COVID-19-associated anxiety among trainees and employees in Canadian dental schools



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DEDICATION

To Amma, Appa, and Sai. For their kind words, unwavering support, and blessings.

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LIST OF ABBREVIATIONS

SARS-CoV-2: Severe Acute Respiratory Syndrome COVID-2

COVID-19: Coronavirus disease 2019

RNA: Ribonucleic acid

GAD: Generalized Anxiety Disorder

GAD-7: Generalized Anxiety Disorder scale-7

C19ASS: COVID-19 Anxiety Syndrome Scale

C19: COVID-19

LMER: Linear Mixed Effects model

LME: Linear Mixed Effects

SD: Standard Deviation

ABSTRACT

Background: The COVID-19 pandemic has significantly increased anxiety levels among those in education settings like dental schools. The fear of being infected, infecting friends and family, and challenges adapting to distance learning with limited practical training may have caused anxiety among dental school students, support staff, and faculty. However, we know little about the pandemic's psychological impacts on people working in Canadian dental schools.

Objectives: The study objectives were to a) describe the levels of COVID-19-associatedanxiety (C19A) levels among dental students, including undergraduates, graduates, residents, and employees, including faculty and support staff, across all Canadian dental schools between April 2021-April 2022; b) assess the differences in anxiety levels among the students and employees across the 1-year period.

Methods: We used a prospective cohort study design with 600 participants at baseline. Questionnaire data were collected at baseline and monthly between April 2021-April 2022. Data included demographics, roles performed, participation in dental care, presence of chronic conditions, vaccination doses, dental school province location, living alone versus otherwise, and C19A. C19A was measured using a validated and reliable COVID-19 Anxiety Syndrome Scale (C19ASS). This is a 9-item scale with 3 items of avoidance domain (scores 0-12) and 6 items of perseverance (scores 0-24), with a total score between 0-36. Following descriptive analyses, we used a linear mixed-effect model to assess the differences in anxiety levels among students and employees across these two domains of avoidance and perseverance anxiety scores.

Results: In our study, 66.8% of the participants were females, 53% were students, 30% were academic staff, and 17% were support staff. The mean (\pm 1 SD) avoidance ratings at baseline were 7.3 (3.2) for students and 6.1 (3.6) for employees, which includes academic staff and support staff. These ratings decreased to 2.6 (3.0) for students and 3.5 (3.5) for employees by April 2022. Similarly, the mean (\pm 1 SD) perseverance ratings at baseline were 12.6 (5.3) for students and 11.4 (5.7) for employees, which decreased to 7.7 (6.6) for students and 7.6 (6.1) for employees, respectively. Females, participants with one vaccination dose, and participants in Ontario had higher avoidance and perseverance anxiety ratings. All other participant characteristics, such as participation in dental care, living arrangements, and the presence of

chronic conditions, did not affect COVID-19 anxiety scores over time. Linear mixed effects analyses did not reveal significant differences in anxiety ratings between dental students and employees in Canadian dental schools over time.

Conclusions: Our study among students and employees at Canadian dental schools found that C19A decreased significantly over time, and all participant groups followed a similar trend during the 1-year study period. There were no significant differences in the anxiety ratings between students and employees. Females, participants in Ontario province, and those not fully vaccinated had higher anxiety ratings. However, the differences between these groups were small, and the clinical significance associated with these variations in C19ASS scores remains uncertain. Overall, the COVID-19 anxiety experience between the students and employees in Canadian dental schools were similar across time. Results from this study can help develop proactive mental health interventions in these groups and beyond for other educational institutions or cohorts, should a similar infectious disease outbreak arise.

RÉSUMÉ

Contexte : La pandémie de COVID-19 a provoqué une augmentation significative de l'anxiété chez les individus évoluant dans des environnements éducatifs tels que les écoles dentaires. La crainte de l'infection, de la contamination des proches et les difficultés liées à l'apprentissage à distance avec une formation pratique limitée ont généré de l'anxiété chez les étudiants en médecine dentaire, le personnel de soutien et les enseignants. Toutefois, les impacts psychologiques de la pandémie sur les travailleurs des écoles dentaires canadiennes sont peu connus.

Objectifs : Les objectifs de l'étude étaient de a) décrire les niveaux d'anxiété associée à la COVID-19 (C19A) parmi les étudiants en dentisterie, y compris les étudiants de premier cycle, les diplômés, les résidents et les employés, y compris les membres du corps professoral et le personnel de soutien, dans toutes les écoles dentaires canadiennes entre avril 2021 et avril 2022 ; b) évaluer les différences de niveaux d'anxiété parmi les étudiants et les employés au cours de la période d'un an.

