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How to provide an effective primary health care in fighting against severe acute respiratory syndrome: the experiences of two cities

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Objectives: This study was designed to compare the response and management of severe acute respiratory syndrome (SARS) by the family physicians of the Hong Kong and the Toronto health systems, and to provide evidence to improve health policy and practices in a newly emerging infectious disease.

Methods: A questionnaire was sent to family medicine tutors affiliated with either the Chinese University of Hong Kong or the University of Toronto in 2003. The survey questions covered training for SARS, the use of screening tools, an anxiety scale, clinical practices, and demographic data.

Results: 137 (74.8%) and 51 (34%) doctors from Hong Kong and Toronto replied to the questionnaire, respectively. Most (80-84.6%) had no training in infectious disease control and were not confident in dealing with SARS (68.1-73.5%). In Hong Kong, the screening tools provided by international agencies did not meet the local needs. In Toronto, lack of a centralized hospital admission policy and fully public laboratory probably resulted in appointment cancellation and dissatisfaction. There may be a need for deployment of personnel between institutions but loss of income was not a major concern.

Conclusions: Sharing the "lessons learned" in different regions during a SARS outbreak will help prepare for the next epidemic. (Am J Infect Control 2007;35:50-5.)

The SARS (severe acute respiratory syndrome) epidemic created international anxiety because of its novelty, ease of transmission, and speed of its spread by way of airline travel.¹⁻⁴ Both Canada and Hong Kong set up separate committees to carry out inquiries into the handling of this epidemic and published their reports at the end of 2003.^{5,6} There were many similarities in the management of SARS and its impact in these two locations. Neither had faced an epidemic that took such a direct toll on health care workers. No satisfactory laboratory tests were initially available to confirm diagnoses in suspected cases. Surveillance and warning systems were inadequate in preventing the outbreak of this emerging infectious disease, and many weaknesses of the clinical systems were exposed. However, very little was mentioned in the reports

regarding the difficulties with which the frontline doctors in the community were confronted. One exception was the suggestion of developing integrated protocols for disease outbreak management at a population level, which would link both institutional and noninstitutional clinicians with intersectoral staff compensation.⁷

During the SARS epidemic, family physicians in both locations were very much left to their own devices for screening, diagnosing, and managing anxious patients and families of suspected or confirmed disease.⁸ In Hong Kong, seven family physicians and one community dentist contracted SARS, resulting in two subsequent deaths and the infection of at least one family member of one of the doctors.⁹ In greater Toronto, three hospitals were closed. Although no casualties were noted from community health care personnel in Canada, many health care workers were quarantined, resulting in severe staff shortages and cancellations of all hospital-based outpatient clinics. The purpose of this study was to identify problems that family physicians had encountered during the outbreak, factors that had affected their readiness in managing SARS, and the degree of their satisfaction with their respective government's performance using cross-sectional surveys. The spontaneous communication and information exchange triggered by SARS have led to a series of international discussions that are

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likely to set a new standard for disease response and control.

THE TWO SYSTEMS ON TRIAL

The health system in Hong Kong is confusing, if not chaotic: although the public sector serves as a health care provider for all citizens at a low cost to the consumers and accounts for 90% of the hospital care, the fee-for-service private sector is substantial, providing 70% of primary care and some specialized and institutional services to a large number of her citizens.¹⁰ The Secretary of the Health, Welfare and Food Bureau has an overall responsibility to oversee the Department of Health, which is responsible for public health issues and surveillance whereas the Hospital Authority runs the public hospitals and outpatient services for 6.8 million residents in Hong Kong. Hong Kong serves as a main gateway for China to the rest of the world and, the close integration and high volume cross-border travel between Hong Kong and the neighbouring Pearl River Delta offers a sharp reminder of the geographical importance of this city as a step stone for the spread of infectious diseases that continue to emerge in South of China.

The provision of health services in Canada involves complex arrangement among federal, provincial, and municipal authorities.¹¹ Personal health care is provided through a provincially administered universal health insurance system with no private provisions. However, Ontario, the province where Toronto is situated, is the only Canadian province with no regional health authorities. All family physicians work on a fee-for-service basis as independent contractors and all acute hospitals in Toronto enjoy a high degree of autonomy. Greater Toronto, with a population of 5.3 million, is the financial and business powerhouse of the country and its airport serves as a major hub for North America.

