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# New Zealand oral health practitioners' cross-infection control practices

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## Abstract

**Background and objectives:** The only national study of cross-infection control (CIC) practices among New Zealand dentists was conducted 25 years ago. It found that many dentists did not routinely adhere to CIC protocols. The aim of this study was to update information on New Zealand dentists' and allied dental practitioners' adherence to current CIC protocols.

**Methods:** Electronic and paper survey of 889 randomly-selected New Zealand oral health practitioners, comprising dentists (general dental practitioners and specialists) and allied dental practitioners (dental hygienists, dental therapists and clinical dental technicians).

**Results:** The response rate was 39.7%. Most practitioners (69.3%) reported that they always wash their hands between patients, wear gloves, wear a mask, use eye protection and offer eye protection to patients, while the remainder did not always do one or more of these. Proportionally more allied dental practitioners than dentists reported that they always follow all of these practices. Nearly all respondents (98.8%) indicated that they used an autoclave and most respondents (99.5%) reported that they always autoclave dental handpieces. Fewer than half of practitioners (45.2%) had read all three Dental Council New Zealand (DCNZ) CIC-related documents. A majority (94.2%) reported that they had full immunity against Hepatitis B. Some (21.4%) had received a dental sharps injury in the past year.

**Conclusion:** Most New Zealand practitioners are following CIC protocols, but a number are still not doing so, putting patients and the dental team at risk.

## Introduction

Dentistry is a high-risk environment for infectious exposures. Cross-infection pathways include patient-to-dental team, dental team-to-patient and patient-to-patient. The most common transmission routes are direct contact with a patient's oral fluids, droplet infection from aerosols, or indirect contact via contaminated surfaces or instruments. Infectious agents can spread between patients indirectly through inadequately prepared instruments, operatory surfaces and hands (Miller et al., 2014). Breaches can harm both patients and the profession (NZ Herald, 2017). Appropriate cross-infection control (CIC) is essential for patient and clinician safety and to maintain public trust in the dental profession (Thomson et al., 1997).

Current information about New Zealand oral health practitioners' CIC practices is unavailable. The only

New Zealand Study was published in 1994, based on a 1992 survey of general dental practitioners (Treasure and Treasure, 1994). This study found that 92.0% of practices had an autoclave, only 42.8% of practitioners reported autoclaving handpieces, and 13.6% did not always autoclave extraction forceps. A small percentage of dentists reported not wearing personal protective equipment: 11.9% did not wear masks, 10.8% did not wear eyewear, and 2.6% did not wear gloves. These estimates are not likely to reflect current practice standards, but they are the most recent national data available.

While there is a lack of data on CIC behaviours in New Zealand, there have been many overseas studies. In an Australian study undertaken in 1996, just over half (55.7%) of Australian dentists reported always wearing a mask while over three quarters reported they always wear eyewear (77.6%) and gloves (84.6%; Lange et al., 1996). Several Canadian studies (McCarthy and MacDonald, 1997; McCarthy and MacDonald, 1998a; McCarthy and MacDonald, 1998b; McCarthy et al., 1999a; McCarthy et al., 1999b) undertaken in the mid-to-late 1990s reported use of gloves to range from 91.8% to 95.0%, that of eyewear from 75.4% to 83.8%, and mask use from 63.4% to 82.0%. McCarthy and MacDonald (1998a) compared the CIC practices of Canadian general dental practitioners and dental specialists. While the same percentage of those reported always wearing gloves (91.8%), a greater proportion of general dentists than specialists reported always using eyewear (83.6% versus 74.7%) and masks (74.8% versus 62.9%).

