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RESEARCH ARTICLE

Organizational Preventative Strategies Undertaken by Dental Clinics in Fiji during COVID-19 Pandemic: A Qualitative Study

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Abstract:

Aim:

This research aims to determine the organizational preventative strategies implemented by dental clinics in Fiji during the COVID-19 pandemic.

Methods:

This qualitative study was conducted amongst Dental Officers (Dos) and Dental Managers (DMs) who were working at government dental clinics, private dental clinics, and the School of Dentistry and Oral Health clinic (SDOH), in the Central Division, Fiji. A semi-structured open-ended questionnaire was used for data collection through in-depth interviews *via* zoom. A manual thematic analysis of the data was conducted.

Results:

Thirty Dos and 17 DMs participated in this study. 16 themes emerged from data analysis: Major Strategies implemented, Staff perception about strategies in place, Triage and Screening, Hand hygiene, Waiting room changes, Operational Capacity, Universal precautions, Personal Protective Equipment (PPEs), Disinfection and decontamination protocols, Ventilation, Sterilization, Pre-procedural mouth rinse, Waste management, Vaccination status, Bubbles and Adaptation of Protocols. The Dos were generally satisfied with the strategies implemented by the DMs. The DMs along with other Dos had used various guidance documents to devise tailor-made ones suited for dental clinics in Fiji.

Conclusion:

Various strategies were adopted from several guidelines and tailor-made Standard Operating Procedures (SOPs) for each workplaces were developed by the various DMs. The majority of Dos were in favor of and satisfied with the protocols in place. Future research can be conducted in other divisions and include other health care professionals as well apart from just Dos and DMs.

Keywords: COVID-19, Protocols, Preventive strategies, Dental professionals, Dental clinics.

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1. INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as COVID-19, is a respiratory disease that emerged from a novel coronavirus in December 2019 [1, 2]. This virus emerged as acute pneumonia and was first identified in Wuhan City, China [3 - 5]. The outbreak has exceedingly spread worldwide and has become a public health crisis [5]. The disease was declared a global pandemic by the World Health Organization (WHO) on 11 March 2020 [6, 7]. The most common symptoms of COVID-19 are fever, cough,

sore throat, fatigue, myalgia, headache, shortness of breath, and in some cases diarrhea [2, 5, 8, 9].

COVID-19 has created a significant impact on dentists and oral health professionals [3, 10, 11]. The scientific literature has drawn attention to factors such as dentists close contact with patients [12]. This causes constant exposure to body fluids such as blood and saliva as well as the spread of aerosols during dental procedures [12]. The US Centers for Disease Control and Prevention (CDC) has stated that the droplets and aerosols generated during dental procedures are regarded as high risk [10, 13]. COVID-19 has significantly affected Fiji and its people. The pandemic had caused unprecedented changes to dental settings, dentists, and dental patients. There was fear

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amongst dental professionals in Fiji to safely reopen during the pandemic. Hence, the need for organizational preventive strategies to safeguard dental professionals and patients in a high-risk environment, such as a dental clinic. No research has yet been conducted in Fiji to report these findings. Hence, this study aims to determine the organizational preventative strategies implemented by dental clinics in Fiji during the COVID-19 pandemic.

2. MATERIALS AND METHODS

2.1. Study Design and Setting

A qualitative study was conducted among Dental Officers (Dos) and Dental Managers (DMs) through in-depth interviews in Central Division, Suva, Fiji between 9th August to 12th September 2021. A qualitative study helps to collect genuine ideas and provides valuable insights into relevant issues and experiences. It helps to explore and understand social and behavioral issues as well [14 - 16].

The study was conducted in government dental clinics, private dental clinics, and the School of Dentistry and Oral Health clinic (SDOH). There are approximately 10 government dental clinics including the main Colonial War Memorial Hospital (CWMH) dental clinic, 26 private dental clinics, and 1 SDOH in the Central Division, Suva, Fiji. Nine private dental clinics and eight government dental clinics were selected based on random sampling. As for schools, there is only 1 dental school in Fiji that was selected for the study.

2.2. Study Sample

The study population comprised all the dental staff of the dental clinics in Suva, Fiji. The study sample on the other hand was selected based on the inclusion and exclusion criteria. The inclusion criteria for DOs included; Dentists and dental interns of any ethnicity and gender with at least 6 months of working experience. The exclusion criteria included any other dental practitioners, DOs from other dental clinics, and those DOs who were not willing to participate in the study. The inclusion criteria for DMs included; Sub-divisional Dental Officers (SDDO), Senior Dental officers (SDOs) and Principal Dental officers (PDO) of the selected government and private dental clinics, DMs of any ethnicity and gender with at least 6 months of working experience. The exclusion criteria included DMs of other clinics apart from the selected dental clinic and DMs who do not provide consent or were not willing to participate in the study.

A purposive sampling method was used for the selection of DOs and DMs. Thirty DOs out of approximately 40 were selected for the study based on the inclusion and exclusion criteria; 6 from private dental clinics, 18 from government dental clinics, and 6 from SDOH. All 30 DOs had undergone an in-depth interview *via* zoom until data saturation was reached. Seventeen DMs out of approximately 35 were selected based on the exclusion and inclusion criteria who had undergone an in-depth interview *via* zoom until data saturation was reached; 9 from private dental clinics and 8 from government dental clinics.

