

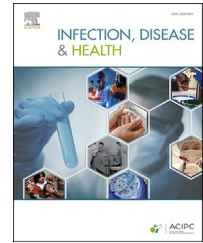


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Research paper

Australian dentists' knowledge, preparedness, and experiences during the COVID-19 pandemic

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COVID-19;
Dentists;
Infection control;
Dental health services;
Outbreaks

Abstract *Background:* COVID-19 is a global health crisis. Close contact with the mucous membranes and respiratory secretions of patients and aerosol-generating procedures renders dentists and other oral health professionals at high risk of exposure to SARS-CoV-2. We examined dentists' knowledge, preparedness, and experiences of managing COVID-19 in Australia. *Methods:* A cross-sectional online survey of dentists with a current membership with The Australian Dental Association (ADA) was conducted between March and April 2021. *Results:* Of the 368 survey responses, most dentists (72.3%) reported having a good level of knowledge about COVID-19, with most visiting the ADA Federal COVID-19 (74.7%) and state/territory department of health websites (62.8%), respectively to source up-to-date information. Most dentists (87.6%) felt prepared to manage COVID-19 into the future, although 66% reported not receiving training or certification in the use of PPE. Over half (58.7%) reported not

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being concerned about contracting SARS-CoV-2 at work, with some (28.9%, n = 98/339) feeling more stressed than usual and having heavier workloads.

Conclusion: COVID-19 had significant impact in oral healthcare in Australia. Dentistry has adapted to the varied challenges raised by the pandemic. Comprehensive training and detailed guidelines were fundamental for successful patient management during the COVID-19 outbreak.

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Highlights

- COVID-19 had significant impact in oral healthcare in Australia.
 - Australian dentistry quickly adapted to the varied challenges raised by the pandemic.
 - Additional IPC precautions were promptly implemented across dental practices.
 - Training and detailed guidelines were fundamental for successful patient management.
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Introduction

It has been over a year since the World Health Organization (WHO) declared the then novel coronavirus disease a global pandemic [1]. As of 21st June 2021 there have been 178,333,767 cases and 3,862,286 deaths of COVID-19 globally [2], with emerging SARS-CoV-2 variants that have had, and will have, significant and sustained impact on society and economies resulting in significant pandemic fatigue for healthcare workers and the general public [3].

Frontline healthcare workers continue to experience numerous physical and mental health challenges as the COVID-19 pandemic evolves [4,5]. This includes oral health professionals [6]. Studies from Asia and the Middle East have found that dentists experienced anxiety due to concerns about contracting SARS-CoV-2 and passing the infection to household members [7–9]. Restrictions on movement and gathering (lockdowns) and the subsequent changes in clinical activity together with cancellation of non-urgent dental care has meant that many dentists working in private practice are concerned for patient care and report financial stress [10–12]. Oral health professionals have had to adjust their services and infection prevention and control practices to ensure patient safety and to minimise risk of transmission [13]. Such measures have included triage and screening of patients for COVID-19, additional infection prevention and control measures, and use of personal protective equipment (PPE) [14–17].

We have previously reported the knowledge, preparedness and experiences of emergency nurses and physicians [18], paramedics [18], general practitioners [19], infectious diseases physicians [20], infection control professionals [20], and intensive care nurses [21] in managing the COVID-19 pandemic in Australian healthcare settings. This paper adds evidence regarding an additional professional craft group, namely dentists. To the best of our knowledge, no similar research has been conducted on Australian dentists during COVID-19. This study examined the knowledge, preparedness and experiences of dentists during the COVID-19 pandemic in Australia.

Methods

Study design

A cross-sectional study using an online survey was conducted in collaboration with The Australian Dental Association (ADA).

Setting and population

Practising dentists holding current membership with ADA were invited to participate via email. Consent was based explicitly on submission of the survey. Ethics approval was granted for this study by the University of Sydney (HREC number 2020/200).