METHODS

Surveys were sent anonymously to a total of 183 family medicine tutors affiliated with the Department of Community and Family Medicine, at the end of May 2003, following the removal of the World Health Organization's recommendation to postpone all essential travel to Hong Kong. These family physicians were mostly private doctors working in different parts of Hong Kong who voluntarily taught fourth-year medical students. All local family physicians were welcome to register for this supernumerary position after they had fulfilled the criteria set forth by the department. A reminder with a copy of the questionnaire was posted again in the middle of June. A similar survey, including modifications to accommodate the differences

in local health care organization, was sent to 150 family medicine tutors working in an undergraduate teaching practice affiliated with University of Toronto in June 2003, followed by a reminder two weeks later.

As SARS was a newly emerging disease, no standardized instruments were available to the investigators. We decided to look into five different areas thought to be important in the management of SARS, namely: 1) training in infectious diseases and information access to SARS, 2) application of the screening tools from various agencies, 3) clinical practices and perceived changes in the behavior of the patients, 4) anxiety level experienced by doctors and their satisfaction in the government's performance when confronted with SARS, and 5) physician personal data such as age, sex, postgraduate qualifications and types of practice. When formulating the questionnaire, we considered what information was already available from the guidelines provided by Hong Kong Department of Health or Canadian Ministry of Health, World Health Organization, or Centre of Communicable Diseases and Prevention Web sites and respective professional bodies.

We hypothesized that some of the behavioral changes were suggested based on the Health Belief model¹² and Theory of Planned Behaviour.¹³ Therefore, we looked specifically at the perceived threat to physicians (or their readiness to deal with SARS) and their subsequent preferred actions (eg, requests for more blood tests or radiographs) and barriers to action (eg, training or loss of income). Based on the Theory of Reasoned Action, Ajzen¹⁴ incorporated this type of conceptual framework with the idea that people's behavior is a consequence of their perceived control in terms of their knowledge base (what, how, and where information is obtained), their attitudes (confidence in diagnosing SARS and the types of training perceived as most appropriate), and their satisfaction (measured for future reference). The questionnaire was content tested and adjustments were made accordingly.

In the questionnaire, doctors were asked to rate the usefulness of various information sources and screening tools, whereby "1" was viewed as being most valuable and "7" was of no value at all. We used a visual analogue scale to assess the anxiety levels of family physicians dealing with SARS with responses ranging from extremely frightened (high score) to not frightened at all (zero score). We studied the impact of SARS on their clinical practices and precautions they undertook to protect their staff, patients, and families with "yes" or "no" options, followed by several provided options to explain the response. The data was entered, cleaned, and analyzed using SPSS (version 13). The chi-square test was used to test the significance of associations between the correspondences

Table 1. Comparison of demographic characteristics of tutors from HK and Toronto

	Canadian tutors		HK tutors		Tutors		Chi-square P value
	No.	%	No.	%	No.	(%)	
Number of doctors	51		137		183		N/A
Age group							
Young (under 39)	19	38.0	47	34.6	N/A		N/A
Middle (40-49)	18	36.0	48	35.3	N/A		
Old (over 50)	13	26.0	41	30.1	N/A		
Gender							
Male	17	44.7	112	82.4	155	(84.7)	.57
Female	21	55.3	24	17.6	28	(15.3)	
Post-graduate education							
Yes	41	95.3	119	87.5	157	(85.8)	.66
No	2	4.7	17	12.5	26	(14.2)	
Experience (>10 years)							
Experienced	24	57.1	106	77.9	148	(80.9)	.52
Inexperienced	18	42.9	30	22.1	35	(19.1)	
Primary practice setting							
Work in hospital	29	58.0	NA		114	(62.3)	.003
Not work in hospital	21	42.0	NA		18	(9.8)	
					51	(27.9)	

and odds ratios (OR) and their 95% confidence intervals (CI) were used to measure the strength of the associations. Independent samples *t* tests were used to compare anxiety levels in dealing with SARS between the two countries. Multiple logistic regression was applied to obtain adjusted OR (AOR) for anxiety about dealing with SARS (defined as a score of > 5 out of 10 on the visual analogue scale) for the question above and the physician's satisfaction with their government's handling of the epidemic. The Chinese University and University of Toronto Clinical Research Ethics Committees approved this study.

