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Knowledge of and attitudes toward severe acute respiratory syndrome among a cohort of dental patients in Hong Kong following a major local outbreak

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Objective: To assess the knowledge of and attitudes toward severe acute respiratory syndrome (SARS) among patients attending a teaching dental hospital and private dental practices in Hong Kong during a major local SARS outbreak. ***Methods:*** 250 dental patients were interviewed by questionnaire and 213 were interviewed by phone. ***Results:*** Less than one-third (30.0%) of the 463 respondents said they were not afraid of contracting the SARS coronavirus from their dentists and did not avoid dental treatment for that reason. Nearly three-fifths (56.7%) did not worry about contracting SARS from dental treatment. Fewer than 10% of the respondents thought that dentists ran a high risk of contracting SARS. From the patients' experiences, 85.2% and 21.7% of the dentists wore face masks and face shields, respectively, when delivering dental treatment. ***Conclusions:*** The majority of patients interviewed had confidence in their dentists, their treatment environments, and the infection control measures taken, and were not worried about contracting SARS in the dental setting. This perception is an improvement from that described in an earlier study, in which more than half of the patients were concerned about contracting an infection during dental treatment and perceived that the infection control measures undertaken by the dental profession to prevent infectious diseases were not satisfactory. Patients, however, demanded better infection control measures during the SARS outbreak.

Key words: Coronavirus pneumonia infection, new infection, virus-loaded aerosol, dental office

Introduction

An alarming outbreak of a new lethal disease entity, termed severe acute respiratory syndrome (SARS), took place in southern China, Southeast Asia, and North America in the spring and early summer of 2003 (Samaranayake & Peiris, 2004). SARS is now considered to have emerged from Guangdong province in Southern China before spreading to Hong Kong and, eventually, to 29 other countries (Chan-Yeung & Yu, 2003). SARS lasted for more than 4 months in Hong Kong. According to a report published in July 2003 by the Hong Kong Special Administrative Region (HKSAR) Department of Health, 1,755 patients were infected with SARS (Hong Kong Department of Health Report, 2003). Of these patients, 298 had died, 1,431 had recovered and been discharged from hospital, and the remainder were still receiving hospital care. These statistics were ranked second after China, according to the World Health Organization (WHO). Older patients were more susceptible to the fatal effects of SARS: the mortality rate for patients aged 60 years or older was about three times that for patients younger than 60 years (43.3% vs 13.2%) (Donnelly *et al*., 2003). The outbreak began on February 20, 2003, and the peak period lasted from March 27 to April 3, 2003; WHO removed the HKSAR from its list of infected areas on June 23, 2003.

The infectious agent of SARS has now been identified as a coronavirus, termed the Urbani strain of SARS coronavirus (SARS-CoV). It is not closely related to any of the previously characterized coronaviruses (Rota, 2003). A standard treatment protocol (So *et al*., 2003) and list of precautions against droplets and contact to prevent nosocomial transmission of SARS (Seto *et al*., 2003) have been developed. Sequence analyses have confirmed the existence of SARS-CoV in the sputum samples of SARS patients (Wang *et al*., 2003). Mapping of the SARS-CoV has been completed and molecular modeling indicates that rhinovirus 3C(pro) inhibitors could be modified to make them useful for SARS therapy (Anand *et al*., 2003). Putative epitopes for vaccine development have also been identified (Marra *et al*., 2003).

The virus is spread by close person-to-person contact and most readily so by respiratory droplets. The virus can also spread when a person touches a surface or object contaminated with infectious droplets and then touches his or her mouth, nose, or eyes(s). It is possible that the SARS virus spreads more broadly by airborne transmission (www.cdc.gov/nicdod/sars/factsheet.htm) than by droplets, direct contact, or fomite (indirect contact) transmission (Samaranayake & Peiris, 2004). Researchers believe that a combination of factors, including universal infection control measures, and/or the low degree of viral shedding in the prodromal phase of SARS, may have obviated the spread of the disease in dental settings (Samaranayake & Peiris, 2004). But because of its short incubation period, SARS is likely to be transmissible in dental settings (American Dental Association, 2004).

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Dentists should therefore suspect a diagnosis of SARS if a patient shows symptoms and within 10 days of onset of those symptoms has traveled (or even transited in an airport) in a WHO-listed SARS-infected area, or has had close contact with someone suspected to have SARS (including caring for, living with, or directly contacting respiratory secretions and/or body fluids of that person). The dentist should refer the patient to a medical facility for diagnosis and further care. The recommended preventive measures during and after the outbreak of SARS epidemics in the dental office include the use of disposable gloves, surgical face masks, goggles/face shields, high-volume suction, and reusable or disposable gowns (American Dental Association, 2004; Harrel & Molinari, 2004).

