Infection Control Practices Across Canada: Do Dentists Follow the Recommendations?

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Abstract

This study investigated provincial and territorial differences in dentists' compliance with recommended infection control practices in Canada (1995). Questionnaires were mailed to a stratified random sample of 6,444 dentists, of whom 66.4% responded. Weighted analyses included Pearson's chi-square test and multiple logistic regression. Significant provincial and territorial differences included testing for immune response after hepatitis B virus (HBV) vaccination, HBV vaccination for all clinical staff, use of infection control manuals and post-exposure protocols, biological monitoring of heat sterilizers, handwashing before treating patients, using gloves and changing them after each patient, heat-sterilizing handpieces between patients, and using masks and uniforms to protect against splatter of blood and saliva. Excellent compliance (compliance with a combination of 18 recommended infection control procedures) ranged from 0% to 10%; the best predictors were more hours of continuing education on infection control in the last two years, practice location in larger cities (> 500,000) and sex (female). Clearly, improvements in infection control are desirable for dentists in all provinces and territories. Extending mandatory continuing education initiatives to include infection control may promote better compliance with current recommendations.

MeSH Key Words: *Canada; dental offices; guideline adherence; infection control, dental.*

This article has been peer reviewed.

Infection control forms an important part of practice for all health care professions and remains one of the most cost-beneficial medical interventions available.[1] In dentistry, both patients and health care workers may be exposed to a number of bloodborne and upper respiratory pathogens through exposure to blood and saliva. Professional dental associations, including provincial licensing authorities in Canada, have advocated that universal precautions be applied to all patients, as their potential infectivity may not be known.[2-5]

Most studies of dentists' infection control practices have investigated compliance with specific procedures, such as the use of gloves and masks, eye protection, hepatitis B virus (HBV) vaccination and heat sterilization of dental handpieces. There are few comprehensive studies of dentists' compliance with recommended infection control procedures, and there are no national data for dentists in Canada. In 1995, we conducted a national survey of dentists in Canada to investigate compliance with recommended infection control practices[6] and access to care for patients with bloodborne pathogens.[7] This paper reports the results of a comparison of infection control practices of dentists in different provinces or territories.

Survey of Canadian Dentists

Questionnaires were mailed to a random sample of all dentists licensed to practice in Canada (n = 6,537), stratified by province or territory. Lists of dentists were obtained from each provincial or territorial authority. There were 15,232 dentists listed by Canadian licensing bodies in Canada in 1995. All listed dentists from the smaller or less densely populated provinces and territories were included. Dentists from the remaining provinces and territories were randomly sampled such that the size of the subsamples for each region were approximately equal and would yield reasonably small

confidence intervals for the estimates of interest. When adjusted for non-delivery of questionnaires, the sample size was 6,444: Newfoundland, *n* = 149; Prince Edward Island, *n* = 48; Nova Scotia, *n* = 418; New Brunswick, *n* = 246; Saskatchewan, *n* = 332, Yukon Territory, *n* = 13; Northwest Territories, *n* = 34; British Columbia, *n* = 1,011; Alberta, *n* = 805; Manitoba, *n* = 477; Ontario, *n* = 1,655; Quebec, *n* = 1,256.

Ethics approval was gained from the Review Board for Health Sciences Research involving Human Subjects at the University of Western Ontario. To ensure anonymity, the study was designed such that no individual could link names and responses. Administration of the survey included an initial mailing of questionnaires with ID numbers, a reminder postcard and two additional mailings of questionnaires to non-respondents.

The survey instrument, tests for reliability, survey administration, weighting of the data and investigation of non-response bias have been described elsewhere.[6-8]

Statistical analyses were conducted using SPSS/PC+ (SPSS Inc., Chicago, Ill.). All statistical analyses were weighted to allow for different probability of selection and non-response among the provinces and territories.[9] Pearson's test of association and multiple logistic regression analyses were used to investigate provincial and territorial differences in compliance.

The response rate, adjusted for non-delivery, was 66.4%. Of the respondents, 174 were deemed ineligible because they did not actively treat patients, leaving 4,107 responses for data analysis. There was minimal evidence of non-response bias.[8]

We found significant provincial differences in occupational health measures (see **Table 1**). For example, for post-HBV immunization serology, compliance ranged from 49 to 78%, with 68 to 100% of dentists in a province or territory reporting HBV immunization for all hygienists and 46 to 100% for all other clinical staff. Only 0 to 70% of a province's or territory's dentists had a post-exposure protocol; however, 44 to 92% reported safe recapping of needles.

