.
- Owing to the need to keep the assessment survey during the outbreak very brief, we only assessed stress level.
- The study was not a within-subject repeated measures study, so comparison of the stress levels in the 2003 and 2004 samples should be made with caution.

Key Words: *severe acute respiratory syndrome, SARS, depression, anxiety, posttraumatic symptoms, long-term psychological distress, health care workers, infectious disease outbreak, Hong Kong*

Infectious diseases remain one of the biggest threats to the well-being of the human race. Despite great advances in medicine, infectious diseases are still major causes of death and morbidity, with new and reemerging infectious diseases threatening the health and well-being of individuals in developing and developed countries alike.¹⁻³ In 2003, the world was stricken by the deadly SARS epidemic. In less than 3 years, we are facing the imminent threat of another possible pandemic—a pandemic flu potentially triggered by the current global spread of avian influenza.^{4,5} The SARS experience was a good lesson for the health care community to prepare for the next pandemic.

During the SARS outbreak, more than 8000 individuals in 29 countries were infected in 7 months.⁶ In Hong Kong alone, 1755 individuals were infected, and 299 died.⁶ Infectious diseases threaten not only life but also the psychological health of those infected. The immediate psychological sequelae of SARS have been reported to include significantly higher stress levels among affected individuals, compared with matched healthy control subjects, as well as poor sleep, depressed mood, weepiness, nightmares, and poor concentration.⁷ Acute psychosis was also observed in a few patients.⁸ The psychological impact of SARS can be long-lasting, extending well beyond the initial threat to life. Short-term follow-up studies undertaken about 1 month after discharge found significant levels of anxiety, depression, and posttraumatic stress symptoms in SARS patients, with 13% to 32% and 18% to 26% having moderate-to-severe levels of anxiety and depression, respectively, and 4% possibly suffering from PTSD.^{9,10} Among the general public, there has been

an overall decrease in anxiety from the peak outbreak to the postoutbreak period.¹¹ The psychological impact of SARS may evolve over time,¹² but there is little information on the longer-term mental health implications of exposure among SARS survivors. The longest follow-up study reported in the literature examined anxiety, depression, and PTSD in SARS survivors 3 months after discharge and found that levels of anxiety, posttraumatic intrusion, and posttraumatic hyperarousal symptoms decreased from 1 month to 3 months postdischarge, while levels of depression and posttraumatic avoidance symptoms remained stable.¹⁰

Data on the psychological well-being of patients beyond 3 months are currently lacking. It is possible that anxiety and posttraumatic symptoms continue to decrease over time; however, given the wide range of potential stressors that SARS survivors face as residual symptoms, complications, and treatment side effects persist, or even worsen,^{13,14} and negatively affect quality of life and role functioning, it is also possible that their psychological health might worsen. Accordingly, we conducted a 1-year follow-up study of stress levels and psychological problems experienced by SARS survivors in Hong Kong. The study compared stress levels in 2004 with stress levels reported during the outbreak. In 2004, we also characterized the psychological distress of these survivors in terms of various putative psychological indices. Since SARS survivors who are also health care workers constitute a distinct group that is more prone to psychological morbidity⁹ by virtue of the compounded stress of fighting an epidemic as a health care worker and being infected with SARS, we further examined whether there are significant differences in stress and psychological distress between health care workers who survived SARS and their non-health care worker counterparts 1 year after the outbreak.

Methods

The study was approved by the institutional review boards of the participating hospitals. We obtained written informed consent from all study participants. At the peak of the outbreak, we assessed SARS patients in 2 hospitals in Hong Kong, using a brief self-administered questionnaire that included demographic information and the PSS-10.¹⁵ The PSS-10 is a well-validated measure of subjectively perceived stress levels over the past month. Details of the methodology of this part of the study have been previously reported.⁷ We used data from the previous study as baseline data in the current study to examine changes in PSS-10 scores over time.

One year later, in April to May 2004, we asked recovered SARS patients from the same 2 hospitals to complete a questionnaire containing the PSS-10, the Anxiety and Depression subscales of the DASS-21,¹⁶ the IES-R,^{17,18} and the GHQ-12.¹⁹ Questionnaires were anonymous to ensure confidentiality and reliability of data. During both periods, healthy control subjects matched on age, sex, and education level

Abbreviations used in this article

ANCOVA	analysis of covariance
ANOVA	analysis of variance
CI	confidence interval
DASS-21	21-item Depression Anxiety Stress Scales
df	degrees of freedom
GHQ-12	12-item General Health Questionnaire
IES-R	Impact of Events Scale-Revised
OR	odds ratio
PSS-10	10-item Perceived Stress Scale
PTSD	posttraumatic stress disorder
SARS	severe acute respiratory syndrome
SD	standard deviation

were recruited from the community and administered the PSS-10. They were in good health and had no contact with SARS patients or suspected SARS patients.

