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1 **Title page**

2 **Title: Dentists' perceptions of personal infection control measurements**
3 **in response to COVID-19**

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36 **Dentists' perceptions of personal infection control measurements in**
37 **response to COVID-19**

38

39 **Knowledge Transfer Statement:**

40 Clinicians, Educators and policy makers can use the results of this study to
41 understand the process through which guidance is transformed into
42 implementable patient care pathways in the dental practice.

43

44 **Abstract**

45 **Objective:** To explore through focus groups (FG) the perceptions of dental
46 practitioners (DPs) from different countries of the challenges of implementing
47 COVID-19 related biosafety measures, especially Personal Protection
48 Equipment (PPE), during the COVID-19 pandemic period. **Methods:** DPs from
49 Colombia, Germany, the UK and the USA were invited to participate in country-
50 based FGs. These were facilitated by an experienced moderator who explored
51 the factors that guided the implementation of COVID-19 related biosafety
52 measures and PPE use. Data were analyzed through thematic analysis on the
53 basis of categories defined by the researchers deductively and inductively.

54 **Results:** A total of 25 DPs participated in three FGs (Colombia: n=8; UK: n=7;
55 USA: n=9) and one in an in-depth interview (Germany). DPs described using
56 several processes to judge which guidance document to adopt, and which
57 aspects of the guidance were important in their practice. These included making
58 judgements concerning: the views of any indemnity organization to which the
59 DPs was responsible; the staff's views in the practice, and the views of patients.
60 In the absence of a single overarching guidance document, DPs filtered the
61 available information through several considerations to find a level of PPE
62 which they deemed 'Implementable' in local practice. **Conclusion:** The findings
63 suggest that the implementation of evidence-based practice is subject to
64 modification through a lens of what is 'feasible' in practice.

65

66 **Introduction**

67 Dental Practitioners (DPs) are exposed to pathogens due to their close
68 proximity, face-to-face contact with patients, and aerosol-generating

69 procedures (AGPs) during dental care (Meng et al. 2020, Dar Odeh et al. 2020),
70 In 2019, the third outbreak of an infection caused by a coronavirus emerged in
71 less than 20 years (Drosten. 2003; WHO. 2020). The new beta coronavirus
72 SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus type 2) was
73 identified as the trigger for the coronavirus disease 2019 (COVID-19). SARS-
74 CoV-2 has been detected in saliva (To et al. 2020) and a viral transmission
75 through Aerosol Generating Procedures has been identified (Orenes-Piñero et
76 al. 2021; Samed et al. 2021).

77 After March 2020, when the pandemic was declared, elective dental care in
78 dental services was ceased globally due to a lack of appropriate related
79 biosafety clinical management guidelines. In April 2020, recommendations and
80 guidance for the re-opening of dental services were published by Governments
81 and professional organisations, commencing with the American Dental
82 Association (Cochrane Oral Health 2020). The US Center for Disease Control
83 and Prevention (CDC) released Interim Infection Prevention and Control
84 Guidance for Dental Settings during the COVID-19 Response (CDC 2020), and
85 the World Health Organization (WHO) released its Guidance for Health
86 Workers during Coronavirus Disease (COVID-19) Outbreak. Based on these
87 documents, most of the countries went on to develop their own guidelines to
88 promote safe dental care.

89 The most widely advocated measure to avoid the spread of SARS-CoV-2 was
90 the implementation of enhanced personal protective equipment (PPE) for
91 AGPs, such as disposable fluid-resistant gowns, filtering face piece (FFP)
92 respirators, eye protection and full-face shields (Baghizadeh 2020; Verbeek et
93 al. 2020). A challenge to the universal adoption of these measures was the lack
94 of their availability and the related high prices of such equipment. The pandemic
95 situation triggered pressure on private DPs and struggling public oral health
96 care systems due to the need of implementing new protocols, enhanced PPE
97 and its shortages, and the general anxiety fueled by inconsistent information
98 about the COVID-19 pandemic (Coulthard et al. 2020).

99 The aim of the present study was to explore the perceptions of DPs residing in
100 four countries of the challenges of implementing the use of enhanced PPE,
101 and additional infection prevention and control measures during the COVID-19
102 pandemic period.