RESULTS

In Hong Kong, a total of 183 questionnaires were sent to family medicine tutors with 137 valid replies (74.8%). In Toronto, 51 (34.0%) doctors replied. **Table 1** shows the demographic characteristics of the participating physicians from both regions. We observed that there were more male doctors and doctors with over 10 years of experience (in addition to postgraduate training) in the Hong Kong sample. In Hong Kong, 33 (24.1%) respondents diagnosed SARS cases in their community, whereas in Toronto, only 2 (4%) had diagnosed this disease.

The majority of family medicine tutors from either Hong Kong or Toronto had no training in infectious disease control (84.6% and 80.0%, respectively) and lacked confidence in dealing with SARS (68.1% and 73.5%, respectively) (**Table 2**). Doctors from Hong Kong were more likely to order blood tests and/or a chest radiograph (OR 37.8; 95% CI 12.65, 113.06) and

less likely to wait a longer time period for the results (OR 0.02; 95% CI 0.01, 0.06). Doctors from Hong Kong were much less likely to experience appointment delays or cancellations (specialists: OR 0.05; 95% CI 0.02, 0.11; surgery: OR 0.16; 95% CI 0.08, 0.31; family doctors: OR 0.17; 95% CI 0.08, 0.35), or difficulties in making referrals to specialists (OR 0.07; 95% CI 0.03, 0.14). At the same time, 88.2% and 80.4% of family physicians in Hong Kong and Toronto, respectively, reported reductions in income with a significantly higher increase in overhead costs (OR 7.73; 95% CI 3.77, 15.83), yet there were fewer appointment cancellations (OR 0.39; 95% CI 0.20, 0.76), clinic closures (OR 0.12; 95% CI 0.04, 0.34), or restricted access to the hospital (OR 0.16; 95% CI 0.07, 0.38) reported in Hong Kong.

Family physicians from Hong Kong were much less likely than their Toronto counterparts to adopt standardized screening tools (OR 0.04; 95% CI 0.01, 0.30) (**Table 2**). Doctors from Hong Kong found that the screening tools changed too rapidly (OR 2.34; 95% CI 1.15, 4.76). There was no significant difference observed in the usefulness of the screening tools found by doctors from Hong Kong and Toronto, with scores of 2.43 and 1.94, respectively ($P = .79$). For screening tool applications, doctors from Hong Kong were much less likely to answer questions over the phone (OR 0.09; 95% CI 0.04, 0.22) and post updates at the entrances to their clinics (OR 0.03; 95% CI 0.01, 0.09). In Hong Kong, just over half of the family physicians reported appreciation of daily updates on SARS, whereas in Toronto, 63.3% of doctors wanted regular updates (OR 0.68; 95% CI 0.35, 1.33).

Table 2. Comparison of responses and management of SARS among primary care doctors from Hong Kong and Toronto