The DASS-21 is a well-validated screening instrument for use among medical patients and community populations. It provides independent measures of depression and anxiety with recommended severity thresholds for the Depression and Anxiety subscales.¹⁶ Reliability analysis showed that the internal consistency of the Depression subscale was poor in the present study, as measured by Cronbach's alpha ($\alpha = 0.49$). When Item 5 ("I found it difficult to work up the initiative to do things"), the main source of the internal inconsistency, was removed, Cronbach's alpha improved substantially to 0.90. We therefore excluded this item from subsequent analyses and adjusted the Depression subscale score accordingly by multiplying the total subscale score by a factor of 7/6. Cronbach's alpha was 0.86 for the Anxiety subscale.

The IES-R is a 22-item measure of psychological responses to trauma, and its 3 subscales (Intrusion, Avoidance, and Hyperarousal) are closely affiliated with PTSD symptoms. It can be anchored to any specific event, such as SARS infection. For each subscale, a cut-off mean score of 2 or higher indicates a moderate level of distress.¹⁷ Cronbach's alpha coefficients for the 3 subscales were 0.93 (Intrusion), 0.88 (Avoidance), and 0.86 (Hyperarousal). For the GHQ-12, 0-0-1-1 scoring was used, with a cut-off of 3 representing a potential case of psychiatric morbidity.¹⁹ Cronbach's alpha was 0.80 for the present sample.

Data were analyzed with the SPSS Version 13.0 (SPSS Inc, Chicago, IL, 2006). Descriptive statistics, including frequencies and central tendencies, were used to characterize the sample's demographic profile, stress level, and levels of psychological distress on the various measures used. ANOVA was used to examine the associations between subject characteristics and measures of stress and psychological distress. Multivariate logistic regression was used to examine the association between subject characteristics and GHQ-12 caseness. Group comparisons on nominal variables were analyzed with chi-square tests, ordinal variables with Mann-Whitney tests, and interval variables with independent *t* tests with Bonferroni corrections for multiple comparisons. Spearman's rho was used to examine the relations among the various dimensions of psychological distress and stress. ANCOVA compared groups (health care worker SARS survivors and non-health care worker SARS survivors) in which variables on subject characteristics need to be controlled for. Two-way ANOVA was performed to test for the interaction effect between health care worker status and year (during the outbreak and 1 year after) on stress level.

Results

In 2003 and 2004, the response rates were 55.6% (100 of 180 individuals) and 80.8% (97 of 120 individuals), respectively. After excluding questionnaires with substantial incomplete responses (21 in 2003 and 1 in 2004), we had a final sample of 79 participants in 2003 and 96 participants in 2004. The 2 samples were balanced on age, sex, and education level (Table 1). The 2003 sample consisted of 49 non-health care workers and 30 health care workers. The 2004 sample consisted of 63 non-health care workers and 33 health care workers. In both samples, the health care worker subgroup tended to include more women and more highly educated individuals than the non-health care worker subgroup. Age differences were also significant across the 2 subgroups in both years (Table 1). Hence, age, sex, and education level were controlled for in subsequent analyses comparing health care worker SARS survivors with non-health care worker SARS survivors.