2.3. Data Collection Tool

A self-developed semi-structured open-ended questionnaire was used for data collection through in-depth interviews with DOs and DMs. Semi-structured in-depth interviews are one of the common methods used in qualitative studies to collect data in health service research [17]. It involves dialogue between the researcher and participant and is guided by a flexible interview protocol [17]. This method of data collection enables the researcher to collect open-ended data, share feelings and beliefs about a particular topic, explore the thoughts of participants, and also helps to explore more deeply into personal and sensitive issues as well [17]. The questionnaires had 2 sections respectively. The first section recorded the demographic information for the DOs; unique identification number, age, gender, highest qualifications attained, designations, and job experience of the DOs. The second section included 6 open-ended questions to gauge the dentist's perception of the impact of COVID-19 on dentistry.

2.4. Study Procedure

The dental managers of the respective clinics received the flyers 2 weeks prior to commencing the data collection *via* email. The flyer contained brief information regarding the study. The DMs were requested to inform their staff regarding the study as well. The interested DMs and DOs emailed and called the principal investigator directly for participation. An interview time was selected by the principal investigator based on the availability of the participants. Each participant was given a participant information sheet. Following this, those participants who agreed to take part in the research were given a consent form. The consent forms were collected and kept by the principal investigator safely. 30 to 35 minutes in-depth interviews were conducted for each participant by the trained principal investigator *via* zoom. An abductive approach to the interview was undertaken, whereby the results from the first interview guided the subsequent ones [18]. Voice recording was done as a means of back up and written notes were also taken during each interview.

2.5. Data Management and Analysis

Immediately after each interview, it was transcribed manually by the principal investigator into Microsoft word. After the initial interview was transcribed, the principal researcher read the transcript repeatedly to identify any potential errors which were considered and improved in subsequent interviews [18]. The principal investigator read the transcript multiple times also to become familiar with the content and identify common and significant elements to create codes. Codes are shorthand labels to describe the contents of the interviewee [19]. These codes were grouped (subthemes) to identify common patterns to create broader themes [19] which were reviewed and confirmed by the principal supervisor. Data were interpreted in the context it was obtained to see if the interviewer had any influence on the participant's answers and if the answers were requested or not. Data were entered after each interview until data saturation was reached [18].

2.6. Study Rigour

It is important to ensure methodological rigour when conducting qualitative studies [20]. Four-Dimensions Criteria

(FDC) to establish trustworthiness which has been applied to this study as well; credibility, dependability, confirmability, and transferability [20]. Credibility was ensured by engaging with participants, distributing flyers, and verbal explanations regarding the study, and the in-depth interviews ranged from 30-60 minutes. Dependability was maintained by having a thorough literature search, data coding was done and transcripts were re-read to identify errors, and raw data were kept by the principal investigator. Confirmability was maintained in the following ways: thorough methodology and investigator and data source triangulation were ensured. To ensure transferability, random and purposive sampling methods were used, and data were collected until data saturation was reached.

2.7. Ethical Considerations

Ethics approval was obtained from the College Health Research Committee (CHREC) of Fiji National University (FNU) with ID#035.21, Fiji Health Research Ethics Committee (FHRERC), and facility approval from various private dental clinics selected for the study. Written consent forms were obtained from them before collecting data. Participant confidentiality was maintained at all times using unique identification numbers (codes) instead of using their names. The participants were informed that their participation in the study is voluntary and they could leave the study at any stage. The transcribed scripts and recorded interviews were only accessible to the principal investigator and were kept on a computer that was password protected.

3. RESULTS

3.1. Characteristics of DOs and DMs

Thirty DOs participated in the interview virtually *via*

zoom; 6 DOs from the private dental clinics, 6 DOs from the school dental clinics, and 18 DOs from the government dental clinics. There were more female participants (66.7%) noted. The majority of participants were from the age range of 20-30 years (50%). 80% of participants were Fijians of Indian Descent (FID). The majority of participants attained a Bachelors degree as their highest qualification level (70%). After attainment of BDS qualification, the majority of participants had work experience ranging from 1-5 years (33.3%).

Seventeen DMs participated in the interview virtually *via* zoom; 9 DMs were from private dental clinics and 8 DMs were from government dental clinics. There were more male participants (58.8%). The majority of participants were from the age range of 31-40 years (47.1%). An equal number of Fijians of Indian Descent (FID) and I-taukei (IT) (47.1%) participants were noted. The majority of participants had work experience ranging from 11-20 years (58.8%) with the majority of participants having the highest qualification level as Bachelor's level (94.1%) (Table 1).

3.2. Themes Identified

Sixteen themes emerged from data analysis. Two themes are discussed under perceptions of DOs: Major Strategies implemented and Staff perception about strategies in place. 14 themes are discussed under perceptions of DMs: Triaging and Screening, Hand washing and hand sanitization, Waiting room changes, Operational Capacity, Universal precautions, Personal Protective Equipment (PPEs), Disinfection protocols, Ventilation, Sterilization, Pre-procedural mouth rinse, Waste management, Vaccination status, Bubbles and Adaptation of Protocols. Table 2 summarizes the themes and codes.

Table 1. Characteristics of DOs (n= 30) and DMs (n= 17).