	HK		Canada		OR	CI
	No.	%	No.	%		
No training in handling infectious diseases in primary care	116	84.6	41	80.0	0.73	(0.32, 1.68)
Feeling confident in dealing with SARS	92	68.1	36	73.5	0.77	(0.37, 1.60)
Having updates of SARS on a daily basis	74	54.0	31	63.3	0.68	(0.35, 1.33)
Satisfied with governments' handling of SARS in the community	30	23.1	29	72.5	0.11	(0.05, 0.26)
Appointment arrangements						
Requested more blood tests and/or chest x-rays	103	76.3	4	7.8	37.80	(12.65, 113.06)
Family practice appointments postponed/cancelled	42	31.1	37	72.5	0.17	(0.08, 0.35)
Surgical procedures postponed/cancelled	32	23.7	34	66.7	0.16	(0.08, 0.31)
Longer waiting time for laboratory investigations	4	3.0	31	60.8	0.02	(0.01, 0.06)
Specialist appointments postponed/cancelled	22	16.3	41	80.4	0.05	(0.02, 0.11)
Had difficulties/were unable to make specialist referral	17	12.6	35	68.6	0.07	(0.03, 0.14)
Use of screening tools						
Used a SARS screening tool	87	64.9	47	97.9	0.04	(0.01, 0.30)
Screening questions over the phone	7	9.2	28	54.0	0.09	(0.04, 0.22)
Written screening questions in waiting room	15	18.4	6	10.0	2.03	(0.70, 5.92)
Written screening questions at clinic entrance	8	10.3	40	78.0	0.03	(0.01, 0.09)
Receptionist/nurse asked screening questions in office	53	62.1	27	52.0	1.51	(0.75, 3.05)
Agreed that SARS screening tool was helpful	79	90.8	47	92.2	0.84	(0.24, 2.94)
Agreed that SARS screening tool changed too often	53	60.9	20	40.0	2.34	(1.15, 4.76)
Agreed that questions were too difficult for patients	26	29.9	9	18.0	1.94	(0.83, 4.57)
Agreed that language barriers prevented use of a screening tool	18	20.7	16	34.8	0.49	(0.22, 1.09)
Agreed that SARS screening tool was too time consuming	23	26.4	17	34.0	0.70	(0.33, 1.48)
Knew what to do if a patient had failed SARS screening	68	78.2	42	85.7	0.60	(0.23, 1.54)
Incomes						
Income was not reduced	16	11.8	10	19.6	0.55	(0.23, 1.30)
Loss of income due to cancelled appointments	54	39.7	32	62.7	0.39	(0.20, 0.76)
Loss of income due to fewer nursing home visits	2	1.5	2	3.9	0.37	(0.05, 2.67)
Loss of income due to increased overhead costs	106	77.9	16	31.4	7.73	(3.77, 15.83)
Loss of income due to clinic closure	6	4.4	14	27.5	0.12	(0.04, 0.34)
Loss of income due to less emergency room work	7	5.1	3	5.9	0.87	(0.22, 3.50)
Loss of income due to restricted access to the hospital	11	8.1	18	35.3	0.16	(0.07, 0.38)
Loss of income due to staff on sick leave or being quarantined	2	1.5	1	2.0	0.75	(0.07, 8.41)

Nearly identical proportions of doctors in the Canadian sample, 26 of 51 (51.0%) and in Hong Kong, 61 of 136 (50.7%) were classified in the high-anxiety group. Factors independently predicting anxiety are shown in Table 3. In Hong Kong, older doctors who put high value on SARS information from television, those who put low value on information from the Hong Kong Medical Association Web site/circular, and those who did not lose income due to clinic closure were significantly more likely to be in the high-anxiety group. While gender was not quite significant ($P = .11$), this variable was included in the final model due to the

large effect size, with women having close to two and a half times the odds of being in the high-anxiety group compared to men. For the Canadian sample, only having had previous training in handling infectious disease outbreaks was significantly associated with a higher likelihood of being in the high-anxiety group.

There was a large discrepancy between the groups in their degree of satisfaction in how their respective governments handled the SARS epidemic: 23.1% and 72.5% of the Hong Kong and Toronto doctors, respectively, reported satisfaction (95% CI 0.05, 0.26). Table 3 shows that dissatisfaction with the government's

Table 3. Results of multivariable stepdown logistic regression showing factors associated with anxiety and satisfaction with government measures among family physicians

		Hong Kong - anxiety				
		Mean scores	AOR	95% CI	P- value	
Value of sources of SARS information (more: less valuable)						
HKMA website/circular		2.8	0.74	(0.55, 0.99)	.043	
TV news/ programs		2.4	1.67	(1.05, 2.64)	.030	
		n	%	AOR	95% CI	
Loss of income due to cancelled appointments (yes:no)		54	39.7%	0.46	(0.26, 1.03)	.048
Gender (female:male)						
Females		24	17.8%	2.43	(0.82, 7.22)	.11
Males		111	82.2%			
Age (per year)				1.05	(1.01, 1.10)	.026
Canada - anxiety						
Formal training in handling infectious diseases in primary care (yes:no) yes		10	20.0%	5.41	(1.02, 28.79)	.048
		Hong Kong - satisfaction				
		Mean scores	AOR	95% CI	P value	
SARS screening tool changed too often		3.4	1.88	(0.94, 3.73)	.072	
Age (per year)			1.19	(1.04, 1.36)	.011	
		n	%	AOR	95% CI	
Clinically experienced doctor (yes:no)		101	78.3%	.045	(.002, .89)	.042
Full time (yes:no)		120	93.0%	INF	*	.020
Canada - satisfaction						
Closed clinic (yes:no)		15	37.5%	INF	*	.003

*Odds ratio is infinity and confidence interval could not be computed, the P value in this case is from the likelihood ratio test.

handling of SARS by Hong Kong doctors was independently associated with being younger, having more clinical experience, working full-time, and feeling that the SARS screening tool changed too often. In Toronto, dissatisfaction was associated with not having had the clinic closed.

