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By the book: Adherence of NZ Oral Health Practitioners to Health and Safety at Work Guidelines

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Abstract

Background: Workplace health and safety in New Zealand is regulated under the Health and Safety at Work Act 2015. However, little is known about how those regulations are applied within the dental workplace. This study aimed to investigate the health and safety behaviours of NZ oral health practitioners. ***Methods:*** An electronic questionnaire was distributed from June to July 2024 (Otago Human Ethics Committee approval 24/0135). A random sample of currently practising oral health professionals (n=791 valid) and students from the University of Otago oral health professional programmes were invited to participate. ***Results:*** Responses were received from 236 practitioners (29.8% participation) and 123 students (21.2%). Awareness of health and safety legislation among practitioners was relatively low, with only 41.2% having read two or more health and safety policies, and 35.3% being familiar with the Hierarchy of Controls model. However, uptake among those familiar with the model was high (88.4%). Recommendations to improve safety were mandatory continued professional development courses (54.4%) or increased training for undergraduate students (64.4%). More regulatory oversight was unpopular across all practitioner groups. ***Conclusion:*** Significant gaps persist in occupational health and safety practices among NZ oral health professionals. Practitioners show moderate support for mandatory CPD and further undergraduate training. Ongoing research is required to monitor incident statistics and to develop and evaluate strategies to improve health and safety in the dental workplace.

Background

Worldwide, occupational hazards represent a major public health burden (Takala *et al.*, 2024; Teufer *et al.*, 2019). A considerable proportion of workplace incidents occur among healthcare professionals (Aljabri *et al.*, 2020; Almost *et al.*, 2018; Free *et al.*, 2020; Heier *et al.*, 2021) who operate in high-stress environments with repetitive tasks and daily exposure to sharp instruments, saliva, and blood. In 2021, the New Zealand (NZ) healthcare and social assistance sector accounted for 10.8% of work-related injuries resulting in more than one week away from work–third behind only construction and manufacturing (Stats NZ, 2023). Failure to adequately manage these risks may result in preventable harm to practitioners and their patients, as well as carrying legal and professional consequences for those responsible.

Between 2015-2016, NZ introduced two key legislative reforms promoting a systematic, preventative approach to risk-management: the Health and Safety at Work Act 2015 (HSWA, 2015), and the Health and Safety at Work Regulations 2016 (HSWR, 2016). Under the HSWA, all oral health practitioners are classified as Persons Conducting a Business or Undertaking (PCBU) and are legally required to identify, eliminate, or–if not practicable–minimise workplace risks. The HSWR further stipulates that workers must receive adequate health and safety information, training, or supervision. These legal obligations align with professional standards outlined in the Health Practitioners Competence Assurance Act 2003 (HPCAA, 2003) and the Dental Council of New Zealand Standards Framework (DCNZ, 2024).

WorkSafe advocates a plan-do-check-act framework for workplace hazard management. The “plan” phase involves identifying hazards and prioritising them according to their likelihood of occurrence and the severity of the potential outcome. Maintaining a hazard register is recommended to help keep track. In the “do” phase, effective control measures must be implemented. The Hierarchy of Controls (HoC) model ranks interventions from most to least effective: elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE). PPE is considered a last resort because it depends on a steady supply and appropriate use (Sehgal & Milton, 2021). The “check” phase concerns providing appropriate means for workers to report health or safety concerns or incidents (incident reporting systems). Finally, the “act” phase involves regular reviews of control measures, investigating incidents or near misses, and updating protocols as needed to ensure continuous improvement (WorkSafe, 2017).

Workplace safety depends on both individual responsibility and management’s commitment to enabling safe practices (Tamene *et al.*, 2022). Unsafe behaviours often stem from system-level failures such as inadequate training, unclear procedures, weak safety culture, and insufficient safety measures (Attwood *et al.*, 2006; Kwon, 2006; Hughes & Kornowa-Weichel, 2004; Rundmo, 1996). Implementation of safety management systems (SMSs) has been shown to improve employee attitudes, reduce accidents, and strengthen core processes like hazard identification and training (Bottani *et al.*, 2009). Companies with SMSs report fewer incidents

and benefit from higher productivity, lower staff turnover, and improved financial outcomes (Fernández-Muñiz *et al.*, 2009; Lamm *et al.*, 2020; Lari, 2024). In healthcare settings, use of safety systems is associated with enhanced patient care (Aljabri *et al.*, 2020; Chalak *et al.*, 2022), while neglect of workplace health and safety is associated with adverse patient outcomes (Kapinos *et al.*, 2012).

Despite these systems being embedded in NZ law for nearly a decade, their uptake in oral healthcare settings remains under-explored. While national data suggest health and safety attitudes across NZ workplaces are improving (WorkSafe, 2018), little is known about how oral health practitioners engage with risk management tools. Most existing research focuses on specific risks—such as needlestick injuries (Siddiqi *et al.*, 2017), stress (Ayers *et al.*, 2008), or infection control (Lamb *et al.*, 2019)—rather than compliance with workplace safety legislation. Moreover, studies have largely focused on the experiences of dentists, overlooking students, technicians, and allied practitioners (oral health therapists, dental therapists, dental hygienists, and orthodontic auxiliaries).

This study aims to address these gaps by examining the adherence of NZ oral health practitioners to WorkSafe guidelines. It evaluates engagement with key safety mechanisms–including hazard registers, incident reporting, safety inductions, and training–and explores awareness and implementation of the HoC model. In doing so, it aims to identify strengths and weaknesses in current practices and inform strategies to improve workplace safety culture across the oral health workforce.

