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Staff perception and institutional reporting: two views of infection control compliance in British Columbia and Ontario three years after an outbreak of severe acute respiratory syndrome

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Summary Few studies have audited the resources available to infection control (IC) and occupational health (OH) to promote safe work behaviour, whilst comparing audited findings with perceptions by healthcare workers (HCWs). We aimed to determine the IC and OH resources available and compare this with HCWs' perception of resources, following an outbreak of severe acute respiratory syndrome (SARS). A survey of IC and OH resources and a questionnaire completed by HCWs were compared with on-site observational audits. HCWs believed that plans were available to protect against future SARS-like events but audits revealed that these did not exist in many facilities. Both OH and IC were under-resourced post-SARS, with OH professionals particularly lacking in British Columbia. There is a discrepancy between HCWs' perception of what is available

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and what is actually accessible in facilities. Experts in IC and OH need to focus on communication.

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Introduction

Severe acute respiratory syndrome (SARS), avian influenza and the increasing awareness of other new or changing pathogens (e.g. *Clostridium difficile*, monkeypox) have highlighted the importance of adequate and accessible infection prevention and control resources, and have emphasised the importance of a well-prepared and properly protected workforce at the front lines of patient care. Previous work established the importance of environmental, organisational and individual factors in the adoption of safe work practices amongst healthcare workers (HCWs) but few studies have critically audited the resources available to infection control (IC) and occupational health (OH) services in order to promote safe practice.^{1–6} In addition, it is known that communication and 'feeling safe' are important determinants of willingness to provide care in outbreak situations.⁷ Yet we are aware of no studies to date that have examined how well perceptions of adequacy of safety measures compare with more objective assessments in this regard.

This article describes the results of objective workplace audits that assessed IC and OH resources in 16 acute care facilities in the Greater Vancouver Region (GVR) and four facilities in Toronto, Ontario, Canada. The audit was part of a larger project that was designed to examine barriers and facilitators in the healthcare setting that promote or hinder compliance with IC, OH and safety protocols. Within this study a questionnaire was designed and administered to HCWs in these same facilities to assess workers' perception of their workplaces with regard to IC.

As a result of the new attention that SARS focused on infection control, it was hypothesised that, three years after the SARS outbreak, IC programmes would be well resourced and that no differences would be found between resources available to IC programmes in Ontario compared with those in British Columbia. It was also hypothesised that HCWs, the front line of defence in healthcare settings against infection, would have accurate perceptions of their own facility's policies, procedures and practices with regard to IC.

Methods

Study population

Twenty facilities participated in the study for a period of five months (October 2004 to March 2005). Sixteen acute care facilities were situated in two regional health authorities in the Greater Vancouver area, British Columbia, Canada and four were situated in Toronto, Ontario, Canada. Institutional bed size in the community and tertiary care facilities surveyed ranged from 89 to 950.

Fraser Health and Vancouver Coastal Health (GVR) are the two largest of five regional health authorities established in British Columbia in December 2001. Fraser Health serves 1.47 million people and employs 22 000 people. Vancouver Coastal Health serves a population of more than one million people and employs 24 500 staff. Toronto is the largest urban centre in Canada; the Greater Toronto Area has a population of more than five million. The four hospitals surveyed in Ontario were selected because they represent those facilities involved in the SARS epidemic. Their bed size ranged from 170 to 550 beds.

Measurement tools

Two measurement tools were used: the first, an audit tool of occupational and IC resources (personnel, educational resources and equipment); the second, a questionnaire completed by HCWs detailing their perception of the OH and IC resources available to them.

The audit tool

A three-part, 84-question audit tool was adapted from prior assessment forms available from Vancouver General Hospital, the Community and Hospital Infection Control Association (CHICA) and the UK.^{8–10} The first part of the audit consisted of an assessment of OH resources that was completed by the senior OH professional at the facility (the audit tools are available by request to the corresponding author). The senior IC staff completed the second part, an assessment of IC resources in

the facility. The third part was an observational audit using a standardised form and was completed by an independent occupational hygienist working as a research assistant on the study. The occupational hygienist performed an observational walk-through audit at each facility after receiving initial training on observational techniques from a pilot hospital site. An infection control practitioner (ICP) accompanied the occupational hygienist through three critical areas in the facility to validate observations: the emergency department (ER), general medicine units (including a respiratory unit if present) and the intensive care unit (ICU). Each walk-through took about three hours to complete using the standardised audit form.