DISCUSSION

Prior to the epidemic, no hospitals or medical schools in either location had made infectious disease a top priority in their health care agendas. For example, there were only six infectious disease specialists registered in all of Hong Kong.¹⁵ As for Canada, 42% of the hospitals failed to meet the current United States standard of one infection control practitioner per 250 beds and fewer than 60% had a qualified physician serving as an infection control director.^{16,17} Only 15% to 20% of our sample reported any formal training in infectious disease control and over two-thirds were not confident in dealing with SARS, which was a major source of anxiety identified by the Canadian physicians.

Expert committees in both regions were critical of the lack of a framework for outbreak management to

lead, support, or coordinate responses between the institutions' public health services with various health service sectors.^{7,8} Family physicians received little to no guidance or support until well into the outbreak. Screening tools drafted by various agencies written in English were mainly targeted at hospital doctors and were found less useful in communicating with their patients, thus for example, fewer doctors from Hong Kong put them up at the entrance. In Hong Kong, those who found information from professional bodies useful were less anxious whereas those who obtained information from the mass media tended more anxious. The constant and rapid change of these screening tools without clear referral instructions to secondary care facilities affected their satisfaction with government efforts to deal with the epidemic.

One of the strategies to manage the outbreak in Hong Kong was to centralize caseloads in selected institutions. For example, the Princess Margaret Hospital (a hospital with a specialty of infectious diseases even before SARS epidemic) was designed to receive all SARS cases at the beginning of the large community outbreak in the Amoy Gardens housing complex, which affected more than 300 residents. Toronto went in the opposite direction, allowing SARS cases to enter a large number

of Toronto hospitals during the first wave of the outbreak, while decreeing that all nonurgent hospital activities should be suspended. This resulted in a massive backlog of deferred elective surgery and ambulatory services with immeasurable longterm damages.

Laboratory services were also under strain: in Toronto, private corporations, nonprofit hospitals, and health regions operate medical laboratories. SARS testing was transferred to local hospitals because the public health reference laboratories were overwhelmed. The lack of a common data system and absence of prior agreements on data sharing undermined the laboratories' full capacities, which resulted in long delays in obtaining results.⁹ Hong Kong, in contrast, had a large private laboratory capacity with linked data resources, but the lack of good laboratory protocol resulted in additional requests for laboratory tests, which were expensive and/or harmful for some patients. It is believed that having to continue the clinical service under these working conditions might have contributed to the dissatisfaction of the government's handling of the epidemic in Toronto.

Generally, family physicians from Hong Kong were much less satisfied with the way their government had handled SARS than their counterparts in Toronto. This was related to the age, clinical experience, and working status of the doctor as well as the perception that the screening tools were seen as changing too often. Loss of income and the specific applications of the screening tools were not important factors considered by family physicians when confronted with this disease outbreak, and were not sources of dissatisfaction toward the physicians' respective governments.

The findings of this study highlight weaknesses in organization and support for primary care systems, the need to improve collaboration and communication, and suggest ways to better manage epidemics in the future. Relevant and practical training in infection control can be made available to family physicians in the form of continuous medical education. An active and collaborative laboratory surveillance system would integrate frontline laboratories into the public health system to assist detection and control of infectious diseases in the future. Our study also reinforces the recommendations from expert committees in both regions that there is a need for instituting a mechanism for deployment of personnel between institutions. In

contrast to these reports, family physicians did not associate loss of income with either readiness to deal with SARS or degree of satisfaction with the governments' handling of the outbreak, suggesting that doctors from both locations were ready to take up the professional and social responsibilities involved to deal with public health emergencies.

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