# Knowledge of Severe Acute Respiratory Syndrome among Community Physicians, Nurses, and Emergency Medical Responders

**Alan Douglas Tice, MD;[1] Mitsumasa Kishimoto, MD;[1] Chuong Hoang Dinh, DO;[1] Geoffrey Tak-Kin Lam, BS;[2] Michelle Marineau, APRN[3]**

1. Department of Medicine, University of Hawaii, John A. Burns School of Medicine, Honolulu, Hawaii USA
2. University of Hawaii, John A. Burns School of Medicine, Honolulu, Hawaii USA
3. Kaiser Permanente Medical Center, Honolulu, Hawaii USA

**Correspondence:**
Alan D. Tice, MD
Department of Medicine
John A Burns School of Medicine
University Tower–7th floor
1356 Lusitana Street
Honolulu, Hawaii 96813-2427 USA
E-mail: alantice@idlinks.com

**Keywords:** community; education; healthcare workers; media; preparedness; severe acute respiratory syndrome (SARS)

**Abbreviations:**
SARS = severe acute respiratory syndrome
WHO = World Health Organization
HCP = healthcare provider
CDC = Centers for Disease Control and Prevention
EMR = emergency medical responder

**Funding**
*This study was supported as part of a grant from the Hawaii State Department of Health.*
*Dr Tice has no conflicts of interest to declare in regard to the work of this manuscript.*

**Received:** 28 June 2005
**Accepted:** 25 October 2005

**Web publication:** 21 June 2006

## Abstract

**Introduction:** The preparedness levels of front-line clinicians including physicians, nurses, emergency medical responders (EMRs), and other medical staff working in clinics, offices and ambulatory care centers must be assessed, so these personnel are able to deal with communicable and potentially lethal diseases, such as severe acute respiratory syndrome (SARS). In order to determine the knowledge of these clinicians, a survey of their understanding of SARS and their use of educational resources was administered.

**Methods:** A questionnaire was distributed to physicians, nurses, and EMRs attending conferences on SARS in the summer of 2003. Questions related to information sources, knowledge of SARS, and plans implemented in their workplace to deal with it. Statistical analysis was performed using the Statistical Package for the Social Sciences (10.1 Program, SPSS Inc., Chicago, Illinois).

**Results:** A total of 201 community healthcare providers (HCPs) participated in the study. A total of 51% of the participants correctly identified the incubation period of SARS; 48% correctly identified the symptoms of SARS; and 60% knew the recommended infection control precautions to take for families. There was little difference in knowledge among the physicians, nurses, and EMRs evaluated. Media outlets such as newspapers, journals, television, and radio were reported as the main sources of information on SARS. However, there appears to be a growing use of the Internet, which correlated best with the correct answers on symptoms of SARS. Fewer than one-third of respondents were aware of a protocol for SARS in their workplace. A total of 60% reported that N-95 masks were available in their workplace.

**Conclusion:** These findings suggest the need for more effective means of education and training for front-line clinicians, as well as the institution of policies and procedures in medical offices, clinics, and emergency services in the community.

**Tice AD, Kishimoto M, Dinh CH, Lam GTK, Marineau M: Knowledge of severe acute respiratory syndrome among community physicians, nurses, and emergency medical responders. *Prehosp Disast Med* 2006;21(3):183–189.**

## Introduction

Severe acute respiratory syndrome (SARS), first described in November 2002, is a life-threatening respiratory infection caused by a strain of coronavirus (SARS-CoV), previously not recognized to cause disease in humans.[1,2] The first cases were recognized in China before spreading throughout Asia and to parts of Europe and North America. A total of 8,458 cases were reported to the World Health Organization (WHO) from 29 countries between 01 November 2002 and 24 June 2003.[1] The fatality rate of SARS is estimated to be 10–15% worldwide.[3] Possible SARS cases were reported in 42 of 50 states in the United States. Of these, 334 were suspected and 75 were probable cases.[4] Healthcare providers (HCPs) are at high risk for SARS infection due to their close contact with infected patients. In Hong Kong and Hanoi, >50% of SARS cases have affected HCPs.[5]

Symptoms of SARS are similar to those of influenza, bacterial pneumonia, and other respiratory infections.[3] Clinical and laboratory findings may vary and usually are not definitive for weeks. Therefore, front-line clinicians must identify patients with SARS before it can be spread to others. This depends on the clinical judgment of the front-line physicians and their knowledge of the clinical manifestations and epidemiological features of SARS.