103

104 **Methods**

105 IRB approval was given by the Universidad El Bosque (Identification number
106 UEB-561-2020). Qualitative data were obtained through focus group
107 discussions aiming to explore the factors that influence the use of Personal
108 Protective Equipment (PPE) in dental practice. In order to obtain views from a
109 broad range of healthcare systems we decided to invite DPs from four countries
110 (Colombia: n=13; Germany: n=13; the United Kingdom (UK): n=8, and the
111 United States of America (USA): n=21). These represented a range of majority
112 publicly funded, privately funded, insurance schemes and mixed funding
113 approaches which we felt *a priori* were likely to influence the uptake of
114 guidance. A total of four online meetings were held covering a wide range of
115 topics restricted to five guiding questions concerning how DPs were dealing
116 with their personal protection. The focus groups were moderated by an expert
117 researcher (JTN); rapporteurs (VA, EB, SM) took notes and contributed with
118 additional questions.

119 ***Characteristics of participants***

120 An invitation to join the FG was sent to DPs through an academic network which
121 had been formed as part of a separate caries-prevention research programme.
122 The initial goal was to recruit eight DPs in each country. We sought to have
123 representation from different clinical practice areas in each country and DPs
124 not exclusively working in academic settings. In addition, the researchers
125 sought as far as possible to recruit participants of both genders, different
126 areas/regions in each country and a broad range of age groups. Each
127 participant was asked to agree his/her participation and confidentiality by
128 signing the written informed consent. This invitation process started when
129 vaccines were not yet available (June 2020).

130

131

132 ***Conduct of the focus groups***

133 Each focus group meeting was conducted online and lasted from 60 to 90
134 minutes. All were audio recorded for analysis. The moderator introduced the
135 overall aims of the project, the importance of PPE and biosafety during the
136 dental care. Five guiding questions were previously agreed by the research

137 team with follow up questions guided by the moderator who adopted a naïve
138 approach to the topics. The five guiding questions were as follows:

- 139 1. What PPE do you use?
- 140 2. How do you decide what PPE to use?
- 141 3. Where do you get information about PPE from?
- 142 4. Is it easy or difficult to follow the guidance?
- 143 5. How would you advise a new dentist just joining the profession, about PPE?

144 Discussions were conducted in English. In Colombia and Germany, English is
145 not the native or majority language however, the decision to conduct the FGs
146 in this language was taken based on the fact that it was a common language
147 for the researchers involved. It was established as one of the inclusion criteria
148 in the recruitment of DPs. The meetings were held between September 2020
149 and March 2021.

150 ***Data analysis and information validation***

151 Audio recordings were transcribed and analyzed line-by-line in order to
152 categorize the data obtained in the discussions. Three *a priori* categories were
153 defined:

- 154 - Sources of information identified;
- 155 - Barriers to adhering to PPE;
- 156 - Impact of changes.

157 Through the technique of constant comparison, utterances falling into these
158 three coding categories were identified. Coding was independently conducted
159 by two coders. Where dissimilarities in coding were identified, the two coders
160 met to discuss the coding, referring to the core definitions of each code and
161 reconciled the coding through discussion.

162

163

164 **Results**

165 In total three focus group discussions were held (Colombia: June 2020; USA:
166 June 2020; UK: September 2020) and one individual meeting (Germany: May
167 2021). Focus groups were conducted before vaccination availability and the
168 latter afterwards. In total 25 DPs took part in the focus groups, corresponding
169 to 45.4% of invited DPs. The characteristics of the participants are described in
170 Table 1.

171

172 Table 1: Characteristics of the focus group participants*.

	DPs (n)	Areas/Regions by country (n)	Sex		Type of dental practice			Years of practice (mean± SD)
			Female %	Male %	State Health Provider %	Private %	Both %	
Colombia	8	5	100	0	12	63	25	22±10.3
Germany	1	1	0	100	100	0	0	20
UK	7	6	43	57	100	0	0	18±6
USA	9	5	78	22	28	51	21	28±13

173

174 * To obtain a broad range of views we invited DPs from four countries based on the
 175 following considerations: Timing of guidance development; Availability of PPE; Funding
 176 system. The first guidance on biosafety dental practice emerged from USA and UK. In
 177 Colombia, research has previously identified restrictions in the availability of PPE, and there
 178 was little published information about dental practice in Germany at the time of the study.
 179 The four countries represent a range of funding models for dental healthcare, as noted
 180 previously.

