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<td><strong>Author(s)</strong></td>
<td>Leung, GM; Quah, S; Ho, LM; Ho, SY; Hedley, AJ; Lee, HP; Lam, TH</td>
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Community psycho-behavioural surveillance and related impact on outbreak control in Hong Kong and Singapore during the SARS epidemic

Key Messages

1. The promotion of personal protective health practices must take into account background perceptions of risk and psychological responses in the community-at-large.
2. Population psycho-behavioural factors in Hong Kong and Singapore are shown to be an important potential vector for the transmission of an infectious agent.
3. Comparative psycho-behavioural surveillance and analysis can yield important insights into generic versus population-specific issues that could be used to inform, design and benchmark public health infection control measures.

Introduction

During a new epidemic such as the SARS outbreak, medical and public health communities focused on identification of the responsible agent as well as pathophysiology, clinical presentation, diagnosis, and treatment of the condition. Interest was less in the epidemiology of the disease and the effectiveness of infection control measures in various hospitals; population psycho-behavioural surveillance received almost no research coverage. However, formulation and implementation of public health infection control measures deserves equal attention and such recommendations should be based on public perceptions, beliefs and attitudes. Standard data collection and analysis in outbreak control strategies rarely include information about population perceptions about the disease and their relevance to the agent-vector-host epidemiological triangle.

As there may be a possible return of SARS, it is useful to compare the public responses in different cities that were similarly affected. Such comparative analyses enable policy makers to disentangle generic issues from culture-specific concerns and to share practices that successfully controlled the outbreak.

We report a cross-sectional, population-based survey on psycho-behavioural responses to SARS in two centres of the epidemic, Hong Kong and Singapore.

Aims and objectives

To compare public knowledge and perceptions about SARS and the extent to which precautionary measures were adopted in Hong Kong and Singapore.

Methods

Respondents were recruited using random-digit dialling of all land-based telephone lines in Hong Kong and Singapore. A total of 705 Hong Kong (aged ≥18 years) and 1201 Singaporean (aged ≥21 years) residents completed the survey conducted from 15 May to 10 June 2003 in Hong Kong and 5 to 10 May 2003 in Singapore. The respective response rates were 54.7% (705/1288) and 62.3% (1201/1928).

The survey consisted of 60 questions, five of which had multiple parts. It was translated and back-translated from Cantonese to English and vice versa in Hong Kong, and from Cantonese to Mandarin, Malay and English in Singapore. It was pre-tested for face and content validity, length and comprehensibility. The questionnaire was administered in Cantonese in Hong Kong, and in Mandarin, Malay or English in Singapore (at the respondents’ choosing).

The respondents were asked: (1) their self-perceived general health status, febrile and respiratory symptoms in the previous 2 weeks, and general anxiety levels using the State-Anxiety Scale of the State Trait Anxiety Inventory (STAI)²;
(2) their use of health services in the previous 2 weeks; (3) the presence, intensity and setting of direct and indirect contacts with SARS patients; (4) their risk perception in terms of their self-perceived likelihood of contracting SARS and survival if diagnosed with the disease; (5) their beliefs about routes of transmission and confidence in physicians’ ability to diagnose the disease; (6) the extent to which various precautionary measures were being adopted and possible changes in lifestyle practices to prevent transmission of the virus; and (7) sociodemographics.

We determined differences in proportions between baseline demographics in this survey and corresponding population statistics in the two cities by calculating the effect size. A value of 0.1 indicates a small effect, 0.3 a medium effect, and 0.5 a large effect. To adjust for possible sampling biases due to sociodemographic differences between respondents and non-respondents and to ensure that the sample was representative of the general populations, we weighted the responses based on the latest figures from the Hong Kong Census and Statistics Department and Singapore Department of Statistics for age, gender and level of educational attainment. All 95% confidence intervals (CIs) were generated using logistic and multinomial regression for dichotomous and multi-categorical variables, respectively.