Stress Levels

Mean PSS-10 scores of SARS survivors were significantly higher than those of matched community control subjects in 2003 (mean 19.8, SD 5.0, for SARS survivors and mean 17.9, SD 5.6, for community control subjects; $t_{207} = 2.37$, $P < 0.05$, effect size 0.36). The elevated stress level of SARS survivors was maintained in 2004 (mean 19.9, SD 6.4, for SARS survivors and mean 17.3, SD 3.7, for community control subjects; $t_{191} = 3.44$, $P = 0.001$, effect size 0.51). Mean PSS-10 scores of SARS survivors did not decrease between 2003 and 2004 (mean 19.8, SD 5.0, in 2003, compared with mean 19.9, SD 6.4, in 2004; $t_{163} = -0.15$, $P = 0.88$). At both time points, PSS-10 scores were higher among female survivors (mean 20.7, SD 5.2, for female survivors, compared with mean 18.0, SD 3.8, for male survivors; $t_{75} = 2.35$, $P < 0.05$ in 2003; and mean 21.0, SD 5.8, for female survivors, compared with mean 17.9, SD 7.1, for male survivors; $t_{86} = 2.21$, $P < 0.05$ in 2004) but were not associated with education level ($F_{3,73} = 0.28$, $P = 0.840$ in 2003; $F_{3,84} = 1.45$, $P = 0.23$ in 2004). Age was marginally associated with PSS-10 scores at both time points ($F_{4,72} = 2.80$, $P < 0.05$ in 2003; $F_{4,83} = 3.00$, $P < 0.05$ in 2004), but post hoc tests failed to find any significant pairwise difference across age categories in 2003 and 2004.

Psychological Distress

In 2004, the mean DASS Depression and Anxiety subscale scores were elevated at 11.1, SD 9.1, and 10.4, SD 8.0, respectively; these scores are much higher than the published normative values of mean 6.3 for the Depression subscale and mean 4.7 for the Anxiety subscale.¹⁶ Depressive symptoms were moderate-to-severe in 36.3% of the participants, and even extremely severe in 4.4% of the participants. Anxiety symptoms were moderate-to-severe in 36.7% of the participants and extremely severe in 14.4% of the participants. The mean IES-R Intrusion score was 1.4, SD 0.9, and the mean Avoidance and Hyperarousal scores were 1.1, SD 0.8, and 1.3, SD

Table 1 Demographic characteristics of the 2003 and 2004 samples

Sociodemographic factors	2003 sample			2004 sample			2003 compared with 2004 whole sample test
	Non-health care worker SARS survivors (n = 49)	Health care worker SARS survivors (n = 30)	Test value	Non-health care worker SARS survivors (n = 63)	Health care worker SARS survivors (n = 33)	Test value	
Age (years)							
18 and under	4 (8.2)	0 (0.0)		0 (0.0)	0		
19 to 30	10 (20.4)	20 (66.7)	$U = 490.0$ $P = 0.01$	10 (15.9)	16 (48.5)	$U = 625.5$ $P = 0.001$	$U = 1241.5$ $P = 0.065$
31 to 40	14 (28.6)	5 (16.7)		21 (33.3)	8 (24.2)		
41 to 50	18 (36.7)	3 (10.0)		20 (31.7)	8 (24.2)		
51 to 60	2 (4.1)	2 (6.7)		5 (7.9)	1 (3.0)		
61 or older	1 (2.0)	0 (0.0)		7 (11.1)	0 (0.0)		
Sex							
Male	22 (44.9)	5 (16.7)	$\chi^2 = 6.592$ $P = 0.01$	31 (49.2)	4 (12.1)	$\chi^2 = 12.857$ $P < 0.001$	$\chi^2 = 0.205$ $P = 0.651$
Female	27 (55.1)	25 (83.3)		32 (50.8)	29 (87.9)		
Education level							
No formal education	2 (4.1)	0 (0.0)		2 (3.2)	0 (0.0)		
Primary education	7 (14.3)	1 (3.3)	$U = 410.0$ $P < 0.001$	15 (23.8)	2 (6.1)	$U = 546.5$ $P < 0.001$	$U = 1327.5$ $P = 0.171$
Secondary education	23 (46.9)	6 (20.0)		31 (49.2)	9 (27.3)		
Tertiary education	17 (34.7)	23 (76.7)		15 (23.8)	22 (66.7)		

Figures in parentheses are relative percentages.

0.9, respectively. All scores exceeded the reported norms for accident and emergency department attendees.¹⁸ The proportion of participants with at least a moderate level of distress (> 2) on the 3 dimensions of posttraumatic symptoms were 32.2% (Intrusion), 20.0% (Avoidance), and 22.2% (Hyperarousal). On the GHQ-12, a total of 64% of subjects scored above the threshold (having a score of 3 or above), indicating potential psychiatric morbidity.

When measured as continuous variables, all the measures of psychological distress were strongly intercorrelated (with Spearman's rho ranging from 0.63 to 0.89 and all $P < 0.001$). Perceived stress was also positively and significantly associated with all dimensions of psychological distress (with Spearman's rho ranging from 0.59 to 0.82 and all $P < 0.001$).

