

# Lessons Learned from Contact Tracing COVID-19 cases in Dental Settings in East Scotland

Niall Mc Goldrick<sup>1</sup> and Emma O’Keefe<sup>2</sup>

<sup>1</sup>School of Dentistry, University of Dundee, UK; <sup>2</sup>Department of Public Health, NHS Fife, UK

**Introduction:** Dental settings were considered high risk settings for COVID-19. A Dental Public Health Team in East Scotland worked to risk assess each situation timeously to break chains of transmission. **Aim:** To present learning from routine data collected from contact tracing COVID-19 cases in the dental setting. **Design:** Retrospective analysis of a routine data set of COVID-19 cases associated with a dental setting reported via the national contact tracing system for two health board areas in the East of Scotland. **Methods:** Descriptive statistics summarise the data collected over a 13-month period (Oct 2020-Dec 2021) during which all included COVID-19 cases were confirmed by PCR. A narrative presents output from contact tracing of all cases and includes themes identified during contact tracing that led to transmission within a dental setting. A case study illustrates impact of transmission. **Results:** 752 cases are included. No evidence of staff to patient transmission or vice versa was found in this study. Staff to staff transmission occurred in non-clinical areas contributing to 33% of total staff cases with the remainder assessed to result from community transmission. **Conclusion:** Transmission of COVID-19 in a dental setting, in the context of this study, appears to be confined to non-clinical areas with the majority of staff cases resulting from community transmission. Future pandemic plans should include tools to aid with implementation of guidance in non-clinical areas.

**Keywords:** dentistry, public health, COVID-19, contact tracing, pandemics, epidemiology

## Introduction

COVID-19 is a disease caused by the SARS-CoV-2 virus that was first detected in Wuhan, China in 2019 (Public Health England, 2020). On 11<sup>th</sup> March 2020 the World Health Organisation (WHO) declared a global pandemic of COVID-19 (World Health Organisation, 2020). Dental settings were identified as high risk for transmission of SARS CoV-2 by a number of sources due to the nature of the care provided (Marcenes, 2020; Meng *et al.*, 2020; Peng *et al.*, 2020). In the early stages of the pandemic a precautionary approach was taken by authorities including issuing of stay at home advice, and retraction of healthcare services to emergency care only (Chief Dental Officer Scotland, 2020a; Institute for Government, 2023; Nicola Sturgeon, 2020).

The global literature on transmission of SARS CoV-2 in dental settings continues to develop as the world reflects on the pandemic and the response taken. A recent systematic review estimated the prevalence of SARS CoV-2 infection amongst oral health care workers (OHCW) reported a pooled estimate of 9.3% in the context of no vaccination based on 17 studies from the international literature (Bitencourt *et al.*, 2022). The review discussed difficulties in ascertaining where the OHCW became infected with the virus. A prospective cohort study in Scotland exploring seroprevalence for SARS CoV-2 antibodies in health care workers found that dentists were the most likely healthcare worker to test positive (Abo-Leyah *et al.*, 2021). A number of cross sectional studies have attempted to provide further evidence of prevalence of COVID-19 amongst OHCW but have recognised the

limitation of self-reported measures and limited access to detailed contact tracing data making it impossible to assess the route of transmission (Bitencourt *et al.*, 2022). A prospective study in Israel that used contact tracing to explore transmission amongst OHCW found very low transmission (Natapov *et al.*, 2021). More studies utilising contact tracing and SARS CoV-2 infection status are required to build on the current evidence around prevalence and inform future pandemic planning. It is important that the response to managing COVID-19 cases associated with dental settings is reported and assessed.

The aim of this study is to analyse routine data collected during the contact tracing of COVID-19 cases to better understand modes of transmissions of SARS COV-2 in dental settings. Further, the study aims to identify learning from the public health response to COVID-19 cases in a dental setting to better inform future pandemic planning.

The objectives were to analyse results from routinely collected data related to COVID-19 cases associated within a dental setting, identify the areas in dental practices that give rise to onward transmission and to inform future pandemic preparedness by sharing lessons learned and the tools used as part of the public health response.

## Materials and Methods

The study is observational and is reported in line with the reporting of studies conducted using observational routinely collected data statement (RECORD) (Benchimol *et al.*, 2015). The Medical Research Council & Health Research Authority decision tool was used to inform the need for ethical approval (Medical Research Council,

2022). The tool found that this study is not considered research by the NHS. An opinion was sought from the Research and Development office of NHS Fife, who agreed with the decision tool outcome and deemed the study to be service evaluation. This study was registered and approved via NHS Fife Clinical Effectiveness Register as service evaluation.