In the US, many hospitals did not have protocols prepared for the management and infection control equipment necessary to prevent the spread of this infection.[6] This has been attributed to weak communication networks, limited infection control personnel, an under-funded public health system, and outdated public health regulations.

Front-line clinicians must be educated and prepared for possible epidemics because they are vulnerable and must diagnose, quarantine, and isolate patients quickly during a SARS epidemic. The preparedness levels of front-line clinicians including physicians, nurses, emergency medical responders (EMRs), and other medical staff working in clinics, offices, and ambulatory care centers must be assessed, so these personnel are able to deal with communicable and potentially lethal diseases, such as SARS.

The medical literature only provides a few articles about preparedness, education, or training in regards to SARS, although now there are many timely guidelines and publications available about the disease through Websites sponsored by the WHO and the US Centers for Disease Control and Prevention (CDC).[3,7]

## Methods

As part of a series of educational programs sponsored by the Hawaii State Department of Health and the John A. Burns School of Medicine of the University of Hawaii, a survey was conducted within four months after the SARS epidemic peaked. This study was reviewed by the Committee on Human Studies of the University of Hawaii and determined to be exempt from Department of Health and Human Services regulations (45 CFR Part 46) and specifically by section 46.101(b).[2,4]

### *Study Population*

Thirteen educational sessions on SARS were provided to approximatley 650 HCPs through medical centers of the islands of Oahu, Hawaii, Maui, and Kauai. The attendees consisted of ambulatory care physicians, nurses, medical office staff, and EMRs (which consisted of firefighters and ambulance crews).

The educational sessions took place from June through September 2003, shortly after the incidence of SARS peaked (middle of May-end of June 2003). Survey questionnaires and handouts of the slides of the presentation were distributed at the beginning of each meeting and collected at the end.

### *Data Collection*

Each respondent was asked six questions. The first question asked what sources of information were used to learn about SARS (Internet, conversations, lectures, television, radio, journals, and newspapers). The next three questions were about knowledge of SARS, including incubation period (correct answer was 2–10 days, with options of 0–20, 4–14, and 1–10 days), ways for families to prevent spread (correct answer was hand washing, gloves, masks, and disinfectants) and symptoms (correct answer was fever, cough, diarrhea, myalgias, and headache, but not runny nose).[3] The fifth question asked what equipment was present in the office to stop the spread of SARS (options included gloves, masks, face shields, and hand washing gels). The last question asked if a protocol was in place in their office for SARS, tuberculosis, chicken pox, influenza, immunizations, or bioterrorist agents (Table 1).[8] Knowledge was assessed by responses to individual questions and by a cumulative score of 0–3 by adding up to score of up to three correct responses. The only personal identification information requested was the profession and specialty of the participant.

### *Statistical Analysis*

The survey results were categorized according to whether the participant was a physician, nurse, EMR, or "other". "Other" included office assistants, social workers, and administrators. Professional education and learning methods were analyzed in relationship to knowledge and protocol use. Chi-square ($\chi^2$) analysis was used to determine whether methods of learning were related to correct answers to the knowledge questions. Independent sample $t$-tests were used to determine if the cumulative knowledge score correlated with the profession or method of learning. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) 10.1 program (SPSS Inc., Chicago, Illinois) with $p$-value $<0.05$ considered statistically significant.