Characteristics		Do	DMs
		Frequency (%)	Frequency (%)
Gender	Male	10 (33.3)	10 (58.8)
	Female	20 (66.7)	7 (41.2)
Age Group (Years)	20-30	15 (50)	4 (23.5)
	31-40	9 (30)	8 (47.1)
	41-50	3 (10)	3 (17.7)
	51-60	2 (6.7)	2 (11.7)
	Above 60 years	1 (3.3)	0 (0)
Ethnicity	I-taukei	3 (10)	8 (47.1)
	Fijian of Indian Descent	24 (80)	8 (47.1)
	Others	3 (10)	1 (5.8)
Highest Qualification	Bachelor level	21 (70)	16 (94.1)
	Post graduate level	9 (30)	1 (5.8)
Number of Years of Practice	6 months - 1 years	2 (6.7)	0 (0)
	1-5 years	10 (33.3)	3 (17.7)
	6-10 years	7 (23.3)	3 (17.7)
	11-20 years	7 (23.3)	10 (58.8)
	21-30 years	3 (10)	1 (5.8)
	More than 30 years	1 (3.3)	0 (0)

Table 2. Themes and open cods from the interview.

Themes	Open Codes	Quotation Examples
Perceptions of Dos		
Major Strategies Implemented	Protocol, Sterilize, Infectious, Waste, PPE, Infection Control, Wipe, Triage, Appointments, app	<i>"When we have our Meetings..."</i> , <i>"Definitely this was on Appointment Basis..."</i> , <i>"And I think the way we are Handling..."</i> , <i>"We do have an AC and fan..."</i> , <i>"Previously we used to just wear..."</i> , <i>"The Protocols in terms of Wiping..."</i> , <i>"And then the Students, they..."</i> , <i>"Yeah, we Actually Stopped..."</i> , <i>"So, in the School Clinic Actually..."</i> , <i>"The Tamanu app Just got Introduced..."</i>
Staff Perception about Strategies	Changes are Really Good, Good thing, not Prepared, Increased Waiting time, Accept	<i>"I think these Changes are..."</i> , <i>"It's a Good thing but..."</i> , <i>"The thing is, when..."</i> , <i>"Our Clinic is in Heavily Populated..."</i> , <i>"I feel with the PPEs..."</i>
Perceptions of DMs		
Triaging and Screening	Triage, Symptoms, Registration	<i>"We ask them if..."</i> , <i>"Before the Pandemic..."</i>
Hand Hygiene	wash their hands, hand Sanitizer, Sanitize	<i>"We have to Follow the..."</i> , <i>"I didn't Realize that..."</i>
Waiting Room Changes	Waiting Room, Waiting area	<i>"We have taken out..."</i> , <i>"We have a Designated..."</i>
Operational Capacity	50% Capacity, Patient Numbers, MCTTT, Infection Control	<i>"The other thing is that..."</i> , <i>"We were not able to Initially..."</i>
Universal Precautions	no Contact, very Strict,	<i>"We are no Longer Making..."</i> , <i>"Whatever the Card or the Pink..."</i> , <i>"Basically, we very Strict..."</i>
Personal Protective Equipment (PPEs)	Clinical Coat, PPE, Disposable Gowns, hair net, face Shield, Donning, Doffing,	<i>"Before we would be..."</i> , <i>"The other is the use of Disposable..."</i> , <i>"Another thing what I was..."</i> , <i>"We try to see the Morning..."</i> , <i>"We are Blessed to have..."</i>
Disinfection and Decontamination Protocols	Wiping down, Disinfection, Decontamination, Contaminated, Disinfect	<i>"Wiping down! Before we..."</i> , <i>"As for now since we..."</i> , <i>"We used to have a..."</i> , <i>"We Still Follow all..."</i>
Ventilation	Ventilation, fallow Time, Aerosolized, Non-aerosolized, Negative Pressure Rooms, air the Clinic	<i>"We've got the Ventilation..."</i> , <i>"The fallow time is 22 Minutes..."</i> , <i>"And Regarding the Ventilation..."</i> , <i>"One Requirement for seeing..."</i>
Sterilization	Sterilized, Sterilization, Infection, Soiled Instruments,	<i>"Like after every patient..."</i> , <i>"unplanned returns, dry Sockets..."</i> , <i>"Sterilization needs to be Strict..."</i>
Pre-procedural mouth rinse	Mouthwash, mouth Rinse, Rinsing	<i>"After Patients come..."</i> , <i>"For that mouth Rinsing..."</i>
Waste Management	Clinical waste, waste, Rubbish Bags, Clinical Bags	<i>"Also Waste Management..."</i> , <i>"But now we have Stopped..."</i>
Vaccination Status	Vaccinated, Unvaccinated, Vaccine, Vaccination	<i>"At the Moment we have..."</i> , <i>"I don't wanna Encourage..."</i> , <i>"Just Today the OHS..."</i> , <i>"We cannot Choose Patients..."</i>
Bubbles	Bubbles, Working Bubbles, Chair time	<i>"We have Bubbles..."</i> , <i>"We couldn't have..."</i> , <i>"The Clinic is open now..."</i>
Adaptation of Protocols	Guideline, WHO, Ministry of Health, FDA, MCTTT, Webinars	<i>"The Guideline is there ay..."</i> , <i>"Yes, all these are from..."</i> , <i>"The changes have been adapted..."</i> , <i>"So yeah, Everything..."</i> , <i>"Information is from Ministry..."</i>

3.3. Perceptions of DOs

3.3.1. Major Strategies Implemented in the Dental Clinic

The Majority of DOs noted that there was strengthening and reinforcement of universal precautions. The majority of participants noted changes in the PPEs. There were additional PPEs used by all DOs for safety reasons. Another strategy noted by a few DOs was forgoing lunch breaks and serving the public in order to avoid the wastage of PPEs. This gave them an earlier break as well.

