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Positive mental health-related impacts of the SARS epidemic on the general public in Hong Kong and their associations with other negative impacts

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Summary *Objectives:* To investigate 2 positive impacts (better family/social support and lifestyle changes) and their associations with other negative impacts.

Study design and participants: A telephone survey using random telephone numbers and a structured questionnaire was conducted in Hong Kong general population. Eight hundred and eighteen Hong Kong residents of age 18–60 years completed the interview (response rate: 65%) at around end of June 2003, the early ending phase of the epidemic.

Results: Over 60% of the respondents stated that they cared more about the family members' feelings; about 30%–40% stated that they found their friends, their family members more supportive or having more sharing with others when not feeling happy; only a few percent felt the opposite. Further, about 2/3 of the respondents paid more attention to their mental health. About 35%–40% took more time to rest, for relaxation or doing exercise. These items were, in general, negatively associated with post-traumatic stress, perception of stress and other perceptions that were related to SARS.

Conclusions: SARS have brought some positive impacts on social/family support, mental health awareness and lifestyle changes. These positive impacts were associated with other relevant negative impacts and might be important cushions of the negative impact.

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Background

The first Severe Acute Respiratory Syndrome (SARS) outbreak occurred in Hong Kong at around March 10, 2003¹ and the last SARS case of the epidemic was reported in June 11, 2003.² During this time period, a total of 1755 suspected or probable SARS cases and a death toll of 298 were recorded in Hong Kong. The first outbreak occurred in the Prince of Wales Hospital on March 10, 2003, resulting in 138 cases.¹ This was followed by the second major outbreak, which occurred in the Amoy Gardens housing estate at around March 26, 2003, affecting a total of 321 residents.³ The highest number of new cases per day was reported on March 31, 2003. Quarantine measures for family members of SARS cases were implemented on April 1, 2003 and the WHO issued a travel advisory against Hong Kong on April 2, 2003. The epidemic can thus be seen as reaching its peak on April 1, 2003.⁴ It has also been reported that mood disorders have been common in the general population during the SARS epidemic.⁵

A total of 13 new SARS cases were reported in 3 areas in China (Guangdong, Beijing, and Anhui), during December 16, 2003 through April 30, 2004.^{6,7} It is therefore possible that SARS may resurge in some parts of the world. In addition, other epidemics or bioterrorism may also occur in the future. It is important to understand the mental health impacts of such disasters fully. A number of studies on post-traumatic stress symptoms have been documented in the United States, Japan, France and Israel.^{8–13} For the SARS epidemic, there are yet few studies focusing on the mental health aspects of community responses. In fact, little data have been obtained to understand how people cope with major disasters. Kinship support has been shown to be an important way to cope with the stress arising from the September 11 disaster⁹ and other positive coping behaviours, such as information search, social support¹³ and professional services seeking,¹⁴ etc., have also been documented. Studies show that post-traumatic growth is possible but there is scant information obtained on this topic.^{15,16} Relevant research is warranted.

Hong Kong was very badly affected by SARS, which had been a major public health disaster in Hong Kong. Its devastations may be comparable to the September 11 experience in the United States and disasters occurred in other countries. Another report showed that noticeable proportions of the respondents in Hong Kong were having moderate or severe post-traumatic stress symptoms.¹⁷ Over 2/3 of the respondents felt horrified or apprehensive

due to SARS; a high percentage felt helpless or worried themselves/their family members would contract the virus. Other negative mental health impacts, such as increased frequencies of sleeping problems, smoking and drinking, were also documented by that paper.¹⁷ Further, increased family stress and financial stress have been reported both during and after the SARS period in Hong Kong¹⁸ and many people avoided going out.⁴ In such circumstances, people might feel irritable and isolated, which might result in worsened family and social relationships. It is also possible that such stressful circumstances would lead to avoidance behaviours, such as avoidance of information seeking or developing more passive lifestyle. Societal capacity to recover from the crisis would then have been compromised.

It is not certain whether the epidemic had any simultaneous positive impacts on mental health; such positive impacts may help citizens to cope with other negative impacts. The Hong Kong SARS experience offers a unique opportunity to investigate both the positive and negative community responses to disasters.

The study hence investigated whether societal and family support, concern for mental health and some mental health-related lifestyle habits have been improved during the SARS epidemic period in Hong Kong, as compared to the pre-SARS period. The hypotheses of whether improvement in societal/family support and mental health-related lifestyle changes were positively or negatively associated with perceived negative impacts of SARS (such as post-traumatic stress symptoms and perceived stress due to SARS) were tested in the study.