Audit data collection

The respective workplace assessment sections of the audit tool were both emailed and mailed to ICPs and OH and safety specialists at each of the participating facilities two weeks prior to the scheduled audit date. Sections of the questionnaire were to be mailed or faxed back to the research assistant within 10 working days. Follow-up phone calls were made to those who did not comply with the 10-day deadline, in order to increase participation.

The questionnaire tool

The HCW questionnaire consisted of 103 items, assembled from the Johns Hopkins University School of Hygiene and Public Health Safety Climate Questionnaire, the Effort–Reward Imbalance scale and the Copenhagen burnout scale.^{5,11,12} Additional supplemental items were also created by the research team comprised of experts in the fields of IC, occupational medicine, psychology and questionnaire construction, stemming from an extensive literature review conducted regarding individual, organisational and environmental factors affecting HCW behaviour at work with regard to self-protection relevant to SARS.^{1,13–17}

Questionnaire data collection

Data collection occurred between October 2004 and August 2005. On the hospital units, a study team member administered the questionnaires to nurses (intensive care, ER, general medicine, respiratory, acute care, cardiac care, palliative, and rehabilitation), physicians (emergency, intensive care, respiratory and anaesthesiology), respiratory therapists, and physiotherapists. The questionnaires were

coded to ensure confidentiality and took ~20 min to complete.

Analysis

Standard descriptive statistics were used to present the mean and standard deviation for continuous variables and the frequency and percentages for categorical data to demonstrate the demographics of subjects and characterise the distribution of variables. Analysis of variance was used to compare means for normally distributed data; non-parametric methods were applied to other data. To compare rates or proportions between groups, Chi-squared test was used to compare for categorical variables overall. If more than 25% of cells had an expected count of less than five, Fisher's exact test was employed. Distributions of a range of dichotomous variables of interest between the OH and IC groups were compared using a Chi-squared statistic or Mantel–Haenszel Chi-squared to test for independence after controlling for factors such as facility size or full-time equivalent (FTE) employees per bed.

Comparison between audit tool and questionnaire data

All facilities were categorised as small (<150 beds), medium (150–300 beds) and large hospitals (>300 beds). In the GVR, there were six small, five medium and five large hospitals; and in Ontario, one medium and three large hospitals. A total of 1290 subjects in the GVR and 403 subjects in Ontario from the above hospitals participated in the survey.

Most questions in both questionnaires were a dichotomous type of question ('yes' or 'no'). Three questions in the survey data were Likert-scale questions. For these questions, the answers of 'strongly disagree' or 'somewhat disagree' were coded as 'no', and those answered 'agree' or 'strongly agree' were coded as 'yes' in order to match the dichotomous responses in the workplace assessment data. Any questions answered 'don't know' or 'not applicable' were excluded from the analyses.

The positive rates of responses for each matched item were the number of 'yes' answers as a percentage of total subjects who properly answered the corresponding question. These were calculated for all occupations and nursing staff in the survey and workplace assessment data respectively, stratified by the size of the facility. The comparisons were made in each matched item between the

participants from the hospitals and the auditors from the independent observational assessment.

All descriptive analyses and comparisons were carried out across health regions, facility sizes and FTEs per bed, respectively. Analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 12.0, Chicago, IL, USA). All tests of significance were based on two-sided hypotheses at $P \leq 0.05$.

Results

Table I compares the IC and OH resources in GVR hospitals as compared to the four hospitals in Toronto that admitted SARS patients. In British Columbia, the median infection control practitioner (ICP)/bed ratio was 1 ICP/175 beds (range: 1 ICP/32 beds to 1 ICP/809 beds). In Ontario the average ratio was 1 ICP/90 beds (range: 1 ICP/62 beds to 1 ICP/135 beds) ($P = 0.014$). No significant differences were noted in whether there was a dedicated ICP for each hospital site, whether they were available after regular working hours, the number of ICPs that were certified or whether training was available to ICPs. No significant differences were seen in the average ratio of IC officer (ICO) to bed between British Columbia and Ontario hospitals. In British Columbia, two hospitals

reported no dedicated ICO. No significant difference was noted regarding the availability of an ICO after regular working hours. A total of 15 of the 16 facilities surveyed in British Columbia (94%) had after-hours IC coverage, whereas 100% of Ontario hospitals surveyed did. However, it should be noted that in the GVR there is only one part-time OH physician covering all the hospitals reporting access to an occupational physician. In the GTA facilities, one facility reported no OH physician and the three that had an OH physician reported a range of availability from a 0.1 FTE to a 0.4 FTE.