"Previously we used to just wear the mask and just the normal eyewear but now we wear face shields, at least a KN95 mask, we even have the yellow disposable gowns that we wear and in terms of the infection control" (DO18, a 26-year-old, FID).

Triaging and screening became more stringent in the majority of dental clinics. In the school dental clinics, even the students were being triaged and screened. Only one-way

movement of the individuals was allowed.

"And then the students, they had to be triaged as well in terms of the temperature, the hand sanitizer and then they had to walk in, in a single file, one by one they had to walk into the clinic" (DO9, a 39-year-old, FID).

Changes in the disinfection techniques were noted in the majority of dental clinics as well. Mostly Milton's solution was used for disinfection in the majority of dental clinics. A change was noted in terms of sterilization, by a few DOs, which was the major reason for seeing appointment cases only for conservative treatment after the first wave of the pandemic.

"Definitely this was on an appointment basis because the handpieces needed to be sterilized. Previously we used to cold sterilize but with covid 19 being such highly transmissible, we could only see certain patients. So, we have like about 7 or 8 handpieces, so we could only see [7] or 8 patients in a day for fillings" (DO18, a 26-year-old, FID).

Changes were noted in the waste management techniques as well. As for the ventilation systems, the school dental clinic was well-equipped and had a proper ventilation system in place (negative pressure clinic). However, since none of the government dental clinics and the majority of dental clinics did not have appropriate ventilation and filtration systems in place, they were utilizing the resources available.

"We do have an AC and fan and we do have windows, but we make use of the windows. So in between patients we open up the window and try to air out the clinic." (DO13, a 28-year-old, FID).

One major change noted by the MoHMS DOs was the introduction of the new app during the pandemic.

"The Tamanu app just got introduced maybe a month ago, so its relatively new. They are still updating it I suppose. So now it's working better" (DO28, a 25-year-old, FID).

3.3.2. Staff Perception about Strategies in Place

The majority of DOs from the MoHMS were happy with the protocols in place and wanted them to continue.

"I think these changes are really good and it should just continue after covid even. Because there is less risk, there are no chances of cross infection and all." (DO12, a 26-year-old, FID)

A few DOs from the MoHMS shared their views regarding the Tamanu app as well.

"It's a good thing but I feel like they needed this app like maybe about 4 months ago when the cases were at the peak." (DO28, a 25-year-old, FID)

While the majority of DOs appreciated the protocols in place currently in the MoHMS dental clinics, a few others thought the clinics should have been better prepared after the first wave to be able to tackle it better. A few others thought that they are only able to serve a limited number of people due to the protocols in place while the demand for treatment is still there.

A few of them shared their views and expressed their interest to start seeing patients with precautionary measures as the pandemic may last longer in the country and the public are on the losing side.

"I feel with the PPEs that we have, I feel we have to go ahead with the procedures we can provide for the benefit of our patients ay, because we can't be waiting on impacted teeth, we can't be waiting on infected teeth, on the impacted tooth to become infected, in that way, we are not doing our patients a favor, its unethical on our side to do that because this is the new normal now, we have to accept that this is the new normal now" (DO27, a 34-year-old, IT).

3.4. Perceptions of DMs

3.4.1. Triage and Screening

All DMs reported triaging and screening patients in their practices. Some private dental clinics reported doing tele-triage and triaging once the patient comes face to face as well.

"We ask them if they have any symptoms, like fever and all over the phone and then we triage them at the main entrance downstairs too when they come. We check their temperature and look for obvious signs and symptoms of any fever or running nose or anything like that and, yeah... if they are clear with regards to everything then they come upstairs to the clinic. They are not allowed to enter unless we triage them downstairs" (DM6, a 29-year-old, FID).

Private dental clinics that are operational have the (Quick Response) QR codes in practice which the patients used to scan and enter the clinic for proper record keeping and tracking of COVID-positive cases. However, none of the government dental clinics in the central have the QR codes in practice, they have a manual register for patients instead.

"Before the pandemic, people were just entering through the main door right to the registration area, getting registered and waiting to be called in. During the pandemic, we have stopped everyone in through the main door, they are assessed, triaged, and vitals taken from outside, and registered from outside. So, these things are done by the dental hygienist ay with full PPEs" (DM14, a 40-year-old, IT).

3.4.2. Hand Hygiene

The majority of dental practices reported having compulsory hand washing or hand sanitization technique in their practices for the patients.

"We have to follow the protocols, first there is a sink outside where they have to wash their hands, then hand sanitize, temperature also has to be taken before they walk into the clinic" (DM2, a 50-year-old, IT).

The DMs shared their thoughts and stated the importance of dental professionals strictly following hand hygiene as well.

"I didn't realize that I don't actually really practice 100% infection control, like, I remove the gloves and thinking my hands are sterile and I wear another new glove.... After this pandemic, the use of hand sanitizer, was something that I have improved on, I sanitize before and I sanitize after each patient" (DM7, a 58-year-old, IT).

3.4.3. Waiting Room Changes

The majority of DMs had made changes to their waiting rooms and did not allow a lot of patients inside.

"We have taken out all extra stuff that's sitting there, like no magazines, ummm you know we used to put our business cards on top, we don't do that anymore, even the pens, we wipe the pens down as soon as it is being used. Ummm the girls wipe the front surfaces all the time, no one is allowed to sit in the waiting room, normally we have like lots of patients waiting in the waiting room, we don't do that anymore" (DM4, a 34-year-old, FID).

One of the DMs from the MoHMS dental clinic highlighted keeping patients separated in the waiting area, in terms of those who were to be seen for the day and those who didn't get numbers for the day.