Methods

The Dental Council of New Zealand (DCNZ) register for 2024 listed 5,999 entries (including multiple entries for practitioners with more than one scope of practice). Of these, 3,899 practitioners consented to share their contact details for purposes of oral health research during the most recent recertification cycle. After removing duplicate entries and those without a current Annual Practising Certificate, a sampling frame was established. Based on a workforce population of n = 5000, a minimum sample size of 235 participants was required to achieve a confidence level of 95%, margin of error of 5%, and an expected population proportion of 80% on the main outcome (compliance with workplace health and safety requirements). Knowing that recent workforce surveys achieved around 30% participation, a simple random sample of 800 oral health practitioners was drawn using the "sample" function in Stata SE 18.5 (StataCorp, 2023). All students (n=580) enrolled in the three undergraduate programmes at the Faculty of Dentistry University of Otago (Bachelor of Dental Surgery, Bachelor of Oral Health, Bachelor of Dental Technology) were invited to participate. Māori consultation was conducted, and ethical approval was obtained from the University of Otago Ethics Committee following review by the Sir John Walsh Research Institute (ref. 24/0135).

A cross-sectional study design was employed using a web-based questionnaire newly developed on Qualtrics (Qualtrics, 2020). The questionnaire sought information on participant demographics, experiences of workplace hazards, knowledge of health and safety regulations in NZ, and suggestions to improve workplace safety. Face validity of the questionnaire was evaluated by 10 dental practitioners and minor revisions to the questionnaire were made in response to their evaluation.

Data collection began in early June 2024. A link to the online questionnaire was distributed via email to the 800 randomly selected practitioners. Of these, nine emails bounced, leaving 791 potential participants. A separate anonymous link was sent to all undergraduate students at the Faculty of Dentistry University of Otago. An information sheet was provided on the first page of the questionnaire, and informed consent was implied by proceeding. Both practitioners and students were offered an incentive to participate in the form of a chance to win one of two NZD 100 vouchers via random selection. Data collection closed in early August 2024.

Resulting data points were exported from Qualtrics into SPSS, then imported into Stata for analysis. Variables were renamed and labelled for ease of management. String variables were converted to numeric codes (e.g., "no" = 0, "yes" = 1). Each response was assigned a unique ID, and identifying information (IP addresses, names, emails) was removed to ensure anonymity of participants. Chi squared and Fisher Exact tests were used to assess statistical significance, where appropriate.

Results

Of the 791 practitioners invited to participate, 236 responded (29.8% response rate), with 161 completing the questionnaire in full (68.2% completion rate). Among these respondents, 64.0% were dentists (n=151), 31.8% allied practitioners (n=75), and 2.8% dental technicians (n=10). An additional 123 responses were received from a student cohort of 580 (21.2% response rate), of which 69 were completed (56.1% completion rate). In total, 359 responses were collected: 42.1% dentists, 34.3% students, 20.8% allied practitioners, and 2.8% technicians.

Representativeness of respondents was evaluated by comparing demographic characteristics with the 2020-2022 DCNZ Workforce Analysis (DCNZ, 2022; Table 1). Notable differences were observed in the sex and country of qualification of dentists, and the age distribution of allied practitioners. While the NZ oral health workforce will have evolved since 2022, results of this study should be interpreted with caution when generalising to the broader practitioner population.

Table 2 shows the number of health and safety policies read by participants, broken down by sex, age, and practitioner type. Most respondents (78.5%) had read at least one policy. A higher proportion of female participants (44.7%) reported reading two or more policies compared to males (38.3%); however, this difference was not statistically significant. In contrast, there was a significant association between age and policy readership (p=0.005), with the proportion of participants reading two or more policies increasing steadily from 31.6% (<30 years) to 52.6% (45+ years).

Practitioner type was also significantly associated with the number of policies read (p=0.007). Allied practitioners had the highest proportion who reported reading two or more policies (52.0%), followed by dentists (46.4%), and

Table 1. Comparison between most recent DCNZ Workforce Analysis (2020-2022) and the study sample

	Dentists, N (%)		Allied, N (%)		Technicians, N (%)	
	DCNZ	Study	DCNZ	Study	DCNZ	Study
TOTAL	2678 (59.4)	151 (64.0)	1496 (33.2)	75 (31.8)	336 (07.5)	10 (02.8)
Sex						
Male	1450 (54.1)	68 (45.0)	92 (06.2)	3 (04.0)	227 (67.6)	7 (70.0)
Female	1228 (45.9)	83 (55.0)	1404 (93.8)	72 (96.0)	109 (32.4)	3 (30.0)
Age						
<30 years	446 (16.7)	30 (20.0)	379 (25.3)	19 (25.5)	46 (13.7)	
30-49 years	1201 (44.9)	73 (48.2)	644 (42.7)	21 (27.7)	155 (46.1)	4 (40.0)
50+ years	1031 (38.4)	48 (31.8)	473 (32.0)	35 (46.8)	135 (40.2)	6 (60.0)
Country						
NZ	2193 (67.0)[a]	119 (78.8)	1305 (87.2)	62 (82.7)	286 (85.0)	8 (80.0)
Overseas	1081 (33.0)[a]	32 (21.2)	191 (12.8)	13 (17.3)	50 (15.0)	2 (20.0)

[a] Note that the total number of dentists by country of qualifications in Table 1-10 of the DCNZ Workforce Report does not sum to 2678.

students (26.9%). Technicians showed a relatively balanced distribution across all categories but represented a small sample size.

Of the 247 participants who responded to the question, the majority (64.8%) were unfamiliar with the HoC model (Table 3). Among those who were familiar (n=87), most (88.5%) implemented it in their practice. No significant differences were observed between male and female respondents. Familiarity and implementation were lowest among practitioners aged 30-44 years, and highest among those aged 45 years and older. However, older practitioners were also most likely to be familiar with the model and yet not implement it (6.6%).