Instrument development

An anonymous, voluntary online survey was developed using the Research Electronic Data Capture (REDCap™) software by a panel of experts from dentistry and infection prevention and disease control. Questions from instruments studying healthcare workers' perspectives during previous outbreaks were adapted and used [22–29]. The survey comprised of 39 closed and open questions related to: i) respondents' demographics; ii) knowledge about COVID-19; iii) preparedness for COVID-19; and iv) experiences of working under COVID-19 ([supplementary material](#)). The survey was pilot tested by the expert panel prior to distribution, with modifications to wording and format to improve clarity and readability.

Data collection and analysis

The survey was sent out to 11,173 dentists via emails and remained active between March and April 2021. There were 443 survey responses collected. Of these, 75 were incomplete beyond the demography-related section. Consequently, a total of 368 survey responses were included in the analysis. Upon survey closure, raw data were

downloaded from REDcap™, cleaned in Microsoft Excel, and analysed in IBM SPSS 26®. Questions with no response were treated as missing values and the respective denominators were adjusted accordingly. Descriptive statistics were used to analyse the data.

Results

Of the 368 responses, all but one dentist (99.7%) reported residing in Australia, with the majority currently working in the states of New South Wales, Victoria and Queensland. Respondents reported an average of 25.10 (SD 12.91) years of professional experience (Table 1).

Knowledge

When asked to rate their current knowledge of COVID-19, a majority of dentists (72.3%, $n = 266$) selected 'very good' or 'good'. Only one respondent (0.3%) rated his/her level of knowledge as 'poor'.

Respondents were introduced to 15 available sources of COVID-19 information to choose from and then asked where they routinely went for up-to-date information (Fig. 1). Almost three-quarters of dentists (74.7%, $n = 275$) visited the ADA Federal COVID-19 website, followed by their respective state/territory department of health websites (62.8%, $n = 231$), and information provided by the ADA Branch website (61.4%, $n = 226$).

Since the earliest stages of the pandemic in March 2020, the ADA has provided a variety of COVID-19 resources to its members, designed to keep dentists and their patients safe (Fig. 2). The three main ADA resources visited by dentists were 'COVID-19 webinars' (78.5%, $n = 289$), 'information on dental service restrictions during COVID-19' (75%, $n = 276$), and the 'COVID-19 decision trees for patient management' (66.6%, $n = 245$).

We asked respondents how easy it was for them to keep up-to-date with 11 different COVID-19 topics. The majority indicated it was 'easy' or 'very easy' to follow COVID-19 information across eight of the presented topics (Fig. 3). However, three topics that respondents found 'very difficult' or 'difficult' to keep up with included 'contact tracing and outbreak management' (18.5%, $n = 68/367$), 'treatment and management' (17.2%, $n = 63/367$), and 'isolation practices' (43.5%, $n = 104/367$).

Preparedness

In terms of the respondents' level of preparedness for COVID-19 on 31 December 2019, when the WHO was notified about an emerging cluster of pneumonia-like cases in Wuhan, China, most dentists (60.4%, $n = 215/356$) reported they were 'not at all prepared'. At the time of this study, and one year from the onset of the pandemic, the vast majority (87.6%, $n = 312/356$) felt 'moderately' or 'extremely prepared' to manage COVID-19 into the future. Likewise, most respondents (82.8%, $n = 295/356$) agreed their dental practice/service was 'moderately' or 'extremely prepared' to manage COVID-19, whereas only a small proportion (16.3%, $n = 58/356$) felt similarly about nation-wide preparedness.

Table 1 Dentists' demographics and other characteristics.