## Results

A total of 232 persons participated in the study. Thirty-one (13%) surveys were excluded because not all of the questions were answered. Of the remaining 201 participants, 86 were physicians, 61 were nurses, 18 were EMRs, and 36 were classified as "other." A total of 149 of these participants were from Oahu, and 52 were from the neighboring islands.

The methods by which HCPs learned about SARS are displayed in Figure 1. The most frequent source of information about SARS was from newspapers/journals (81%), followed by television/radio (79%), lectures (49%), conversations (48%), and the Internet (38%). Among the professionals surveyed, physicians were more likely to have learned through lectures than were nurses or EMRs. Nurses learned primarily through television/radio and less often through newspapers/journals, lectures, conversations, and the Internet than physicians or EMRs. Emergency medical responders reported the highest use of multiple sources, including television/radio, conversations, and the Internet, but rarely were informed by lectures.

The responses to the three questions regarding knowledge are shown in Figure 2. Overall, 51% knew the correct incubation period of SARS, with EMRs scoring the highest (78%) and physicians the lowest (42%). The fact that a runny nose is not part of the symptom complex of SARS was known by 48% of all responders with physicians scoring the highest (62%) and EMRs the lowest (28%). The ways by which family members could prevent the spread of SARS were known by 60% of the respondents. Emergency

**SARS Information**
**(please circle all that apply)**

**Source of information**
Word of mouth
Television
The Internet or e-mail
Newspapers, journals

**Cities at risk for travel as of June 2003**
Beijing
Manilla
Hong Kong
Toronto
Rome
Moscow
Singapore

**Symptoms of SARS**
Fever
Cough
Runny nose
Myalgias
Diarrhea
Headaches

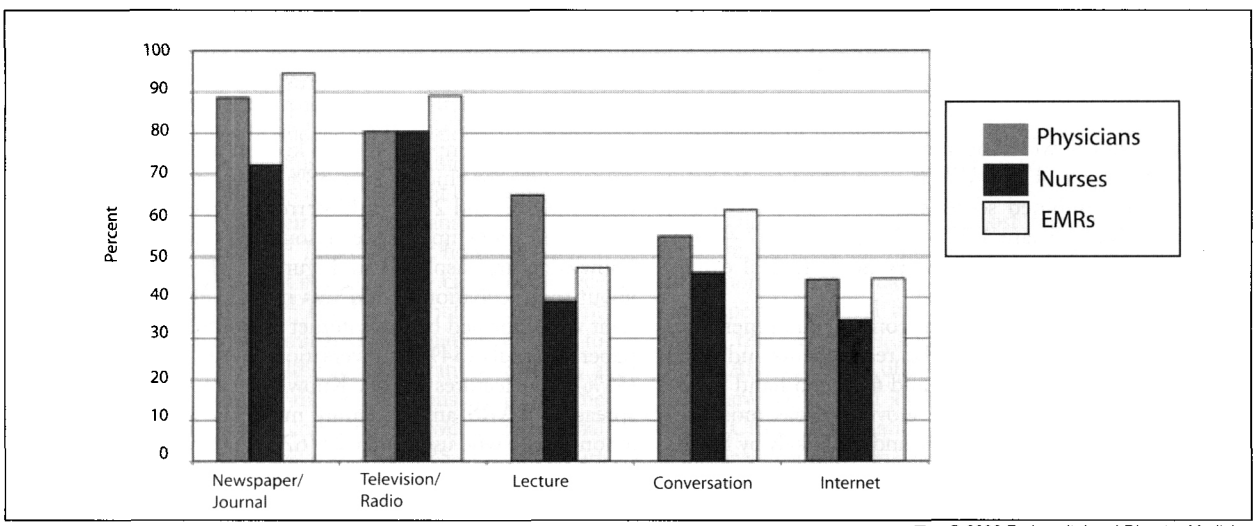
**Incubation period of SARS**
1-20 days
4-14 days
2-10 days
1-10 days