Students ranked first (39.2%) in awareness of the HoC model, and second in implementation (35.4%) only behind allied practitioners (36.7%). Dentists and technicians reported considerably lower implementation rates (27.3% and 20.0% respectively), although this difference was not

Table 2. Number of health and safety policies read

	0 policies read, N (%)	1 policy read, N (%)	2+ policies read, N (%)
TOTAL	54 (21.6)	93 (37.3)	103 (41.2)
Sex			
Male	22 (27.2)	28 (34.6)	31 (38.3)
Female	29 (18.2)	59 (37.1)	71 (44.7)
Age			
<30 years	31 (31.6)	36 (36.7)	31 (31.6)
30-44 years	10 (17.2)	20 (34.5)	28 (48.3)
45+ years	8 (10.3)	29 (37.2)	41 (52.6)
Practitioner type			
Dentists	23 (20.5)	37 (33.0)	52 (46.4)
Allied	3 (06.0)	21 (42.0)	26 (52.0)
Technicians	1 (20.0)	2 (40.0)	2 (40.0)
Students	26 (33.3)	31 (39.7)	21 (26.9)

Table 3. Familiarity with and implementation of the HoC model

	Unfamiliar, N (%)	Familiar + no use, N (%)	Familiar + use, N (%)
TOTAL	160 (64.8)	10 (04.1)	77 (31.2)
Sex			
Male	48 (61.5)	5 (06.4)	25 (32.1)
Female	108 (67.9)	4 (02.5)	47 (29.6)
Age			
<30 years	66 (67.4)	2 (02.0)	30 (30.6)
30-44 years	41 (70.7)	2 (03.5)	15 (25.9)
45+ years	44 (57.9)	5 (06.6)	27 (35.5)
Practitioner type			
Dentists	74 (67.3)	6 (05.5)	30 (27.3)
Allied	30 (61.2)	1 (02.0)	18 (36.7)
Technicians	4 (80.0)		1 (20.0)
Students	48 (60.1)	3 (03.8)	28 (35.4)
Policies read			
0	42 (84.0)	1 (02.0)	7 (14.0)
1	62 (67.4)	5 (05.4)	25 (27.2)
2+	54 (52.4)	4 (03.9)	45 (43.7)

statistically significant. Technicians also demonstrated the highest level of unfamiliarity with the HoC model (80.0%), though the small sample size limits meaningful comparison.

Familiarity with the HoC model was lower among those who reported reading fewer health and safety policies. Conversely, reading a greater number of policies was significantly associated (p=0.002) with higher implementation. Despite this, more than half of practitioners (52.4%) who had read more than two policies remained unfamiliar with the model.

Figure 1 represents responses to the following questions regarding the use of hazard registers: (1) "My workplace keeps a hazard register", (2) "My workplace has discussed our hazard register with me", (3) "I know where the hazard register is kept", (4) "I know how to use the hazard register", and (5) "I feel safe to report hazards".

Most respondents (79.6%) reported that their workplace maintained a hazard register (HR). However, far fewer actively engaged with it: 57.0% had discussed the HR, 48.7% knew how to locate it, and 48.4% indicated they were able to use it. Four in every five respondents (80.3%) reported feeling safe to report hazards in their workplace.

Responses were comparable between sexes across most domains. Practitioners aged 45 years or older reported significantly higher scores across all measures compared to younger age groups, including awareness of keeping an HR (p=0.002), discussion of the HR (p=0.001), knowledge of its location (p<0.001), ability to use it (p<0.001), and feeling safe to report hazards (p=0.002).

In respect to practitioner type, allied practitioners consistently reported the highest levels of engagement with HRs across most domains. In contrast, students showed the lowest rate of engagement (excluding technicians due to limited sample size), particularly regarding knowledge of the location of the register (25.3%) and confidence in using it (23.0%). Proportionally, dentists felt most safe to report hazards (87.1%) followed by allied practitioners (84.2%) and students (66.7%). Practitioner type was significantly associated with all items: awareness (p<0.001), discussion (p=0.029), knowledge of location (p<0.001), ability to use (p<0.001), and feeling safe to report hazards (p=0.001).

Familiarity and implementation of the HoC model was positively associated with greater engagement with HRs. Those who reported using the HoC model were significantly more likely to report that their practice kept an HR (p=0.002), that it had been discussed with them (p=0.015), that they knew its location (p<0.001), that they were able to use it (p=0.005), and that they felt safe reporting hazards (p=0.015).

A free-text response option ("I have other thoughts about our hazard register") yielded 30 responses. Most reported using an internal reporting system for hazards (either online or via a manager) but expressed being unaware of a formal HR. A few questioned the value of maintaining a HR. Statements to this effect included "I feel it is just another pile of overly complicated and unnecessary documentation" and "much of it is virtue signalling, recording for recording's sake".

Responses to the following prompts about incident reporting are shown in Figure 2: (1) "My workplace has an incident reporting system", (2) "I know how to use/access the incident reporting system", (3) "I feel safe to report incidents", (4) "My workplace incident reporting system records near misses", and (5) "Incidents which do occur are investigated to identify cause and limit reoccurrence".

Almost all practitioners (89.3%) were aware of having an incident reporting (IR) system in their workplace, and a similar proportion (86.8%) felt safe to report incidents. However, 66.4% reported being able to use or access their IR system, 60.4% claimed to investigate incidents, and only 36.8% reported recording near misses.