Méthodes : Nous avons mené une étude de cohorte prospective impliquant 600 participants lors de l'inclusion. Des questionnaires ont été utilisés pour collecter des données à l'inclusion et chaque mois d'avril 2021 à avril 2022. Les données comprenaient des informations démographiques, les rôles occupés, la fréquence des soins dentaires, les maladies chroniques, les doses de vaccination, la localisation de l'école dentaire, la situation de vie (seul ou non) et l'anxiété liée à la COVID-19 (C19A). L'anxiété a été mesurée à l'aide de l'échelle validée et fiable du syndrome d'anxiété lié à la COVID-19 (C19ASS), qui comprend 9 éléments répartis en 3 éléments pour l'évitement (scores de 0 à 12) et 6 éléments pour la persévérance (scores de 0 à 24), avec un score total de 0 à 36. Après des analyses descriptives, nous avons utilisé un modèle linéaire à effets mixtes pour évaluer les différences d'anxiété entre les étudiants et les employés dans les domaines d'évitement et de persévérance.

Résultats : Dans notre étude, 66,8 % des participants étaient des femmes, dont 53 % étaient des étudiants, 30 % du personnel académique et 17 % du personnel de soutien. Les scores moyens (\pm 1 écart-type) d'évitement initiaux étaient de 7,3 (3,2) pour les étudiants et de 6,1 (3,6) pour les employés, incluant le personnel académique et de soutien. Ces scores ont diminué respectivement à 2,6 (3,0) pour les étudiants et 3,5 (3,5) pour les employés entre le début de l'étude et avril 2022. De même, les scores moyens (\pm 1 écart-type) de persévérance initiaux

étaient de 12,6 (5,3) pour les étudiants et de 11,4 (5,7) pour les employés, diminuant respectivement à 7,7 (6,6) pour les étudiants et 7,6 (6,1) pour les employés. Les femmes, les participants ayant reçu une seule dose de vaccin et les participants en Ontario ont montré des scores d'évitement et de persévérance plus élevés liés à l'anxiété. Toutes les autres caractéristiques des participants, telles que les soins dentaires, le mode de vie et les maladies chroniques, n'ont pas affecté les scores d'anxiété liés à la COVID-19 au fil du temps. Les analyses des effets mixtes linéaires n'ont révélé aucune différence significative dans les scores d'anxiété entre les étudiants en médecine dentaire et le personnel des écoles dentaires canadiennes au fil du temps.

Conclusions : Cette étude a révélé une diminution significative de l'anxiété liée à la COVID-19 au fil du temps parmi les étudiants et le personnel des écoles dentaires canadiennes. Les différences d'anxiété entre les groupes étaient légères et l'importance clinique de ces variations reste incertaine. Les résultats de cette étude peuvent contribuer au développement d'interventions en santé mentale pour les étudiants et le personnel des écoles dentaires, en particulier lors d'épidémies infectieuses similaires dans d'autres institutions éducatives.

PREFACE

This thesis follows a traditional monography style. As per McGill University standards, this thesis is logically coherent and has a unified theme. This thesis explores the levels of COVID-19-associated anxiety among trainees and employees in Canadian dental schools over a one-year period from April 2021 to April 2022. After introducing the topic in the first chapter, the second chapter examines existing knowledge on anxiety and COVID-19-associated anxiety among various groups, including the general population, healthcare workers, oral healthcare providers, and educational institutions. Building upon this knowledge, the third and fourth chapters outline the study's rationale and objectives, respectively. The study methodology is discussed in chapter five, followed by the presentation of results in chapter six. Chapter seven offers a comprehensive analysis of the findings, addressing methodological considerations and suggesting future research directions. Finally, chapter eight presents the conclusion for this project. The thesis acknowledges the contributions of multiple authors, and their individual roles are explicitly appreciated in the subsequent section.

CONTRIBUTION OF AUTHORS

Srimathi Iyer, BDS, M.Sc. Candidate: Conceived the investigation, carried out the literature review, study analyses, visualization, and interpretation of findings. Authored the entire thesis, including study tables and figures.

Paul Allison, Professor, Faculty of Dental Medicine and Oral Health Sciences, McGill University. Supervised the candidate, as a PI contributed to conceptual design, and acquired funding for the project. Contributed to designing this thesis project, statistical analyses, editing, and reviewing the entire thesis work.

Sreenath Madathil, Assistant Professor, Faculty of Dental Medicine and Oral Health Sciences, McGill University. Contributed to the planning and implementation of the statistical analyses for the project, and as a committee member contributed to reviewing and improving the project.

1. INTRODUCTION

The emergence of COVID-19, a highly infectious respiratory viral disease, was first reported in December 2019 in Wuhan City, China [1, 2]. Caused by the SARS-CoV-2 virus, a single-stranded RNA virus with a rapid replication and transmission rate, it quickly spread across the globe, resulting in a global pandemic [2, 3]. Governments and leaders worldwide implemented various health and safety protocols, including lockdowns, social distancing, travel restrictions, and quarantine measures for symptomatic and asymptomatic individuals, to curb the spread of the infection. However, the persistently rising infection rates, the loss of loved ones, uncertainties about the future, and social restrictions, have contributed to heightened psychological symptoms such as fear, perceived threat, anxiety, and depressive symptoms among individuals. Over two years since its initial outbreak, COVID-19 was a prevalent concern in 2022, with the constant evolution and emergence of new variants like the Delta, Omicron, and others observed worldwide. People from diverse backgrounds, including the general population, healthcare providers, oral healthcare providers, and students attending schools and universities, are still grappling with the challenges of adapting to the "new normal" amidst an ongoing pandemic.