Provincial or territorial differences in other infection control practices included use of an office infection control manual (30 to 78%); biological monitoring of heat sterilizers (50 to 91%); handwashing before treating patients (40 to 84%); using gloves when treating patients (93 to 100%) and changing gloves after each patient (94 to 100%); heat-sterilizing handpieces between patients (60 to 96%); and using masks (50 to 100%), eye protection (70 to 100%) and uniforms (17 to 65%) to protect against blood and saliva splatter (see **Table 2**).

Reports of the routine use of gloves when treating patients, plus mask and eye protection to protect against blood and saliva splatter, ranged from 36 to 100%. Such routine use was significantly associated with younger age, marital status (single or married), fewer patients per day, female dentist, population centre where primary practice was located (population of 100,000 to 500,000) and attending continuing education on infection control.

Compliance with a combination of 18 recommended infection control practices ("excellent compliance")[6] ranged from 0 to 10%. Statistically significant predictors of excellent compliance with recommended infection control procedures were attending more than six hours of continuing education on infection control in the past two years (10+ hours, odds

Table 1 Provincial differences in percentages of participants reporting occupational health measures (n = 4,107)

Variable	Province/Territory											
	NWT	YT	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NF
Hepatitis B immunization	96	90	90	93	88	89	91	90	92	90	90	79
HBV natural immunity	0	10	4	2	4	2	3	3	1	2	0	2
Post-HBV immunization serology[a]	78	56	74	71	63	49	76	58	72	58	58	51
HBV immunization for all hygienists[a]	92	100	89	91	85	72	85	88	88	88	95	68
HBV immunization for all other clinical staff[a]	100	86	75	79	75	57	78	70	76	80	86	46
Post-exposure protocol[a]	70	0	36	54	37	48	36	48	39	43	55	38
Always recap needles with device or scoop technique[a]	78	44	50	52	59	55	50	92	48	56	44	50
Always use puncture-proof container for sharps disposal	100	100	93	95	92	95	94	95	90	96	100	94

[a] $p < 0.0001$

ratio [OR] = 9.0; 6 to 10 hours, OR = 3.8; reference group = none), population of town or city where practice was located (> 500,000, OR = 2.5; reference group = < 10,000) and female dentist (OR = 2.1). There were no significant differences by province or territory.

Discussion

The Canadian Dental Association (CDA) and the provincial licensing authorities have published recommendations and guidelines for infection control in the dental office. Our study provides information that may be useful to focus continuing education at the provincial level.

Handwashing

Handwashing is one of the most important practices for preventing cross-infection in dental practice, yet there is only partial compliance among health care professionals, including dentists.[10-13] CDA guidelines recommend handwashing with a germicidal soap prior to and immediately after the use of gloves.[2,3] Even if gloves are worn, hands may become

Table 2 Percentage of respondents from each province/territory who reported infection control practices (*n* = 4,107)

Variable	Province/Territory											
	NWT	YT	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NF
Office infection control manual[a]	78	30	44	78	55	61	48	49	46	59	58	48
Biologically monitor heat sterilizers[a]	80	50	71	91	68	75	67	70	66	74	84	57
When treating patients:												
• handwashing before patients[a]	83	40	71	71	74	77	74	82	77	80	84	73
• handwashing after degloving	74	30	63	63	67	61	62	65	59	69	74	62
• always wear gloves[b]	100	100	93	99	96	98	94	94	93	97	95	95
• always change gloves after each patient[b]	100	100	94	98	95	99	96	98	98	100	100	97
• always heat sterilize handpieces after each patient[a]	96	80	60	94	82	89	80	71	81	79	86	76
• always give antimicrobial mouthwash prior to intraoral procedures[a]	4	0	2	5	4	2	4	3	2	2	0	0
• always flush waterlines after each patient	64	20	53	58	56	55	54	57	55	57	68	52
• always use rubber dam for restorative procedures[a]	9	20	60	52	53	62	21	18	44	58	51	24
To protect against splatter of blood/saliva:												
• always wear a mask[a]	100	80	84	90	81	85	79	86	82	75	50	75
• always wear protective eyewear/faceshield[c]	70	100	85	84	80	82	84	79	71	76	71	73
• always wear a protective uniform[a]	65	50	38	49	45	53	49	55	48	43	17	51
• always use high-volume suction[b]	96	90	95	96	94	95	90	90	91	93	95	93