Females were proportionally more likely to record near misses (40.3%) than males (29.4%) and significantly more likely to report having an IR system in their workplace (p=0.001). However, by proportion males were slightly

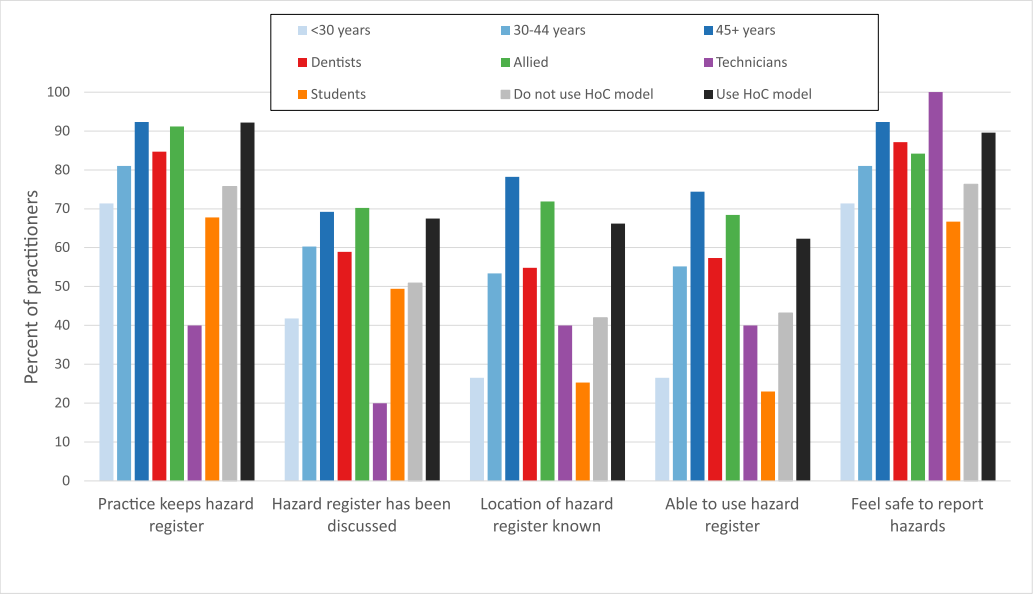

Figure 1. Responses to prompts regarding the use of hazard registers: (1) "My workplace keeps a hazard register", (2) "My workplace has discussed our hazard register with me", (3) "I know where the hazard register is kept", (4) "I know how to use the hazard register", and (5) "I feel safe to report hazards".

more likely to investigate incidents which occurred (65.9%) compared to females (59.1%).

Older practitioners (aged 45 or more years) scored highest across all domains. Practitioner under the age of 30 scored lowest except in presence of an IR system where they were 5.3% higher than the 30-44 years age group. Significant differences were seen in age with regards to ability to use/access the register (p=0.010), reporting of near misses (p=0.022), and investigation of incidents (p<0.001).

Allied practitioners were most likely to report having an IR system (96.5%), being able to use/access the system (75.4%), and recording of near misses (56.1%). Dentists felt safest reporting incidents (91.2%) and had the highest rate of investigating incidents (75.2%). Disregarding technicians (due to low sample size), students reported the lowest rates across the board, particularly in being able to use/access the IR system (52.9%), recording near misses (24.1%), and investigating incidents (37.9%). Significant differences across practitioner type were seen for awareness of having the IR system (p=0.001), use/access of the system (p=0.004), reporting of near misses (p=0.002), and investigative behaviours (p<0.001).

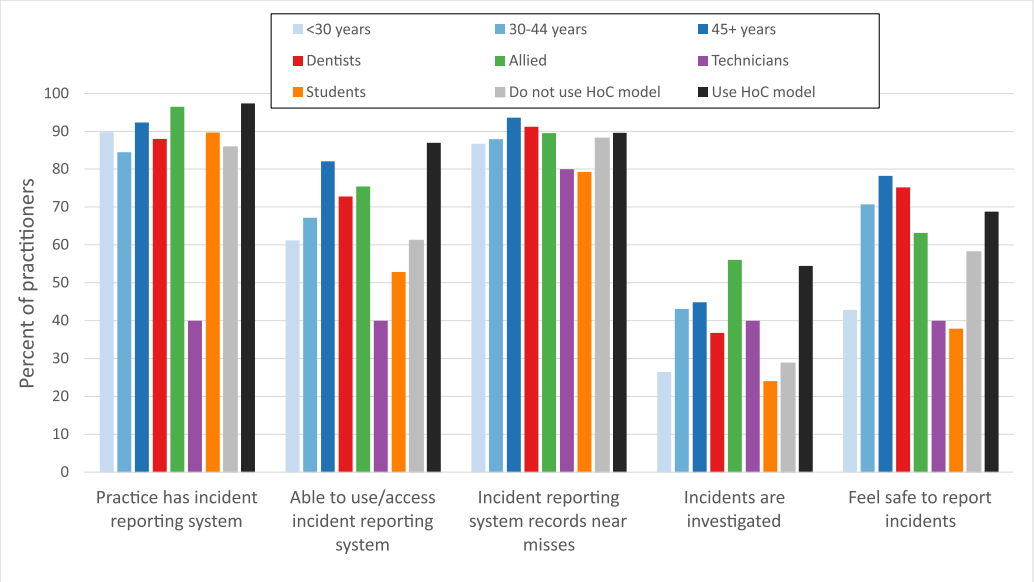

Figure 2. Responses to prompts about incident reporting: (1) “My workplace has an incident reporting system”, (2) “I know how to use/access the incident reporting system”, (3) “I feel safe to report incidents”, (4) “My workplace incident reporting system records near misses”, and (5) “Incidents which do occur are investigated to identify cause and limit reoccurrence”.