Numerous international studies have reported that females (McCarthy and McDonald, 1998a; McCarthy et al., 1999a; Cheng et al., 2012a) and younger practitioners (McCarthy and MacDonald, 1998a; Tada et al. 2014) are more likely to adhere to CIC protocols than males and older practitioners. Other studies have found that the more CIC-related documents that had been read by dentists, the better the adherence to CIC protocols (McCarthy et al., 1999a; Cheng et al., 2012a; Tada et al., 2014). However, while dentists have been extensively studied internationally, very few studies have reported on allied dental practitioners' CIC practices. One study of American dental hygienists found that 68.9% routinely use eyewear, 93.2% wear masks, and almost all wear gloves (King and Muzzin, 2005). Table 1 gives an overview of the previous literature on practitioners' CIC practices.

Under the Health Practitioners Competence Assurance Act (2003), the Dental Council of New Zealand



**Table 1** Previous studies that show the percentage of practitioners who report routine use of recommended CIC protocols.

Country	Study	Practitioner type	Year of data collection	Eye-wear	Mask	Gloves	Change gloves	Autoclave	HBV	Hand-washing
Scotland	Gore et al., 1994	Dentists	1991	NR	34.0	78.0	NR	85.0	88.0	NR
Italy	Angelillo et al., 1994	Dentists	1991	48.3	49.1	56.1	53.2	NR	NR	78.5
New Zealand	Treasure and Treasure, 1994	Dentists	1992	83.7	83.4	94.5	NR	92.0	NR	NR
Australia	Lange et al., 1996	Dentists	1993	77.6	55.7	84.6	87.1	NR	NR	NR
Canada	McCarthy & MacDonald, 1998(a)	Specialists	1994	75.4	63.4	91.8	93.0	78.9 <sup>a</sup>	95.3	NR
Canada	McCarthy & MacDonald, 1998(a)	Dentists	1994	83.6	74.8	91.8	NR	83.9	92.3	NR
Canada	McCarthy & MacDonald, 1998(b)	Dentists	1994	82.5	73.3	91.8	NR	83.0 <sup>a</sup>	93.0	NR
Canada	McCarthy & MacDonald, 1998(b)	Dentists	1995	83.8	78.6	93.8	NR	95.0 <sup>a</sup>	94.0	NR
Canada	McCarthy et al., 1999(a)	Dentists	1995	82.0	82.0	95.0	97.0	94.0 <sup>a</sup>	91.0	63.0
Ireland	Kearns, 2001	Dentists	1997	NR	68.0	92.0	73.8	97.0	NR	NR
USA	Gershon et al., 1998	Dentists	1998	80.8	79.7	97.6	NR	NR	84.0	59.1
Romania	Bancescu et al., 1999	Dentists	1999	65.1	39.3	98.9	NR	16.4	6.4	NR
South Africa	Yengopal et al., 2001	Dentists	1999/00	52.9	82.4	97.1	NR	89.7	88.2	NR
Taiwan	Cheng et al., 2012 (a)	Dentists	1999	20.8	97.7	67.7	80.8	60.0 <sup>a</sup>	NR	NR
Taiwan	Cheng et al., 2012 (a)	Dentists	2010	26.5	100.0	93.0	97.2	81.8 <sup>a</sup>	NR	NR
China	Su et al., 2012	Dentists	2000	13.9	93.0	73.7	63.2	41.2 <sup>a</sup>	32.7	NR
China	Su et al., 2012	Dentists	2010	95.4	97.6	99.7	99.2	96.1 <sup>a</sup>	68.1	NR
South Africa	Oosthuysen, 2003	Dentists	2001	55.0	83.5	88.4	NR	84.5	NR	NR
Italy	Veronesi et al., 2004	Dentists	2002	94.3	95.1	98.0	98.0	94.3	89.2	68.0
Turkey	Yüzbaşıoğlu et al., 2009	Dentists	2005	96.3	96.3	96.3	NR	46.7	NR	NR
USA	King and Muzzin, 2005	Hygienists	2005	68.9	93.2	99.0	NR	NR	NR	NR
UK	Shah et al., 2009	Dentists	2007-08	78.0	35.0	98.0	100	NR	52.0	98.0
Japan	Tada et al., 2015	Dental directors	2008	34.0	NR	71.5	NR	NR	65.4	NR
Japan	Tada et al., 2015	Dental directors	2011	37.5	NR	79.9	NR	NR	67.1	NR
Japan	Tada et al., 2014	Dentists	2009	37.0	97.7	79.8	NR	NR	67.1	NR
Germany	Mutters et al., 2014	Dentists	2014	86.2	100.0	100.0	91.4	NR	NR	36.2
New Zealand	Lamb et al., 2019	Dentists, specialists and ADPs	2016	94.7	91.5	99.7	NR	98.8	94.2	86.4