Characteristics	$n = 368$ (%)
Current state or territory of work:	
New South Wales	104 (28.3)
Victoria	97 (26.4)
Queensland	72 (19.6)
Western Australia	45 (12.2)
South Australia	32 (8.7)
Northern Territory	7 (1.9)
Australian Capital Territory	7 (1.9)
Tasmania	4 (1.1)
Country of residency:	
Australia	367 (99.7)
Other countries	1 (0.3)
Member of a COVID-19 planning and response committee:	
Not a member	291 (79.1)
At local practice level	53 (14.4)
At hospital level	7 (1.9)
At health district level	2 (0.5)
At multiple group practice level	3 (0.8)
At state level	2 (0.5)
At national level	1 (0.3)
At international level	0 (0)

Most dentists reported that the ADA (85.3%, $n = 303/355$) and their respective dental practice/service (81.2%, $n = 289/356$) provided clearer and more timely and authoritative information about COVID-19 than their state/territory government health departments (76.4%, $n = 272/356$) or the Australian Department of Health (71.1%, $n = 253/356$) (Fig. 4).

Most respondents (69.9%, $n = 249/356$) confirmed that their dental practice/service had COVID-19 guidelines and an outbreak response plan. The vast majority (87.9%, $n = 219/249$) indicated they were 'moderately' or 'extremely familiar' with these guidelines and plans, and that they were 'easy' or 'very easy' to adhere to (77.9%, $n = 194/249$). Some respondents (15.4%, $n = 55/356$) reported their respective workplace did not have COVID-19 guidelines and plans, while others (14.6%, $n = 52/356$) reported not knowing.

Over half of respondents (61.2%, $n = 218/356$) reported receiving specific education, training, or instruction about COVID-19 within their workplace. This training varied, with respondents reporting it as webinars provided by the ADA (50.5%, $n = 186/368$), in-house practice education (25.8%, $n = 95/368$), and webinars by external providers (16%, $n = 59/368$). Less than 10% of respondents indicated that their training was provided by the primary health network (7.9%, $n = 29/368$). The vast majority (81.6%) rated these trainings as 'mostly' or 'entirely' adequate ($n = 178/218$).

Most of the respondents (66%, $n = 235/356$) reported not receiving training or certification in the use of PPE for managing COVID-19. For those respondents who received PPE-related training, 76.9% rated it as 'mostly' or 'entirely' adequate ($n = 93/121$). Regarding their level of confidence