"We have a designated waiting area for dental patients"

and even with our designated dental area, we have it divided into 2 ay... yeah... so we have a place for those who have numbers on one end and those who come in late and don't have numbers, they sit on a different side of the room. These patients are sitting 2 meters apart." (DM12, a 29-year-old, IT)

3.4.4. Operational Capacity

All the DMs highlighted having only one patient inside the clinic at one time.

"The other thing is that before, we have got a 2-chair clinic, so 2 dentists could generally work together all the time, but now because of the new law by MCTTT that only 50% of your business can be running so me and my other colleague are alternating so we only have like one patient in the clinic at one time. So that sort of effects the number of patients we can see as well." (DM4, a 34-year-old, FID)

A few DMs were highlighted on the one-way entry and exit to keep a flow for the patients. This minimized patients interaction as there was only one-way patient flow.

"We were not able to initially accommodate everything that was required to create a good environment for good infection control ay.... Like the entrances, one area of entrance and one area of exit, you enter the clinic one door, you go out the other door....and you know we only have one door, you enter and you exit using one door." (DM12, a 29-year-old, IT)

3.4.5. Universal Precautions

All DMs highlighted practicing universal precautions. Various examples of this were given. A few DMs tried to avoid any contact with the patients and themselves or their staff.

"Whatever the card or the pink slips they bring down from the MOs, we have got a small trash bag at the reception, so the numbers or anything, normally which we used to take from the patients, we just tell them to put it in that bag. So there is no contact with that patient on that aspect as well." (DM3, a 39-year-old, FID)

The majority of DMs required the patients to be masked until their oral examination.

"Basically, we very strict, we allow only the patient inside the clinic and yeah..... and they have to keep their mask on, and the only time they can take their masks down is when I am having a look in their mouth or when we are taking x-rays." (DM9, a 34-year-old, FID)

3.4.6. Personal Protective Equipments (PPEs)

All DMs highlighted wearing full PPEs: the hair net, face shields, eyewear, gloves, disposable gowns, clinical coats or scrubs, and shoe covers. The majority of DMs highlighted that they have strict protocols in place for PPEs; one PPE per patient.

"Before we would be in our clinical coats and we can be using that throughout the day for the number of patients that we see but now we have limited that to one PPE per patient." (DM6, a 29-year-old, FID)

Donning and doffing of PPEs were strictly monitored by

almost all DMs. A few dental clinics had their designated PPE donning and doffing areas. A few dental practices worked through the lunch hour even to prevent repeated donning and doffing.

"We try to see the morning and afternoon patients in the morning, so we try to work through, we try to work through the lunch hour. So that we put on the PPE once. So that we don't put the PPE on and off in between the meals ay." (DM12, a 29-year-old, IT)

3.4.7. Disinfection and Decontamination Protocols

The majority of DMs were very strict with their disinfection protocols. Majority DMs reported of using Milton's solution for disinfection purposes.

"As for now since we are in the red zone area, I have to be very careful with what I do so, disinfection is a must. I use Milton to wipe the chair, clean all those high risk and highly contaminated surfaces ay.. like the doorknob, the mixing areas, the chairs, the patients waiting area." (DM13, a 28-year-old, IT)

The DMs of the government dental clinic also reported having the dental clinics decontaminated.

"We used to have a lot of instruments on the counter in the clinics ay, but now we have removed everything from the clinic....I have tried to minimize the number of things in the clinics, so its easy for the decontamination team to come and wipe down." (DM10, a 48-year-old, IT)

3.5. Ventilation

Only one of the private dental clinics had the proper ventilation and filtration system installed. This was confirmed by the DMs of the clinic. A few DMs from private practices are looking into purchasing the filtration units for their practices. Some are looking into loans.

"And regarding the ventilation, yeah... it is an investment so we ..aaaaa.... we have already lodged for the grant, the business link grant, we are waiting for that. Otherwise...but we will definitely have to look at probably applying for a loan, getting a loan in order to get ventilation sorted out in the office so that we can at least practice safely and more comfortably." (DM9, a 34-year-old, FID)

However, none of the MoHMS dental clinics have these filtration and ventilation systems in place, hence, they have a set protocol to allow proper ventilation.

"One requirement for seeing COVID-positive patients is negative pressure rooms but our facilities do not have that. So, what our practice, what we used to do is, after every one or one and half hours of seeing patients, we open up the windows on both sides, and we just air the clinic, everyone comes out, the staff and we stop patients and then we air out the clinic." (DM15, a 53-year-old, IT)

The DMs followed fallow times which varied among different practitioners and the type of procedures performed.

"The fallow time is 22 minutes. That's for aerosolized procedures, but if we are not going aerosolized procedures, the

fallow time is a bit lower. If its non-aerosolized then we just do 10 minutes.” (DM4, a 34-year-old, FID)

3.6. Sterilization

While none of the DMs from the private sector reported any changes made to their sterilization techniques. A few from the MoHMS had made some changes in their sterilization techniques. A few DMs from the MoHMS stated that improvements in sterilization techniques had resulted in fewer unplanned returns to the clinics.

“Like after every patient, the soiled instruments are soaked for a while so once our basin is full, its washed, packed and sterilized. So, all the instruments in our clinic, from mirror, probe, forceps, elevators, everything is packed, we don't leave any instrument open.” (DM17, a 36-year-old, FID)

One of the DMs from the private sector highlighted the importance of sterilization and avoided sterilization during the peak of the pandemic and used disposable sets instead.