NR = Not recorded

<sup>a</sup> = reported that handpieces were autoclaved as opposed to owning an autoclave

ADPs = allied dental practitioners

(DCNZ) introduced the Standards Framework for Oral Health Practitioners (Dental Council of New Zealand, 2014a), which outlined mandatory standards intended to ensure safety and quality in dental care. The Control of Cross Infection in Dental Practice Code of Practice (2008) was revised in 2015 to place more emphasis on hand hygiene and use of personal protective equipment. The Spaulding classification system for the processing of re-usable instruments was also introduced (Dental Council of New Zealand, 2015a). However, adherence to this revised practice standard is unknown. Accordingly, this study aimed to investigate the self-reported adherence of New Zealand dentists and allied dental practitioners to the Draft Infection Prevention and Control Practice Standard.

## Methods

This study was approved by the University of Otago Ethics Committee. Data were collected between March and July 2016. Practitioners were randomly selected using the random sample selection function of the

Statistical Package for Social Sciences (SPSS) from the 2015-2016 Dental Register, obtained from the DCNZ. The 896 randomly-selected practitioners represented 20% of the source population for each practitioner type with a clinical role (general dental practitioners, dental specialists, hygienists, therapists, and clinical dental technicians). A small number (7) who did not have a clinical role or were not practising in New Zealand were considered ineligible and were excluded from the sample, leaving 889 eligible participants. A link to the online questionnaire (Qualtrics TM software) was emailed to each participant in March 2016. Participants who failed to respond within two weeks were sent a reminder email. Those who did not respond to the electronic survey were then sent a questionnaire with a cover letter and a reply-paid envelope.

## Questionnaire

The questionnaire sought information on the respondents' socio-demographic characteristics (specifically gender, age, ethnicity, year of primary dental

qualification, and practice location). The questionnaire was divided into three parts and sought information on practitioners' experience of medical emergencies (previously reported – Hong et al., 2017), use of new dental technologies (previously reported – Van Der Zande et al., 2018), and CIC practices. In the CIC section, information was sought on practitioners' use of personal protective equipment (gloves, mask and eyewear) and adherence to other CIC measures (offering eye-wear to patients and washing hands between patients). These five measures will be referred to hereafter as the five CIC measures. Respondents were asked to indicate the frequency with which they practised CIC measures (always, sometimes, and never). We also sought information on practitioners' methods of sterilising dental equipment and the number of CIC-related documents they had read. Of the five CIC-related documents, three were DCNZ-related CIC documents (Control of Cross Infection in Dental Practice Code of Practice 2008; Draft Infection Prevention and Control Practice Standard, 2015; Transmissible Major Viral Infections Practice Standard, 2015 and two were NZDA-related CIC documents (Infection Prevention and Control in Dental Practice, 2015 and Transmissible Major Viral Infections, 2014). Participants were also asked about their Hepatitis B virus (HBV) vaccination status, experience of dental sharp injuries, and their disinfection of laboratory work.

These questions were based on the Draft Infection Prevention and Control Practice Standard 2015 (the finalised version of the 2016 Infection Prevention and Control Practice Standard was not in effect when the questionnaire was circulated). The minor differences between the draft and finalised practice standard were in relation to the actions and behaviours that enable practitioners to meet the standards, not the actual standards of CIC that practitioners must meet.

