GM Leung 梁卓偉
S Quah
LM Ho 何禮明
SY Ho 何世賢
AJ Hedley 賀達理
HP Lee
TH Lam 林大慶

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.

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Department of Community Medicine, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong SAR, China
GM Leung, LM Ho, SY Ho, AJ Hedley, TH Lam
Department of Sociology, National University of Singapore
S Quah
Department of Community, Occupational & Family Medicine, National University of Singapore
HP Lee

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Principal applicant and corresponding author:
Prof GM Leung
Department of Community Medicine, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong SAR, China
Tel: (852) 3906 2000
Fax: (852) 3920 1945
E-mail: gmleung@hku.hk

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.[1-4] 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.[5,6] 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)[7];

(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) directed against the two main modes of transmission (person-to-person droplet spread and fomites) 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 possible 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 4.1% 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 adoption 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 comprehensive 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 control and quarantine directives, as well as predictors of greater adoption of precautionary steps and health services use. Public health action to curb the transmission of SARS coronavirus was mainly effected through enhanced personal hygiene and health protective measures. This was dependent on the public knowledge, psychological responses (viz anxiety level) and the perceptions of the community-at-large. There were sociodemographic subgroups that were less likely to take personal protective steps or to seek 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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References

1. Fouchier RA, Kuiken T, Schutten M, et al. Aetiology: Koch's postulates fulfilled for SARS virus. Nature 2003;423:240.
2. Nicholls JM, Poon LL, Lee KC, et al. Lung pathology of fatal severe acute respiratory syndrome. Lancet 2003;361:1773-8.

3. Tsang KW, Ho PL, Ooi GC, et al. A cluster of cases of severe acute respiratory syndrome in Hong Kong. N Engl J Med 2003;348:1977-85.
4. So LK, Lau AC, Yam LY, et al. Development of a standard treatment protocol for severe acute respiratory syndrome. Lancet 2003;361:1615-7.
5. Donnelly CA, Ghani AC, Leung GM, et al. Epidemiological determinants of spread of causal agent of severe acute respiratory syndrome in Hong Kong. Lancet 2003;361:1761-6.
6. Seto WH, Tsang D, Yung RW, et al. Effectiveness of precautions against droplets and contact in prevention of nosocomial transmission of severe acute respiratory syndrome (SARS). Lancet 2003;361:1519-20.
7. Spielberger C, Gorusch R, Luschene R. State Trait Anxiety Inventory: a test manual/test form. Palo Alto, CA: Consulting Psychologists Press; 1970.