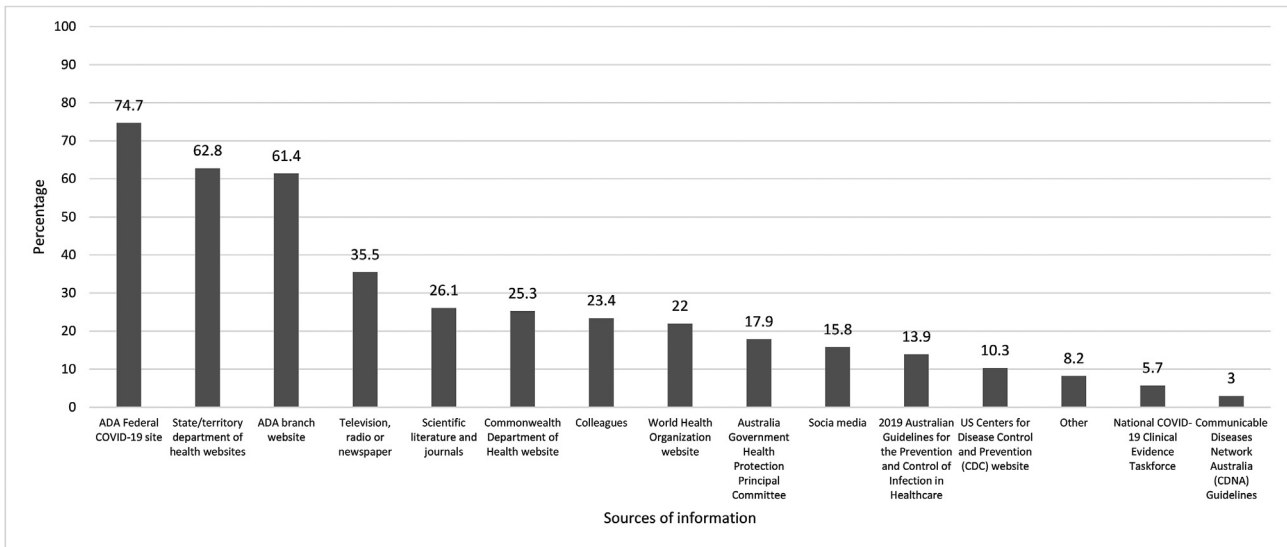


Figure 1 Sources of up-to-date COVID-19 information used by respondents.

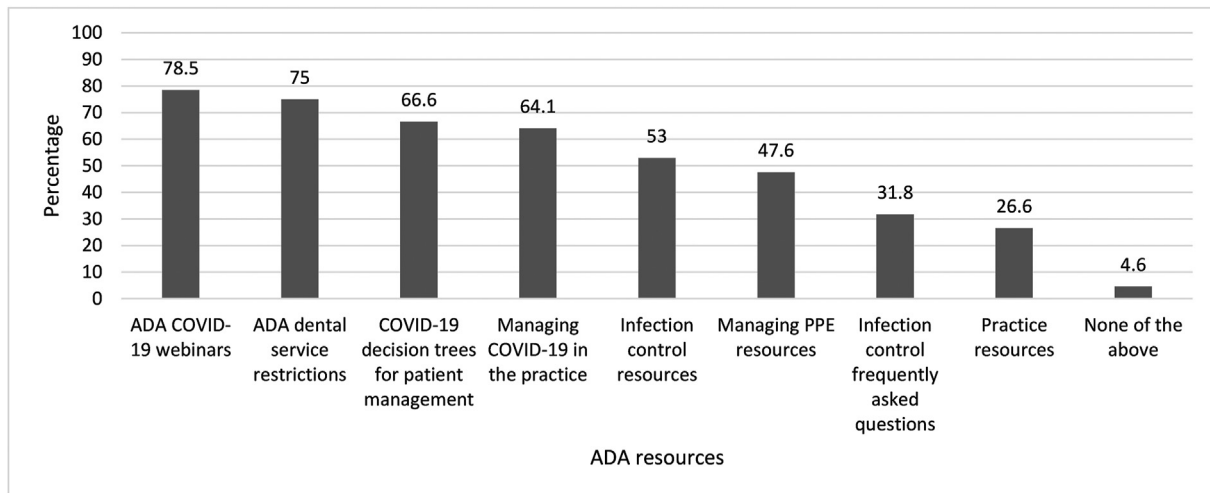


Figure 2 COVID-19 resources available within the ADA website used by respondents.

in using PPE for managing COVID-19 patients, 68% (n = 242/356) reported they were 'mostly' or 'entirely' confident (see Table 2).

Experiences

Most dentists (75.8%, n = 257/339) reported that their practice/service was not involved in assessing or treating suspected or confirmed cases of COVID-19 (93.2%, n = 316/339). Just over half the dentists (55.5%, n = 188/339) referred relevant cases to other facilities. In terms of their participation in COVID-19 outbreak response activities, half of the respondents (51.9%, n = 191/368) reviewed and updated policies or procedures, almost a quarter were involved in supporting healthcare staff (23.9%, n = 88/368) as well as other staff (26.4%, n = 97/368), as summarised in Table 3.

At the time of the survey, most respondents (58.7%, n = 199/339) indicated feeling 'not at all' or 'slightly

concerned' about contracting SARS-CoV-2 at work, with a few (5.9%, n = 20/339) feeling 'extremely concerned'. A majority (82%, n = 278/339) reported no absence from work due to these concerns, while 32.2% had taken an absence from work while waiting for SARS-CoV-2 testing results (109/339). Few respondents (14.2%, n = 48/339) avoided telling others about their involvement caring for COVID-19 patients out of fear of negative reactions. Likewise, 10% of respondents felt their family or friends had avoided contact with them due to the nature of their work (n = 34/339) and had experienced or witnessed racial or other forms of discrimination at work associated with the outbreak (10.3%, n = 35/339).