Data were entered electronically and analysed using version 21 of SPSS. Cross-tabulations and Chi-square tests were used. The level of statistical significance was set at  $p < 0.05$ .

## Results

Responses were received from 353 of the 889 invited practitioners, of whom 332 answered the CIC questions, giving a response rate of 39.7%. Dentists represented

65.4% of respondents, while the remainder were allied dental practitioners. For analysis purposes, the respondent age was dichotomized to less than 50 years old and 50 years or older.

Table 2 summarises the adherence to CIC measures by practitioner type, age of practitioner and qualification of practitioner. No practitioners reported never wearing gloves, five (1.6%) reported never wearing masks, one (0.3%) never wore eye protection, two (0.6%) never washed their hands prior to and following patient contact and three (1.0%) reported never offering eyewear to patients. Adherence to all five CIC measures among females was greater (73.7%) than among males (62.4%). Among those who had read two or fewer of the CIC-related documents, proportionally fewer (59.6%) reported always adhering to the five CIC measures than those who had read more documents (73.8%).

Table 3 summarises the method of equipment sterilisation by practitioner type. Reusable impression trays ( $n=29$ , 16.4%) and amalgam carriers ( $n=19$ , 12.3%) were the most common equipment to be cold-sterilised by dentists. Endodontic hand files ( $n=46$ , 24.6%) and endodontic rotary files ( $n=42$ , 22.9%) were the pieces of equipment disposed of by the highest percentage of dentists.

Nearly all practitioners reported using an autoclave ( $n=328$ , 98.8%). A small proportion reported using chemiclaves ( $n=12$ , 3.6%) and dryclave/dry heat sterilisation ( $n=4$ , 1.2%). None reported using boiling water. Almost all ( $n=323$ , 98.5%) cleaned reusable instruments/equipment prior to sterilisation. Information on the frequency of autoclave validation was available for 291 respondents. About two in three ( $n=176$ , 60.5%) did it at least twice annually, 29.2% ( $n=85$ ) reported annual validation and the remaining 10.3% ( $n=30$ ) were not aware how frequently the validation was done for their autoclave.

Fewer than half of practitioners ( $n=150$ , 45.2%) had read all three DCNZ CIC-related documents. Of these, 18 (12%) had also read both NZDA CIC-related documents. About one in nine ( $n=38$ , 11.4%) reported they had not read any of the five documents. The three most read documents were the NZDA Infection Prevention and Control in Dental Practice document ( $n=254$ , 76.5%), the DCNZ Control of Cross Infection in

**Table 2** Adherence to cross infection control measures by practitioner type

Measure	All respondents N (%)	Dentists, N (%)	Allied Dental Practitioners, N (%)	Age > 50, N (%)	Age <= 50, N (%)	NZ graduates, N (%)	Overseas graduates, N (%)
Use regular/surgical soap to wash hands	280 (86.4)	174 (82.4)	106 (93.8)	142 (92.2)	135 (96.4)	243 (94.9)	34 (87.2)
Wear masks for patient examinations	291 (91.5)	190 (90.5)	101 (93.5)	144 (90.6)	145 (93.5)	251 (92.7)	37 (82.2)
Wear eye protection (oral health practitioner)	305 (94.7)	198 (93.8)	107 (96.4)	159 (97.5)	143 (92.3)	261 (94.9)	41 (93.2)
Wear eye protection (patient)	292 (93.3)	194 (92.8)	98 (94.2)	144 (91.1)	144 (95.4)	249 (93.6)	40 (90.9)
Wear gloves for patient examinations	326 (99.7)	213 (99.5)	113 (100.0)	166 (99.4)	156 (100.0)	278 (99.6)	45 (100.0)
All 5 measures	230 (69.3)	142 (65.4)	88 (75.9)	112 (65.8)	115 (72.3)	200 (70.2)	26 (57.8)