“Sterilization needs to be strict. Proper sterilization is very important at this time. Luckily just before the pandemic, one of my staffs' husbands do whole selling so they had brought some disposable OE sets, so patients whom I am not very confident about I just use those disposable sets and there is no need for sterilization. Even one mistake can lead to so many other problems.” (DM3, a 39-year-old, FID)

3.7. Pre-procedural Mouth Rinse

Very few DMs from the private practice reported using pre-procedural mouth rinses.

“After patients come in, they rinse with a mouthwash, after the mouth wash then I proceed with the treatment and consultation.” (DM8, a 37-year-old, FID)

The DMs from the MoHMS did not have strict protocols in place regarding mouth rinses and it depended much on the supplies.

“For that mouth rinsing, we are still trying to discuss with FPBS if they can provide us with that. Maybe chlorhexidine mouth wash because it's really expensive to buy mouthwash that is commercialized so for mouth rinses, we are just waiting for FPBS to come up with something so we can do mouth rinsing before we do any work on the mouth ay...” (DM10, a 48-year-old, IT)

3.8. Waste Management

None of the DMs from private dental clinics reported changes to their waste management protocols. However, a few dental clinics from the government dental clinics reported changes had been made.

“Also waste management, is part of the SOP and it is very important. How we manage our clinical waste before. It is something that was kind of lacking, so we have strengthened our infection control protocols with regard to this as well. We managed to build an incinerator for the hospital so all our clinical waste is just burnt there. So that is part of the SOP, the waste management part.” (DM14, a 40-year-old, IT)

3.9. Vaccination Status

The majority of private dental practices only saw vaccinated patients only. DMs of private practices did not want to see unvaccinated patients for various reasons; one of them is to encourage people to get vaccinated. Vaccination was mandatory for practicing staff as well. Government officials would do random checks to ensure this.

“At the moment we have decided to see vaccinated patients only. Just to, you know, for our safety, and also try to encourage people in a manner.... It's a little negative but in a manner that they should try to get vaccinated if they prefer to be treated.” (DM6, a 29-year-old, FID)

While most private practitioners have a choice, the DMs from the MoHMS reported that they cannot be selective regarding patients' vaccination status.

“We cannot choose patients who are vaccinated either. We are not selective with our patients. We don't even know their vaccination status and we don't even know their COVID status, we are treating every patient as positive.” (DM10, a 48-year-old, IT)

3.10. Bubbles

Almost all DMs from the government dental clinics reported having working bubbles. The number of members in each bubble differed depending on the number of staff employed. These bubbles worked on alternating days. Two DMs from the MoHMS dental clinics reported not being able to form bubbles due to staff shortage.

“We couldn't have working bubbles in our dental clinic because we had less staff. So the risk of all the staff going down at one time because they were having COVID, it was because they were all in one bubble. Even though we have discussed, discussed and a lot of discussion regarding how to separate the bubble into two, we really couldn't because of lack of staff.” (DM14, a 40-year-old, FID)

While working in bubbles was a common thing for the government dental clinics, most private dental clinics did not report having this due to the small number of people working in the clinic while a few clinics did have staff working on alternating days.

“... its 2 of us operating at the same time, but now the chair time for each has reduced, so it's the 2 of us operating on 3 days each and then another dentist operating on 1 day.” (DM4, a 34-year-old, FID)

3.11. Adaptation of Protocols

The DMs developed tailor-made clinical standards operating for their clinic's procedures from various guidelines.

“The guideline is there ay, but we have to tailor make that guideline to suit our workplace. So, we have developed our own SOP in accordance to the national guidelines.” (DM10, a 48-year-old, IT)

A few private practitioners are using multiple sources in order to operate safely.

“Information is from the Ministry of health guidance

document, first one because they are following WHO. Secondly, I personally go to WHO websites because I have subscribed to them so if anything, new comes I do get those notifications. Third, are the webinars which the FDA president and team are organizing which is very relevant to private practitioners. There is also a messenger group, so we get updates there too, if there is anything new, we go and read. The FDA Viber group is also very helpful. If I am not sure of anything then I go and read, at this moment we need to be very updated.” (DM3, a 39-year-old, FID)

4. DISCUSSION

Thirty DOs and seventeen DMs were interviewed for this study to determine the organizational preventative strategies implemented by the dental clinics in Fiji during the COVID-19 pandemic. The themes identified were: Major Strategies implemented, Staff perception about strategies in place, Triage and Screening, Hand hygiene, Waiting room changes, Operational Capacity, Universal precautions, Personal Protective Equipment (PPEs), Disinfection and decontamination protocols, Ventilation, Sterilization, Pre-procedural mouth rinse, Waste management, Vaccination status, Bubbles and Adaptation of Protocols.

Proper history taking and temperature measurement of every patient is vital before the dental treatment [6, 21]. Similarly, in this study, all DMs and DOs reported triaging patients as well as their staff. A few DMs had trained their staff to triage patients. A few DMs and DOs particularly at the private and school dental clinic reported tele-triaging patients as well. Literature [7] reported that tele triage was of great help and allowed all necessary paperwork, signatures, explanations, and consent to be handled prior to a dental visit. This ensures a lower risk of transmission for both patients and oral health care providers [7]. Furthermore, a few dental practices were doing COVID tests for the patients and staff. Testing in the MoHMS dental clinic had to stop after directives were given later by the MoHMS. This made the staff working there a bit insecure, however. Literature [22] reported similar findings whereby dental practitioners preferred to have COVID-19 test results from all patients prior to any aerosol-generating treatment procedures.