Some dentists (28.9%, n = 98/339) reported feeling 'moderately' or 'extremely' more stressed than usual at work due to the COVID-19 outbreak, while 20.6% (n = 70/339) were not stressed at all. Over half (51.9%, n = 176/339) reported that COVID-19 had somewhat increased their workload, whereas for 15.9% (n = 54/339) workload

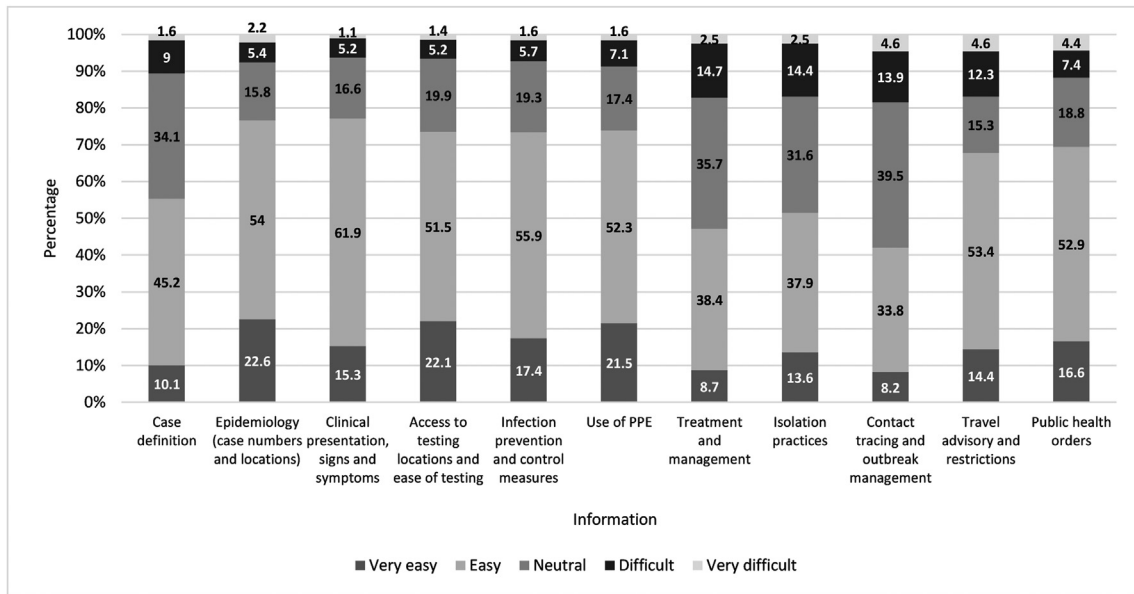


Figure 3 Dentists’ opinion about how easy or difficult it is to keep up-to-date with 11 key themes of information about COVID-19.