Among SARS survivors, women had higher scores on Depression (mean 13.1, SD 8.8, compared with mean 7.8, SD 8.7, for men; $t_{89} = 2.83$, $P < 0.01$) and Anxiety (mean 12.5, SD 7.8 compared with mean 7.0, SD 7.1 for men; $t_{89} = 3.39$, $P = 0.001$), as well as higher scores on IES-R Intrusion (mean 1.6,

SD 0.9, compared with mean 1.1, SD 0.8, for men; $t_{88} = 2.78$, $P < 0.01$), Avoidance (mean 1.3, SD 0.7, compared with mean 0.9, SD 0.8, for men; $t_{88} = 2.51$, $P < 0.05$), and Hyperarousal (mean 1.4, SD 0.9, compared with mean 0.9, SD 0.9, for men; $t_{88} = 2.54$, $P < 0.05$). Age ($F_{4,86} = 2.86$, $P < 0.05$) and education level ($F_{3,87} = 3.12$, $P < 0.05$) were marginally associated with depression, but post hoc tests did not find any pairwise differences across age or education level categories. Age and education level were not associated with anxiety or with any of the IES-R domain scores.

Multivariate logistic regression showed that only sex was associated with greater odds of GHQ-12 casesness. Female SARS survivors were more than 3 times more likely to score above the GHQ-12 threshold (95%CI, 1.28 to 10.63; OR 3.69; $\chi^2 = 10.77$, df 1; $P < 0.05$) than male SARS survivors. Neither age nor education level was associated with GHQ-12 casesness. An alarming 77.4% of female SARS survivors scored above the GHQ-12 threshold. The rate for male SARS survivors was 42.4%.

Table 2 PSS-10 scores (during and 1 year after outbreak), compared with DASS-21 scores (1 year after outbreak) and IES-R scores (1 year after outbreak), adjusted for age, sex, and education level

Scales	Health care workers Mean (SD)	Non-health care workers Mean (SD)	df	F	P
PSS-10					
During outbreak	20.1 (5.2)	19.6 (4.8)	3,72	1.8	0.14
1-year follow-up	22.8 (5.9)	18.4 (6.2)	3,83	4.3	< 0.001
DASS					
Depression	15.1 (7.9)	9.0 (9.0)	3,86	3.9	< 0.01
Anxiety	14.6 (7.9)	8.2 (7.1)	3,85	5.2	0.001
IES-R					
Intrusion	2.0 (0.9)	1.1 (0.8)	3,85	5.7	< 0.001
Avoidance	1.5 (0.8)	0.9 (0.8)	3,85	3.5	< 0.05
Hyperarousal	1.7 (1.0)	1.0 (0.8)	3,85	3.5	< 0.05

Differences Between Health Care Worker SARS Survivors and Non-Health Care Worker SARS Survivors

Table 2 shows the differences between health care worker SARS survivors and non-health care worker SARS survivors on the various measures of stress and psychological distress. During the outbreak, health care worker and non-health care worker SARS survivors had similar PSS-10 scores (mean 20.1, SD 5.2, for health care worker SARS survivors, compared with mean 19.6, SD 4.8, for non-health care worker SARS survivors; $F_{3,72} = 1.8$, $P = 0.140$). One year after the outbreak, health care worker SARS survivors had significantly higher PSS-10 scores (mean 22.8, SD 5.9), compared with their non-health care worker counterparts (mean 18.4, SD 6.2, $F_{3,83} = 3.7$, $P < 0.01$). Two-way ANOVA showed a significant year \times health care worker status interaction effect ($F_{3,158} = 4.3$, $P < 0.05$). The PSS-10 scores of health care worker SARS survivors increased significantly from the outbreak to 1 year after the outbreak, while those of non-health care worker SARS survivors remained similar over the period.