The transmission of SARS-CoV through droplets also raises the possibility of its spread during dental procedures, owing to the use of water-cooled, high-speed, rotary instruments within the close confines of the oral cavity (Samaranayake, 2002). Fortunately, there is as yet no single documented case of SARS transmission in a dental setting, although the public may be concerned of such a possibility. There has been a substantial amount of literature published that is related to the SARS epidemic (Editorial, 2003), but there are only limited reports on the immediate psychological and occupational effects of the outbreak. One report clearly indicates the importance of adopting a normal, adaptive response to stress in the face of an overwhelming event by staff and patients in a general hospital (Maunder *et al.*, 2003). The authors also describe how SARS prompted the re-evaluation of cross-infection control policies in the management of a major outbreak of a new infection in communities. There are currently no studies on patients' perceptions of SARS in the dental setting.

This survey aimed to study the attitudes toward SARS and infectious disease in the dental setting among dental patients in Hong Kong during a major local outbreak of SARS that occurred from May to June 2003.

Materials and Methods

Study participants were recruited from the following two patient populations:

1. Patients who sought treatment from the Reception and Primary Care Unit, Prince Philip Dental Hospital (the teaching dental hospital of The University of Hong Kong).
2. Members of the general public who had recently sought treatment from private general dental practitioners.

During a 2-week period when Hong Kong was experiencing a SARS epidemic and was listed as a SARS-infected area by the WHO, patients who attended the teaching dental hospital received a letter that explained the reasons for the study. Verbal consent was obtained before the interview. The questionnaire, which contained 31 questions, was formulated with reference to a similar, previous study on attitudes of dental patients toward human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) (Tsang *et al*., 1993). To ensure privacy and confidentiality, the questionnaire was administered in a separate room away from the waiting area. The questionnaire was written in Chinese because the vast majority of the dental patients were local Chinese residents.

The second group of patients was recruited from the general public living in various districts in Hong Kong during the SARS outbreak, 2 days before the WHO declared that Hong Kong was no longer a SARS-infected area. Field workers who were experienced in conducting telephone surveys were provided by the Social Science Research Centre of The University of Hong Kong to administer the questionnaire survey in Chinese. A representative cohort of Chinese residents was chosen by random sampling methods routinely used by the centre for all telephone surveys. A written version of the telephone survey was given to each interviewer who adhered strictly to the structure and format of the script provided. An initial screening question about recent dental attendance was used to recruit patients who had attended a private clinic for dental treatment in the previous year.

The questionnaire was divided into two sections: the first asked for demographic data of the patients and the second comprised questions that aimed to assess knowledge of and attitudes toward SARS and infection control practices in dentistry. The questionnaire included specific questions addressing knowledge of cross-infection control practices such as the use of face masks, goggles, and pre-procedural mouthrinse; monitoring patient temperature, SARS declaration for epidemiological surveillance, as well as knowledge that SARS infection might be spread in the dental office through aerosol transmission. A single-item scale was used to record respondents' replies.

Statistical Analysis

The Statistical Package for the Social Sciences version 11.0 (SPSS Inc., Chicago, Illinois, USA) was used for all statistical analyses. The two patient groups were probably of different socioeconomic backgrounds (the dental hospital primarily serves teaching patients); hence, only gender, age, and educational background were recorded as socioeconomic characteristics. The chi-square test was used to test for significant differences between the two groups by gender, and the Kruskal-Wallis H-test was used for comparisons of age and education level. Because there were no differences in these factors, data from the two populations were pooled for analysis. Bias could have been introduced by the reliance on self-report of data and the use of 12 telephone interviewers one face-to-face interviewer. The former source of bias was assumed to be the same for both patient groups, and the latter was minimized by thorough training and use of very experienced telephone interviewers who adhered to the same script. Post-hoc tests (LSD, Tukey HSD, and Scheffe tests, with Bonferroni adjustment for multiple comparisons) were used to compare pooled questionnaire responses by age group, education level, and gender. A p-value of less than 0.05 was considered to be statistically significant.