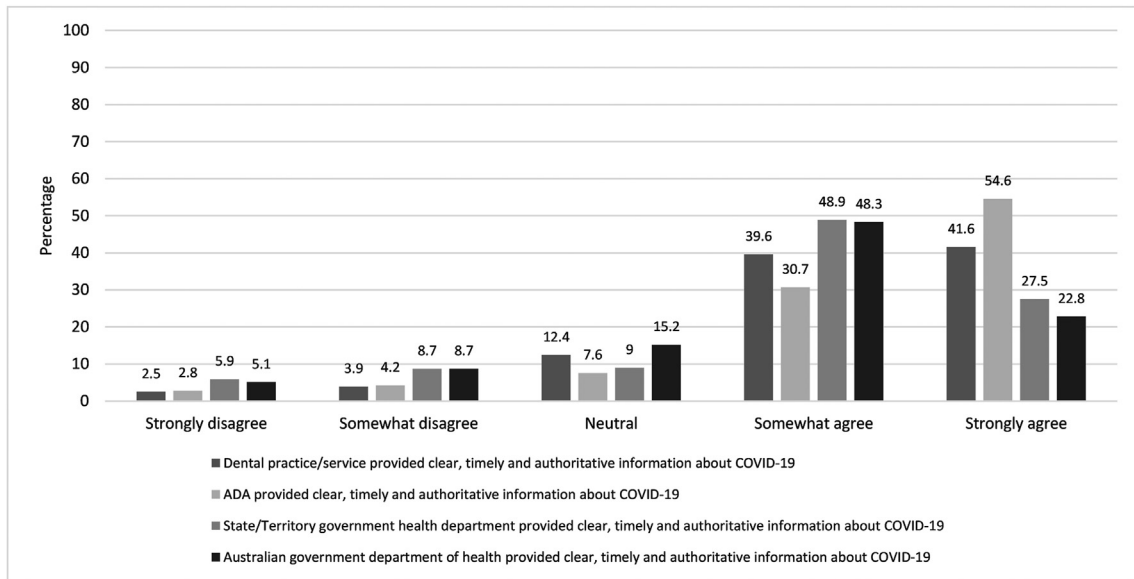


Figure 4 Dentists’ opinion about the provision of clear, timely and authoritative information about COVID-19.

had remained the same or it had lessened (11.8% (n = 40/339)).

Over half of respondents (58.4%, n = 198/339) indicated their workplace did not provide staff debriefing or psychological support services regarding COVID-19. Very few (9.4%, n = 32/339) confirmed both services being available at their workplace. The majority reported never having attended debriefings (69.6%, n = 236/339), while almost all respondents never accessed psychological support services (96.8%, n = 328/339). Among those attending the debriefings and psychological support services, 28.9% (n = 98/339) and 3.3% (n = 11/339) rated them ‘useful’ to some extent, respectively, as details in Table 4.

Discussion

This study examined dentists’ knowledge, preparedness, and experiences managing COVID-19 in the Australian setting. COVID-19 has challenged health systems and healthcare workers across the world at various levels [4], and the results of this study indicate the same can be said of Australian dentists. Routine dental practice requires close contact with the mucous membranes and respiratory secretions of patients and aerosol-generating procedures, which renders dentists and other oral health professionals at high risk of exposure to SARS-CoV-2 [30,31].

For the dentists in this study, timely access to detailed guidelines was critical to the safe management of patients.

Table 2 Adequacy of PPE training and respondents' level of confidence in using PPE for managing COVID-19.

	Dentists (N = 121)	
	n	%
<i>Adequacy of PPE training</i>		
Not at all adequate	0	0
Slightly adequate	9	7.4
Somewhat adequate	19	15.7
Mostly adequate	57	47.1
Entirely adequate	36	29.8
<i>Confidence in using PPE</i>		
Not at all confident	13	3.7
Slightly confident	31	8.7
Somewhat confident	70	19.7
Mostly confident	153	43
Entirely confident	89	25

Table 3 Respondents' participation in COVID-19 outbreak response activities.

COVID-19 outbreak response activities	Yes n (%)	No n (%)
Reviewing and updating policies or procedures	191 (51.9)	177 (48.1)
Establishing fever clinics	3 (0.8)	365 (99.2)
Training in donning and doffing PPE	78 (21.2)	290 (78.8)
Supporting healthcare staff	88 (23.9)	280 (76.1)
Supporting other staff	97 (26.4)	271 (73.6)
Planning for surge capacity	15 (4.1)	353 (95.9)
None of the above	118 (32.1)	250 (67.9)

At the international level, and since early stages of the pandemic, dental associations published advice for dental services and settings on pandemic response, including cancellation of elective dental treatment and other non-urgent care procedures [32]. In Australia, the ADA published a COVID-19 management framework [33] during dental service restrictions in late March 2020, with guidance about treatment and triage, and infection prevention and control measures, including PPE stock. These resources have been continuously updated [34], with the addition of dental practice policies and guidelines as well as resources for financial and mental health support. Despite the extensive list of resources, we note with interest that almost half of the respondents in our study indicated that it was 'difficult to very difficult' to keep up to date with specific information about isolation practices. Nevertheless, the early and proactive approach taken by the ADA to publish a list of COVID-19 related resources may explain why most dentists in our study visited the ADA website to obtain COVID-19 information.