Subjects and methods

Population and sampling

The target population comprised all Hong Kong Chinese-speaking residents (about 95% of the total population in Hong Kong are Chinese)¹⁹ who were of age 18–60 years. Adolescents were not interviewed as it would be difficult to obtain parental consent over the telephone and elderly individuals were not interviewed as recall bias may be stronger in this group. Telephone numbers were randomly selected from up-to-date residential phone directories. Almost 100% of the Hong Kong residents have a telephone at home (Hong Kong Office of the Telecommunications Authority, personal communication, January 28, 2000).

The study was conducted from 27 May to 1 June 2003 (WHO lifted the travel advisory warning against Hong Kong on 23 May 2003). Interviews were conducted between 6:00 p.m. and 10:30 p.m. in order to avoid over-representing unemployed individuals and under-sampling workers and students. All interviews were conducted by trained research staff with a structured questionnaire. Unanswered telephone calls were given at least 2 more follow-up calls, made at different hours and weekdays, before being classified as invalid.

When telephone contacts were successfully established, it was briefed that the study was related to impacts of the SARS epidemic. A household member between the ages of 18 and 60 years, whose birthday was closest to the date of interviews, was invited to participate in the study. Eligible respondents were briefed again. After verbal informed consent was obtained, the respondents were interviewed. Ethics approval was obtained from the ethics committee of the Chinese University of Hong Kong. A number of local studies have used telephone surveys for data collection.^{20–24}

Of all household calls answered, 22.3% did not have an eligible respondent, 14.1% were non-contacts. Among all valid households contacted (one with at least an eligible household member), 35.3% refused to join the study and 64.7% (818: 407 men and 411 women) participated in the study. The overall response rate, defined as the number of respondents joining the study divided by the number of respondents joining the study plus refusals, was approximately 65%. The age by gender distributions of the sample were roughly comparable with those of the general population in Hong Kong (see footnote in Table 1)²⁵ and comparable studies have been conducted using similar sampling methods and sample sizes.^{20–24}

Measurements

Background characteristics

Information on the socio-demographic characteristics of the respondents was collected (see Table 1).

Positive impacts on social and family support

Respondents were asked to compare their situations in the 2 months before the outbreak of the SARS epidemic (from mid-January to mid-March, 2003) with those in the 2 months after the outbreak (from mid-March to mid-May, 2003). These comprise 5 items, including whether getting increased or decreased support from friends, whether getting increased or decreased support from family members, whether having more or less sharing of

Table 1 Background characteristics of respondents

	Male (%)	Female (%)	All (%)	(χ^2 Test) <i>p</i> value
Age group				
18–24	24.8	16.6	20.7	0.001
25–34	20.6	22.9	21.8	
35–49	33.7	45.1	39.5	
50 or above	20.8	15.4	18.1	
Education level				
≤9 Years (form 3)	24.0	32.0	28.0	0.002
10–11 Years (form 4–5)	30.1	33.4	31.8	
12–13 Years	14.3	13.9	14.1	
University or above	31.6	20.7	26.1	
Marital status				
Currently single	44.0	28.3	36.1	<0.001
Currently married or lived together	55.0	69.0	62.1	
Divorced or widow	1.0	2.7	1.8	
Employment status				
Full time	65.4	41.4	53.3	<0.001
Part time	6.4	8.8	7.6	
Unemployed	9.6	5.4	7.5	
Housewife	0.7	33.1	17.0	
Students	13.5	9.0	11.2	
Retired or others	4.4	2.4	3.4	
Religion				
No religion	74.9	64.5	69.7	<0.001
Catholic/protestant	14.5	22.1	18.3	
Buddhist	8.6	7.5	8.1	
Others	2.0	8	3.9	

Distribution of age groups 18–24, 25–34, 35–49, 50+ in 2005 Census data was: male (14.6%, 21.8%, 42.4%, and 21.2%); female (13.2%, 23.8%, 44.2%, 18.8%); all (13.7%, 22.9%, 43.4%, 20.0%).

feelings with other family members, whether having more or less sharing of feeling with others when in the blue and whether becoming more caring for family members' feeling (much increased, increased, same as before, decreased and much decreased) (see Table 2). Using the sum of scores of these 5 items, a composite scale (Cronbach's alpha = 0.66) known as the Perceived Support scale (PSS), was constructed for this study (range = 5–25). Higher points mean that subjects were experiencing improved social and family support.