The setting is two NHS Boards in the East of Scotland, NHS Fife and NHS Lothian. The population served by the NHS Boards is circa 1.2 million people. There are 256 high street dental practices and two salaried services operating across a further 30 sites. The context of dental treatment includes the full range of dental procedures including aerosol generating procedures delivered in line with National Dental Standard Operating Procedure produced by NHS Scotland (Chief Dental Officer Scotland, 2020b, 2020c, 2020d; NHS Scotland, 2020).

Scottish Government established a national contact tracing programme branded as 'Test and Protect' (TAP) for COVID-19 cases, to be delivered by National Health Service Scotland (NHS Scotland), the country's public healthcare service (Scottish Government, 2020). Throughout the pandemic TAP identified cases of COVID-19, their contacts and the physical settings visited. Dental settings were identified as a discrete setting and required enhanced contact tracing due to procedures performed and types of PPE.

A surveillance system was developed to capture all cases associated with dental settings. There were no restrictions on participant characteristics. Cases were confirmed following a positive PCR test for SARS CoV-2. Responsibility for the management of cases in high street dental practices was delegated by the Health Protection Teams (HPT) in both NHS Boards to the Dental Public Health Team (DPH). Therefore, the data presented includes all cases reported in high street dental practices through the routes described. The dataset also includes all patient cases and some staff cases from NHS Board salaried dental services. Responsibility for staff cases within NHS Board salaried dental services rested with the Occupational Health Team. An observation period of 12/10/20 to 31/12/21 was selected because all cases were confirmed by PCR testing during that time. After that the testing advice and access changed with cases confirmed by either PCR or lateral flow device testing, altering our ability to confirm cases. Data were collected in real time.

The data were available in the form of a routine dataset with individuals marked by a coding system. The data were inspected and cleaned with emphasis on data completeness, removal of duplicates and uniformity of variables prior to analysis. Descriptive statistics were used to present the findings and all data were managed in MS Excel.

Cases were defined as having been associated with a dental setting if they were present there during their infectious period (48 hours before onset of symptoms or if asymptomatic 48 hours before positive test and 10 days thereafter for both). Cases included patients, carers, and dental staff. All communication between DPH and TAP took place via email and cases were managed using NHS Scotland's Case Management System (CMS), the national platform for recording all contact tracing activity for COVID-19 cases.

DPH risk-assessed patients/carers and staff using the documents in supplementary material 1 and 2 (available

on request). The risk assessment process was agreed following meetings with colleagues in Health Protection, Infection Prevention Control and Occupational Health alongside guidance from Health Protection Scotland and was based on a risk assessment devised by pharmacy colleagues to ensure similarity across primary care (Public Health Scotland, 2022). Risk assessment included detailed contact tracing of the case's interaction within the dental setting with emphasis on understanding if there was any overlap in time or place with other confirmed cases, review of personal protective equipment used by staff measured against the national standards (NHS Scotland, 2020), review of environmental cleaning following the presence of a known case in line with national standards, and detailed review of the infection timeline for each case.

The CMS was used to record the clinical notes related to the case. Contacts of cases identified in dental settings were added to the CMS and notified.

Cluster investigations ensued where two cases were reported as having been associated with the same dental setting. Further contact tracing and assessment of overlap of cases took place with a detailed look at staff and patient interaction. Transmission or an outbreak was confirmed where two or more cases could be linked in place and time (Public Health Scotland, 2022). Contacts of a confirmed case who were exposed in a dental setting were captured in ongoing surveillance and if contacts went on to develop COVID-19, a chain of transmission was established. Vaccine status of staff was discussed with management as part of the risk assessment: whilst vaccine status did not affect decisions on isolation, low vaccine uptake in a practice provided an opportunity to encourage uptake.

After risk assessment most cases were managed by DPH with verbal or written advice provided to dental teams, and formal isolation advice issued to cases or contacts. (NHS Scotland, 2020). DPH colleagues could recommend dental practices consider the NHS Education for Scotland Quality Improvement in Practice Training Team in Dental Infection Prevention Control for bespoke training as required. Escalation to Health Protection was reserved for cases requiring specialist health protection input or formation of an Incident Management Team.