All participants in this study including the DOs and DMs encouraged hand hygiene among their staff, patients and performed hand hygiene themselves. Participants reported that they took this lightly prior to the pandemic, however, the pandemic was an eye-opener and this section of infection control was strengthened. The majority of DMs had alcohol-based hand sanitizers at their clinic entrance as well. Studies have recommended that patients and staff should sterilize their hands every time they touch something in the clinic [6, 23]. 60-95% alcohol-based hand rub is recommended [23] or soap and water can be used for at least 20 seconds [24, 25]. Both methods are equally effective [26].

Nearly all DMs brought about changes in their clinic waiting room and almost all DOs noticed changes in the waiting room of the dental practices they worked in. The DMs, particularly at the private practice reported having only one patient in the waiting room as per their appointment times.

However, for the MoHMS dental clinics, this was not possible as patients came without appointments as an outpatient during the pandemic. Patients should be advised to enter the clinic with no companion, except for children or people with special needs, or the elderly [23]. Dental clinics should have entry and exit signs for patients to minimize interaction and contacts and the waiting rooms need to be disinfected [1, 23]. The DOs from the SDOH reported having one-way patient flow along with a few dental clinics which were in a hospital setting.

The majority of DMs and DOs from the SDOH and private dental clinics in this study reported seeing patients on an appointment basis. Only a few reported seeing walk-in patients. However, as for the government dental setting, patients were seen as outpatients, and only after the first wave of the pandemic were patients given appointments for AGPs only. However, the patient numbers were limited due to additional precautionary measures put in place in each dental clinic. Literature [6] recommended that the number of patients seen in outpatient reservations should be reduced.

The authors suggested that dental professionals and staff should regard every patient as a suspected COVID-19 carrier [27]. A similar protocol was being followed by all DMs and DOs in order to reduce the chances of any cross-contamination or cross-infection. All DMs and DOs reported having additional PPEs than the usual that they wore before the pandemic. A strict donning and doffing technique in the PPE donning and doffing area was performed. Literature [28] recommended the use of face masks, goggles, and shields as part of standard precautions. PPE selection depends directly on the local epidemiological setting, the patient's characteristics, and the level of risk of the procedure planned [29]. Apart from the staff, patients should also wear masks upon entering [23]. Participants in this study also reported that they encouraged all patients to keep wearing masks until its time for an oral examination.

Disinfection was performed after each patient in all dental settings. Milton's solution was reported as the solution that was used in the MoHMS dental clinics. A few DMs in this study also reported decontamination being performed at their respective clinics after they had positive cases being treated there. All surfaces which the patients might have touched need to be cleaned and disinfected from a distance of 2 meters [23] using alcohol disinfection [6]. Mahdi and colleagues [30] reported Hospital-grade disinfectants, including quaternary ammonium-based, phenol-based, and alcohol-based products such as 0.1% sodium hypochlorite or 70% isopropyl alcohol, have proven to be effective against coronaviruses.

All participants reported following strict ventilation and fallow times. A few dental clinics where not all resources were available; such as negative pressure rooms and HEPA, utilized windows in their practices. While Bordea and colleagues [1] suggest giving several hours of an interval between appointments to allow good ventilation of the surgery, the fallow times varied in each practice in this study. The majority of aerosol settles in the first 10 minutes indicating that environmental cleaning may be appropriate after this time [31]. Negative pressure rooms are recommended which add an additional layer of protection for the healthcare workers [32].

Besides these, using a High-Volume Evacuator (HVE) as well as a High-Efficiency Particulate Arrestor (HEPA), fumigation devices as well as UVC light or room ventilation for 30 minutes prior to surface disinfection after treatment may reduce the risk of infection that can be used to ensure the air is filtered well [1, 21, 23, 27, 30, 33, 34]. Natural ventilation is not recommended as a high amount of particulate matter has been noted with natural ventilation [35].

Suggestions were made to reduce dental aerosol-generating procedures in a dental setting as much as possible [27]. Almost all dental practices (MoHMS dental clinics, private dental settings, and SDOH) had suspended aerosolized procedures for a period of time. The findings of this study revealed that the majority of DMs and DOs did not use rubber dams in their practices. DMs and DOs from the MoHMS dental clinics stated that this was not available in stock. DOs from the school dental clinic reported using rubber dams in teaching clinics. Moreover, while most private dental clinics did have access to high-volume suction, a few MoHMS dental clinics reported that the suction machines were not functional and requested the dental chairs to be upgraded to be able to resume to normalcy. The use of a rubber dam should become a standard practice whenever a high-speed handpiece is used is recommended [1, 6, 21, 23]. Rubber dams could potentially provide a 70% reduction in aerosols and eliminate all sources of aerosol contamination from blood or saliva by blocking the throat and soft tissue area [30]. Suction reduced contamination by 67-75% at 0.5-1.5 m [36]. The use of anti-retraction handpiece usage to reduce the volume of aerosols being generated during dental procedures is also recommended [1]. Chemo- mechanical method of caries removal is preferred as a non-aerosol production method in restorative dentistry [1, 13, 30]. The majority of participants reported performing ART on their patients. Moreover, extraoral radiography is preferred over intra-oral radiography to minimize gag reflex and cough reflexes [1, 21]. A similar finding was reported by a few DOs working in private dental settings in this study.