The COVID-19 pandemic has significantly changed the education sector, including dental schools and universities. Dental students and trainees, as well as graduate students, have had to adapt to remote learning and social isolation, disrupting their practical training and research projects. This has led to a loss of clinical practice and collaborative opportunities. The sudden and drastic changes caused by the pandemic in an already high-stress educational environment have resulted in severe anxiety among these individuals.

There is a need for studies to examine the impact of COVID-19 on dental and dental hygiene students, faculty, and support staff in dental schools. However, there is currently a lack of longitudinal studies focusing on the anxiety levels of these groups over an extended period. As the epidemiological situation of infectious disease outbreaks evolves, more research is necessary to understand the changes in anxiety levels and the associated factors.

To improve mental health outcomes for dental school students and employees, it is crucial to understand and compare anxiety levels among different groups and identify associated factors. In Canada, where a significant proportion of adults already screen positive for generalized anxiety disorder [4], those in the high-risk group may have even higher anxiety levels.

The present prospective cohort study aims to fill this knowledge gap by investigating the mental health outcomes of dental students, staff, and faculty across ten Canadian dental schools. The findings from this study will be instrumental in developing interventions and policies to support the psychological well-being of individuals working in dental school settings and enhance mental wellness services and counseling for these populations.

2. LITERATURE REVIEW

2.1 COVID-19

An infectious viral disease emerged towards the end of 2019 in Hubei province, Wuhan City, China, called Coronavirus disease 2019 (COVID-19) [1, 2]. COVID-19 is a respiratory disease caused by a single-stranded RNA virus belonging to the Coronaviridae family. This RNA virus is genetically similar to the Coronavirus responsible for the 2003 SARS outbreak; therefore, the International Committee on Taxonomy of Viruses named it SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) [2, 3]. COVID-19 typically spreads by droplet or aerosol transmission through the respiratory route. It causes symptoms like fever, dry cough, breathing difficulties, headache and pneumonia, which can progress to respiratory complications like alveolar damage, respiratory failure, and even death [5]. COVID-19, which emerged as a novel disease, escalated exponentially within and beyond China and across the globe, causing disease and deaths among thousands of people in a short span of 3 months. Observing its high infectivity, rapid replication, and transmission rate, the World Health Organization (WHO) declared COVID-19 a global pandemic in March 2020[6]. A brief timeline of the COVD-19 pandemic experience in Canada is outlined in Table 2.1.

As the COVID-19 pandemic rapidly escalated across the world, leaders across nations decided to develop various health safety protocols to contain the spread of infection. Some measures were lockdowns to avoid social and work-related gatherings, social distancing mandates, quarantine of symptomatic and asymptomatic individuals with a history of contact with infected individuals, and local and international travel restrictions to avoid infection spread. As schools and offices were also shut down to prevent gatherings and the potential mass spread of the disease, students and employees, wherever possible, worked from home and communicated primarily using videoconferencing software. People from all walks of life had to learn to live with the newly imposed rules in a very short time. Rising infection rates and grievances due to the loss of loved ones, uncertainties about the future, and social restrictions would naturally lead people to experience increased psychological symptoms like fear, perceived threat, anxiety, and depressive symptoms.

Table 2.1 COVID-19 relevant highlights							
Date	Event						
2020:	March 11: WHO declares COVID-19 a global pandemic [6].						
	March 13: The Government of Canada announces a series of measures,						
	including border restrictions, enhanced screening measures, and mandatory						
	self-isolation for international travelers [7].						
	March 16: Dental schools in Canada temporarily suspend in-person classes						
	and clinical activities following ADA's press release urging suspension of						
	clinical activities to mitigate the spread of COVID-19 infection for 3						
	weeks [8].						
	March 17: The provinces and territories declare states of emergency, leading						
	to various restrictions, including the closure of non-essential businesses and						
	schools [9]						
	September: Dental schools gradually resumed in-person classes and clinical						
	activities with modifications to ensure the safety of students, faculty, and						
	patients. This involved implementing measures such as physical distancing,						
	reduced class sizes, and enhanced infection control protocols [10]						
2021	COVID-19 variants of concern, such as the Alpha (B.1.1.7), Beta						
	(B.1.351), Gamma (P.1), and Delta (B.1.617.2) variants, emerge globally						
	across various months [11].						
	April: Vaccination efforts progress, and dental students, faculty, and staff						
	become eligible for COVID-19 vaccinations as per provincial vaccination						
	plans [12].						
	September: The start of the fall semester sees dental schools resuming						
	regular academic activities, focusing on comprehensive dental education						
	while maintaining necessary precautions. COVID-19 vaccination						
	requirements for students and staff become more prevalent in some dental						
	schools [13].						
	December: Rise in Omicron cases across the Country; lockdowns and						
	restrictions are considered [14].						
2022	January: Lockdowns and restrictions imposed in various capacities across						
	Canada [15].						