One year after the outbreak, health care worker SARS survivors were also substantially more distressed on all dimensions of psychological distress than their non-health care worker counterparts. Health care worker SARS survivors had significantly higher DASS Depression scores (mean 15.1, SD 7.9), compared with non-health care worker SARS survivors (mean 9.0, SD 9.0, $F_{3,86} = 3.9$, $P < 0.01$). They also had substantially higher DASS Anxiety scores (mean 14.6, SD 7.9, compared with mean 8.2, SD 7.1, for non-health care worker SARS survivors; $F_{3,85} = 5.2$, $P = 0.001$). Posttraumatic stress symptoms were also higher among health care workers, with significant differences found on IES-R Intrusion (mean 2.0, SD 0.9, for health care worker SARS survivors and mean 1.1,

SD 0.8, for non-health care worker SARS survivors; $F_{3,85} = 5.7$, $P < 0.001$), IES-R Avoidance (mean 1.5, SD 0.8, for health care worker SARS survivors and mean 0.9, SD 0.8, for non-health care worker SARS survivors; $F_{3,85} = 3.5$, $P < 0.05$), and IES-R Hyperarousal (mean 1.7, SD 1.0, and mean 1.0, SD 0.8; $F_{3,85} = 3.5$, $P < 0.05$) symptoms. There were also significantly more cases scoring above the GHQ-12 threshold among health care worker SARS survivors (90.3%) than among non-health care worker SARS survivors (49.1%) ($\chi^2 = 14.6$, $P < 0.001$). Even after controlling for age, sex, and education level, health care worker status is associated with a six-fold increased chance for GHQ-12 caseness (95%CI, 1.42 to 25.68, OR 6.04; $\chi^2 = 7.05$, df 4; $P < 0.05$).

Discussion

Different studies have documented that SARS patients have compromised psychological health immediately after being infected or shortly after discharge from hospital.⁷⁻¹⁰ Little is known, however, about the long-term mental health implications of SARS exposure. This study is the first to investigate psychological problems in SARS survivors 1 year after the outbreak to address the question of whether exposure to SARS has a long-term adverse mental health impact on survivors.

We found that SARS survivors had persistent elevated stress and were psychologically distressed 1 year after the SARS outbreak. Contrary to expectation, stress levels failed to subside 1 year postoutbreak, and depressive, anxiety, and posttraumatic symptoms were rampant, with GHQ-12 scores indicating that more than 64% of the survivors were potential psychiatric cases. At 1-year follow-up, these patients appeared affected by a combination of stress, anxiety,

depression, and posttraumatic symptoms, as shown by the strong correlation among all the measures used.

In our study, IES-R Intrusion and Hyperarousal subscale scores (mean 1.4 for Intrusion, 1.3 for Hyperarousal) appeared higher than those reported 3 months after hospital discharge (mean 0.91 for Intrusion, 0.85 for Hyperarousal).¹⁰ Previous work at 44 days after hospital discharge reported that 26% of SARS survivors had moderate-to-severe or severe depression and that 32% had moderate-to-severe or severe anxiety.⁹ Our study, however, showed that 30% of participants had at least moderate depression and that 40.7% had at least moderate anxiety at 1-year follow-up. Although the studies are not directly comparable, it is conceivable that study participants gradually decompensated. It appears that, instead of improving over time, survivors' psychological health in terms of stress, anxiety, depression, and posttraumatic symptoms gradually deteriorated. This could not be accounted for by background stressors prevailing in the wider community. Although previous work found that prevailing community stress levels appeared unabated at 6 months postoutbreak,²⁰ the stress levels of SARS survivors in our study were higher than those of matched community control subjects, suggesting that they were more distressed than noninfected individuals in the community. At each time point, survivors' PSS-10 scores were higher than those of community control subjects by at least 2 points, which is statistically significant. Whether such a difference is also clinically significant is debatable, but we believe that such a difference is clinically relevant for 2 reasons. First, the difference is consistent with the magnitude of difference observed in established normative values for PSS-10 scores of recognized high- and low-stress groups in the literature. For example, in Cohen's original normative sample, the PSS-10 score of divorced individuals was 14.7, whereas that of married individuals was 12.4.¹⁵ It is well documented that the former group is under much more stress and is more distressed than the latter.²¹⁻²³ Second, the effect size of the difference between SARS survivors and community control subjects, particularly in 2004 (effect size 0.51), is of a magnitude that reflects a difference considered by convention to have practical significance.²⁴

The reasons for the compromised and deteriorating psychological health of SARS survivors need further examination. It is plausible that during the outbreak all SARS victims were striving mainly to survive and that other concerns therefore faded into the background. When there was no longer an imminent threat to life, other concerns surfaced. The exact nature of such concerns requires further investigation, but it is speculated that they are related to complications of SARS and its treatment (such as avascular necrosis and osteoporosis), financial concerns, stigma, or the threat of a possible impending infectious disease outbreak (for example, the rampant spread of avian flu and the reported human cases of infection with the H5N1 virus). The exact sources of the observed

long-term stress and psychological distress of SARS survivors remains to be clarified, but we do know that they are not caused by acute medical illness or ward isolation, nor can they be attributed to general, nonspecific stressors in Hong Kong. Rather, they represent the long-term psychological sequelae of SARS infection.