Positive impacts on mental health-related lifestyle changes

Respondents were asked in a similar way, to compare whether they were paying more or less

Table 2 Changes in family and social support by demographic factors

	Gender		<i>p</i> Value ^c	Age group				<i>p</i> Value ^c	Education group				<i>p</i> Value ^c	Overall
	Male	Female		18–24	25–34	35–49	≥50		≤9 Years	10–11 Years	12–13 Years	University		
Getting support from friends														
Increased ^a	24.8	31.9	0.065	32.1	27.7	28.3	24.5	0.692	23.2	28.2	27.0	34.7	0.135	28.4
Same as before	70.8	65.0		64.9	69.5	67.6	70.1		72.8	68.3	67.0	62.9		67.8
Decreased ^b	4.4	3.2		3.0	2.8	4.0	5.4		3.9	3.5	6.1	2.3		3.8
Getting support from family members														
Increased ^a	36.9	41.4	0.263	39.3	39.0	40.5	36.1	0.940	62.7	59.1	65.2	53.1	0.200	39.1
Same as before	60.9	57.4		59.5	59.3	57.3	62.6		2.6	1.2	0.9	1.9		59.2
Decreased ^b	2.2	1.2		14.3	21.4	50.0	14.3		34.6	39.8	33.9	45.1		1.7
Sharing feelings with family members														
Increased ^a	36.1	34.5	0.862	18.5	19.9	41.8	19.9	0.640	35.1	32.4	40.9	35.7	0.451	35.3
Same as before	58.7	60.6		63.1	62.1	58.6	55.1		58.8	63.3	52.2	60.6		59.7
Decreased ^b	5.2	4.9		5.4	5.6	4.0	6.1		6.1	4.2	7.0	3.8		5.0
Sharing feelings with others when in blue														
Increased ^a	18.4	25.5	0.002	19.6	21.5	25.2	19.0	0.166	21.5	22.4	17.4	23.9	0.419	22.0
Same as before	77.4	66.7		73.8	75.7	67.0	75.5		20.2	22.1	10.9	18.9		72.0
Decreased ^b	4.2	7.8		6.5	2.8	7.8	5.4		6.1	8.1	5.2	3.8		6.0
Caring for family members' feelings														
Increased ^a	64.1	65.2	0.794	61.3	62.7	65.4	68.7	0.652	63.2	64.1	68.7	64.8	0.959	64.7
Same as before	35.6	34.3		38.1	37.3	34.0	31.3		36.4	35.5	31.3	34.7		35.0
Decreased ^b	0.2	0.5		0.6	0.0	0.6	0.0		0.4	0.4	0.0	0.0		0.4

^a Increased or much increased.^b Decreased or much decreased.^c Chi-square test.

attention to their mental health conditions during the SARS periods, as compared to the pre-SARS period (much increased, increased, same as before, decreased and much decreased). These are subjective overall perceived changes. Besides, 3 other lifestyle items were included in the study; whether spending more or less time to rest, whether spending more or less time for relaxation activities and whether spending more or less time for doing exercise. A composite scale, the mental health lifestyle scale (MHLSS) was created using the sum of 3 items (Cronbach's alpha = 0.82). It ranges from 3 to 15 and higher points mean that the respondents were having more favourable changes in lifestyle.

Impact of event scale (IES)

The Chinese version of IES²⁶ was used to measure the extent of post-traumatic stress. The original version of the IES contains 2 subscales ('Avoidance': 8 items and 'Intrusion': 7 items). The 'Hyperarousal' (6 items) subscale was later added to IES.²⁷ In the present study, the 'Avoidance' and 'Intrusion' scales of the original revision (for the sake of comparability with another local study) and the 'Hyperarousal' scale of the revised version (with slight modifications) were used (Table 4). In accordance with the recommendations given by the original author of the IES, a cut-off score of 26 was used to indicate moderate to severe disturbance.²⁶

Other indicators of negative mental health impacts

Six indicator variables were used in the study to measure negative health impacts. Three questions asked were whether respondents felt much horrified, felt much apprehensive and felt helpless due to SARS. Respondents were also asked whether their level of stress at home, at work and in financial matters has increased or decreased, comparing the SARS period with the pre-SARS period (much increased, increased, same as before, decreased and much decreased).