## Results

A total of 752 cases associated with dental settings were managed between 12/10/20 and 31/12/21. Two hundred and fifty cases (33%) were identified as dental staff 502 (67%) were patients or carers. Figure 1 below maps staff and patient cases against the cases in the general Scottish population over time.

Among the cases there was no evidence of transmission from patients to staff or staff to patients. Most staff cases were individual unlinked cases. There were 20 outbreaks following staff-to-staff transmission within the dental setting, involving 83 cases and representing 33% of total staff cases. Those cases generated 31 close contacts amongst staff. The range of staff cases in an outbreak varied from two to seven cases.

There were three additional instances of transmission amongst staff at social events outside the dental setting, amounting to 10 cases. All other staff cases were assessed as having acquired the virus in the community.

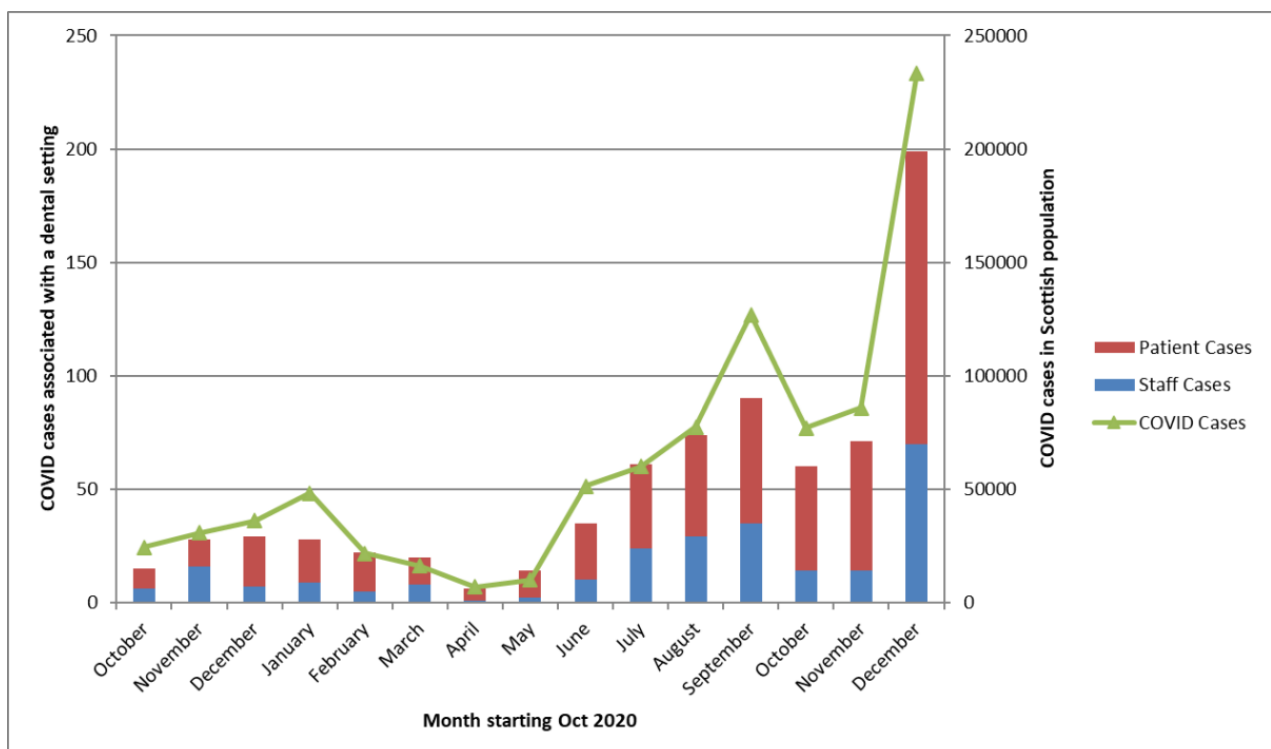
A brief case study, taken from within this dataset demonstrates how COVID-19 can spread rapidly through a practice (Figure 2). Six staff members were confirmed cases and an additional four were identified as contacts. The outbreak restricted the ability of the dental practice to deliver patient care resulting in emergency measures to provide care.