Our findings complement those in the literature on the long-term impact of infectious diseases. Follow-up studies of survivors of infectious diseases showed that persistent distress is common. A longitudinal study of survivors of a Legionnaires' disease outbreak found that, after 17 months, most survivors experienced persistent symptoms, notably fatigue, neurologic symptoms, and neuromuscular symptoms, and that 15% of the survivors had PTSD.²⁵ A study of patients with community-acquired pneumonia found that 51% still reported fatigue 3 months after diagnosis.²⁶ Another study documented that 23.9% of survivors of acute respiratory distress syndrome still had PTSD at 8-year follow-up.²⁷ Studies of infectious mononucleosis showed that chronic fatigue tended to persist well beyond the acute phase of infection.^{28,29} Taken together, these studies documented significant persistent physical symptoms, especially fatigue, among survivors of infectious diseases over a range of follow-up periods. Other than PTSD, little is known about the long-term psychological impact of infectious diseases. Our findings on the significance of PTSD were consistent with those reported in the literature, but our findings extended current understanding of the psychological sequelae of infectious diseases by demonstrating that at 1-year follow-up, in addition to PTSD, survivors are also substantially affected by depression, anxiety, and stress. This calls for greater attention to a range of mental health problems that may be affecting survivors long after the acute infection is under control.

We found that, 1 year after the outbreak, being a woman and being a health care worker were risk factors for poor psychological adjustment. Female SARS survivors had higher stress levels and higher levels of depression and anxiety. They also had more severe posttraumatic stress symptoms. According to their GHQ-12 scores, they were 3 times more likely than male SARS survivors to have psychiatric morbidity. This is compatible with findings from a previous study conducted during the SARS outbreak that found female SARS survivors had more anxiety symptoms.⁹ It appears that their more severe anxiety problem persisted 1 year after the outbreak. In the same study, however, the authors did not find that female SARS survivors suffered more from depression during the outbreak. At 1 year, they were found to have more depression than their male counterparts. It is unclear how their elevated depressive symptoms developed, but it is plausible that, during the outbreak, the presence of protective factors such as feeling fortunate and having increased civic-mindedness and a spirit of unity⁷ acted as a buffer against depression. With this buffer weakening as the outbreak passed, vulnerable

individuals developed depressive symptoms; as noted, female sex is associated with this increased vulnerability.

Being a health care worker also places a survivor at increased risk for developing long-term psychological problems. Compared with non-health care worker SARS survivors, health care worker SARS survivors had higher stress levels and more severe anxiety, depressive, and posttraumatic symptoms. That more than 90% of health care worker SARS survivors scored above the GHQ-12 cut-off is of grave concern and calls for greater attention to the needs of this highly vulnerable group of survivors. We conducted a parallel study of stress levels among noninfected health care workers working in occupational settings with a high risk (respiratory wards) or a low risk (psychiatric wards) of SARS exposure.³⁰ One year after the outbreak, stress levels of health care worker SARS survivors in the present study were higher (PSS-10 = 22.8) than levels in noninfected high-risk (PSS-10 = 18.6) and low-risk (PSS-10 = 14.8) health care workers. This reflects stress beyond that which is associated with either health care worker status or the experience of fighting the SARS outbreak under the risk of SARS exposure. The elevated stress and compromised psychological health appear more related to SARS infection and its long-term sequelae than to health care worker status. It was interesting that the stress levels of health care worker SARS survivors did not differ from their non-health care worker counterparts during the outbreak but that they increased and surpassed that of non-health care worker SARS survivors 1 year later. One possible explanation is that health care worker SARS survivors were under greater stress during both periods because of the compounded stress of illness and of being a health care worker. During the outbreak, they experienced more positive responses to SARS,⁷ which protected them against the anticipated higher levels of negative psychological sequelae.²⁰ As the outbreak subsided, the positive responses faded. With the protective factors removed, their greater vulnerability led to the higher levels of stress and psychological distress observed in the present study.