Statistical methods

Chi-square test was used to test the statistical significance of groups differences. The associations (odds ratio) between different forms of positive and negative impacts, adjusting for demographic factors, were derived using logistic regression analysis methods. Partial correlation coefficients were also calculated to investigate such relationships. SPSS for Windows Release 11.0.1 (SPSS Inc., Chicago, USA) was used for data analyses and $p < 0.05$ was considered to be statistically significant.

Results

Socio-demographic characteristics

In the study population, there were 407 male and 411 female respondents and their demographic characteristics are summarized in Table 1. About 40% of the respondents were 35–49 years of age; about 60% of them attained a secondary or lower level of education; about 36% of the respondents were married and slightly more than half (53%) of them were single at the time of the study and around 70% had no religion (Table 1).

Positive impacts on family and social support

The results are summarized in Table 2. When the SARS period was compared with the pre-SARS period, noticeable proportions of the respondents felt that they were getting increased support from their friends (28.4%) or from their family members when they were in need (39.1%). They were sharing feelings more frequently with their family members (35.3%), and were sharing feelings more frequently with others when feeling blue (22%). Over 60% of the respondents cared more about family members' feelings. Concerning the 5 above-mentioned items, only 0.4%–6.0% of the respondents felt that the family/social support had deteriorated during SARS period in such regards (Table 2).

Male respondents were less likely than female respondents to be sharing feelings with others more frequently when feeling blue ($p = 0.002$). Gender, age and education were not significantly associated with other items listed in Table 2 ($p > 0.05$).

Positive impacts on mental health-related lifestyle

About 2/3 of the respondents reported to be paying more attention to their mental health (Table 3). About 35%–40% stated that they were spending more time to take rest, to relax and to exercise. Similarly, much fewer respondents (<10%) reported spending less time to take a rest, to relax and to exercise during the SARS epidemic (Table 3). Age, education and gender were not associated with any of these 4 items (Table 3).

Negative mental health impacts due to SARS

About 16% of the respondents have IES > 26; those who were less educated were more likely than

Table 3 Improvement in awareness and lifestyle that are conducive to better mental health by demographic factors

	Gender			Age group					Education group				Overall	
	Male	Female	<i>p</i> Value ^c	18–24	25–34	35–49	≥50	<i>p</i> Value ^c	≤9 Years	10–11 Years	12–13 Years	University		<i>p</i> Value ^c
Pay attention to mental health														
Increased ^a	65.8	65.9	1.000	60.1	66.7	66.4	70.1	0.623	68.0	66.0	65.2	63.4	0.270	65.9
Same as before	32.4	32.4		38.1	32.2	31.8	27.9		29.8	33.6	33.9	33.3		32.4
Decreased ^b	1.7	1.7		1.8	1.1	1.9	2.0		2.2	0.4	0.9	3.3		1.7
Time spent to rest														
Increased ^a	37.8	36.5	0.748	36.3	35.0	35.5	44.2	0.378	36.0	27.9	15.0	26.6	0.587	37.2
Same as before	52.8	55.2		54.2	57.1	53.9	50.3		50.0	58.7	53.9	53.5		54
Decreased ^b	9.3	8.3		9.5	7.9	10.6	5.4		9.6	8.9	7.0	8.9		8.8
Time spent to relax														
Increased ^a	41.0	37.5	0.139	43.5	36.7	39.3	36.7	0.676	36.8	37.5	39.1	43.7	0.171	39.2
Same as before	56.5	57.7		52.4	61.0	57.0	58.5		57.0	58.7	58.3	54.9		57.1
Decreased ^b	2.5	4.9		4.2	2.3	3.7	4.8		6.1	3.9	2.6	1.4		3.7
Time spent to exercise														
Increased ^a	36.1	35.3	0.896	36.9	32.2	34.3	41.5	0.172	35.5	32.4	39.1	38.0	0.407	35.7
Same as before	55.3	55.2		51.2	62.1	56.1	49.7		52.6	59.8	51.3	54.5		55.3
Decreased ^b	8.6	9.5		11.9	5.6	9.7	8.8		11.8	7.7	9.6	7.5		9.0

^a Increased or much increased.^b Decreased or much decreased.^c Chi-square test.