Using multivariable logistic regression, we sought to identify predictors for greater adoption of a predefined set of precautionary measures (ie at least five of the seven specified strategies) and health services use (defined as presentation to western, Chinese or other complementary and alternative medical practitioners in any setting during the previous 2 weeks). Potential explanatory variables were anxiety level (STAI mean score), level of confidence in physicians’ ability to diagnose SARS, self-perceived likelihood of contracting SARS and surviving the illness if infected, presence of physical symptoms, contact history, and sociodemographics. All analyses were conducted using Stata version 8.0.

Results

Comparing the sample demographics with those from the respective population census data, most of the baseline parameters were similar to the benchmark statistics as confirmed by the small effect sizes. To improve generalisability, age, gender and education were used to weight the samples in all subsequent analyses.

Health and emotional status

The anxiety level of Hong Kong respondents was significantly higher than their Singaporean counterparts (mean=2.06 vs 1.77, P<0.001), using the STAI 10-item scale (scores ranging from one [not anxious at all] to four [very anxious]).

Only 0.5% of the Hong Kong and 0.9% of the Singaporean respondents (P=0.36) reported persistent fever of 38ºC for at least 1 day within the previous 2 weeks; about half of whom (0.2% and 0.4%, P=0.47) also had cough or dyspnoea. Respondents with this combination of symptoms was eligible for a SARS diagnosis during an acute outbreak. Hong Kong respondents reported significantly higher prevalences for headaches, difficulty breathing, dizziness, running nose, and sore throat, but none of these (except for difficulty breathing) were cardinal symptoms of SARS. In fact, their presence may have suggested other diagnoses.

When the prevalences of these five symptoms were adjusted for the anxiety level (ie STAI score), they decreased by 7% to 23% in the Hong Kong sample, but remained almost unchanged for the Singaporeans. Given the higher anxiety levels in Hong Kong respondents, psychosomatic presentation may have played a role in the larger proportion of respondents giving a positive response to these symptoms.

Extent of direct and indirect contacts with diagnosed cases and willingness to be quarantined

The majority (92.3% in Hong Kong and 96.7% in Singapore) of respondents reported no contact history, whereas 0.2% of Hong Kong and 0.3% of Singaporean respondents had direct, non-close contact, and 4.1% of the Hong Kong and 1.5% of the Singaporean samples had indirect contact (contact of a direct contact) with a confirmed case. The remaining 3.4% (Hong Kong) and 1.5% (Singapore) of the sample believed they might have been exposed to a possible SARS patient or infected materials (eg fomites).

There appeared to have been a high degree of willingness to comply with quarantine procedures, in the event the respondents were to be exposed to SARS patients. More than 90% of the samples in both cities were willing to be quarantined if there was close (eg household or intimate relationships) contact and at least 70% would be compliant for non-close or social contact.

Knowledge and beliefs about SARS

The majority of respondents in both cities (86.7% in Hong Kong vs 71.4% in Singapore, P<0.001) knew that SARS could be transmitted by person-to-person droplets, although fewer (75.8% in Hong Kong vs 62.1% in Singapore, P<0.001) identified fomites or contact through contaminated objects as a possible transmission mode. These are the two main routes of transmission confirmed by the Centers for Disease Control and Prevention and the World Health Organization. However, 40.9% of the Hong Kong and 50.9% of the Singaporean samples thought that the infection could be transmitted via the airborne route (P<0.001), which does not appear to be the case according to the epidemiological evidence. Overall, Hong Kong respondents were more knowledgeable about the routes of transmission, in terms of the total number of correct responses (P<0.001).