**Equipment you have in your office to stop the spread of SARS**
Gloves
Masks
Face shield
Handwashing gel

**Family of possible SARS patient should have at home**
Masks
Disinfectants
Paper plates
Antibacterial soap
Face shields



Table 1—Questions asked in the survey (SARS = severe acute respiratory syndrome)






Figue 1—Sources of information by profession (EMR = emergency medical responder)



https://doi.org/10.1017/S1049023X00003654 Published online by Cambridge University Press

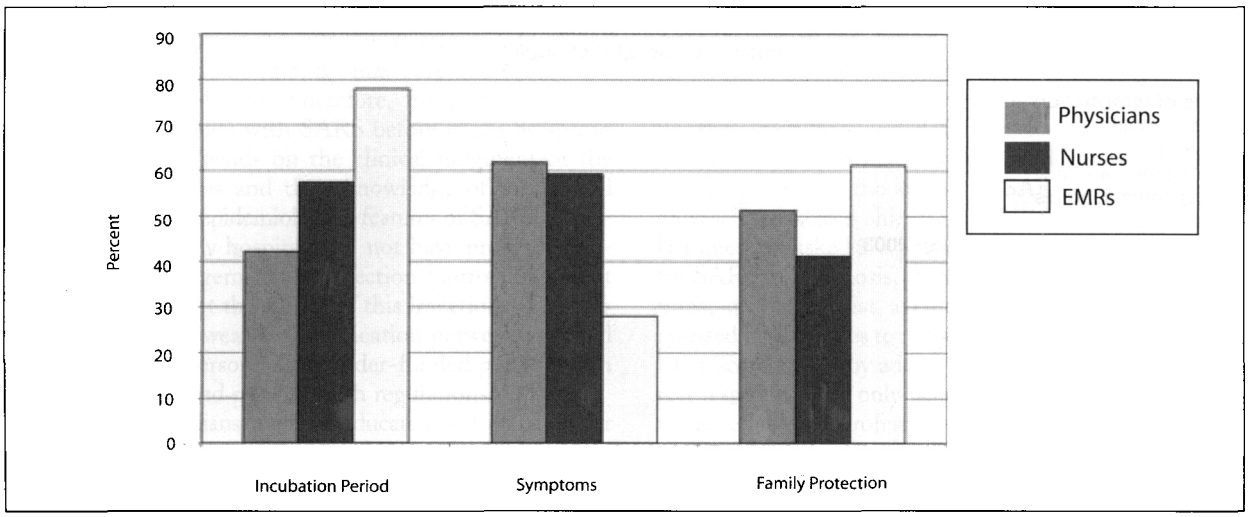





**Figure 2**—Knowledge of critical information about severe acute respiratory syndrome (SARS) and relationship to profession. Correct answers included an incubation period of 2–10 days, that a runny nose is not part of the usual symptoms, and that families should consider prevention of spread through the use of hand washing, masks, gloves, and disinfectants

| Question | | Physicians n (%) | Nurses n (%) | EMRs n (%) | Total (%) |
|---|---|---|---|---|---|
| **Methods of protection available in workplace** | Gloves | 63 (73) | 38 (62) | 6 (33) | **107 (60)** |
| | Masks | 51 (57) | 40 (71) | 14 (78) | **105 (64)** |
| | Face shields | 24 (28) | 27 (44) | 7 (39) | **58 (36)** |
| | Hand washing | 55 (64) | 39 (64) | 7 (39) | **101 (62)** |
| **Office protocols available** | SARS | 21 (24) | 25 (41) | 11 (61) | **57 (33)** |
| | Tuberculosis | 30 (35) | 36 (59) | 8 (44) | **74 (44)** |
| | Chicken pox | 30 (35) | 30 (49) | 6 (33) | **66 (39)** |
| | Influenza | 24 (28) | 29 (48) | 7 (39) | **60 (34)** |
| | Immunization | 30 (35) | 31 (51) | 4 (22) | **65 (38)** |
| | Bioterrorism agents | 14 (16) | 22 (36) | 5 (28) | **41 (27)** |