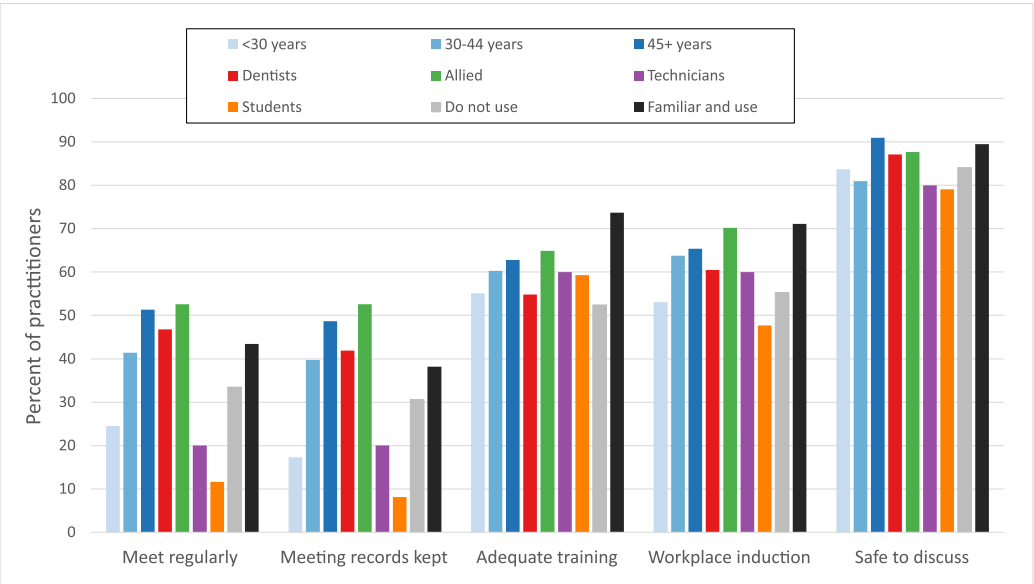

Figure 3. Responses to statements about health and safety culture in the workplace. Statements were: (1) “We hold regular health and safety meetings”, (2) “Our health and safety meetings are recorded manually”, (3) “I feel that I have received adequate health and safety training from my employer”, (4) “We have a first day workplace induction in health and safety for new employees”, and (5) “I feel safe to discuss health and safety concerns I may have”.

Practitioners who implemented the HoC model scored higher across all five categories than those who did not. Significant differences were observed in awareness (p=0.006), use/access (p<0.001), and recording of near misses (p<0.001).

Figure 3 shows responses to statements about health and safety culture in the workplace. Statements were: (1) "We hold regular health and safety meetings", (2) "Our health and safety meetings are recorded manually", (3) "I feel that I have received adequate health and safety training from my employer", (4) "We have a first day workplace induction in health and safety for new employees", and (5) "I feel safe to discuss health and safety concerns I may have".

Few practitioners reported holding regular meetings (36.0%) or recording them manually (32.7%). Just over half felt that they had received adequate training (58.3%) or a first-day health and safety induction (57.9%). However, most practitioners felt safe discussing health and safety concerns in their workplace (84.5%).

Results were relatively similar between sexes. A positive association was seen with increased age: practitioners aged 45 years or more scored highest, while those below 30 years scored lowest in almost all domains (except safety to discuss, where the 30-44 years age group scored 2.7% lower). Older age was significantly associated with holding regular meetings (p=0.001) and recording them (p<0.001).

Allied practitioners reported the highest rates across all domains, closely followed by dentists. Students were significantly less likely to report having meetings (p<0.001) or recording them (p<0.001). Students also reported lower rates of first-day inductions (47.7%) and feeling safe to discuss health and safety concerns (79.1%).

Use of the HoC model was positively associated with all categories. This was statistically significant in the case of receiving adequate training (p=0.002) and having a first day workplace induction (p=0.020).

Table 4 presents practitioner attitudes towards interventions to improve workplace health and safety. Support for increased regulatory oversight was low, whether from WorkSafe (16.7%) or the DCNZ (23.0%). Also unpopular were voluntary continuing professional development (CPD) (34.7%) and support from external organisations (35.6%). Mandatory CPD was supported by just over half of practitioners (54.4%), while undergraduate training was most endorsed (64.4%).

Males were significantly more likely to favour voluntary CPD (p=0.018) but were less supportive of WorkSafe oversight (p=0.002) relative to females. Younger practitioners (under 30 years) were most supportive of further undergraduate training (73.2%), and mandatory CPD (57.7%), while the 30-44 age group was most in favour of voluntary CPD (41.4%) and external support (44.8%). The only significant age-related difference was in support for further undergraduate training (p=0.043).

By practitioner type, dentists were most supportive of voluntary CPD (42.1%) and external support (43.9%), but least supportive of further oversight. Allied practitioners favoured mandatory CPD (69.4%), and students showed greatest support for undergraduate training (81.1%). Practitioners using the HoC model were significantly more likely to support undergraduate training (p=0.018).

In the free-text response to the question "How do you think the dental workplace can be made safer?" (n=24), six practitioners felt the dental workplace is "already

Table 4. Practitioner attitudes towards interventions to improve workplace health and safety

	Training during undergrad, N (%)	Voluntary CPD courses, N (%)	Mandatory CPD courses, N (%)	More oversight from WorkSafe, N (%)	More oversight from DCNZ, N (%)	More support from organisations, N (%)
TOTAL	154 (64.4)	83 (34.7)	130 (54.4)	40 (16.7)	55 (23.0)	85 (35.6)
Sex						
Male	50 (65.8)	34 (44.7)	36 (47.4)	4 (05.3)	14 (18.4)	29 (38.2)
Female	100 (63.3)	46 (29.1)	92 (58.2)	33 (20.9)	39 (24.7)	55 (34.8)
Age						
<30 years	71 (73.2)	27 (27.8)	56 (57.7)	18 (18.6)	29 (29.9)	29 (29.9)
30-44 years	32 (55.2)	24 (41.4)	31 (53.4)	9 (15.5)	12 (20.7)	26 (44.8)
45+ years	45 (59.2)	28 (36.8)	40 (52.6)	10 (13.2)	11 (14.5)	29 (38.2)
Practitioner type						
Dentists	64 (59.8)	45 (42.1)	50 (46.7)	8 (07.5)	15 (14.0)	47 (43.9)
Allied	28 (57.1)	12 (24.5)	34 (69.4)	14 (28.6)	16 (32.7)	17 (34.7)
Technicians	2 (40.0)	2 (40.0)	1 (20.0)			2 (40.0)
Students	60 (81.1)	21 (28.4)	41 (55.4)	16 (21.6)	22 (29.7)	18 (24.3)
Policies read						
0	35 (70.0)	13 (26.0)	29 (58.0)	5 (10.0)	10 (20.0)	12 (24.0)
1	49 (57.0)	32 (37.2)	40 (46.5)	16 (18.6)	24 (27.9)	33 (38.4)
2+	70 (68.0)	38 (36.9)	61 (59.2)	19 (18.4)	21 (20.4)	40 (38.8)
HoC model						
Do not use	98 (59.4)	60 (36.4)	91 (55.2)	27 (16.4)	38 (23.0)	56 (33.9)
Familiar and use	55 (75.3)	23 (31.5)	39 (53.4)	13 (17.8)	17 (23.3)	29 (39.7)