Only a few DMs and DOs reported changes in their sterilization techniques. The DMs and DOs of the respective clinics also reported having fewer dry socket cases and unplanned returns after changes in the sterilization methods were done. The Majority of DMs and DOs, however, stated that they already have stringent sterilization methods in place. The authors stated that all instruments including the nozzles of the air syringes should be sterilized after each patient [23]. Literature [30] stated that reusable instruments should be adequately pre-treated using an oxidizing disinfectant, cleaned, sterilized, and stored in accordance with the local health authorities' protocol.

The use of antiseptic mouth rinse is suggested before conducting any dental treatment [21, 28] or intra-oral radiography, as a regular protocol for each patient [1]. This reduces the bacterial and coronavirus load in saliva [1, 37]. Gargles for further 30 seconds are recommended in the throat and spitting after 1 minute has also been recommended [38]. Very few participants in this study reported using pre-procedural mouth rinses. A few DMs and DOs in the private dental clinic were following this as it was part of the guidance

document.

The majority of participants stated that there was no change in terms of waste management while only a few reported a change in their waste management techniques. Among these included; building of proper incinerator for waste disposal, changing the positions of rubbish bins in the clinics (putting them outside the clinic and away from the operatory area), and immediate disposal of waste after each patient uses the sterilization bags instead of keeping it for longer in the clinics. Almost all participants reported no changes in terms of the management of sharps and the use of yellow bags for clinical waste disposal. All patient-related waste should be regarded as infectious and should be disposed of in accordance with the national legislation [23, 30]. Proper disposal of PPEs is also vital [23]. Literature [5] recommends keeping color-coded bags and bins for proper segregation of waste products. Biomedical wastes need to be collected and stored separately with proper labeling as "COVID-19 waste" before handing over to relevant authorities for disposal [5]. The majority of the waste formed in the dental clinic can be thrown in the regular trash. These include; gloves, masks, and gauze lightly soaked in blood [9, 30].

The majority of DMs and DOs were particular about the patient's vaccine status, although a few did see unvaccinated cases depending on patient symptoms. However, DMs and DOs from the MoHMS dental clinic saw unvaccinated cases, as well as there were no such directives for seeing only vaccinated cases from the relevant authorities. This put the practitioners under a lot of stress as well. Farshidfar and colleagues [39] stated that dental practices may not return to normal, routine operations even after global vaccination as there would still be a significant risk of outbreaks of infection. Hence, a lot of precautionary measures need to be implemented in dental practices itself. The general public needs to be educated about SARS-CoV-2 vaccination and its importance [40].

Formation of working bubbles was a new thing during this pandemic as reported by the DOs and DMs of the MoHMS dental clinics. This was not really done in private dental settings due to fewer operating staff as the majority of private dental clinics had only one DO while other support staff were on rotations. A few DMs from the MOHMS dental clinics were not able to implement this in their clinics due to a shortage of staff. A similar finding was reported in another literature [41] whereby the rotation of teams was not adopted due to insufficient staff.

Various webinars and recommendations from authorities such as WHO, CDC, and other guidance documents were used to develop the different guidance documents and SOPs. All DMs and DOs were aware of the strategies in place and the majority were in support of it except for a few. A few DMs in this study were not in favor of the idea of healthcare workers going to work if they have tested positive but are asymptomatic as the DMs rationalized this thought with viral shredding and that the body needs rest during that period. The DMs reported that the dental staff can get exhausted and this can result in laxity, thus, chances of cross-contamination. Authors suggest that the virus can spread through asymptomatic, symptomatic, and even pre-symptomatic transmission [10]. Another concern

raised in this study was also with regard to the existing treatment range. This was so as the dental settings are not fully equipped to continue with all ranges of treatment during this pandemic. Baracco and colleagues [42] in another study reported that the majority of dentists were not pleased and stated that the Health Authorities did not take the right decisions during the outbreak (86.37%), and were concerned both about getting infected at work (83.16%) and being a potential carrier to their patients (72.97%). Most dentists in this study agreed with the WHO and CDC statements but were concerned regarding the possibility of infection, despite using the PPEs [43].

5. LIMITATIONS

The in-depth interviews were conducted *via* zoom instead of face-to-face interviews, due to the pandemic. The study was limited to the central division only, hence, perspectives of DMs and DOs outside this division haven't been included.

CONCLUSION

Several policies and strategies have been implemented to combat the novel coronavirus and its spread in a dental setting. The various strategies were adopted from several guidelines and tailor-made SOPs for each workplaces were developed by the various DMs. Furthermore, the majority of DOs were in favor of and satisfied with the protocols in place while a few wanted more changes to be implemented so that dentistry proper could be performed in this 'new normal'. The strategies implemented in the dental clinics would be more helpful if it is supported by evidence. Hence, more trainings and webinars can be organized for staff. This study was only conducted in the central division of the Fiji Islands. Future research can be conducted in other divisions and include other healthcare professionals as well apart from just DOs and DMs.

LIST OF ABBREVIATIONS

Dos	=	Dental Officers
DMs	=	Dental Managers
PPEs	=	Personal Protective Equipment
SOPs	=	Standard Operating Procedures

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethics approval was taken from the College Human Health Research Committee (CHHREC) of Fiji National University (FNU) with ID#035.21, Fiji Human Health Research Ethics Committee (FHHRERC), and facility approval from various private dental clinics selected for the study.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Written informed consent was also obtained from each participant prior to data collection.

STANDARD OF REPORTING

COREQ guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author [M.M] upon reasonable request.

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None.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest in this work.

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