181

182 Following the analysis of the data, the first *a priori* theme ‘Sources of
 183 information identified’ was renamed and expanded. The two other *a priori*
 184 codings were not changed. The overall coding scheme was as follows:

- 185 1. Adoption of and adherence to Guidelines
 - 186 a. Interpretation of the guideline
 - 187 b. The views of dental staff
 - 188 c. The views of indemnity providers
 - 189 d. The views of patients
 - 190 e. ‘Experts’
- 191 2. Barriers to adherence with PPE guidance
- 192 3. The impact of the changes

193 Each of the themes will be addressed in turn, with illustrations taken from the
 194 interviews and focus groups.

195

196 **1. Adoption of and adherence to Guidelines**

197 Participants reported that they had been faced with a range of guidance
198 produced from different sources, and this placed emphasis on the individual
199 practitioner or team in using a method to choose which guideline (or
200 combination of elements from different guidelines) they wished to adopt. It
201 emerged that several factors were influential in guiding that choice including the
202 views of stakeholders such as the dental team, indemnity providers and
203 patients. The role of 'experts' providing on line educational opportunities was
204 also discussed.

205 Participants from Colombia referred to use Government Guidance (Ministry of
206 Health and Social Protection). Although this guide was developed based in an
207 expert consensus (Saavedra-Trujillo, 2020), the participants perceived it to be
208 complex and lacking in specific guidance for implementation. As a
209 consequence, other guidelines were used such us those from: Dental societies
210 (American Academy of Paediatric dentistry, Colombian Academy of Paediatric
211 Dentists); Service funders / providers (Dental schools, Health insurance firms).
212 In addition, DPs said that they relied on colleagues' experiences, their own
213 reading or webinars to guide their practice. A perception of the lack of
214 consensus between the various documents, and the relationship between
215 guidelines and personal experience was expressed by the participants. For this
216 reason, they considered that there was a need to make an individual / personal
217 decision about the PPE and biosafety in the dental care.

218 In addition, in this category German participant referred to a process of learning
219 and refinement of guidelines through discussions across the profession.
220 Following the development pf protocols by German Dental Associations and
221 the University Departments, a consensus process was conducted across
222 practitioners with in the dental school and subsequently adopted.

223 In the UK, DPs identified that the four countries comprising the UK each
224 provided different guidelines, which did not agree on certain details. A
225 perception of a lack of clarity and leadership was reported. Participants felt that
226 The Faculty of General Dental Practice UK (FGDP UK) gave very clear
227 guidance, identifying simple rules for 'risk mitigation'. Practitioners reported
228 taking the most stringent guidance and adopting that, in order to ensure they
229 were not open to criticism and discussed a culture of fear – that there would be
230 serious consequences for a practitioner who failed to comply with guidance

231 should there be an adverse event. There was an agreed perception that there
232 existed a culture that was unsupportive, critical and litigious. Members of the
233 dental team reported feeling 'judged'.

234 DPs described a process of adapting Guidance for local practice through
235 considerations of:

- 236 • The views of the staff
- 237 • Indemnity providers (liability issues)
- 238 • The views of the patients (some of whom commented on the lack of
239 sense in recommendations).

240 Finally, the DPs reported the emergence of a number of 'Experts' that provided
241 webinars and other forms of training for the dental team. However, they felt that
242 it was difficult to judge their quality, unless they were associated with teams
243 and institutions that had been pioneering evidence based practice for some
244 time, such as the Scottish Dental Clinical Effectiveness Programme.

245 The USA participants mainly referred to the guidance produced by the Centers
246 for Disease Control and Prevention (CDC). They considered that guidance
247 issued by professional organizations often conflicted with CDC guidelines.
248 These included the American Dental Association (ADA) guidelines and those
249 issued by State level dental associations. DPs highlighted that personal beliefs
250 often were used as the basis for developing an optimal practice through
251 perceptions of what actions were "logical" and "implementable".

252

253 ***2. Barriers to adherence with PPE guidance***

254 The barriers to adherence with PPE guidance included simple physical access
255 (the availability of the required PPE equipment), the challenge of implementing
256 a new and unfamiliar workflow (how people move through the dental office),
257 and cultural and interpersonal barriers.