Results

There were 463 respondents in the study: 250 interviewed by telephone and 213 interviewed face-to-face. Only a few people in the dental hospital refused to participate

in the face-to-face interview. The 250 patients contacted by telephone were all dental clinic attenders in the previous year. The respondents comprised 196 (42.8%) males and 262 (57.2%) females. Gender was not recorded in five questionnaires. Among the respondents, 57.6% had completed secondary school education, 26.9% had completed tertiary education, 10.5% had completed primary school education, and the remaining 5.0% had a level of education below primary school.

Most of the respondents from the different age groups (89.3%) and different education levels (89.2%) commented that they had regularly watched or listened to news about SARS. The time spent watching or listening to news about SARS for those with an education below primary school level was significantly less than the responses of all other groups ($p = 0.015$).

More than two-thirds of respondents of different age groups (68.7%), different genders (68.6%), and different education levels (68.8%) were not afraid of contracting SARS and did not wish to avoid receiving dental treatment. Females were significantly more likely than males to say they would avoid dental treatment because of a fear of SARS ($p < 0.01$; Fig. 1). The responses of the patients who were younger than 20 years were significantly different from those of the patients in the 31- to 40-year and 51- to 60-year age groups. Secondary school leavers were significantly more likely than those with tertiary education to be worried about contracting SARS and avoiding dental treatment as a consequence ($p = 0.028$). Most patients considered the most reliable information on SARS to come from the government SARS hotlines and homepage (93%), followed by family members (81.8%) and doctors (81.3%).

About one-thirds of the respondents (30.0%) said they were worried about being infected with the SARS Co-V when being treated by their dentists; 7.9% felt very worried about this. Female respondents were significantly more likely than male respondents to be very worried ($p < 0.01$; Fig. 2). About a quarter of the patients said that paramedics had a high risk of contracting SARS and 16%-17% said that doctors, nurses, patients from SARS-affected areas, and the elderly all had a high risk of exposure. However, fewer than 10% said that dentists faced a high risk of contracting SARS (Fig. 3).

Most respondents reported that the majority of dentists wore a face mask when treating patients (85.2%). Only small proportions of respondents regarded aerosols (7.7%), sneezing (7.5%), spitting (7.5%), coughing (7.4%), and saliva (7.3%) as the most common routes for the transmission of SARS. Other dental sources of SARS infection included sharing a toothbrush (6.4%), aerosol from the dental surgery (5.5%), and manual scaling of the teeth (2.8%). More than three-fifths of the respondents claimed that their dentists provided them with a preparative mouthwash that contained an antiseptic.

More than 60% of the respondents aged 30 years or younger thought that the identities of SARS victims should not be publicized, whereas more than 60% of the respondents aged 41 years or older thought otherwise. The response of the youngest age group was significantly different from that of the 41- to 50-year-olds, and the 20- to 30-year-olds had a response that was significantly different from those of the 41- to 50-year and 51- to 60-year age groups ($p < 0.01$).

Two-fifths of the respondents considered that SARS would be a long-term health problem in Hong Kong. More than 50% of the respondents in the 31- to 50-year age group said that SARS would be a long-term health problem. The proportion of the youngest age group that shared the same thought was significantly less than that of the 31- to 40-year and 41- to 50-year age groups ($p = 0.004$).

Sizable proportions of respondents considered tuber-

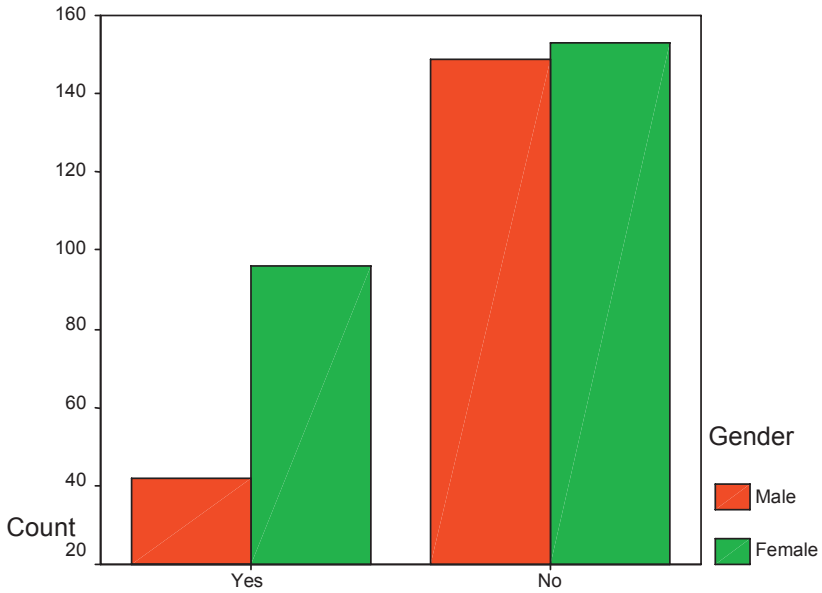

Figure 1. *Responses, by gender, to the question, "Are you afraid of being infected with SARS and hence avoid treatment?"*