April: Restrictions and policies vary across provinces and territories depending on the local COVID- 19 situation. Some regions may continue to implement measures such as capacity limits, mask mandates, and testing requirements, while others may have eased restrictions significantly based on vaccination rates and low case numbers. Fully vaccinated individuals need not provide a negative test before entering Canada [16].

Now, in 2023, after more than 3 years of its first occurrence, COVID-19 is very much still present. With its constantly evolving mutations and emergence of new variants, SARS-CoV-2 is expected to continue with new variants and their sub lineages like the Delta variant, Omicron variant, and several others reported in various parts of the world [17]. People from diverse backgrounds, including the general population, health care providers, oral health care providers, and students attending schools and universities, are now faced with the continued challenge of adapting to the new normal, a life with an ongoing pandemic. These challenges, along with worries, fears and uncertainties about the future can manifest as adverse mental health symptoms like anxiety among the people.

2.2 ANXIETY

2.2.1 Anxiety Disorder

According to American Psychological Association (APA), anxiety as an emotion is characterized by feelings of tension, worried thoughts, and physical manifestations such as increased blood pressure [18]. Individuals who experience anxiety have intrusive and recurring thoughts, often forcing them to avoid certain situations due to their innate fears. Although anxiety and fear are often used interchangeably, fear is a short-term response at the present time due to a valid and clear threat, while anxiety stems from a diffused threat which is far in the future, causing a long-term state of worry [18]. It is normal for people to occasionally worry about certain aspects of their life that usually do not last for a long time, such as finances, wellness or family problems. However, anxiety remains persistent and can get worse over time [19]. Anxiety can also cause symptoms such as sweating, trembling, dizziness and rapid heartbeats [18], and can even hamper routine activities such as schoolwork, job performance and relationships [19]. Indeed, 30% of adults all around the world experience anxiety during their lives, making it the most common mental health disorder [18].

Anxiety disorders can manifest in various ways depending on the timing of onset and its characteristic features. Depending on the type of anxiety, individuals will experience the symptoms differently. There are four main types of anxiety disorders that will be explored in the following section.

2.2.2 Types of Anxiety Disorders

Anxiety disorders can be of several types, namely Generalized Anxiety Disorder (GAD), Panic Disorder, Social Anxiety Disorder, and various Phobia-related Disorders.

Generalized Anxiety Disorder, one of the most common causes anxiety disorders, involves constant feelings of anxiety or dread for months or years, which can interfere with routine life activities. People living with GAD tend to suffer from frequent headaches, muscle aches, stomach aches and unexplained aches in the body, insomnia and fatigue, causing them to be on edge and irritable [19].

Panic Disorder involves sudden and unexpected bouts of fear, discomfort, or a sense of losing control, even without an external trigger or danger. These bouts are called panic attacks, which occur frequently in a panic disorder. An individual undergoing a panic attack may have a rapid heartrate, profuse sweating, chest pain, feelings of impending doom and fears of being out of control, often leaving them worrying about when their next attack might occur. Not everyone experiencing a panic attack will develop a panic disorder [19].

Social Anxiety Disorder is an intense and constant fear of being judged and watched by others in a social setting, so much so that an individual fears social interaction. They may experience sweating, trembling, stomach aches, increased heartrate, difficulty making eye contact and feelings of self-consciousness about being judged negatively by others, often hampering their work, school and daily activities [19].

Phobia-related disorders involve a strong dread or aversion to specific objects or situations, usually in highly irrational amounts in comparison to a normal individual reacting to the same situation or object. Some types of phobias are fear of heights, blood, needles, specific animals like dogs or snakes [19].

Adverse mental health outcomes like anxiety are often confused or used interchangeably with similar mental health experiences like stress symptoms. However, there are subtle differences between these terms, which should be used with caution as the approaches used to care for

patients experiencing these are different. Therefore, understanding the differences between stress and anxiety is essential.

2.2.3 Difference between stress and anxiety

Although both stress and anxiety are often used interchangeably and are characterized as emotional responses, stress is caused by a definite external trigger. This trigger can either be a long-term problem such as discrimination, chronic illness experience or inability to work, or a short-term problem such as a work or school deadline, or an argument with a loved one. Individuals experiencing stress also experience mental and physical symptoms such as anger, fatigue, muscle pain, irritability, digestive and sleep difficulties. This shows that stress occurs due to an external trigger or a "stressor", on the other hand, anxiety is defined as persistent worries even in the absence of a stressor [20].