**Table 2**—Survey reports of equipment and protocols known to be available in workplaces for severe acute respiratory syndrome (SARS) and other infectious diseases (EMR = emergency medical responder)

medical responders were the most knowledgeable (61%) and nurses the least (41%). When cumulative scores were calculated, the combined score was 1.59 ±0.91 (standard deviation), with physicians 1.55 ±1.01), nurses 1.57 ±0.88), and EMRs 1.67 ±0.69). There were no statistical differences between professions.

When asked about infection control equipment for SARS in their offices, 80% of the respondents indicated they had masks, 67% had gloves, and 62% had hand washing gels (Table 2). The need for glove use was most frequently reported by physicians (73%) and least likely by EMRs (33%). The use of masks was reported highest by EMRs (78%). Availability of N-95 masks was reported by 63% of HCPs and face shields by 39%.

Table 2 also indicates that 33% of participants knew of a protocol for the management of SARS existed in their workplace. In comparison, 44% knew a protocol for tuberculosis, 39% for chicken pox, 38% for immunizations, 34% for influenza, and 27% for bioterrorist agents.

The relationships between sources of information and knowledge are displayed in Figure 3. The correct answer about the incubation period was most likely if the respondent was informed by the Internet (54%) followed by newspapers/journals (54%), conversation (54%), television/radio (51%), and lectures (51%). Knowledge of means to avoid spread of SARS among family members was also highest among those who used Internet (62%, $p = 0.038$) followed by newspapers/journals (56%), television/radio (55%), conversation (50%), and lectures (48%). Awareness that a runny nose is not a symptom of SARS was best correlated with lectures (55%), followed by conversation (51%), television/radio (50%), newspapers/journals (49%), then the Internet (41%).



https://doi.org/10.1017/S1049023X00003654 Published online by Cambridge University Press