Table II details the results of the independent observational audit by the units surveyed, across the two provinces. Of note were the similar availabilities of gloves, gowns and masks across the two provinces. Although the differences were not significant, overall protective eyewear was not readily available in the majority of GVR hospitals and the crash carts on the selected units audited were inadequately stocked with personal protective gear in both the GVR and Toronto facilities.

Table III compares 'like items' between the questionnaire administered to HCWs and the workplace assessments conducted by OH and IC in the GVR. A total of 1290 HCWs responded to the worker questionnaire, administered at the 16 facilities in the GVR. A total of 80% of the respondents were female.

Table I Comparison of infection control (IC) and occupational health (OH) resources in British Columbia and Ontario

Question	British Columbia		Ontario		P-value
1 ICP/x beds	1 ICP/175 beds average (range: 1 ICP/32 beds to 1 ICP/809 beds)		1 ICP/90 beds (range: 1 ICP/62 beds to 1 ICP/135 beds)		0.014
OHP/FTE staff	Mean: 2.67 Median: 1.50 (range: 0.25–13.20)		Mean: 8.28 Median: 9.81 (range: 1.00–13.50)		0.127
Dedicated ICP to site	15 (93.8%)		3 (100.0%)		0.591
Are ICPs available after regular working hours	15 (93.5%)		4 (100.0%)		–
Continuing medical education	12 (92.3%)		4 (100.0%)		0.999
Dedicated OHN to site	14 (93.3%)		4 (100.0%)		–
Are OHPs available after regular working hours	8 (50%) are available		3 (75%) are available		0.477
Does the health authority have an ICO?	Yes	No	Yes	No	0.509
	14 (87.5%)	2 (12.5%)	3 (75.0%)	1 (25.0%)	
ICO available after regular working hours?	Yes	No	Yes	No	–
	15 (93.5%)	1 (6.5%)	4 (100.0%)	0 (0.0%)	
Does the health authority or facility have an OH physician?	Yes	No	Yes	No	1.000
	13 (81.3%)	3 (18.8%)	3 (75.0%)	1 (25.0%)	
OHPs available after regular working hours?	Yes	No	Yes	No	0.228
	8 (50.0%)	8 (50.0%)	3 (100.0%)	0 (0.0%)	

ICP, infection control professional; OHP, occupational health professional; FTE, full-time equivalent; ICO, infection control officer.

Table II Results of independent observational audits by facilities/departments (values record the number and percentage of 'yes' answers)

	Intensive care department (BC: N = 14) (Ont.: N = 4)	Emergency department (BC: N = 16) (Ont.: N = 4)	General medical department (BC: N = 16) (Ont.: N = 4)	Respiratory unit (BC: N = 1) (Ont.: N = 1)
Is access readily available to an up-to-date IC manual on the unit?				
British Columbia	13 (92.9%)	13 (81.3%)	16 (100.0%)	1 (100.0%)
Ontario	3 (66.7%)	3 (66.7%)	3 (66.7%)	1 (100.0%)
Is access readily available to an up-to-date OH/employee health manual on the unit?				
British Columbia	10 (71.4%)	11 (68.8%)	12 (75.0%)	1 (100.0%)
Ontario	1 (25.0%)	2 (50.7%)	2 (50.7%)	1 (100.0%)
Are isolation gowns readily available on the unit for immediate use?				
British Columbia	13 (92.9%)	14 (87.5%)	16 (100.0%)	1 (100.0%)
Ontario	4 (100.0%)	4 (100.0%)	4 (100.0%)	1 (100.0%)
Are N95 masks readily available on the unit for immediate use?				
British Columbia	14 (100.0%)	16 (100.0%)	15 (93.8%)	1 (100.0%)
Ontario	4 (100.0%)	4 (100.0%)	4 (100.0%)	1 (100.0%)
Is there a selection of:				
Sterile gloves?				
British Columbia	14 (100.0%)	16 (100.0%)	15 (93.8%)	1 (100.0%)
Ontario	3 (66.7%)	4 (100.0%)	4 (100.0%)	1 (100.0%)
Protective eyewear?				
British Columbia	9 (64.3%)	5 (35.7%)	6 (40.0%)	1 (100.0%)
Ontario	4 (100.0%)	4 (100.0%)	4 (100.0%)	0
Are the crash carts stocked with:				
Sterile gloves?				
British Columbia	5 (35.7%)	2 (12.5%)	3 (23.1%)	1 (100.0%)
Ontario	3 (75.0%)	2 (50.0%)	3 (75.0%)	0
N95 masks?				
British Columbia	5 (35.7%)	1 (6.3%)	4 (30.8%)	0
Ontario	3 (75.0%)	2 (50.0%)	2 (50.0%)	0
Protective eyewear?				
British Columbia	10 (71.4%)	7 (43.8%)	6 (46.2%)	1 (100.0%)
Ontario	3 (75.0%)	2 (50.0%)	2 (50.0%)	0

IC, infection control; OH, occupational health.