Table 4 Negative mental health impacts by demographic factors

	Gender		<i>p</i> Value ^c	Age group				<i>p</i> Value ^c	Education level				<i>p</i> Value ^c	All
	Male	Female		18–24	25–34	35–49	≥50		≤9 Years	10–11 Years	12–13 Years	University		
IES > 26														
Yes ^a	13.3	18.0	0.060	10.8	15.4	17.2	18.1	0.249	19.6	17.5	14.2	9.4	0.021	15.7
No ^b	86.8	82.0		89.2	84.6	82.8	81.9		80.4	82.5	85.8	90.6		84.3
Increased stress from work														
Yes ^a	35.4	38.2	0.403	22.0	40.1	45.8	30.6	<0.001	38.2	36.3	40.0	34.7	0.778	36.8
No ^b	64.6	61.8		70.8	59.9	54.2	69.4		61.8	63.7	60.0	65.3		63.2
Increased financial stress from														
Yes ^a	38.6	37.0	0.639	28.0	39.5	42.4	36.7	0.018	46.5	40.2	33.9	28.2	0.001	37.8
No ^b	61.4	63.0		72.0	60.5	57.6	63.3		53.5	59.8	66.1	71.8		62.2
Increased stress from home														
Yes ^a	25.1	28.0	0.344	17.9	26.6	32.1	25.2	0.009	30.3	28.2	24.3	22.1	0.218	26.5
No ^b	74.9	74.0		82.1	73.4	67.9	74.8		69.7	71.8	75.7	77.9		73.5
Felt horrified due to SARS														
Yes ^a	65.4	80.3	<0.001	54.8	72.9	78.5	81.0	<0.001	81.6	73.7	68.7	64.3	0.001	72.9
No ^b	34.6	19.7		45.2	27.1	21.5	19.0		18.4	26.3	31.3	35.7		27.1
Felt apprehensive due to SARS														
Yes ^a	55.5	69.1	<0.001	41.1	62.7	67.6	74.1	<0.001	72.4	61.8	53.0	57.3	0.001	62.3
No ^b	44.5	30.9		58.9	37.3	32.4	25.9		27.6	38.2	47.0	42.7		37.7
Felt helpless due to SARS														
Yes ^a	60.5	63.7	0.703	61.1	58.2	68.8	66.7	0.076	68.9	69.4	65.2	52.6	<0.001	64.4
No ^b	35.0	36.3		38.9	41.8	31.2	33.3		31.1	30.6	34.8	47.4		35.6

^a Increased/much increased.

^b Same/decreased/much decreased.

^c Chi-square test.

others to have a high IES score ($IES > 26$). Gender and age were not of statistical significance (Table 4). About 27%–38% of the respondents felt an increased level of stress at home, at work or in financial matters during the SARS period, as compared to the pre-SARS period (Table 4). Those who were older were more likely to have experienced an increased level of stress (Table 4), while gender and education level were not significant (except that those who have a higher level of education were less likely to have experienced an increased level of stress in financial matters). Around 62%–73% of the respondents felt horrified, apprehensive or helpless due to SARS (Table 4). Those who were female, older and less educated were more likely than others to have such negative feelings (Table 4).

Associations between positive and negative impacts

The associations between items representing positive and negative mental health impacts due to SARS are summarized in Table 5. Those with high IES score (>26) were more likely than others to have experienced positive changes. The odds ratios were statistically significant for all item indicators of positive mental health impacts, except the 2 on increased attention to mental health and increased time spent to exercise (significant adjusted OR = 1.5–2.3). It is seen that work-related stress (significant adjusted OR = 1.41–2.11) and home-related stress (significant adjusted OR = 1.4–2.31) were also statistically associated with many items representing positive mental health impacts of SARS (i.e. increased family and social support, increased mental health concern and increased mental health-related lifestyle). Increased financial stress was also significantly associated with 4 of the positive impact items ($p < 0.05$, Table 5). Similarly, those who felt apprehensive or horrified were more likely than others to have experienced positive changes in support, mental health awareness or lifestyle changes (8 items and 3 items, respectively, OR = 1.40–2.08, $p < 0.05$). Feeling helpless due to SARS was associated with only 2 items (increased sharing feeling with family members, OR = 0.72 and taking more time to do exercise, OR = 0.62, $p < 0.05$, Table 5). In Table 6, the 3 subscales of IES were also significantly correlated with the 2 composite scales for measuring social/family support (PSS) and improved mental health-related lifestyle (MHLSS) after adjusting for background factors ($p < 0.05$, Table 6).