[a] $p < 0.0001$
[b] $p < 0.01$
[c] $p < 0.05$

contaminated as a result of punctures or when gloves are removed.[14-16]

Some respondents appeared to use gloves as a substitute for handwashing. It is somewhat reassuring to note that of the people who never wore gloves, 100% washed hands between patients. A number of factors associated with lower rates of compliance with handwashing have been previously identified: availability of sinks, the effect of handwashing on skin conditions, workload and low perceived risk.[17-23] A major motivational factor for compliance with handwashing is an understanding of the risk of transmission of infection,[18-19] suggesting that continuing education may be a useful intervention to improve compliance, although it is difficult to achieve a sustained change in behaviour without constant reinforcement.[24-28]

HBV Immunization

HBV immunization among dentists in Canada compares favourably with recent results from surveys in the United States (93% immunized)[5] and the United Kingdom (86% immunized)[29] and is higher than reported from earlier studies of dentists in Canada completed between 1987 and 1993.[30-32] However, the proportion of respondents reporting testing for an immune response after HBV immunization ranged from 49% in Manitoba to 78% in the Northwest Territories, indicating some uncertainty about the efficacy of protection against HBV in Canadian dentists. This is a concern, as knowledge of HBV antibody titre is required for appropriate management of exposure to HBV. The finding indicates a need for more education focused on HBV immunization and post-exposure protocols.

Although rates of HBV immunization among dentists were generally high, lower rates of immunization of all clinical staff were reported, particularly by respondents in Newfoundland and Manitoba. Unfortunately, respondents who reported lower compliance with HBV immunization for staff were also less likely to report the use of post-exposure protocols ($p < 0.0001$), yet prophylaxis for HBV in non-immune persons is required within 48 hours of exposure. Since the completion of our survey, it has been found that zidovudine (AZT) reduces the risk of HIV seroconversion after an occupational injury by 79% if given within two hours of exposure.[33,34] It is possible that dentists in Canada are now more aware of HIV post-exposure prophylaxis and may therefore be more likely to have a post-exposure protocol for occupational injuries. Occupational injuries were also investigated in this study; these results are presented elsewhere.[35]

Use of Heat Sterilizers

More than 95% of respondents from all provinces and territories other than the Northwest Territories (87%) reported using heat sterilizers.

The routine use of biological monitoring to verify heat sterilization has been recommended by CDA.[2,3] The low use of biological monitoring in some provinces and territories raises concerns about the quality of sterilization in some dental practices. Although there is no evidence that pathogens, including HIV, have been transmitted via the dental handpiece, the potential for cross-infection has been demonstrated.[36,37] Routine heat sterilization of handpieces between patients is therefore recommended.[2,3]

We found significant provincial and territorial differences in handpiece sterilization, with reports of heat sterilization after each patient ranging from 60 to 96%. Nonetheless, compliance with heat sterilization of handpieces was higher in this study than reported by previous studies of dentists in Canada,[30,32] which confirms reports of improvement in compliance over time.[38,39]

Dental Unit Waterlines

Biofilms found in dental unit waterlines are a potential source for the transmission of pathogens,[40- 43] an issue that is causing increasing concern. At the time of this study, CDA recommended that waterlines be flushed after each patient; however, provincial variation in reports of compliance ranged from 20 to 68%. CDA recommendations for dental unit waterlines have recently been updated[44] but are still less stringent than those published by the American Dental Association.[45]

Handling of Sharps

If recommended infection control practices are used, the risk of occupationally acquired infection with bloodborne pathogens such as HBV, HCV or HIV is limited to sharps injuries. These injuries can be minimized if puncture-proof containers for sharps disposal are used and two-handed recapping of used needles is avoided.