Our study was carried out in March–April 2021, and the early provision of resources and guidance by the ADA could explain why most respondents had 'good to very good' knowledge of COVID-19. This finding is consistent with international studies [9,15,35–38], where it has been

Table 4 COVID-19 support services provided by respondents' workplace and respondents' attendance and access.

Support services provided by the dental practice/facility	n (%)
Yes, debriefing only	54 (15.9)
Yes, staff psychological support only	13 (3.8)
Yes, both	32 (9.4)
Neither	198 (58.4)
Do not know	42 (12.4)
Total	339 (100)
<i>Attending debriefings and their usefulness</i>	
No	236 (69.6)
Yes, but it was not useful	5 (1.5)
Yes, and it was slightly useful	36 (10.6)
Yes, and it was moderately useful	41 (12.1)
Yes, and it was extremely useful	21 (6.2)
Total	339 (100)
<i>Accessing psychological services and their usefulness</i>	
No	328 (96.8)
Yes, but it was not useful	0 (0)
Yes, and it was slightly useful	2 (0.6)
Yes, and it was moderately useful	4 (1.2)
Yes, and it was extremely useful	5 (1.5)
Total	339 (100)

reported that dentists have a good command of COVID-19 knowledge. Only one study from Pakistan has reported insufficient knowledge among dentists, particularly regarding fundamental COVID-19 disinfection protocols, despite available guidelines [39]. In Australia, as per the *ADA Guidelines for Infection Control* [40], all registered dental practitioners are required to implement mandatory infection control guidelines in their practices. The guidelines state that standard precautions, including hand hygiene and use of PPE, are required for routine patient care. Furthermore, they indicate that transmission-based precautions (i.e. airborne, droplet, or contact) are to be implemented for patients with confirmed or suspected infectious diseases such as blood-borne viruses, prion diseases, influenza, measles, tuberculosis and multi-resistant *Staphylococcus aureus*. The guidelines also provide strategies to separate clean and contaminated zones to prevent transmission. Hence, it is interesting that the majority of respondents in our study did not feel prepared to manage COVID-19 at their practices at the beginning of the outbreak. This could be attributed to several factors including, the lack of COVID-19-specific guidelines, the sudden onset of the COVID-19 pandemic, and the immediate implementation of Level 3 restrictions in Australia [41,42].

The combination of these factors may have left dentists feeling overwhelmed and as such, underprepared to manage COVID-19. To strengthen preparedness of their dental practitioners, the ADA published a 'Risk Management Plan' [43] in August 2020, where they emphasised the importance of infection prevention and control training for all staff in public and private dental practices, with

detailed information on transmission-based precautions including videos on PPE donning and doffing sequences. Despite this, two thirds of our respondents reported not receiving any training on the use of PPE for managing COVID-19.

In terms of levels of concern about contracting SARS-CoV-2 at work, over half of the respondents in this study reported being 'not at all concerned or 'slightly concerned'. This could be related to the overall low numbers of COVID-19 and minimal community transmission in Australia [44]. Furthermore, this may also be influenced by how knowledgeable and prepared dentists felt. Almas et al. reported that dentists who had attended a COVID-19 workshop felt more comfortable in treating patients [45]. This also applies to other healthcare professionals. Nurses with a better command of COVID-19 knowledge were more willing to care for COVID-19 patients [46,47]. Likewise, knowledge and preparedness can also be linked to confidence in patient care and implementation of good and adequate infection prevention and control practices. A Japanese study found that cardiovascular healthcare workers did not feel confident towards COVID-19 care, which was linked to insufficient knowledge about infection prevention and control measures, including PPE usage and how to isolate COVID-19 patients [48]. Abou-Abbas et al., reported that physicians who had good knowledge of COVID-19 were also likely to adopt good infection prevention and control practices [49]. It is essential that dentists and other healthcare professionals continue to receive easily accessible COVID-19-related education and training to support their confidence and willingness to care for COVID-19 patients.