**Table 3** Method of equipment sterilisation by dentists, therapists and hygienists.

Dentist sterilisation method			
Equipment	Autoclave, N (%)	Cold sterilise, N (%)	Dispose, N (%)
Hand-pieces	209 (99.5)	1 (0.5)	0 (0.0)
Triplex syringe tip	181 (89.2)	3 (1.5)	19 (9.3)
Scaler tips	194 (99.5)	1 (0.5)	0 (0.0)
Reusable impression trays	128 (72.3)	29 (16.4)	20 (11.3)
Matrix holders	175 (92.1)	0 (0.0)	15 (7.9)
Amalgam carriers	132 (85.7)	19 (12.3)	3 (1.9)
Extraction forceps	203 (100.0)	0 (0.0)	0 (0.0)
Endodontic hand files	140 (74.9)	1 (0.5)	46 (24.6)
Endodontic rotary files	139 (75.5)	3 (1.6)	42 (22.9)
Therapist and Hygienist sterilisation method			
Equipment	Autoclave, N (%)	Cold sterilise, N (%)	Dispose, N (%)
Hand-pieces	104 (99.0)	1 (1.0)	0 (0.0)
Triplex syringe tip	98 (95.1)	0 (0.0)	5 (4.9)
Scaler tips	86 (97.8)	1 (1.1)	1 (1.1)
Matrix holders <sup>a</sup>	75 (98.7)	0 (0.0)	1 (1.3)
Amalgam carriers <sup>a</sup>	62 (98.4)	1 (1.6)	0 (0.0)
Extraction forceps <sup>a</sup>	76 (100.0)	0 (0.0)	0 (0.0)

<sup>a</sup> only therapists included in analysis

Dental Practice – Practice Standard (n=231 69.6%), and the DCNZ Draft Infection Prevention and Control Practice Standard (n=212, 63.9%).

Most (n=308, 94.2%) reported full immunity against HBV. Five (1.5%) had not been vaccinated against HBV and the remaining 4.3% were either unsure about their status or were part way through a vaccination programme. About one in seven (n=51, 15.4%) had received a dental sharp injury to themselves, 12.9% (n=43) reported that a dental assistant had received an injury, and 6.0% (n=20) reported injuries to both themselves and a dental assistant. One respondent reported ten injuries in the past year, and another two reported five injuries to their dental assistants in the past year.

A high proportion of respondents (n=178, 71.8%) reported always disinfecting impressions and models prior to sending them to a dental laboratory; 31 (12.5%) sometimes did, and 39 (15.7%) never did. Just over half of the respondents reported using a laboratory that always returned work already disinfected (n= 125, 50.2%). Of the remainder, 31 (12.5%) always disinfected work returned from the laboratory, 30 (12.0%) sometimes did, and 63 (25.3%) never did.

## Discussion

This study investigated cross-infection control practices in New Zealand dentistry and reports considerable improvements since the 1990s. However, there were still many practitioners who were not fully adhering to the Draft Infection Prevention and Control Practice Standard.

A couple of factors affect the generalisability of our findings. Firstly, the response rate of 39.7% was lower than that achieved in the earlier national study (Treasure and Treasure, 1994), but response rates in contemporary questionnaire-based surveys of health professionals do

tend to be lower than in the past (Funkhouser et al., 2017). This low response rate is possibly a contributing factor to no findings being statistically significant ( $p > 0.05$ ). The response rate may have been higher if an inducement was offered to participants. Comparison with DCNZ 2013-2015 Workforce data (Dental Council New Zealand, 2017) suggested an over-representation of New Zealand qualified dentists and dentists aged above 50 years of age within our sample. The use of a self-administered survey could have resulted in reporting and recall bias, but there are no other research methods that could be used in this study. Since the 1994 Treasure and Treasure study did not include allied dental practitioners, the comparisons between that national survey and the current study must be limited to the dentist respondents. Slight differences existed in the wording of some questions, but these were minor, and the findings are still comparable.