2.2.4 Global prevalence of anxiety before the pandemic

American Psychological Association's reports of about 30% of people globally experiencing anxiety during their lifetime [18]. According to the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019, anxiety disorders are among the most disabling mental disorders, ranking in the top 25 leading causes of burden worldwide [21-23]. A systematic review focusing on the global regional and national burden of mental disorders in 204 countries and territories by the GBD collaborators reported the global prevalence of mental disorders in 1990 and 2019. The global prevalence of mental disorders in 2019 was 970.1 million, an increase of 48.1% since the year 1990, where it was 301.4 million [22]. This study further reported the age-standardized anxiety prevalence, which remained consistent among males and females in both these years. Still, females tended to have higher anxiety levels than males across the period from 1990-2019 [22]. Higher anxiety disorders were also observed among children, adolescents and young adults between the ages of 10-24 years. In this school and college student age group, the prevalence of anxiety disorders rose from 12th place in 1990 to 6th place in 2019, when compared with varied forms of diseases and injuries, like headaches, tuberculosis or road injuries [23].

High anxiety among the student population was also documented when The WHO Mental Health Surveys International College Student Project (2018) reported anxiety disorders to be the 2nd most common mental health problem among students. This survey involved 19 colleges across eight countries including Australia, Belgium, Germany, Mexico, Northern-Ireland,

South-Africa, Spain and United States, where approximately 1 in every 3 students screened positive for a mental health disorder. The results revealed that Generalized Anxiety Disorder has a lifetime prevalence (proportion of population having the disorder at some point in their life) of 18.6%, second only to Major Depressive Disorder (21.2%) among these students [24]. Similar to the WHO survey, in 2019, The Annual Report of the Center for Collegiate Mental Health in the USA revealed that 62.7% of the 82,685 responding students who completed their counseling center assessment of psychological symptoms, experienced anxiety [25]. This was further confirmed by clinicians at educational institution counselling centers in the USA reporting anxiety as one of the primary reasons students approach them [25].

Considering the already high global prevalence of anxiety in 2019, it is plausible that it could be exacerbated during times of crisis such as a natural calamity, an infectious disease outbreak, or a pandemic. The following section will focus on anxiety experiences of individuals from various backgrounds during a pandemic.

2.3 ANXIETY EXPERIENCE DURING A PANDEMIC

2.3.1 Anxiety experience due to past pandemics

Fear and anxiety due to a potential threat are natural when an infectious disease develops and starts spreading within a region or across nations. For instance, during the past SARS outbreak in 2003, the H1N1 influenza pandemic of 2009-'10, or the MERS-CoV outbreak in 2014, there have been multiple reports of poor mental health outcomes among the general population, frontline health care workers, auxiliary health professionals, oral health professionals, and even students.

For example, during the SARS outbreak, a cross-sectional study was conducted among healthcare workers in a tertiary hospital in Taiwan (2004). When asked to self-report the psychological impacts of the SARS outbreak, participants reported anxiety as the most common symptom during the initial phase of infection. Interestingly, during the 'repair' phase, or when the disease was controlled, they felt more depressed and experienced avoidance behaviours [26]. Healthcare workers like nurses, doctors, and healthcare assistants usually feel high anxiety levels as they are primarily in contact with infected patients. Feelings of vulnerability or loss of control, fear for self-health, and potentially spreading the infection to family members have been significant concerns during the SARS outbreak among healthcare workers [27].

Similarly, during the H1N1 influenza (Swine flu) outbreak in 2009, significant anxiety experience was reported in various studies worldwide. Rubin et al. in 2009 investigated the perceptions of the Swine flu outbreak among the general public in England, Scotland, and Wales. They reported that 23.8% of the participants experienced significant anxiety levels [28]. Anxiety experienced during this outbreak was also notable in several different populations and across many countries, like the general population in Malaysia and Europe [29] and even the college students in the US.[30]

During the Middle East Respiratory Syndrome (MERS-CoV) in 2014, the psychological impacts of the outbreak among people in the affected regions were analogous to the previous examples of epidemics, with elevated anxiety levels. In fact, there was a significant difference in anxiety among healthcare providers, specifically, those working in the MERS-CoV suspected or positive frontline healthcare workers [31].

Infectious disease outbreaks have invariably caused poor mental health outcomes among general population, healthcare workers and students, often leading them towards general stress, anxiety, health anxiety and post-traumatic stress. These feelings usually have the potential to last well after the pandemic is brought under control. Given this context, poor mental health outcomes during this global COVID-19 pandemic are likely to be a significant issue. It is essential to understand how the current COVID-19 pandemic is contributing to anxiety experiences among people from various backgrounds.

2.3.2 COVID-19-associated anxiety

COVID-19 anxiety (C19A) can be described as an emotional state of nervousness among individuals caused by the COVID-19 pandemic [32]. The concept of COVID-19 anxiety syndrome was first developed by professors in the UK, Ana Nikcevic (Kingston University of London) and Marcantonio Spada (London South Bank University) in October 2020 [33, 34]. They describe C19A as a combination of avoidance (for instance, avoiding public places or social interactions), compulsive symptom checking (frequently checking for symptoms despite not being in a high-risk scenario), worrying and threat monitoring (keeping up with all the latest news about the COVID-19 pandemic).