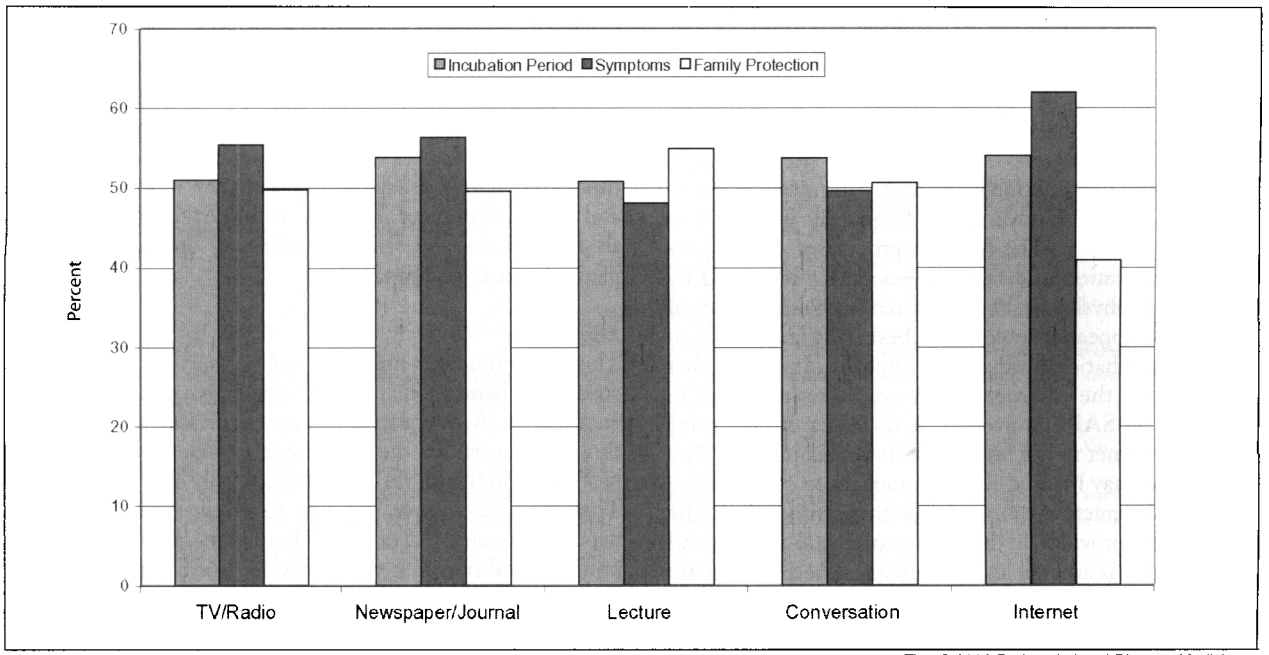





**Figure 3**—Knowledge of questions about severe acute respiratory syndrome (SARS) related to methods of learning

The different responses by professions or between Oahu and the non-Oahu responders did not reach statistical significance by the $\chi^2$ criteria.

## Discussion

This survey was conducted when knowledge and concern about SARS should have been at or near its peak. Seeking knowledge reflects the perceived need and/or an immediate problem.[9] A survey of Hong King residents suggests people were more likely to know about and take precautions against SARS if they perceived themselves at risk, were older, female, and/or highly educated.[10]

It is alarming that only half of the participants knew the incubation period for SARS, that a runny nose was *not* a symptom, and of educational methods for the family of a SARS patient to use regarding preventing spread of the disease. These results were disappointing, particularly as the epidemic should have been fresh in the minds of the community clinicians. It is difficult to explain the lack of knowledge and to realize how ill-prepared the front-line responders are to respond to a recurrence of SARS or other serious emerging infections. This is consistent with recent findings in Hawaii that only a minority of HCPs feel confident in their ability to manage the diseases associated with bioterrorism.[11] This does not, however, suggest that Hawaii HCPs who work in ambulatory care are less prepared than others in the US.[12] The Hawaii State Department of Health actively has disseminated information directly to physicians and multiple healthcare organizations through a variety of methods, including the presentations given with the survey. There is not a strong correlation between professional training and essential knowledge about SARS in regard to its incubation period, how to diagnose the ailment, and what to tell patients to do to stop its spread at home.

Emergency medical responders reported that radio and television were their dominant forms of learning and obtain more information from this source than from doctors or nurses. This may be explained by the availability of time that they may have to listen or read during the work hours compared with the other professions surveyed.

The Internet was reported as a source of information by 44% of physicians, which is twice the rate of physicians reporting the Internet as a source of information about bioterrorism two years ago.[12] Only one-third of the nurses used the Internet as a source of information about SARS, but this number is likely to be growing. Lectures were reported as a source of learning by considerably more physicians than nurses or EMRs, which simply may reflect the availability of this form of learning in their profession.

A limited number of offices are prepared with the equipment needed to prevent the transmission of SARS. This is consistent with the low percentage of offices with a protocol for SARS and with the absence of protocols for other serious infections that could be easily spread in a doctor's office or clinic.

Methods of improving the knowledge of SARS or other emerging infections among HCPs is not clear, but it is important to understand how information is acquired.[9,11,13–15] Radio and televison are used most frequently and deserve attention, however, the information provided seems to be oriented more to sensational isssues. It could be adapted to report more specific medical information, such as the incubation period, the symptoms, and the means of protection against SARS. Also, repetition of the messages appearing on television, radio, newspapers, and journals at different times assist these efforts. Critical information could be presented between news items or as captions on television. Special radio or television channels could be activated for healthcare providers in times of emergencies. According to interviews in China, the public knowledge of SARS also is a problem.[16] Even access to educational media such as newspapers, television, and radio may not

be sufficient to develop an adequate understanding.[17] Tailored educational programs on SARS have been proposed for patients and staff after interviews in a nursing home in Hong Kong.[7] This also may be a useful method of spreading valuable information around the globe.