very safe" or emphasised individual caution. Others felt practice-specific protocols and training were most important. A final group cited the importance of establishing a health and safety culture, with regular meetings to discuss hazard management. Suggestions also included greater involvement of auxiliary staff (assistants), lectures at conferences, expanded support from the NZDA, and interdisciplinary training alongside associated clinicians such as physiotherapists.

Discussion

Most respondents (78.5%) reported reading at least one health-and-safety-related policy. While encouraging, this also means over one in five NZ oral health practitioners have never engaged with any practice-level or national workplace safety guidelines. Policy readership was positively associated with age (p=0.005). Older practitioners also demonstrated more consistent engagement with safety behaviours, including use of hazard registers, incident reporting, and creation of a workplace safety culture. This may reflect greater risk awareness, an increased sense of responsibility in senior roles, or a deeper appreciation of safety practices developed through clinical experience.

In contrast, younger practitioners–particularly students–reported lower familiarity with safety protocols and less confidence in reporting hazards. While this may reflect worries about academic or professional consequences, it raises questions about their preparedness for early clinical practice. Given the importance of formative training in shaping long-term professional behaviours, targeted educational support systems are likely to be important. Scenario-based learning and mentoring could be key to fostering lasting safety compliance.

Equally important for young practitioners is entering workplaces with already established health and safety systems. However, just 57.9% of respondents reported receiving a structured health and safety induction, and only 58.3% felt they had received adequate training. Employee perceptions of workplace safety are known to influence their adoption of safe work practices (Gershon *et al.*, 2000), and occupational safety is increasingly understood to be a critical component of advancing patient safety (Hesgrove *et al.*, 2024).

Despite this, awareness of the HoC model remains limited–64.8% of practitioners are still unfamiliar with it a decade after its introduction in NZ legislation. Given its recognised importance in workplace health and safety management (Ajslev *et al.*, 2022; Dosman *et al.*, 2015; Sehgal & Milton, 2021), this gap is concerning. Among those who were aware of the HoC, 88.5% report implementing it in their practice, suggesting it is both practical and well-suited to oral healthcare settings. Moreover, its implementation was significantly associated with better health and safety behaviour, including the use of hazard registers, reporting of near-miss incidents, safety inductions, and adequate training. These findings support the model's relevance in strengthening organisational safety practices.

Participants showed a clear preference for educational approaches to improving health and safety engagement. Support was highest for further undergraduate training (64.4%) and mandatory CPD (54.4%), while stricter regulatory oversight was unpopular. Free-text responses reinforced this view, emphasising the importance of safety culture, regular meetings, lectures, and interdisciplinary collaboration rather than top-down enforcement. These findings suggest that a sustainable improvement in workplace safety is more likely to be achieved through culture-building and education rather than regulatory pressure.

This study identifies two key areas for improvement: (1) circulation of health and safety resources, and (2) health and safety education and training.

1. **Resources:** Although relevant documents and policies are available, practitioner engagement remains limited. Over 20.0% of practitioners had not read any health and safety policies, and 37.2% had read only one. Enhancing visibility and offering resources in diverse, accessible formats (such as short videos or infographics) may improve uptake and cater to different learning preferences. Multimedia learning has been shown to boost comprehension and retention (Palmer *et al.*, 2012), a finding which has been validated in healthcare settings (Fontaine *et al.*, 2019; McCall *et al.*, 2018).
2. **Education:** Resources alone are insufficient without effective training. Interactive learning methods – while more time-consuming and expensive–are associated with greater knowledge retention, leading to reductions in workplace accidents, illnesses, and injuries (Burke *et al.*, 2006). Redesigning curricula to include engaging case-based scenarios may strengthen safety outcomes.

To our knowledge, this study is one of the first to examine workplace health and safety attitudes across all oral health practitioner types in the NZ context – a shift away from the dentist/student experiences traditionally seen in the literature. Use of validated survey methods, pilot testing, random sampling, and anonymisation of responses helped limit introduction of bias. Our focus on the legal framework for workplace health and safety as well as practitioner attitudes has helped to identify gaps in implementation and offers actionable insights for education providers, policymakers, and regulatory bodies.

A major limitation of this study was the low response rate (29.8%), well below the average online survey response rate (44-46%) (Meyer *et al.*, 2022; Wu *et al.*, 2022) and the recommended 67.0% (Wilson *et al.*, 2024). While questionnaire response rates are generally low (and trending downwards) among health professionals (Funkhouser *et al.*, 2017), future studies may be able to increase participation by pre-contacting potential participants and using phone (rather than email) reminders (Wu *et al.*, 2022). Low response rates led to small samples when data were stratified, particularly for dental technicians (n=10). Such small samples limit meaningful analysis.

While efforts were made to minimise bias, questions reliant on self-reporting of past behaviours are inherently prone to recall bias, and the questionnaire length likely contributed to non-response bias.

Future research should adopt qualitative approaches to explore the underlying attitudes and contextual factors shaping health and safety behaviours in the dental workplace. Dental technicians warrant particular attention given their distinct hazard exposures. Further studies should gauge

support for a revised health and safety curriculum and evaluate the impact of multimedia tools–such as videos, infographics, or interactive modules–on policy engagement and knowledge retention. Longitudinal research is also needed to track changes in attitudes over time, especially in response to new workplace policies or educational interventions.