Several potential routes of transmission were identified during the contact tracing and investigation of the 20 outbreaks including, car sharing, facilities and staff health and wellbeing. Transmission may have occurred between staff sharing a car without any precautionary measures. In practices, small poorly ventilated rooms without capacity control used for various activities including changing, administrative work and taking breaks may have supported transmission. Staff presenting at work while feeling unwell but wanting to fulfil their

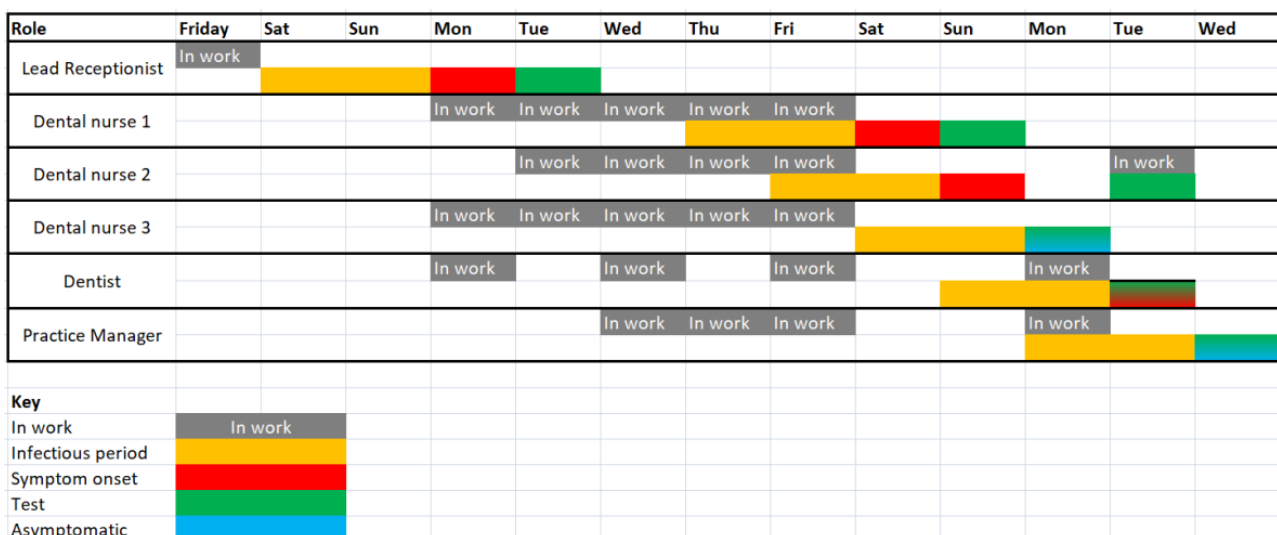
work duties and support service delivery was also seen in relation to transmission.

## Discussion

The trend over time of cases associated with dental settings in this study follows the trend in the general Scottish population. Throughout the observation period no evidence of transmission between staff and patients or vice versa was found. This is following in depth contact tracing and risk assessment. A study in the West Midlands, England suggested that before enhanced infection prevention control measures were put in place, dental care professionals who provided direct patient care showed higher rates of natural infection of SARS COV-2 infection (Shields *et al.*, 2021). Our data were collected after infection control measures, including screening of patients



**Figure 1.** COVID-19 cases (patient and staff) associated with a dental setting for NHS Fife and NHS Lothian and cases in the Scottish population October 2020 - December 2021.



**Figure 2.** Contact tracing timeline for cases in one dental practice indicating possible routes of transmission.

for symptoms of COVID-19 before dental attendance were enhanced (NHS Scotland, 2020). Another study around the same time found a prevalence of 0.5% SARS CoV-2 infection amongst dental patients who were screened as asymptomatic using Scottish Guidance (Conway *et al.*, 2021). This is lower than estimates taken from the Office for National Statistics, where a figure of 0.71% of the Scottish Population had COVID-19 in December 2020 (Office for National Statistics, 2020).

Our study has demonstrated that the combination of infection prevention control and public health measures in place in dental settings in the East of Scotland during the observation period were protective and prevented transmission between staff and their patients, thereby reducing occupational risk. Further investigation beyond the scope of our study is required to identify the active components of the protective measures. However, future pandemic plans for novel viruses with similar modes of transmission can learn from the application of such protective measures during a background of high uncertainty. Our study adds to the evidence from Alterman *et al.* (2021) that suggests adherence to strict infection prevention control measures results in very low transmission from patients to staff: in that study no evidence of patient to staff transmission was found. Natapov *et al.* (2021) also report a cohort study that used similar contact tracing methods to our own and found transmission between patients and staff was very uncommon. Other studies using surveys and self-reports have suggested that there may have been transmission from patients to staff in dental settings, but the nature of those designs and lack of detailed contact tracing limit inference about whether infections were acquired in the dental setting (Araujo *et al.*, 2021; Malsam & Nienhaus, 2021; Meng *et al.*, 2020).