258 Colombian DPs reported that PPE led to communication problems with patients
259 including a clash with cultural beliefs and values. The Colombian population
260 places great value on social interaction, including in healthcare settings – PPE
261 was perceived as a barrier to this, particularly when the practitioner was working
262 with children. DPs reported: "... the thing that has really changed are all those
263 protocols to interview the patients before you can attend them". In addition, the

264 fallow time between patients was a special concern between Colombian DPs,
265 "... the waiting time between patients, is difficult to establish, and we have to
266 generate safe spaces. Not only the coronavirus but also other respiratory
267 viruses can be suspended in the air". As a consequence, DPs were concerned
268 that patients may choose to delay seeking dental care. The physical strain of
269 wearing PPE was reported too, mainly associated with heat and making
270 breathing more difficult. On the other hand, DPs indicated PPE were not always
271 available and re-use had to be considered because of the shortages in some
272 cases. DPs said: "One of the problems that we face, have been trying to adjust
273 to the new protocols, and the access or availability to the PPE. They have been
274 running out very fast, there are some institutions that have priority to buy them,
275 and the prices have gone up". As a consequence, high costs were reported as
276 limiting strict adherence to guidelines.

277 DPs from UK also reported the physical access to PPE and lack of clear
278 guidance on the use of PPE as a barrier to adoption. The need to restructure
279 the physical space and the patient flow, and staffing issues were also reported,
280 with staff isolating or infected with COVID.

281 Participants in the USA reported the following barriers to adhering to PPE:
282 Physical strain, reluctance of staff to comply, availability of staff, "having child
283 care responsibilities or off sick, isolating". In Germany, restrictions in obtaining
284 PPE were reported, as well as the additional costs and the acceptability of the
285 PPE to patients.

286

287 ***The Impact of the changes***

288 The COVID pandemic raised a number of issues for the dental team ranging
289 from concerns about individual safety to concerns about the financial viability
290 of the practice. Paradoxically some changes introduced as a result of the
291 pandemic had a positive and supportive impact on the well being of the team –
292 for example enhancing the social cohesion of team members.

293 The Colombian DPs reported concerns about being contaminated themselves
294 or contaminating their family with SARS-CoV-2, some suggesting that it was
295 the first time they had been fearful about the practice of dentistry. In the UK the
296 business impact was at the forefront of discussion, including the costs of
297 following all aspects of the guidance such as the direct costs of PPE, and the

298 indirect costs of reduced patient flow. A perceived shift in treatment provision
299 was noted with an increased likelihood of extracting posterior teeth and the
300 avoidance of complex operative care. In addition, DPs highlighted broader
301 issues of access to dental services and a shift to preventive care. This change
302 was challenging, particularly under the UK funding model. In addition, dentists
303 who were leading the dental team reported feeling that their professional
304 freedom was challenged by their perceived need to adhere to the
305 recommendations. They also reported additional stress as a result of leading
306 the team in a new way of working; “being the person the team look for giving
307 the answers is very stressful”.

308 Some dental personnel were redeployed to other healthcare settings, others
309 were paid to stay at home through a government initiative termed ‘furlough’. On
310 the other hand, redeployed staff often found it challenging to return to dentistry,
311 exhausted after working in unfamiliar and highly stressful environments

312 DPs from the UK spotlighted the needing to prepare patients for the new
313 approach to PPE as it would differ from their usual experience. Furthermore,
314 DPs in the UK felt that some of their patients were fearful of attending the dental
315 office since it was portrayed in a variety of media as a risky environment,
316 despite the excellence of dentists at cross infection control. Social media often
317 was reported as a “source of evidence for patients”, which is problematic since
318 the source and quality of such information is varied. Practitioners in the UK felt
319 that there had been a shift towards the delivery of preventive care (but this was
320 acknowledged to be challenging, particularly within the UK funding model). The
321 need for staff to be trained in a more preventive approach was also noted.

322 In the United States, DPs reported changes to the interactions between staff
323 with informal gatherings such as lunchtime meetings and informal chats no
324 longer being held. This resulted in a lowering of job satisfaction, and feelings of
325 exhaustion. As with the UK DPs, the US participants reported a change in care
326 planning, in order to avoid complex aerosol generating procedures.

327 For the German participant, the main impact related to the finances of the
328 practice since they incurred additional costs to implement the PPE, but were
329 not reimbursed as the national dental funding has fixed fees for dental
330 procedures.