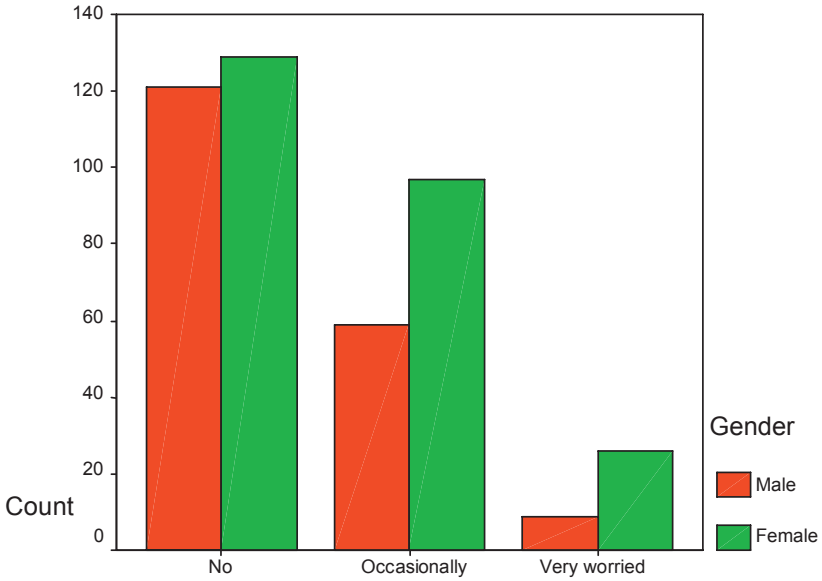

Figure 2. *Responses, by gender, to the question, "When you were treated by your dentist, were you worried about being infected by SARS?".*

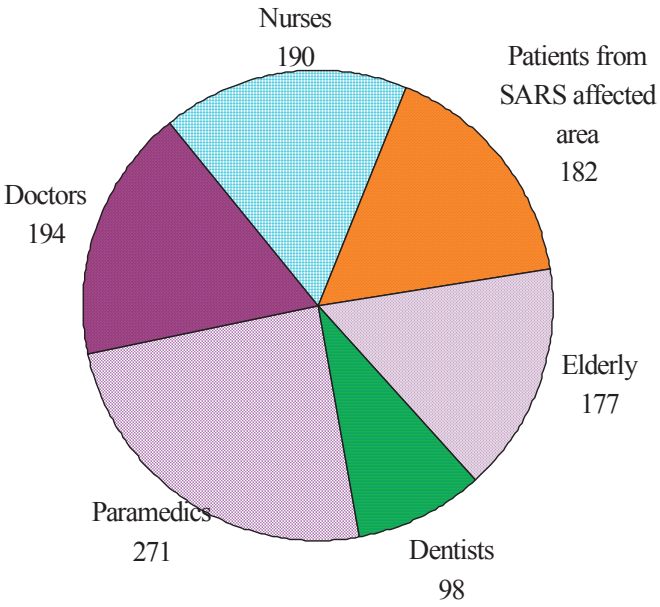

Figure 3. *Proportions of respondents saying that certain groups have a high risk of contracting SARS.*

culosis (32.0%), SARS (23.9%), anthrax (19.7%), Ebola (10.8%), and H5N1 avian influenza virus (9.4%) to be airborne pathogens. Only 0.6%-2.0% of the respondents thought that other pathogens (Nipah, herpes simplex virus, *Candida albicans*, and *Aspergillus spp*) could be spread by airborne transmission.

Discussion

Knowledge

Respondents in the youngest and 20- to 30-year age groups received higher exposure to the official mass media, which was a reliable means of receiving regular SARS information. Because exposure of the older age groups to the mass media was less than for these two age groups, they were less likely to obtain regularly updated SARS information. Similarly, respondents with higher education levels had a higher regularity of receiving SARS information. This finding suggests that the ability to access relevant information on SARS and the desire to do so increases with education level.