The possible routes of transmission between staff could only be identified in the detailed contact tracing undertaken for each outbreak. Through this process, key learning points were formulated for rapid action by the practice management. Learning from each outbreak formed part of regular communications to all dental practices to highlight and mitigate risks.

In contrast to our finding of no transmission between staff and patients, transmission between staff was demonstrated multiple times in non-clinical areas. Despite having risk assessments and protocols in place this did not always translate to staff behaviour and action. Quality improvement tools were not evident in the implementation of protocols. There was a reliance on staff reading, signing for, and implementing ever changing protocols. In preparation for future pandemics with a similar virus, guidance and implementation methodology may wish to consider the suggestions presented in Table 1. Further, the structure and design of dental practices often reduced the ability of teams to social distance due to limitation of breakout spaces, whilst ventilation systems were often basic or non-existent.

The strengths of this study include how the surveillance system recorded all confirmed cases of COVID-19 associated with dental settings. This enabled continued surveillance for onward transmission therefore providing a high level of ascertainment of cases associated with dental settings. Collaboration between HPT, DPH and

**Table 1.** Areas for consideration in future pandemic planning to mitigate risk of transmission of similar virus to SARS-CoV-2.

Building/space management	<ul style="list-style-type: none"> <li>• Surveillance of maximum number of staff in all rooms.</li> <li>• Maximising natural and mechanical ventilation.</li> <li>• Re-evaluate the building and systems to determine if the building can accommodate the number of staff and patients safely.</li> <li>• Environmental cleaning protocols in non-clinical areas.</li> <li>• Use of remote technology to support patient triage and non-clinical activity.</li> </ul>
Guidance implementation support	<ul style="list-style-type: none"> <li>• Promote positive health and wellbeing messages to foster a culture of safety and openness about staff symptom reporting.</li> <li>• Develop morning huddles and ensure a culture of openness where staff members feel comfortable to raise concerns, take a 'Pause' and put in place greater monitoring of adherence to protocols (NHS Scotland).</li> <li>• Identify champions to influence the culture, especially when management are not present.</li> <li>• Gain support from local Dental Practice Advisors and other agencies, e.g., Quality Improvement Teams to look at bespoke training including importance of teamwork and understanding capabilities</li> </ul>

primary care provided a holistic response to cases in dental settings using local experience and knowledge of dental provision to devise processes to mitigate risk while trying to maintain access to safe patient care. A similar process was adopted by other NHS Boards in Scotland. Limitations of the study include that genome sequencing was not employed in contact tracing. Cases that did not engage with the national contact tracing system and those that did not report an interaction with a dental setting will not have been picked up, leading to possible under ascertainment. Contact tracing relies on recall of individuals and for cases to be well enough to take part. Some cases experiencing the worst symptoms and morbidity will not have been able to partake fully or at all in contact tracing reducing ability to break chains of transmission. Cluster and outbreak locations were not visited by DPH to assess the measures in place but instead relied on reporting by local practice management teams. Our work has demonstrated the need for skilled questioning and courageous conversations from practice staff in a safe space to help identify risk areas and put measures in place. The openness and trust enabled DPH to identify key areas of discussion with practice management in a supportive manner to work towards common goal of patient safety.

The DPH team constantly reflected, using regular team huddles to debrief, share learning and ask questions. Reactive trouble shooting huddles took place via MS TEAMS daily. Use of a shared folder for documenting actions on cases and maintaining case notes provided ease of handover between staff working remotely.



In conclusion, we found no evidence of staff to patient or patient to staff transmission in this study. The combination of infection prevention control and public health measures in dental clinical areas during the study period appear to have been protective. Staff to staff transmission within the non-clinical areas of dental settings was a repeated problem, suggesting that more work is required to develop effective preventive measures including tools to aid implementation of guidance in non-clinical areas. Most staff infections appear to have resulted from community transmission.

### Declaration of interests

The authors declare no conflicts of interest.

### Funding

No funding supported the preparation of this paper or the evaluation activity.

### Author contributions statements

Both authors have contributed equally to this study and should be viewed as joint first authors.