Limitations of the present study include the relatively small sample size and the fact that our data were obtained by self-report. We were also unable to directly compare individual participants longitudinally from 2003 to 2004 because the questionnaires were anonymous to ensure confidentiality. Anonymity was essential to ensure data accuracy, given the substantial stigma associated with both SARS infection and psychological problems and the fact that many SARS survivors were involved in lawsuits and compensation cases. However, since the population is a relatively captive one and since the 2 samples were not statistically different on core demographic variables, it is reasonable to conclude that stress levels of SARS survivors remained persistently elevated over the 1-year period.

Conclusion

The present study provides insight into the potential long-term negative psychological effects of infectious diseases. Our study shows that, instead of abating with time, stress levels remained persistently elevated 1 year after the outbreak. Stress levels of health care worker SARS survivors actually increased over the period. As a group, the SARS survivors showed worrying levels of psychological distress 1 year after the outbreak, as demonstrated by the alarmingly high levels of depression, anxiety, and posttraumatic symptoms, as well as by a high prevalence of potential cases of psychiatric morbidity. The strong correlation among the different stress and psychological distress indices means that survivors were affected simultaneously by a multitude of psychological problems and were not merely struggling with isolated problems. The psychological health of health care worker SARS patients is particularly worrying, given their poor psychological state in comparison with non-health care worker SARS survivors across all measures of stress and psychological distress. That more than 90% of health care worker survivors scored above the GHQ-12 threshold is a major concern. The high levels of stress and psychological distress indices among SARS survivors were unexpected, interlinked, and robust. They suggest that psychological services could be important in the rehabilitation phase and should not be forgotten as we face the evolving new outbreak of H5N1 virus.

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Résumé : Le stress et la détresse psychologique chez les survivants du syndrome respiratoire aigu sévère 1 an après l'épidémie

Objectif : Notre étude a examiné le niveau de stress et de détresse psychologique des survivants du syndrome respiratoire aigu sévère (SRAS), 1 an après l'épidémie.

Méthode : Durant l'épidémie de SRAS en 2003, nous avons utilisé l'échelle de stress perçu en 10 items (PSS-10) pour évaluer les survivants du SRAS traités dans 2 grands hôpitaux (travailleurs de la santé, $n = 49$; non-travailleurs de la santé, $n = 30$). Nous avons invité les survivants du SRAS des mêmes hôpitaux (travailleurs de la santé, $n = 63$; non-travailleurs de la santé, $n = 33$) à remplir la PSS-10 de nouveau en 2004. On leur a également demandé, au même moment, de répondre au Questionnaire sur l'état de santé général (GHQ-12) et à des mesures de la dépression, de l'anxiété et des symptômes post-traumatiques. Des scores à la PSS-10 ont aussi été obtenus de sujets témoins assortis de la communauté durant l'épidémie ($n = 145$) et ensuite en 2004 ($n = 112$).

Résultats : Comparés aux sujets témoins, les survivants du SRAS avaient des niveaux de stress plus élevés durant l'épidémie (scores à la PSS-10 = 19,8 et 17,9, respectivement; $P < 0,01$), et cela a persisté 1 an plus tard (scores à la PSS-10 = 19,9 et 17,3, respectivement; $P < 0,01$) sans signe de diminution. En 2004, les survivants du SRAS montraient aussi des niveaux inquiétants de dépression, d'anxiété et de symptômes post-traumatiques. Une proportion alarmante (64 %) a obtenu des scores au-dessus du seuil d'inclusion du GHQ-12 qui suggère une morbidité psychiatrique. Durant l'épidémie, les travailleurs de la santé ayant survécu au SRAS avaient des niveaux de stress semblables à ceux des non-travailleurs de la santé, mais les travailleurs de la santé présentaient un stress significativement plus élevé en 2004 (score à la PSS-10 = 22,8, comparé au score à la PSS-10 = 18,4; $P < 0,05$) et avaient des taux plus élevés de dépression, d'anxiété et de symptômes post-traumatiques, et des scores plus élevés au GHQ-12.

Conclusions : Un an après l'épidémie, les survivants du SRAS avaient encore des niveaux de stress élevés et des taux inquiétants de détresse psychologique. La situation des travailleurs de la santé ayant survécu au SRAS est particulièrement préoccupante. Les implications psychologiques à long terme de maladies infectieuses ne doivent pas être ignorées. Les services de santé mentale pourraient jouer un rôle important dans le rétablissement.