During a high stress situation like an ongoing pandemic, people tend to experience social isolation due to reduced physical gathering and social activities, job losses due to losses in businesses due to the lockdown and restrictions, as well as lifestyle changes incurred due to the

rapidly changing health and safety protocols. Although changes in thoughts, feelings and actions can be a normal response to a stressful situation and might not always indicate a mental health disorder, such symptoms can deteriorate an individual's well-being and quality of life [35].

Less than 6 months into the pandemic, in April 2020, reports were published revealing more than 25% of the general population in China's nationwide survey experienced moderate to severe levels of stress related symptoms due to the COVID-19 pandemic and its consequences [36]. As the pandemic progressed with its high mortality and morbidity in a relatively short period, it became apparent that many people experienced poor mental health consequences like stress, anxiety, and depression. Another survey conducted on the US general population in June 2020 focused on mental health during the COVID-19 pandemic, and yet again, the results were not unexpected. Among 5,470 participants, 40.9% of them reported at least one adverse mental or behavioral health condition. Among these, anxiety disorder or depressive disorder was observed in 30.9% of the participants, followed by trauma or stressor-related disorder due to the pandemic in 26.3%, and substance abuse to cope with the stressors of the COVID-19 pandemic in 13.3% of the participants [37].

Measuring anxiety quantitatively is an important step in understanding its impact on mental health. To measure anxiety specifically related to the COVID-19 pandemic, we can use instruments specifically designed and validated for COVID-19. One such scale addressing COVID-19- anxiety is COVID-19 Anxiety Syndrome Scale (C19ASS).

2.4 COVID-19 ANXIETY SYNDROME SCALE

The COVID-19 Anxiety Syndrome Scale was developed by Nikcevic and Spada in 2020 to identify the presence of anxiety syndrome precisely due to the COVID-19 pandemic [33]. This scale is a 9-item scale measuring 2 factors, avoidance and perseveration (Table 2.2). Out of the 9 items, 3 items characterize avoidance behavior with questions like "I have avoided using public transport because of the fear of contracting coronavirus (COVID-19)", "I have avoided going out to public places (shops, parks) because of the fear of contracting coronavirus (COVID-19)", "I have avoided touching things in public spaces because of the fear of contracting coronavirus (COVID-19)", "I have avoided touching things in public spaces because of the fear of contracting coronavirus (COVID-19)". The rest 6 items are perseveration thinking behaviors, with questions like, "I have checked myself for symptoms of coronavirus (COVID-19)", "I have been concerned about not having adhered strictly to social distancing guidelines for coronavirus (COVID-19)", "I have read about news relating to coronavirus (COVID-19) at the

cost of engaging in work", "I have checked my family members and loved one for the signs of coronavirus (COVID-19)", "I have been paying close attention to others displaying possible symptoms of coronavirus (COVID-19)", "I have imagined what could happen to my family members if they contracted coronavirus (COVID-19)". Each item has a five-point Likert-type scale to indicate the level of agreement ("0. Not at all", "1. Rarely, less than a day or two", "2. Several days", "3. More than 7 days", and "4. Nearly every day"). Higher scores on the scale indicate higher levels of C19A. This scale has demonstrated acceptable levels of reliability and concurrent validity [33]. This scale was first developed for the US general population, and has been validated to be used in the Canadian dentists in both English and French [38], which makes it a valid and reliable scale to be used in Canadian dental school cohort.

Table 2.2 COVID-19 Anxiety Syndrome Scale (C19ASS)						
COVID-19 Anxiety Syndrome Scale	Not at all	Rarely,	Several	More	Nearly	
(C19ASS)		less than	days	than 7	every day	
		a day or		days		
Avoidance (0-12)		two				
Perseverance (0-24)	(0)	(1)	(2)	(3)	(4)	
1. I have avoided using public						
transport because of the fear of						
contracting coronavirus						
(COVID-19)						
2. I have avoided going out to						
public places (shops, parks)						
because of the fear of						
contracting coronavirus						
(COVID-19)						
3. I have avoided touching things						
in public spaces because of the						
fear of contracting coronavirus						
(COVID-19).						
4. I have checked myself for						
symptoms of coronavirus						
(COVID-19)						

5.	I have been concerned about			
	not having adhered strictly to			
	social distancing guidelines for			
	coronavirus (COVID-19)			
6.	I have read about news relating			
	to coronavirus (COVID-19) at			
	the cost of engaging in work.			
7.	I have checked my family			
	members and loved one for the			
	signs of coronavirus (COVID-			
	19).			
8.	I have been paying close			
	attention to others displaying			
	possible symptoms of			
	coronavirus (COVID-19).			
9.	I have imagined what could			
	happen to my family members			
	if they contracted coronavirus			
	(COVID-19).			