A total of 23% of Hong Kong and 11.9% of Singaporean
respondents believed that they were ‘very likely’ or
‘somewhat likely’ to contract SARS during the outbreak
(P<0.001). This proportion remained the same even after
excluding those who reported any contact (direct or indirect)
with a SARS patient. Singaporean respondents were more
confident about the ability of physicians to diagnose
SARS (29.5% vs 16.1% were ‘very confident’, P<0.001).
However, the corresponding proportions for feeling ‘not
very confident’ or ‘not at all confident’ were similar in
the two cities. Regarding the likelihood of surviving SARS if
they contracted the disease, 9.9% of Hong Kong and 11.2%
of Singaporean respondents believed their survival was ‘not
very likely’, and 1.9% and 2.2% was ‘not at all likely’. Up
to the time of the survey, the case fatality rates were 17.1%
in Hong Kong and 13.9% in Singapore.

Precautionary measures

The respective proportions of respondents who reported
practising each of seven specified precautionary measures
to prevent the transmission and contracting of SARS
were analysed. There were large differences between Hong
Kong and Singapore for six of the seven measures, except
for washing hands with soap. Compared with Singaporean
respondents, more Hong Kong respondents would cover
their mouths when sneezing or coughing (83.6% vs 94.4%)
and wash their hands afterwards (72.6% vs 85.6%) as well
as after touching possibly contaminated objects (48.3%
vs 81.2%). About 47.7% of Hong Kong and 27.3% of
Singaporean respondents used serving utensils during
meals; this is important in Chinese culture, in which dishes
are commonly shared with everyone at the table. The
difference in proportion of facemask wearing was most
striking (79.0% in Hong Kong vs 41.1% in Singapore). At
least two thirds of the Hong Kong sample but only 12.6%
of the Singaporeans practised at least five of the seven
specified preventive strategies.

Predictors for the adoption of precautionary
measures and health services use

The level of anxiety (as measured on the STAI scale)
demonstrated a positive dose-response relationship with
adoptions of personal protective measures, especially in Hong
Kong (P<0.01). Recent physical health (as inferred from
acute respiratory or febrile symptoms) or a contact history
with SARS patients was not associated with adoption of
precautionary measures. Higher self-perceived likelihood
of contracting SARS was a positive predictor in Hong Kong
(odds ratio [OR]=1.53; 95% CI, 0.99-2.38), although the
results were equivocal for Singapore (OR=1.24; 95% CI,
0.83-1.87). Other variables such as the level of confidence
in the ability of physicians to diagnose SARS and the
likelihood of surviving SARS did not appear to be predictive.
Greater knowledge about the transmission routes of SARS
predicted the adoption of more precautionary measures in
Hong Kong (OR=2.09; 95% CI, 1.39-3.13). The lack of
significant association in Singapore may reflect the much
lower adoption of personal protective measures. In terms of
sociodemographics, males were much less likely to adopt
precautionary measures against SARS. There were positive
dose-response relationships with increasing age and the level of educational attainment in
both cities, where the former relationship was stronger in
Singapore and the latter in Hong Kong. To assess whether
anxiety level was an intermediary between risk perception
and uptake of precautionary measures, we re-analysed
the model while omitting the STAI score as an independent
variable. This revealed that the OR estimates for the two self
perceived likelihood factors did not change appreciably, thus
confirming that anxiety was not a significant intermediary
causal factor.

The presence of symptoms was the only robust predictor
for higher health services use. Respondents’ health-seeking
behaviour did not appear to have been influenced by
extraneous factors such as risk perception, anxiety level or
contact history. However, younger, male respondents were
less likely to seek health care services.

Discussion

This population-based, cross-sectional survey revealed
substantial differences in the knowledge, beliefs, emotional
status, and extent of adopting personal protective measures
between Hong Kong and Singapore at the end of the SARS
epidemic. Areas of commonalities between two cities
included levels of civic compliance with public health
care. The strength of this study was that respondents were
interviewed during an actual outbreak, compared with other
studies of infectious disease epidemics or bioterrorism
attacks in which hypothetical questions were usually
posed.