More lectures for nurses or EMRs may help, although there was not a demonstrable benefit of this mode of learning for physicians. Conversation frequently was used in adjunct to education. The Internet provides a new opportunity for education and training—not only is it used by nearly half of physicians, but compared with other types of education, it appeared to correlate best with knowledge of the SARS incubation period and symptoms. It may be that those who use the Internet simply are more interested in learning about SARS, however, the doubling of physicians using the Internet in the last few years is encouraging. The Internet also may be used to communicate to HCPs using list serves, interactive tools, and learning modules.[3] The Internet also provides a timely list of facts, advice, and guidelines that is accessible continuously. The Internet also was found useful in the critical care community in Toronto for Web-based training and education as well as the rapid communication of research activities.[18] *Telemedicine*, the transmission of images or video broadcasts via computer, also may be helpful, and could be adapted for use on home and office computers.

Further studies must be conducted to understand the preparedness of HCPs for SARS and other life-threatening epidemics. More detailed information from a greater number of provider from different geographic areas would help answer important questions about how these clinicians and office workers obtain information, how they respond to epidemics, how they can help in a public health emergency, and how they share their knowledge and advice with their patients and families. The most frequently used learning methods by front-line healthcare providers must be evaluated for effectiveness and opportunities for learning.

There has been a tremendous emphasis on preparing hospitals to deal with SARS. Public health authorities have made some improvements in providing information to the public as well as healthcare providers about SARS, but there still is much to be done. Front-line providers are responsible for early identification of cases, early reporting, and triage. Most recently, they also would first diagnose outbreaks of anthrax, dengue, monkeypox, and influenza. Front-line providers also are most likely to recognize a sentinel case, but are lacking in their preparedness.

Far more health care is provided to patients in the community than in hospitals.[19] Therefore, the need to interrupt transmission in the community is far greater and more important. The role of front-line providers in referral and triage in an epidemic may be extremely valuable. There already is a network of referral among practicing physicians that could be used to disseminate knowledge and speed clinical evaluations and consultations. As plans evolve to deal more effectively with emerging infections, it will be important to establish better channels of communication between hospitals and community providers. Developing a continuum of care for emerging infections that can be transferred from the home to the office to the hospital will be essential for an effective response to a widespread, fatal, infectious disease or a "surge" of disease cases. Ambulatory care clinics and physician offices also may serve as valuable and trusted sources of information and educational materials for patients and families during an outbreak and the panic that may accompany it.

*Limitations*

There are numerous limitations of this survey that must be considered before conclusions can be drawn or actions taken in response. A selection bias may be present because only those who attended the educational sessions were asked to participate in the survey and, of those, only one-third did so. Therefore, the sample size was relatively small, heterogeneous, and consisted only of Hawaii HCPs. Many of the providers had not dealt with a SARS patient, although there were six suspect cases in Hawaii on several islands—four of whom were hospitalized with SARS precautions. Little information was gathered about the HCPs who responded, and no information was collected regarding the percentage of outpatient work they performed compared to hospital care. The questions might have been phrased differently to better reflect important elements of knowledge. The responses of participants who worked in the same office were not compared to learn of the actual presence of equipment and protocols. Other factors that could have affected the responses include late arrival, hearing the answers during the presentation, or seeing the answers on the lecture handout sheets before filling out the survey. The differences observed were not statistically significant.

## Conclusion

This survey demonstrated that preparedness for SARS among physicians, nurses, and other front-line healthcare providers is limited. Medical organizations and public health authorities must improve the knowledge of community physicians, nurses, office assistants, and emergency response personnel and contribute to their use of learning resources. The Internet, lectures, and creative use of newspapers, television, and radio appear to offer opportunities for effective use of fiscal resources and educational materials. Front-line providers must be able to detect infectious diseases and cope with them in the community. This should encourage the delegation of resources to providers regarding education, and bolster the network of patient care and existing clinical consulting services.