2.5 COVID-19 ANXIETY EXPERIENCE

The COVID-19 pandemic has had diverse impacts on different populations. The COVID-19 Anxiety Syndrome Scale specifically focuses on the fears and concerns associated with the risk of contracting the virus. It encompasses worries about personal health and the well-being of family members, the transmission of the infection, and the potential consequences of being infected. However, it is essential to recognize that the pandemic has also led to a more general increase in anxiety levels, which may not be directly linked to the fear of infection. Factors such as government-imposed travel and social gathering restrictions, financial difficulties resulting from the loss of jobs, and emotional distress caused by social isolation could also have significantly contributed to the overall anxiety experienced by the population during the pandemic.

In the upcoming sections, I will explore the experiences of anxiety related to the pandemic in the general population, healthcare providers, oral health care providers, education institutions, and students in this section.

2.5.1 COVID-19 Anxiety among general population

The pandemic has cost the lives of thousands of people worldwide and has also negatively impacted the psychological well-being of the general population. At the beginning of the pandemic and then periodically over the past two years, COVID-19 has caused an economic slowdown due to the initial shutdown of many businesses and the reduction of all but essential services in most countries leading to job losses. This economic downturn, fear of self or family member being infected, and self-isolation have caused elevated levels of anxiety and distress globally. As the World Health Organization (March 2022) highlighted, the global prevalence of anxiety and depression rose by 25% during the first year of the COVID-19 pandemic. This massive spike was attributed to the general causes of anxiety, mainly to social isolation, resulting from restrictions on people's ability to work, seek support, and engage with their loved ones in their communities [39].

The general population in China rated the psychological impact of the COVID-19 outbreak as moderate to severe (53.8%) [40]. In this population, 28.8% reported moderate to severe anxiety, 8.1% reported moderate to severe stress levels, and 75.2% were worried about their family members contracting the COVID-19 virus [40].

In Canada, 15% of adults (18 and above) screened positive for generalized anxiety disorder and 19% for major depressive disorders from February to May 2021 [35], as per Statistics Canada and the Public Health Agency of Canada. In fact, the general population who were already diagnosed with anxiety before the onset of the COVID-19 pandemic, experienced a four-fold increase in the anxiety levels, from 5% to 20% during the pandemic [4]. In addition to the previously discussed causes of anxiety among the general population, anxiety, and depression were associated with perceived unmet healthcare needs in Canadians during this pandemic [41]. In a cross-sectional study conducted between September to December 2020 in the Canadian Longitudinal Survey on Aging (CLSA), the presence of anxiety and depression were associated with higher odds of challenges in accessing health care, not visiting a hospital or a doctor when needed, experiencing barriers to COVID-19 testing, and among females in general [41]. These findings indicate that the COVID-19 pandemic has had substantial mental health impacts in Canada. These effects can be attributed to the fear of contracting the virus as well as the more general anxiety stemming from external factors such as government restrictions and financial hardships brought about by the pandemic.

While the general population encompasses people from various backgrounds and age groups without any distinctions, it is also essential to understand the specific impacts on those who are the backbone of the entire healthcare system, the healthcare workers in various disciplines. Being at the forefront of the pandemic, with the risk of being infected, along with added worries of caring for the patients, healthcare workers are the most susceptible to suffering from adverse mental health outcomes.

2.5.2 COVID-19 Anxiety among Health Care Workers

Healthcare providers, be they frontline workers, second-line healthcare workers or support staff, all played a huge and courageous role in battling the devastating war between the infectious viral pathogen and humans. Even through the frequently and drastically changing hospital protocols, health care providers understood their key role in saving the lives of thousands of people, all while ensuring they did not get infected themselves or transmitted the disease to other non-COVID, but sick patients. Fear of being infected or potentially infecting friends, family, colleagues or patients, and the psychological burden of mounting cases of death due to COVID-19 can induce psychological distress and anxiety among the healthcare workers.

This hypothesis of the COVID-19 pandemic negatively affecting the mental health of the health care workers was supported in multiple studies. For instance, a study in Singapore described health care workers as a vulnerable population, experiencing high levels of psychological distress and needing psychological interventions to support their well-being [42]. Similar mental health outcomes were observed in health care workers in acute hospital settings in South East Ireland, where, 42.58% of the health care workers reported depression, 45.13% reported anxiety, and 45.13% reported stress as per the Depression Anxiety Stress Scale-21(DASS-21) [43]. Additionally, in one of Australia's first studies on mental health outcomes on health care workers at a tertiary hospital, which included senior and junior medical staff, nurses, allied health practitioners and non-clinical support staff, 21% of health care workers experienced moderate-to-severe symptoms of depression, 20% of them experienced anxiety and 29% reported Post Traumatic Stress Disorder (PTSD) [44]. Similar patterns of poor mental health outcomes among healthcare workers were observed during the COVID-19 pandemic in various countries, including the UK, China, Italy, and Russia [45-48].