As the survey was conducted during the epidemic (close
to the end), knowledge indices were expected to be at their
highest given the cumulative effects of sustained promotion
of health practices through mass media. Nonetheless, there
were still significant knowledge gaps in terms of the routes
of SARS coronavirus transmission (more so in Singapore
than Hong Kong). In addition, respondents’ risk perception
as indicated by their perceived likelihoods of contracting and
surviving SARS were exaggerated and overly pessimistic
when benchmarked against the overall probabilities based
on the numbers of patients infected and died. This could
be explained by a combination of knowledge deficits and
excessive anxiety generated by the outbreak, although the
present analyses preclude drawing of definite conclusions.

The stage of the epidemic at which we conducted the survey could have affected our observations regarding public behavioural responses. Singapore’s lower adoption prevalence of precautionary measures might arguably have been due to the low daily new case counts at the time of the survey, although it would have been difficult for the population to foretell this given that in Singapore similarly low new daily counts were observed towards the end of March and early April, only to peak again 2 weeks later. Toronto also experienced a similar bimodal distribution of cases. The Hong Kong survey was also carried out during the end of the outbreak, but a much larger proportion of respondents reported continued vigilance for personal protective precautions and more comprehensively. Assuming this cross-sectional pattern was representative of the entire epidemic in both cities and that there was no ecologic fallacy, the very different extent of the respective outbreaks in Hong Kong and Singapore must be due to other factors. For instance, the impact of the two superspreading events at the Prince of Wales Hospital (n=239) and Amoy Gardens (n=329) in Hong Kong (where the former ‘seeded’ the latter) might have dominated over the much smaller effects of community transmission (where one infected individual typically spread the disease to three others in the absence of any preventive measures), which was dependent on public collective adoption of personal preventive measures. This hypothesis, if substantiated, underlines the often stochastic or random nature of such epidemics.

Our findings have important implications for public health and infection control. Public health messages in providing appropriate advice and education during this epidemic were highlighted. There were significant gaps in the public knowledge about SARS such as the route of transmission and risk perception, which were associated with inadequate adoption of precautionary measures. Therefore, health education and promotion efforts should be stepped up to prepare for a possible return of SARS.

Anxiety can be either a facilitator or barrier for promoting adoption of precautionary measures. This study confirmed that the population attitudes and perception of events were important indices. They should be closely monitored during an outbreak like SARS, as they can be highly predictive of key behaviours.

Younger, less-educated males (ie traditional risk-takers) were least likely to adopt appropriate preventive measures. Targeting health promotion messages through intermediaries such as female significant others (eg mothers, wives or girlfriends) who are more health conscious and risk averse may raise the level of protective precautions undertaken by this vulnerable subgroup.

Only those with symptoms were more likely to seek medical attention. Other factors, such as risk perception and anxiety level, did not significantly influence health care use, suggesting that there was little detectable panic or irrational use of health services in both cities. This could have been due to avoidance of health care facilities by the public to minimise exposure to high-risk areas (hospitals) and health care personnel. Nonetheless, panic and irrational use of health services during large outbreaks could in theory overwhelm any health care system.

The limitation of this survey was that it was administered at a single time point such that the stability of the responses is unknown, although in Hong Kong repeated cross-sectional and time series data as well as prospective panel data at various points of the epidemic were collected. The analysis of this longitudinal data set can track possible psycho-behavioural changes as epidemics evolve and evaluate the macro impact of policy decisions. In addition, the use of structural equation modelling linking different psycho-behavioural variables to better delineate the causal chain of events deserves further examination. Further exploration of public beliefs and their interplay with traditional health beliefs and practices would be a useful adjunct to understand population psycho-behavioural responses. Such qualitative research should be a high priority to prepare for future large-scale epidemics.

Conclusions

Promotion of personal protective health practices must take into account background perceptions of risk and psychological responses in the community-at-large. Population psycho-behavioural factors in Hong Kong and Singapore were a potential vector for the transmission of an infectious agent. Comparative psycho-behavioural surveillance and analysis can yield important insights into generic versus population-specific issues. Such issues could be used to inform, design and benchmark public health infection control policy measures.

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