### Acknowledgements

We wish to acknowledge Jacky Burns, Specialty Registrar in Dental Public Health in Fife was a key member of the team handling situations and took a similar approach to NHS Ayrshire and Arran in her role as Consultant in Dental Public Health. We are grateful to our Health Protection Team and Test and Protect colleagues for supporting us. We are grateful to the practice involved in the embedded case study for allowing us to share their challenging experience.

### References

- Abo-Leyah, H., Gallant, S., Cassidy, D., Giam, Y.H., Killick, J., Marshall, B., Hay, G., Snowdon, C., Hothersall, E.J., Pembroke, T., Strachan, R., Gallant, N., Parcell, B.J., George, J., Furrie, E. and Chalmers J.D. (2021): The protective effect of SARS-CoV-2 antibodies in Scottish healthcare workers. *European Respiratory Journal Open Research* **7**, 00080-02021.
- Alterman, M., Nassar, M., Rushinek, H., Cohen, A., Shapira, L. and Casap, N. (2021): The efficacy of a protective protocol for oral and maxillofacial surgery procedures in a COVID-19 pandemic area-results from 1471 patients. *Clinical Oral Investigations* **25**, 5001-5008.
- Araujo, M.W.B., Estrich, C.G., Mikkelsen, M., Morrissey, R., Harrison, B., Geisinger, M.L., Ioannidou E and Vujicic M (2021): COVID-2019 among dentists in the United States: A 6-month longitudinal report of accumulative prevalence and incidence. *Journal of the American Dental Association* **152**, 425-433.
- Benchimol, E.I., Smeeth, L., Guttman, A., Harron, K., Moher, D., Petersen, I., Sørensen, H.T., von Elm, E. and Langan, S.M. (2015): The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLOS Medicine* **12**, e1001885.
- Bitencourt, F.V., Lia, E.N., Pauletto, P., Martins, C.C., Stefani, C.M., Massignan, C. and Canto, G.D.L. (2022): Prevalence of SARS-CoV-2 infection among oral health care workers worldwide: A meta-analysis. *Community Dentistry and Oral Epidemiology* **51**, 718-728.
- Chief Dental Officer Scotland. (2020a): *Cessation of Routine Dental Care*. Edinburgh: Scottish Government. [www.scottishdental.org/wp-content/uploads/2020/03/CDO-Letter-Cessation-of-Routine-Dental-Care-Further-Advice-23-March-2020.pdf](http://www.scottishdental.org/wp-content/uploads/2020/03/CDO-Letter-Cessation-of-Routine-Dental-Care-Further-Advice-23-March-2020.pdf)
- Chief Dental Officer Scotland. (2020b): *NHS Dental Remobilisation*. Edinburgh: Scottish Government. [www.scottishdental.org/wp-content/uploads/2020/10/CDO-Letter-NHS-Dental-Remobilisation-12-October-2020.pdf](http://www.scottishdental.org/wp-content/uploads/2020/10/CDO-Letter-NHS-Dental-Remobilisation-12-October-2020.pdf)
- Chief Dental Officer Scotland. (2020c): *NHS Dental Services Phase 3-Remobilisation*. Edinburgh: Scottish Government. [www.scottishdental.org/wp-content/uploads/2020/06/DC20200624RemobilisationPhase3.pdf](http://www.scottishdental.org/wp-content/uploads/2020/06/DC20200624RemobilisationPhase3.pdf)
- Chief Dental Officer Scotland. (2020d): *Reintroduction of AGPs to NHS Dental Services*. Edinburgh: Scottish Government. [www.scottishdental.org/wp-content/uploads/2020/08/CDO202011.pdf](http://www.scottishdental.org/wp-content/uploads/2020/08/CDO202011.pdf)
- Conway, D.I., Culshaw, S., Edwards, M., Clark, C., Watling, C., Robertson, C., Braid, R., O'Keefe, E., McGoldrick, N., Burns, J., Provan, S., VanSteenhouse, H., Hay, J. and Gunson, R. (2021): SARS-CoV-2 Positivity in Asymptomatic-Screened Dental Patients. *Journal of Dental Research* **100**, 583-590.
- Institute for Government. (2023): *Timeline of UK Government coronavirus lockdowns and restrictions*. London: Institute for Government. [www.instituteforgovernment.org.uk/data-visualisation/timeline-coronavirus-lockdowns](http://www.instituteforgovernment.org.uk/data-visualisation/timeline-coronavirus-lockdowns)
- Malsam, R. and Nienhaus, A. (2021): Occupational Infections among Dental Health Workers in Germany-14-Year Time Trends. *International Journal of Environmental Research and Public Health* **18**, 10128.
- Marcenes, W. (2020): The impact of the COVID-19 pandemic on dentistry. *Community Dental Health* **37**, 239-241.
- Medical Research Council. (2022): *Health Research Authority Decision Tool*. Swindon: Medical Research Council. [www.hra-decisiontools.org.uk/research/about.html](http://www.hra-decisiontools.org.uk/research/about.html)
- Meng, L., Hua, F. and Bian, Z. (2020): Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. *Journal of Dental Research* **99**, 481-487.
- Meng, L., Ma, B., Cheng, Y. and Bian, Z. (2020): Epidemiological Investigation of OHCWs with COVID-19. *Journal of Dental Research* **99**, 1444-1452.
- Natapov, L., Schwartz, D., Herman, H.D., Markovich, D.D., Yellon, D., Jarallah, M., Liphshiz, I., Carmeli, Y. and Karakis, I. (2021): Risk of SARS-CoV-2 transmission following exposure during dental treatment - A national cohort study. *Journal of Dentistry* **113**, 103791.
- NHS Scotland (2021): *It's kind to remind*. Edinburgh: NHS Scotland. [www.scotlanddeanery.nhs.scot/media/399174/appendix-l-covid-19-hcw-toolkit.pdf](http://www.scotlanddeanery.nhs.scot/media/399174/appendix-l-covid-19-hcw-toolkit.pdf)
- NHS Scotland. (2020): *Standard Operating Procedures for Dental Teams in Scotland*. Edinburgh: NHS Scotland. [www.scottishdental.org/wp-content/uploads/2021/03/SOPS\\_28Jan2021\\_PHrevision.pdf](http://www.scottishdental.org/wp-content/uploads/2021/03/SOPS_28Jan2021_PHrevision.pdf)
- Nicola Sturgeon. (2020): *Coronavirus (COVID-19) update: First Minister's speech 23 March 2020*. Edinburgh: Scottish Government. [www.gov.scot/publications/first-minister-covid-19-update-1/](http://www.gov.scot/publications/first-minister-covid-19-update-1/)
- Office for National Statistics. (2020): *Coronavirus (COVID-19) Infection Survey, UK: 24 December 2020*. London: Office for National Statistics [www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveys/pilot/24december2020](http://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveys/pilot/24december2020)