The COVID-19 pandemic has exhausted global healthcare systems, and the results of this study indicate that Australian dentists are no exception [50]. Psychological factors including fear, concern and anxiety have been previously linked to pandemics, especially in settings where there are increased rates of infection and mortality [51]. Almost 30% of our respondents stated that they felt 'moderately to extremely stressed' at work. In terms of stress, the repercussions associated with the rapid spread of COVID-19 have resulted in a considerable psychological burden and fear among dentists which have been reported across different nations [50–54]. Additionally, financial hardships associated with concerns about losing their job or loss of earning in the practice as well as unexpected investments in infection control procedures have been reported as triggers of financial stress [55,56]. Jungo et al., reported that dentists in France were more concerned about the financial viability of their practice than they were about being infected with the virus [57]. Despite reporting being stressed at work, over half of the respondents indicated that they did not have debriefing or psychological support services at their workplace. This may be due to the fact that the majority of dental practitioners in Australia work in private practices, with only 5.2% of dentists working in public clinics in Australia in 2019 [58]. Although, these private practices may not have sufficient resources to support the delivery of mental health services, a national 24/7 telephone service [59] run by the Dental Board of Australia is available to support Australian dental practitioners.

Most dentists reported an increase in their workload. A recent Australian study [60] found that the total number of

paediatric dental services significantly dropped during March–June 2020, when compared to the same time period in 2019, with the largest drop occurring in April 2020, which saw a reduction of 86.9% of services being provided. The reported increase in workload by our respondents, despite the apparent reduction in overall dental services, is an interesting finding which may be explained by the sudden need of implementing additional infection prevention and control precautions in their dental practices.

This study has some limitations. The voluntary nature of the survey as well as accumulated survey-fatigue may have impacted the low number of responses. Additionally, the self-reporting nature of the survey may have generated a level of bias in the responses obtained. This cross-sectional study took place almost a year after the start of the pandemic in Australia, it was not designed to capture the full dentists' experiences during the different phases of the pandemic. Due to the lower levels of infection and deaths associated with COVID-19 in Australia, compared to other countries, there may be limitation in terms of the generalisability of our findings.

Conclusion

COVID-19 had significant impact in oral healthcare in Australia. Dentistry has adapted to the varied challenges raised by the pandemic. Our results provide clear insight into what Australian dentists experienced during the COVID-19 pandemic and will be of use in future emerging outbreak management.

Ethics

Ethics approval was granted for this study by the University of Sydney's Human Research Ethics Committee (HREC number 2020/200).

Authorship statement

CSC: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Project administration, Manuscript submission. CL: Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – review & editing. KKF: Formal analysis, Data curation, Writing – review & editing. SN: Conceptualization, Methodology, Validation, Data curation. LW: Methodology, Writing – review & editing. SL: Methodology, Writing – review & editing. AH: Methodology, Writing – review & editing. EI: Methodology, Writing and Editing. RSZ: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing. All authors contributed to the drafting of this manuscript and approved it for submission.

Conflict of interest

[RZS - Anonymised] is an [Anonymised] of [Anonymised] but was blinded to this submission in the journal's editorial management system and had no role in the peer review or

editorial decision-making whatsoever. There are no other conflicts of interest to declare.

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Provenance and peer review

Not commissioned; externally peer reviewed.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.idh.2021.10.001>.

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