Although there was high compliance with the use of puncture-proof containers for the disposal of used sharp items, there was considerable variation in compliance with the recommendation to recap used needles using a scoop technique or a mechanical device,[3,4] indicating a need for educational interventions to reduce sharps injuries. Those dentists who did not use puncture-proof containers or post-exposure protocols also reported significantly more percutaneous injuries.[35]

Use of Barriers

Although there is evidence of improvement in compliance with barrier use among dentists in Canada,[38,39] a minority of respondents in this study complied with recommendations for handwashing in addition to the appropriate use of barriers. Taking the influence of sociodemographic variables and continuing education into account, the results of multivariate analysis indicated that dentists in Alberta were more compliant than dentists in other provinces and territories with the use of barriers.

Our study does provide evidence of the protective effect of barriers. Eye protection or masks significantly reduced (but did not eliminate) mucous membrane exposures. In addition, dentists who reported the routine use of gloves averaged fewer percutaneous injuries per year compared to those who reported occasional use or non-use of gloves. It is clear that better compliance with barriers reduces the risk of occupational exposures and infection.[35]

Combinations of Recommended Infection Control Procedures

Although dentists' reports of compliance with many specific

infection control procedures were very high in this study, compliance with combinations of recommended infection control procedures necessary to reduce the potential for cross-infection in dental practice was low. This may explain why many respondents reported that they would use extra infection control measures for patients with HIV. If universal precautions are used, all patients are treated as if they are infected with HBV, HCV or HIV; additional infection control measures are unnecessary for patients with known bloodborne infections.

Many of the dentists in this study reported concerns about HIV. These concerns included staff fears about patients with HIV (66.5%), practitioner fears about the loss of patients from the practice as a result of treating patients with HIV (67.5%), practitioner fears about personal safety (62.6%) and worry that the cost of infection control procedures necessary to treat patients with HIV would be a financial burden for the practice (45.1%). It is possible that some dentists take unnecessary infection control precautions for patients who are known to be infected with HIV to alleviate staff fears and concerns for personal safety. In Canada, such extra precautions can lead to charges of discrimination.[46,47] Recent publicity about such charges may have contributed to increased compliance with recommended infection control procedures and a better understanding of the concept of universal precautions.[39]

This study had some limitations. Not all infection control procedures recommended by CDA were investigated because of concerns that a larger number of items would reduce the response rate. Furthermore, because the frequency of routine use of pre-procedural antimicrobial mouthwash and rubber dams for restorative procedures was low, neither practice was included in our measure of "excellent compliance": the subset of compliers would have been too small for further analyses. It should also be noted that post-HBV immunization serology was not included as this was not a recommendation at the time of the survey, although this has now changed.[48] Also, there is evidence that self-reports may overestimate compliance with recommended infection control procedures.[49] Given the low frequency of compliance reported for certain procedures and combinations of procedures, this problem may not be relevant in this study.

Provincial and territorial differences in "excellent compliance" appeared to be influenced by attending continuing education on infection control, sex (female) and practice location in population centres greater than 500,000. Reports of more than six hours of continuing education on infection control in the preceding two years were the most important predictor of "excellent compliance" with recommended infection control procedures, although the dynamics of this association are not clear. Dentists who are more conscientious about the use of recommended infection control procedures may also be more conscientious about attending continuing education programs. The association with continuing education confirms a previous report that improvements in compliance with recommended infection control procedures by dentists in Ontario may be linked to the introduction of mandatory continuing dental education by the Royal College of Dental Surgeons of Ontario.[39] Continuing dental education is currently required in nine of the 12 provinces and territories in order to maintain licensure. If additional weight was given to credits for courses in infection control or if these were mandatory components of continuing dental education, compliance with recommended infection control procedures might increase further.

Conclusion

In conclusion, we found that most dentists comply with the use of gloves, masks, protective eyewear and HBV immunization for themselves; however, many dentists do not utilize the full range of recommended infection control procedures that are necessary to minimize the risk of cross-infection in dental practice. It is important to note that in international comparisons of the infection control practices of dentists, Canadian practice appears better or comparable to the practices of dentists reported in the international literature.[6] Our results lend support to the concept of mandatory continuing education that includes a specific component on infection control. With today's increasing concerns about the transmission of bloodborne pathogens, such as the hepatitis viruses and HIV, and the rise in drug-resistant micro-organisms, compliance with recommended infection control must improve.

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This study was supported by a grant from the National Health Research and Development Program, Health Canada (6606-5463-AIDS).

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