The occupations that responded consisted of: 18% ICU nurses, 19% ER nurses, 36% general medicine nurses, 9% physicians, 9% respiratory therapists and 10% physiotherapists. Questions regarding on-site plans to mitigate against SARS and biological agents received high responses of agreement from staff (i.e. they believe they exist) but scored lower marks from facilities as to their actual existence. The inverse occurred when dealing with staff fit-testing for respirators: facilities unanimously agreed (100% across all sizes of facilities) that workers had been fit-tested but workers themselves did not agree that they had been fit-tested (60.1% of HCWs in small facilities, 72.9% in medium and 78.2% in large facilities responded 'yes' they had been fit-tested).

The discrepancy between staff perception and institutional reporting was aptly demonstrated

when both HCWs and OH professionals were asked about compliance on baseline OH assessments performed at time of hiring. In small facilities only 33% of OH professionals said that they had completed the required OH assessments regarding vaccination of HCWs but in the same small facilities 67.6% of HCWs said that they had had the assessment done. This pattern continued across the medium and large facilities (82.3% and 20%, and 81.7% and 60%, respectively).

Discussion

The SARS outbreak had a profound impact on IC and OH professionals working within acute care facilities in Canada.^{14,16-18} Prior to this event, IC

Table III Comparisons of like questions between the questionnaire and workplace assessment, stratified by facility size

Questionnaire workplace assessment	Size of facility	All participants (N = 1290)	OH	IC
Communication				
	S	112/165 = 67.9%	6/6 = 100%	
	M	123/185 = 66.5%	5/5 = 100%	
	L	314/445 = 70.6%	5/5 = 100%	
Availability of resources				
	S	141/182 = 77.5%	2/6 = 33%	
	M	160/204 = 78.4%	2/5 = 40%	
	L	425/501 = 84.8%	3/5 = 60%	
	S	206/218 = 94.5%	6/6 = 100%	
	M	219/233 = 94.0%	5/5 = 100%	
	L	466/495 = 94.1%	5/5 = 100%	
	S	96/214 = 44.9%	6/6 = 100%	
	M	107/237 = 45.1%	5/5 = 100%	
	L	297/596 = 49.8%	5/5 = 100%	
	S	54/135 = 40.0%	2/6 = 33%	2/6 = 33%
	M	47/106 = 44.3%	3/5 = 60%	2/5 = 40%
	L	171/232 = 73.7%	2/5 = 40%	3/4 = 75%
	S	76/128 = 59.4%	4/6 = 67%	2/6 = 33%
	M	45/105 = 42.9%	1/5 = 20%	1/5 = 20%
	L	174/233 = 74.7%	3/5 = 60%	1/4 = 25%
	S	51/72 = 70.8%		1/5 = 20%
	M	73/90 = 81.1%		3/5 = 60%
	L	238/254 = 93.7%		3/4 = 75%
	S	148/161 = 91.9%		4/6 = 67%
	M	211/220 = 95.9%		4/5 = 80%
	L	507/518 = 97.9%		5/5 = 100%
	S	199/215 = 92.6%		6/6 = 100%
	M	210/233 = 90.1%		5/5 = 100%
	L	462/500 = 92.4%		5/5 = 100%
	S	149/248 = 60.1%	6/6 = 100%	
			6/6 = 100%	
	M	218/299 = 72.9%	5/5 = 100%	
			5/5 = 100%	
	L	556/711 = 78.2%	5/5 = 100%	
			5/5 = 100%	
Access to OH advice				
	S	138/204 = 67.6%	2/6 = 33%	
	M	205/249 = 82.3%	1/5 = 20%	
	L	452/553 = 81.7%	3/5 = 60%	
	S	173/231 = 74.9%	6/6 = 100%	
		230/252 = 91.3%		
	M	228/276 = 82.6%	5/5 = 100%	
		283/297 = 95.3%		
	L	544/660 = 82.4%	5/5 = 100%	
		666/709 = 93.9%		