331

332 **Discussion**

333 The COVID-19 pandemic created a great deal of uncertainty within dental
334 practices concerning the required PPE and the types of procedures which could
335 be undertaken. Guidance was generated in a rapid fashion and implemented
336 nationally through a variety of sources. This study explores how practitioners
337 made decisions about the adoption of and adherence to the guidance. The
338 findings have implications for our understanding both of the specific issue of
339 how practitioners responded to the COVID-19 pandemic, as well as the more
340 general adoption of evidence based guidance.

341 Across all participant groups there was a perception that whilst there was
342 general agreement on how to ensure a low risk of infection in the dental
343 practice, the practical implications were less clear. This high level of agreement
344 on the principles of cross infection control has also been reported by Kamate
345 et al., in a survey of participants living in Asia, Americas - North and South,
346 Europe, Africa, and Australia (Kemate et al. 2020). We found little evidence of
347 differences in knowledge among participants by age and duration of practice,
348 mirroring the work of Quadri et al. (2020).

349 The respondents reported using a variety of heuristics to guide the
350 implementation of the particular PPE guidance that they had chosen. These
351 included their perception to the degree to which the guidance was deemed
352 'logical' and 'implementable'. Whilst the basis for these decisions varied across
353 countries and between individuals, the general principle appeared to focus on
354 the balance of being able to maintain patient flow, income generation within the
355 practice with factors such as the availability of PPE and the perceived risk of
356 non-compliance with certain aspects of the guidance. For example, one way of
357 achieving this balance was a shift to virtual appointments, or emergency only
358 appointments. In countries such as Norway and China twice as many patients
359 attended appointments by telephone compared to in person clinical care
360 (Stangvaltaite-Mouhat et al. 2020; Yang et al. 2020), where numerous public
361 dental hospitals only treated emergencies (Yang et al. 2020).

362 The challenge to the implementation of guidance which resulted from resource
363 limitations and pipeline delays was not raised by the participants within the
364 focus groups. The reason(s) for this are unclear. One possibility is
365 methodological – the way in which the question was asked in the present tense,

366 may have led respondents to focus on the current facilitator and barriers to
367 adoption. Alternatively, it may be that this was genuinely not a problem for our
368 respondents or one that featured less significantly than the other barriers
369 mentioned.

370 The use of PPE represented a challenge not only to dental practitioners, but for
371 the entire population, and patients in care and health care settings. Dental
372 practitioners reported that that in children from Colombia and USA, the PPE are
373 seeing as “costumes” and people wearing them “look like astronauts”, as
374 reported by the participants. The authors know of no other published empirical
375 studies that have explored this issue either in dentistry or other healthcare
376 discipline, it would be interesting to understand whether this impact was more
377 general than simply in the dental setting.

378 For all aspects of clinical decision making in dentistry, the clinician is
379 encouraged to weigh the empirical evidence, alongside the views of the patient,
380 and the clinician’s own preferences and experience. To a certain extent this
381 process appears to have taken place during the adoption of the COVID-19 PPE
382 guidance, however a fourth variable appears to have been incorporated,
383 namely consideration of the impact of any change on the business of dentistry.
384 Further research should explore the role that business-based decisions can
385 override the three core decisional influences of evidence based practice:
386 Empirical evidence; patient preference; and clinician preference. Furthermore,
387 it is possible that policymakers and funders of services could use specific
388 business models to encourage the adoption of the best clinical practice
389 guidelines.

390

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396 The authors declare that there are no conflicts of interest with respect to the
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403 **Author contributions**

404

405 Beltrán E, substantially contributed to the conception and design of the study,
406 data acquisition, analysis and interpretation, drafted the manuscript, critically
407 revised the manuscript for important intellectual content, gave final approval
408 and agreed to be accountable for all aspects of work ensuring integrity and
409 accuracy.

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413 and agreed to be accountable for all aspects of work ensuring integrity and
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415 Avila A, contributed to the study conception, data acquisition, drafted the
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418 Pitts NB, contributed to the conception, critically revised the manuscript and
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421 Castellanos JE, contributed to the conception of the study, critically revised the
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424 Tenuta LMA, contributed to the study conception, critically revised the
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427 Martignon S, substantially contributed to the conception and design of the
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432

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