Conclusion

Most practitioners report feeling safe to report safety concerns. However, significant gaps remain – particularly concerning awareness of the HoC model, engagement with hazard registers, incident reporting behaviour, frequency of safety meetings, and workplace induction and training. Based on the findings of this study, we recommend providing access to diversified resources and creating a more interactive undergraduate health and safety curriculum. Further research is required to identify the most effective approaches for implementing and sustaining these approaches across the profession.

Author contributions

Conception and design of the study – DC, JB, KM, JU
Data collection – DC
Data analysis and interpretation – DC, JB, KM
Drafting the article – DC
Critical revision of the article – all authors
Final approval of the version to be published – all authors

Conflict of interest

The authors report no conflicts of interest.

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References

Ajslev JZN, Møller JL, Andersen MF, Pirzadeh P, & Lingard H. (2022). The Hierarchy of Controls as an Approach to Visualize the Impact of Occupational Safety and Health Coordination. *International Journal of Environmental Research and Public Health*, 19(5), 2731. https://doi.org/10.3390/ijerph19052731

Aljabri D, Vaughn A, Austin M, White L, Li Z, Naessens J, & Spaulding A. (2020). An Investigation of Healthcare Worker Perception of Their Workplace Safety and Incidence of Injury. *Workplace Health & Safety*, 68(5), 214–225. https://doi.org/10.1177/2165079919883293

Almost JM, VanDenKerkhof EG, Strahlendorf P, Tett LC, Noonan J, Hayes T, Hulle HV, Adam R, Holden J, Kent-Hillis T, McDonald M, Paré GC, Lachhar K, & Silva VS. (2018). A Study of Leading Indicators for Occupational Health and Safety Management Systems in Healthcare. *BMC Health Services Research*, 18. https://doi.org/10.1186/s12913-018-3103-0

Attwood D, Khan F, & Veitch B. (2006). Occupational accident models—Where have we been and where are we going? *Journal of Loss Prevention in the Process Industries*, 19(6), 664–682. https://doi.org/10.1016/j.jlp.2006.02.001

Ayers KMS, Thomson WM, Newton JT, & Rich AM. (2008). Job Stressors of New Zealand Dentists and Their Coping Strategies. *Occupational Medicine*, 58(4), 275– 281. https://doi.org/10.1093/occmed/kqn014

Bottani E, Monica L, & Vignali G. (2009). Safety management systems: Performance differences between adopters and non-adopters. *Safety Science*, 47(2), 155–162. https://doi.org/10.1016/j.ssci.2008.05.001

Burke MJ, Sarpy SA, Smith-Crowe K, Chan-Seraein S, Salvador RO, & Islam G. (2006). Relative Effectiveness of Worker Safety and Health Training Methods. *American Journal of Public Health*, 96(2), 315–324. https://doi.org/10.2105/AJPH.2004.059840

Chalak MH, Kahani A, Bahramiazar G, Marashi Z, Popov TI, Dadipoor S, & Ahmadi O. (2022). Development and application of a fuzzy occupational health risk assessment model in the healthcare industry. *La Medicina Del Lavoro*, 113(4), e2022035. https://doi.org/10.23749/mdl.v113i4.12800

Dental Council New Zealand. (2022). Workforce Analysis 2020—2022.

Dosman J, Hagel L, King N, Koehncke N, Kirychuk S, Trask C, Neudorf J, Day L, Voaklander D, & Pickett W. (2015). The Hierarchy of Control in the Epidemic of Farm Injury. *Journal of Agromedicine*, 20(3), 360–369. https://doi.org/10.1080/1059924X.2015.1048401

Fernández-Muñiz B, Montes-Peón JM, & Vázquez-Ordás CJ. (2009). Relation between occupational safety management and firm performance. *Safety Science*, 47(7), 980–991. https://doi.org/10.1016/j.ssci.2008.10.022

Fontaine G, Cossette S, Maheu-Cadotte MA, Mailhot T, Deschênes MF, Mathieu-Dupuis G, Côté J, Gagnon MP, & Dubé V. (2019). Efficacy of adaptive e-learning for health professionals and students: A systematic review and meta- analysis. *BMJ Open*, 9(8), e025252. https://doi.org/10.1136/bmjopen-2018- 025252

Free H, Groenewold MR, & Luckhaupt SE. (2020). Lifetime Prevalence of Self- Reported Work-Related Health Problems Among U.S. Workers—United States, 2018. *Morbidity and Mortality Weekly Report*, 69(13), 361–365. https://doi.org/10.15585/mmwr.mm6913a1

Funkhouser E, Vellala K, Baltuck C, Cacciato R, Durand E, McEdward D, Sowell E, Theisen SE, & Gilbert GH. (2017). Survey Methods to Optimize Response Rate in the National Dental Practice–Based Research Network. *Evaluation & the Health Professions*, 40(3), 332–358. https://doi.org/10.1177/0163278715625738

Gershon RRM, Karkashian CD, Grosch JW, Murphy LR, Escamilla-Cejudo A, Flanagan PA, Bernacki E, Kasting C, & Martin L. (2000). Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *American Journal of Infection Control*, 28(3), 211–221. https://doi.org/10.1067/mic.2000.105288

Health and Safety at Work Act. (2015). https://www.legislation.govt.nz/act/public/2015/0070/latest/DLM5976660.ht ml

Health and Safety at Work Regulations. (2016). https://www.legislation.govt.nz/regulation/public/2016/0013/latest/DLM6727 530.html

Health Practitioners Competence Assurance Act. (2003). https://www.legislation.govt.nz/act/public/2003/0048/latest/whole.html#DLM203319

Heier L, Gambashidze N, Hammerschmidt J, Riouchi D, Weigl M, Neal A, Icks A, Brossart P, Geiser F, & Ernstmann N. (2021). Safety Performance of Healthcare Professionals: Validation and Use of the Adapted Workplace Health and Safety Instrument. *International Journal of Environmental Research and Public Health*, 18(15), 7816. https://doi.org/10.3390/ijerph18157816