OH, occupational health; IC, infection control; S, small; M, medium; L, large.

practices were commonly implemented by HCWs as was dictated by the policy within their facilities, but the failure to do so did not put their lives at undue risk during their day-to-day activities. The SARS epidemic increased the profile of IC and OH and directed public attention to infectious disease

transmission in healthcare facilities. Protection from infectious diseases was put 'under the spotlight', and HCWs became more motivated to request advice on appropriate use of personal protective equipment and isolation policies. Subsequent inquiries that identified gaps in IC and

OH resources and further refinement of policies and procedures post-SARS should have improved the status quo.^{18–21}

It was hypothesised by the investigators that three years after the SARS outbreak, IC and OH programmes would be well-resourced and no differences would be found between resources available for these programmes in selected Toronto facilities compared with those in the GVR. The results of this study do not support this hypothesis. IC and OH resources, in the GVR in particular, had fewer staff than those in Toronto. On average, British Columbia hospitals had approximately half the IC staff available when compared with the Toronto hospitals that housed SARS patients and far below the benchmarks set by SENIC and the Public Health Agency of Canada.^{4,22}

Unfortunately there has been no benchmark setting for OH resources in Canadian hospitals. This study found a significant difference in the OH resources available in the Ontario hospitals surveyed as compared to the British Columbia hospitals. Three times as many occupational health nurses were found in Ontario hospitals. The reasons for this large difference are unknown but this is an area where further investigation is needed, particularly as several studies have shown the cost-effectiveness of injury prevention programmes and employee education.²³

Personal protective equipment was generally available at all facilities, but it was noted during the independent observational assessment that protective eyewear was not readily available to staff members in the majority of clinical areas in GVR hospitals surveyed. This is a concern as the use of protective eyewear is recommended as part of the personal protective equipment that should be donned when providing care to patients with a communicable disease capable of being transmitted by droplets or during procedures where there is a generation of aerosolised droplets. The routine use of eye protection may not have been adopted into the routine practice of HCWs in British Columbia as it has been in Ontario. During the SARS outbreak in 2003, IC directives included the use of eye protection as part of the personal protective equipment to be worn during providing care to a patient with febrile respiratory illness. In British Columbia, use of protective eyewear was recommended but, because only four SARS cases occurred, HCWs may not be aware of the recommendations. As was noted in the Results section, even though other personal protective equipment (gloves, gowns and respirators) are available, there is no indication that there is compliance

with their use among HCWs or if they are used correctly. This is an area for further study.

One of the more interesting facets of this study was the discrepancy between staff perception and institutional reporting as to the availability of resources for HCWs. The actual existence of protocols for SARS or SARS-like illness and exposure to biological agents was perceived by HCWs to exist, but in fact this varied widely across the facilities, with the smaller facilities less likely to have formal protocols. In contrast, OH services believed that most HCWs requiring fit-testing had completed this task, while HCWs noted that this was far from true. Incomplete baseline OH assessments were noted by OH personnel for the majority of staff, yet HCWs believed that their documentation was complete. HCWs believed that ICPs were not available during lunchtime and that ICOs were not available after hours. These personnel were, in fact, available at these times. Importantly, approximately one-third of HCWs did not know that there were mechanisms to provide feedback to OH services, nor were they clear on availability of IC services after hours.

Three years post-SARS, IC and OH remain poorly resourced in terms of professional staff and the availability of barriers in high-risk situations is still limited, particularly in British Columbia. This may be due, in part, to the fact that SARS did not have as significant an impact on these healthcare facilities. There were 251 probable cases of SARS in Canada during the outbreak (247 cases in Ontario, four cases in British Columbia) and 44 deaths (all in Ontario). Of these, 109 cases were in HCWs, making SARS, at least in Canada, primarily an occupationally acquired disease.²⁴

Importantly, there was a discrepancy between what HCWs perceive to be available and what is actually accessible in the healthcare facility, indicating an area where communication between the experts in IC and OH and the HCWs could be improved. The perception of HCWs that expertise and resources were indeed available even when they were not is particularly disconcerting, as perception of safety is a strong determinant of safety climate and willingness to work and comply with safety measures. This is important as concerns regarding the potential for pandemic influenza have recently been emphasised. With a potential pandemic on the horizon, serious examination of IC and occupational medical expertise as well as related personnel and other resources in healthcare facilities are warranted. Healthcare worker perception of safety

in regards to communicable diseases needs to be made a reality.

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Conflict of interest statement

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