Discussion

The SARS epidemic might have been a traumatic experience to people in Hong Kong, who had repeatedly been exposed to stressful media messages for an extended period of several months. Most of the general public believed that the epidemic was severe and would result in a major outbreak and that the government did not have the capacity to control the epidemic.⁴ Therefore, it means that they could do little to change the external situation. In fact, many felt horrified, apprehensive and helpless.¹⁷

For the first time, this study conducted in the ending phase of the epidemic documents that some positive changes due to SARS had also been fostered in midst of the negative impacts on mental health. Importantly, better family and social support, better mental health awareness and healthier lifestyle have been documented by noticeable proportion of respondents.¹⁸ Although in many cases, more than half of the respondents reported no changes, the percentages reporting favourable changes were much larger than the percentages reporting unfavourable changes.¹⁸ The better social and family support observed was in line with intensive media coverage depicting a more coherent and harmonious atmosphere in Hong Kong.^{28,29} Family and friends were much valued in this crisis. Family members were more likely to be spending time together with each other as they worried about and avoided going to public places.⁴ Family members also worried about each other being infected.⁴ Friends were sending warm regards to each other. Support, especially to those working under the threat of SARS transmission (e.g. health care workers) had been experienced through all sorts of media channels. The entire society slowed down with people avoiding work and public places. Therefore, with the above observation, it is speculated that due to the SARS epidemic, people may have had more time and opportunities to care for their family members and friends.

It is not certain whether such observed positive changes would last. The magnitude of the reported changes was however, very noticeable. It is possible that the sudden occurrence of dramatic crisis made people reconsider priorities in their life. Value changes may also have been involved. If such is the case, some of the observed behavioural changes may be fundamental and lasting. Further research in this regard is warranted.

The results further showed that the observed positive changes were positively associated with other negative impacts of SARS, adjusting for

Table 5 Associations between positive and negative mental health aspects

	Social and family support					Concern for mental health	Lifestyle changes		
	Getting increased support from friends OR ^a (95% CI) ^b	Getting increased support from family members OR ^a (95% CI) ^b	Increased sharing feelings with family members OR ^a (95% CI) ^b	Increased sharing feelings with others when in blue OR ^a (95% CI) ^b	Increased caring for family members' feelings OR ^a (95% CI) ^b	Increased attention to mental health OR ^a (95% CI) ^b	Increased time spent to rest OR ^a (95% CI) ^b	Increased time spent to relax OR ^a (95% CI) ^b	Increased time spent to exercise OR ^a (95% CI) ^b
IES > 26	1.53 (1.01–2.32)*	1.69 (1.14–2.51)*	1.75 (1.18–2.60)*	1.85 (1.21–2.85)*	2.28 (1.43–3.63)**	1.43 (0.93–2.21)	1.53 (1.03–2.26)*	2.19 (1.48–3.25)**	1.44 (0.97–2.14)
Increased stress from work	1.82 (1.32–2.52)**	2.11 (1.56–2.85)**	1.51 (1.11–2.06)*	1.77 (1.25–2.50)**	1.99 (1.44–2.74)**	1.72 (1.25–2.37)**	1.77 (1.31–2.34)**	1.19 (0.88–1.61)	1.41 (1.04–1.92)*
Increased financial stress	1.22 (0.88–1.69)	1.25 (0.92–1.68)	1.24 (0.91–1.68)	1.36 (0.96–1.93)	1.42 (1.04–1.93)*	1.61 (1.17–2.20)*	1.58 (1.17–2.13)*	1.28 (0.95–1.73)	1.41 (1.04–1.90)*
Increased stress from home	1.35 (0.95–1.91)	2.04 (1.47–2.82)**	1.73 (1.25–2.40)**	2.31 (1.61–3.32)**	2.70 (1.85–3.94)**	1.91 (1.33–2.73)**	1.40 (1.01–1.94)*	1.37 (0.99–1.90)	1.31 (0.95–1.82)
Felt horrified due to SARS	1.18 (0.82–0.71)	1.05 (0.75–1.46)	1.23 (0.87–1.74)	1.69 (1.11–2.59)*	1.37 (0.98–1.91)	1.88 (1.35–2.62)**	1.65 (1.16–2.34)*	1.24 (0.89–1.73)	1.25 (0.89–1.76)
Felt apprehensive due to SARS	1.82 (1.28–2.57)**	1.64 (1.20–2.24)*	1.79 (1.29–2.47)**	1.44 (0.99–2.09)	2.08 (1.53–2.84)**	2.06 (1.51–2.81)**	1.82 (1.33–2.51)**	1.60 (1.72–2.18)*	1.40 (1.02–1.91)*
Felt helpless due to SARS	0.86 (0.62–1.19)	0.80 (0.60–1.09)	0.72 (0.53–0.98)*	1.33 (0.92–1.91)	0.99 (0.73–1.34)	0.82 (0.60–1.12)	0.85 (0.63–1.15)	0.92 (0.68–1.25)	0.62 (0.46–0.84)*