Hesgrove B, Zebrak K, Yount N, Sorra J, & Ginsberg C. (2024). Associations between patient safety culture and workplace safety culture in hospital settings. *BMC Health Services Research*, 24, 568. https://doi.org/10.1186/s12913-024-10984-3

Hughes G, & Kornowa-Weichel M. (2004). Whose fault is it anyway?: A practical illustration of human factors in process safety. *Journal of Hazardous Materials*, 115(1), 127–132. https://doi.org/10.1016/j.jhazmat.2004.06.005

Kapinos KA, Fitzgerald P, Greer N, Rutks I, & Wilt TJ. (2012). Introduction In The Effect of Working Conditions on Patient Care: A Systematic Review [Internet]. *Department of Veterans Affairs (US)*. https://www.ncbi.nlm.nih.gov/books/NBK114447/

Kwon H. (2006). The effectiveness of process safety management (PSM) regulation for chemical industry in Korea. *Journal of Loss Prevention in the Process Industries*, 19(1), 13–16. https://doi.org/10.1016/j.jlp.2005.03.009

Lamb A, Hong C, De Silva H, Thomson W, & Broadbent J. (2019). New Zealand oral health practitioners' cross-infection control practices. *New Zealand Dental Journal*.

Lamm F, Massey C, & Perry M. (2020). Is There a Link between Workplace Health and Safety and Firm Performance and Productivity? *New Zealand Journal of Employment Relations*, 32(1), 75–90. https://doi.org/10.3316/informit.135846714466567

Lari M. (2024). A longitudinal study on the impact of occupational health and safety practices on employee productivity. *Safety Science*, 170, 106374. https://doi.org/10.1016/j.ssci.2023.106374

Palmer BW, Lanouette NM, & Jeste DV. (2012). Effectiveness of Multimedia Aids to Enhance Comprehension During Research Consent: A Systematic Review. *IRB*, 34(6), 1–15.

Qualtrics. (2020). Qualtrics XM (Version 2024.4) [Computer software]. Provo, UT: Qualtrics. https://www.qualtrics.com

McCall M, Spencer E, Owen H, Roberts N, & Heneghan C. (2018). Characteristics and efficacy of digital health education: An overview of systematic reviews. *Health Education Journal*, 77(5), 497–514. https://doi.org/10.1177/0017896918762013

Meyer VM, Benjamens S, Moumni ME, Lange JFM, & Pol RA. (2022). Global Overview of Response Rates in Patient and Health Care Professional Surveys in Surgery. *Annals of Surgery*, 275(1), e75–e81. https://doi.org/10.1097/SLA.0000000000004078

Rundmo T. (1996). Associations between risk perception and safety. *Safety Science*, 24(3), 197–209. https://doi.org/10.1016/S0925-7535(97)00038-6

Sehgal NJ, & Milton DK. (2021). Applying the Hierarchy of Controls: What Occupational Safety Can Teach Us About Safely Navigating the Next Phase of the Global COVID-19 Pandemic. *Frontiers in Public Health*, 9, 747894. https://doi.org/10.3389/fpubh.2021.747894

Takala J, Hämäläinen P, Sauni R, Nygård CH, Gagliardi D, & Neupane S. (2024). Global-, Regional- and Country-Level Estimates of the Work-Related Burden of Diseases and Accidents in 2019. *Scandinavian Journal of Work, Environment & Health*, 50(2), 73–82. https://doi.org/10.5271/sjweh.4132

Tamene A, Habte A, Endale F, & Gizachew A. (2022). A Qualitative Study of Factors Influencing Unsafe Work Behaviors Among Environmental Service Workers: Perspectives of Workers, and Safety Managers: The Case of Government Hospitals in Addis Ababa, Ethiopia. *Environmental Health Insights*, 16, 11786302221109357. https://doi.org/10.1177/11786302221109357

Teufer B, Ebenberger A, Affengruber L, Kien C, Klerings I, Szelag M, Grillich L, & Griebler U. (2019). Evidence-Based Occupational Health and Safety Interventions: A Comprehensive Overview of Reviews. *BMJ Open*, 9(12), e032528. https://doi.org/10.1136/bmjopen-2019-032528

Siddiqi A, Niazi MIK, De Silva H, Firth N, Konthasingha P, & Zafar S. (2017). Percutaneous Exposure Incidents: A Review of Practice and Awareness of Current Protocols at a Dental Faculty. *Oral Surgery*, 10(4), e80–e87. https://doi.org/10.1111/ors.12282

StataCorp. (2023). Stata Statistical Software (Release 18) [Computer software]. College Station, TX: StataCorp LLC. https://www.stata.com

Stats NZ. (2023). Work-Related Injury Targets at a Glance: 2008–2022 | Stats NZ. https://www.stats.govt.nz/reports/work-related-injury-targets-at-a-glance- 20082022/

Wilson AB, Brooks WS, Edwards DN, Deaver J, Surd JA, Pirlo OJ, Byrd WA, Meyer ER, Beresheim A, Cuskey SL, Tsintolas JG, Norrell ES, Fisher HC, Skaggs CW, Mysak D, Levin SR, Escutia Rosas CE, Cale AS, Karim N, Pollock J, Kakos NJ, O'Brien MS, & Lufler RS. (2024). Survey response rates in health sciences education research: A 10-year meta-analysis. *Anatomical Sciences Education*, 17(1), 11–23. https://doi.org/10.1002/ase.2345

WorkSafe. (2017). Identifying, assessing and managing work risks.

WorkSafe. (2018). Health and Safety Attitudes and Behaviours in the New Zealand Workforce.

Wu MJ, Zhao K, & Fils-Aime F. (2022). Response rates of online surveys in published research: A meta-analysis. *Computers in Human Behaviour Reports*, 7, 100206. https://doi.org/10.1016/j.chbr.2022.100206

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