- Peng, X., Xu, X., Li, Y., Cheng, L., Zhou, X. and Ren, B. (2020): Transmission routes of 2019-nCoV and controls in dental practice. *International Journal of Oral Science* **12**, 9.
- Public Health England. (2020): COVID-19 Background Information. London: UK Government. [www.gov.uk/government/publications/wuhan-novel-coronavirus-background-information](http://www.gov.uk/government/publications/wuhan-novel-coronavirus-background-information)
- Public Health Scotland. (2022): *COVID-19 guidance for Health Protection Teams*. Edinburgh: Public Health Scotland. [www.publichealthscotland.scot/publications/covid-19-guidance-for-health-protection-teams-hpts/covid-19-guidance-for-health-protection-teams-hpts-version-18/](http://www.publichealthscotland.scot/publications/covid-19-guidance-for-health-protection-teams-hpts/covid-19-guidance-for-health-protection-teams-hpts-version-18/)
- Scottish Government. (2020): *Coronavirus (COVID-19): test, trace, isolate, support strategy*. Edinburgh: Scottish Government. [www.gov.scot/publications/coronavirus-covid-19-test-trace-isolate-support/pages/3/](http://www.gov.scot/publications/coronavirus-covid-19-test-trace-isolate-support/pages/3/)
- Shields, A.M., Faustini, S.E., Kristunas, C.A., Cook, A.M., Backhouse, C., Dunbar, L., Ebanks, D., Emmanuel, B., Crouch, E., Kröger, A., Hirschfeld, J., Sharma, P., Jaffery, R., Nowak, S., Gee, S., Drayson, M.T., Richter, A.G., Dietrich, T. and Chapple, I.L.C. (2021): COVID-19: Seroprevalence and Vaccine Responses in UK Dental Care Professionals. *Journal of Dental Research* **100**, 1220-1227.
- World Health Organisation. (2020): *COVID-19*. Switzerland: World Health Organisation. [www.who.int/westernpacific/emergencies/covid-19](http://www.who.int/westernpacific/emergencies/covid-19)