* $p < 0.05$; ** $p < 0.001$.^a Odds ratio, adjusted for age, gender, education, marital status, employment status and religion (logistic regression analysis).^b 95% Confidence interval (in brackets).

Table 6 Correlations between positive impacts due to SARS and IES subscales

	PSS (partial r) ^a	MHLSS (partial r) ^a
IES		
Avoidance	0.167**	0.119**
Intrusion	0.210**	0.085*
Hyperarousal	0.101*	0.109*

* $p < 0.05$; ** $p < 0.001$.

^a Partial correlation coefficients, controlling for gender, age group, education level, marital status, employment status and religion.

relevant background factors. Such positive impacts may have served as a cushion against the negative impacts due to SARS. Those who were more affected by the SARS epidemic may mobilise their support systems to deal with the problems. It is also possible that those who were more adversely affected "learnt" to value his/her family, friends and mental health. Causal relationships could not be established by this cross-sectional study. To some extent, the observed change may represent post-traumatic growth.¹⁵ These explanations are hence speculative, but it poses new research questions to the future study of mental health responses in the community in face of major societal disasters. The importance of post-traumatic growth should be further studied.

A high prevalence of mental health problems^{30,31} and unhealthy lifestyles has been recorded in Hong Kong^{32,33} as well as in other developed countries.³⁴ Further studies are warranted to investigate whether observed positive impacts due to SARS could be substantiated. If so, understanding on reasons behind such changes may contribute to the design of more effective mental health campaigns in the future. Health workers may also include mental health promotion as part of the follow-up work in the post-SARS period.

The study has several limitations. The study is a cross-sectional one, carried out at the ending phase of the SARS epidemic. As discussed, causality relationships could not be established and the positive changes may not last. Collection of baseline measurements was not possible for the pre-SARS period. Therefore, only perceived changes were measured. This is a self-reported study and presentation bias may have confounded the results. However, with the anonymous nature and the large magnitude of self-reported positive mental health-related changes, it is believed that the changes reported were genuine. Recall bias may have been incurred. Yet, the SARS epidemic is an unusual experience and should have created strong impressions in the mind of the respondents. The response

rate was only about 65% and no data were available to understand the characteristics of the non-respondents. The age and gender composition however, is roughly comparable with those of the 2005 Census data (see Table 1 footnotes), and the response rate has been typical in surveys carried out in Hong Kong and has been found acceptable in a number of published papers.^{22,35} Telephone surveys have been used in a number of studies on post-traumatic stress symptoms related to the 9-11 crisis.^{36,37} It is in fact, the method of choice at the time of the study when SARS was a concern for everyone and contacts with strangers were minimised, so that face-to-face household interviews were not feasible at all. Those with stress may be more likely to refuse joining the study but the magnitude should be small as there is no evidence that those who are stressed did not want to be interviewed. The age range (18–60 years) also did not allow our results to be generalized to the younger and elderly age groups. It is also important to recognise that the correlation coefficients in Table 6, though statistically significant, were only mild or moderate in magnitude. A large part of the variance in positive changes had not been accounted for by the IES. Finally, as SARS is a new disease and the study was implemented at the early ending phase of the epidemic. No relevant instrument existed and full validation was not available. Two scales have been constructed for this study and were used for a supplementary purpose. Though the MHRCS has a Cronbach's alpha value of 0.82, the Cronbach's alpha value of the PSS was moderate (0.66). However, the analysis using indicator variables gives consistent results (Table 5).

It is acknowledged that the study is an original but a preliminary one. It captured some positive and negative mental health impacts of the important SARS epidemic. It should also have contributed to the scant literature on the study of post-traumatic growth. It has pointed out some important areas for future research in community responses to major societal disasters.

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