About a quarter of the respondents knew that the SARS-CoV is an airborne pathogen, although this fact had not been definitively proven at the time of the interviews and only circumstantial evidence supported the notion. However, this finding at least reveals respondents' awareness of this route of transmission and their intent to know about the virus and diseases in general. For instance, tuberculosis was most often correctly identified as an airborne disease (32.0%). It is unrealistic,

however, to expect a high degree of accurate knowledge about infectious diseases by solely placing an onus on dentists and other health care professionals to directly provide accurate information when it is required (as it is during an outbreak).

Attitudes

Aerosols are now considered the major route of SARS transmission (Seto *et al*., 2003; Hong Kong Department of Health Report, 2003; Centers for Disease Control and Prevention, 2003). Aerosols are defined as airborne particles that range in size from 0.5 to 10 microns. They are produced during the use of ultrasonic instruments, e.g., high-speed rotary hand pieces and 3-in-1 syringes. Irrigating solutions, which produce the therapeutic effects of lavage, also combine with blood, saliva, and bacteria to produce potentially harmful airborne particulates (Jacks, 2002). Although during the SARS outbreak there was a general concern that visiting the dentist might be a source of infection given the potential for virus loading in aerosols generated by many dental procedures, some one-thirds of the respondents were not afraid about contracting SARS and did not avoid dental treatment, and three-fifths were not worried about contracting SARS in the dental setting. Hence, although respondents identified aerosol contamination as a risk, they were not fearful of dental offices. Perhaps, however, the general public has a limited understanding of the extent of aerosol contamination that occurs during dental procedures. In addition, only a small proportion (<10%) of the respondents thought that dentists faced a high risk of contracting SARS, and only small proportions (<8%) thought that some dentally related routes, such as saliva, sharing a toothbrush, aerosol from dental surgery, and manual scaling, would transmit SARS. Further studies are required to verify the probability and possibility of contracting SARS by these routes.

Quite a high proportion (40.5%) of respondents thought that SARS would be a long-term health problem in Hong Kong, and 50% of these respondents were aged between 31 and 50 years. Although this was not the age group with the highest risk of mortality (the at-risk group was the over 60-year age group), 31- to 50-year-olds expressed the greatest concern of the possibility of being infected with SARS. This may be partly attributable to worries among people in this age group about losing their jobs if they contracted SARS from their workmates.

Perceptions about infection control

A concerted effort by local community health officials, academics, and international organizations such as the WHO led to the elucidation of the nature of SARS and the measures that were required to prevent the spread of this new infection. After the SARS outbreak in 2003, local dentists appropriately upgraded their measures to prevent cross-infection. For example, infection control measures were introduced by providing a preparative mouth rinse, taking body temperature before dental treatment, and compiling a medical history relevant to SARS symptoms before commencing dental treatment. A preoperative rinse of chlorhexidine gluconate can reduce the bacterial load of aerosols (Tsang *et al*., 1993), although no study has ascertained the effect on viral load, or even size and distribution of aerosols carrying virus particulates, such as SAR-CoV. However, many respondents were aware of the additional measures adopted by local dentists, and the adoption of these measures may have improved the professional image of local dentists and helped patients gain confidence to receive dental treatment during the SARS epidemic in Hong Kong.

From the results of our survey, it is very encouraging to note that dental patients in Hong Kong have such confidence in their dentists, the treatment they provide, and the cross-infection control measures implemented. This may reflect the successful and prolonged implementation in dentistry of universal infection control policies. A previous study of Hong Kong and UK patients indicated that more than one half of those surveyed were concerned about contracting infections during dental treatment and considered the control measures taken by the dental profession to prevent infections such as HIV/AIDS as unsatisfactory (Porter *et al*., 1993). Perceptions of dental infection control have since improved, however (Tsang *et al*., 1993). In the previous study on dental patients' attitudes, older age groups (age > 31 years) and those with higher levels of education (> secondary school) harbored greater fears than other groups. Male respondents also tended to express more fear than do their female counterparts (Porter *et al*., 1993).

Although the respondents interviewed in this study showed confidence in their dentists' cross-infection control measures, not all respondents noticed that dentists took the precaution of wearing a face mask. Hence, it is worth investigating why dentists do not fully comply with personal protection measures even in the face of a major outbreak of a deadly disease.

In conclusion, this study showed that dental patients' confidence in regard to dental cross-infection control was high and realistic during the 2003 SARS outbreak in Hong Kong. Nonetheless, some patients demanded better infection control measures in the face of the SARS outbreak. Our data indicate the necessity for further continuing education among dental practitioners in the area of contemporary cross-infection control policies as well as improved public education on infectious diseases and the dental setting.

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