## Acknowledgements

The authors thank the Hawaii State Department of Health for their support of this project and Drs. Paul Effler, Salvatore Lanzilotti, and Kamal H. Masaki for their reviews and comments.

References

1. World Health Organization: Cumulative number of reported probable cases of SARS. Available at http://www.who.int/csr/sars/country/2003_06_24/en/. Accessed 17 December 2003.
2. Ksiazek TG, Erdman D, Goldsmith CS, *et al*: A novel coronavirus associated with severe acute respiratory syndrome. *N Engl J Med* 2003;348:1953–1966.
3. US Centers for Disease Control and Prevention (CDC): Clinical aspects of severe acute respiratory syndrome (SARS), 2003. Available at http://www.cdc.gov/ncidod/sars/webcast/broadcast050803.htm. Accessed 17 December 2003.
4. CDC: Update: Severe acute respiratory syndrome—United States, June 18, 2003. *MMWR* 2003;52:570.
5. CDC: Outbreak of severe acute respiratory syndrome—Worldwide, 2003. *MMWR* 2003;52:226–228.
6. McCarthyM: Attacks heighten US concern about threat of bioterrorism. *Lancet* 2001;358:1071.
7. CDC: Draft: Public health guidance for community-level preparedness and response to severe acute respiratory syndrome (SARS). Available at http://www.cdc.gov/ncidod/sars/sarsprepplan.htm. Accessed 17 December 2003.
8. Poutanen SM, Low DE, Henry B, *et al*: Identification of severe acute respiratory syndrome in Canada. *N Engl J Med* 2003;348:1995–2005.
9. Knowles, M: *The Adult Learner: A Neglected Species*. Houston, TX: Gulf Publishing Company; 1978:p 58.
10. Leung GM, Lam TH, Ho LM, *et al*: The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. *J Epidemiol Community Health* 2003;57(11):857–863.
11. Lanzilotti SS, Galanis D, Leoni N, Craig B: Hawaii medical professionals assessment. *Hawaii Med J* 2002;61(8);162–173.
12. Shadel BN, Rebmann T, Clements B, *et al*: Infection control practitioners' perceptions and educational needs regarding bioterrorism: Results from a national needs assessment survey. *Am J Infect Control* 2003;31:29–34.
13. Means RP: How Family Physicians Use Infromtion Sources: Implications for New Approaches. In: Green JS, Grosswald SJ, Suter E, Walthall DB III, (eds). *Continuing Education for the Health Professions*. San Francisco, CA: Joss-Bass;1984:72–86.
14. Lanzilotti SS: Practice Integrated Learning Sequence. In Lanzilotti SS, Finestone AJ, Sobel E, Marks AD: The practice integrated learning sequence: Linking education with the practice of medicine. *Adult Educ Q* 1986;37(1):38–47.
15. Lanzilotti SS, Finestone AJ, Sobel E: The role of evaluation in a practice-integrated continuing medical education program. *J Contin Edu Health Prof* 1986;6(4):15–18.
16. Wang X, Zhang J, Zhang Y, Wang Y: A knowledge, attitude and practice survey on SARS in a rural area. *Beijing Da Xue Xue Bao* 2003;35 Suppl:102–105.
17. Tse MM, Pun SP, Benzie IF: Experiencing SARS: Perspectives of the elderly residents and health care professionals in a Hong Kong nursing home. *Geriatr Nurs* 2003;24(5):266–269.
18. Booth CM, Stewart TE: Communication in the Toronto critical care community: Important lessons learned during SARS. *Crit Care* 2003;7(6):405–406.
19. Schappert SM, Burt CW: Ambulatory care visits to physician offices, hospital outpatient departments, and emergency departments: United States 2001–02. *Vital Health Stat* 2006:159:1–66.