This finding that CIC behaviours in New Zealand have improved since the 1990s is consistent with international findings (Angelillo et al., 1994; Veronesi et al., 2004, Cheng et al., 2012a, Su et al., 2012). A previous systematic review reported that large improvements in personal protective equipment use were made internationally during the 1990s, a time when CIC received considerable mass media coverage (Gordon et al., 2001). More recent German, Turkish, and Chinese studies have reported that the majority (86.0%-100%) of respondents reported routinely wearing eyewear, gloves and mask (Mutter et al., 2014; Yüzbaşıoğlu et al., 2009; Su et al., 2012). However, personal protective equipment use differs among countries, and a recent study of Japanese dentists found that only 79.8% wore gloves and only 37.0% wore eyewear (Tada et al., 2014).

Greater improvements have occurred in the autoclaving of instruments; extraction forceps were



autoclaved by all respondents (13.6% did not always autoclave forceps in 1994); handpieces were autoclaved by almost all (99.5%) respondents (77.6% sometimes boiled, soaked or wiped handpieces in 1994). However, some practitioners still cold-sterilised semi-critical items such as reusable impression trays and amalgam carriers.

A quarter (28.2%) of practitioners reported they do not always disinfect impressions prior to sending them to the laboratory. Disinfection of laboratory work is important with respect to not only cross-infection control, but also impression accuracy, because repeated disinfections can affect the accuracy of an impression (Almortadi and Chadwick, 2010).

Handwashing, HBV vaccination status and dental sharps injuries were not reported in the 1994 New Zealand study but have been investigated internationally in a similar manner to the current study. Handwashing rates reported in the current study were higher than in Italy (Angelillo et al., 1994; Veronesi et al., 2004), the USA (Gershon et al., 1998), Canada (McCarthy et al., 1999a) and Germany (Mutters et al., 2014). The German study reported that a very low proportion of respondents carried out adequate hand disinfection frequently; 30% of dental assistants reported that they would always perform correct hand disinfection but in reality, only 7% were doing so (Mutters et al., 2014). Proportionally more New Zealand practitioners reported that they had been vaccinated against HBV than in other studies except for specialist participants in one Canadian study (McCarthy and MacDonald, 1998a). Reasons for respondents not receiving the vaccine were not explored in that study, but Su and colleagues found concerns over safety, inconvenience, unavailability and a lack of awareness of the seriousness of HBV to be factors (Su et al., 2012). The incidence rate of dental sharp

injuries reported in the literature varies widely. In 2012, Cheng and colleagues reported that 23.0% of dentists experience at least one needle stick injury per week (Cheng et al., 2012b), whereas a study by the US Centers for Disease Control and Prevention found that only 6.0% of dentists had received a percutaneous injury in the previous 12 months (Cleveland et al., 2012); this is lower than in the current study.

Our findings are consistent with previous reports that adherence to proper CIC protocols tends to be better among dental hygienists than dentists (Gerbert et al., 1988; Hastreiter et al., 1992), as well as among females (McCarthy and McDonald, 1998a; McCarthy et al., 1999a; Cheng et al., 2012a), among those aged under 50 (McCarthy and MacDonald, 1998a; Tada et al., 2014), and among those who have read CIC-relevant documents (McCarthy et al., 1999a; Cheng et al., 2012a; Tada et al., 2014).

## Conclusion

Most New Zealand practitioners adhere to CIC protocols, and major improvements have occurred since the early 1990s. However, a sizeable proportion of practitioners report not always following certain CIC protocols, and this may place patient and practitioner safety at risk. While our research did not 'test' practitioner knowledge, New Zealand practitioners have access to many CIC knowledge resources, including DCNZ and NZDA CIC-related documents. To maintain public safety and trust in the dental profession, it is important that practitioner CIC behaviours keep abreast of developments in CIC protocols by reading these documents which are readily available on the internet and by making them available for reading by staff in dental practices.

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