A similar attempt to capture the prevalence of stress, anxiety, depression among health care workers compared to other workers was conducted using a cross-sectional survey in Alberta, Canada. An SMS text messaging service to support mental health of residents of Alberta during the COVID-19 pandemic was used to gather demographic details and self-reported symptoms of mental health. Symptoms of stress, anxiety and depression were statistically significantly higher in people working in other sectors compared to health care workers [49]. While it sounds like health care workers have better mental health outcomes during the pandemic, as the authors point out, participants voluntarily sought psychological support from this SMS service and the study was conducted during early periods of the pandemic. This could lead to bias in the results with more participants reporting higher psychological outcomes, and not truly capture the burden of the pandemic on the population, making it difficult to generalize to the general Canadian population or health care workers [49].

It is worth remembering that healthcare workers tend to put the well-being of their patients above their own when facing a health crisis that they are responsible for managing because of their sense of duty toward their patients and the broader public [43]. In this context, it is also important to acknowledge that a particular subsection of health care providers, namely the oral health care providers, also face challenges during infectious disease pandemics, especially the COVID-19 pandemic, due to proximity to patients' mouths, their common use of aerosol-generating procedures and the psychological burdens associated with the changes in treatment protocols during the pandemic.

2.5.3 COVID-19 Anxiety among Oral Health Care Providers (OHCPs)

2.5.3.1 Infection rates in OHCPs

At the beginning of the pandemic, before high quality evidence was available, it was hypothesised that oral health care providers, such as dentists, dental hygienists, dental assistants and dental trainees, were among those at highest risk of getting infected with COVID-19 [50]. COVID-19 infection is usually transmitted through respiratory droplets, fomite or infectious aerosols generated from coughing, sneezing or speaking by an infected individual [51]. This becomes highly pertinent to oral health care providers, who spend a considerable amount of time in close contact with patients' mouths and are exposed to saliva, blood, and respiratory fluids [52-54]. Dental procedures often involve a variety of high-speed drilling, cleaning, and scaling procedures that require instruments which use water and compressed air. Water and compressed air from these instruments combine with saliva and blood to form aerosols that

may contain viral particles if an infected person is exposed to such procedures [55]. Moreover, COVID-19 has a mean incubation period of 6.5 days [56], but can range between 1 to 14 days [57], where an individual does not demonstrate any clinical symptoms, but can be potentially infectious. This adds to the complexity where both patients and dental professionals are at a mutual risk of being exposed to the infection [58]. Thus, making dental offices a potential source of cross-contamination for SARS-CoV-2 and other viruses[59]. Considering all these factors, in Canada and many countries routine dental practices were temporarily suspended during the initial period of the pandemic to contain the spread of the COVID-19 infection [53, 54, 60], and only urgent and emergency procedures were carried out during this period [61].

In response to the perceived threat, Oral Health Care Providers (OHCPs) diligently implemented measures to curb the transmission of COVID-19 within their profession and the community. A study by Estrich et al. (2020) revealed that by June 2020, only 0.9% of dentists in the United States had contracted the virus [62]. Similarly, low infection rates were observed among healthcare workers in the Netherlands (0.9%) [63] and China (1.1%) [64]. However, a slightly higher infection rate of 4% was reported among dentists, dental assistants, and support staff in an Argentinean dental school[65]. This was consistent with the incidence rate of 5.1 per 100,000 person-days in Canadian dentists between August 2020-February 2021 [66] and 2.39% in Canadian dental hygienists from December 2020 to January 2022 [67]. Despite being initially categorized as a high-risk profession during the early stages of the pandemic, OHCPs exhibited lower infection rates overall.

2.5.3.2 Anxiety in Oral Health Care Providers

While studies have reported relatively lower infection rates among Oral Health Care Providers (OHCPs), their perceived high risk of COVID-19 infection has caused significant stress and anxiety in their professional roles. This consistent finding has been evident in previous pandemics such as SARS and MERS-CoV-2 outbreaks [68, 69]. Even during the ongoing COVID-19 pandemic, oral health care workers, including dentists in Italy (85%) [70], have reported experiencing high levels of anxiety while treating patients. Moreover, dentists in India have expressed fear regarding the potential transmission of the infection to their family and friends [71]. The psychological distress associated with patient care has been a contributing factor, as evidenced by studies highlighting dentists' contact with COVID-19 infected patients, which predicted the development of anxiety, exhaustion, poor concentration, deteriorating work performance, and social detachment in Israel [72].

Another commonly noted cause of higher anxiety and distress was working in direct contact with the patients, for instance, those who provided treatment like dentists, dental hygienists, dental trainees, dental assistants, in comparison to those who did not provide direct dental care, including dental laboratory technicians, front desk receptionists, and other auxiliary health care providers. This was observed in a cross-sectional study conducted in dental clinics in Russia in 2021, where around 20-24% of the oral health care providers experienced mild to extremely severe symptoms of psychological distress, 7-30% of them had clinical symptoms of Post Traumatic Stress Disorder (PTSD) [48], and those providing direct dental care and older health care workers had significantly higher levels of both psychological distress and PTSD [48].

While cross-sectional studies on anxiety levels among oral health care workers highlight the outcome at a particular time point, it is also essential to understand the change of anxiety experience among these groups over time to understand the trends and associations with other environmental factors that could play a role in determining the anxiety levels. To date, only two studies address the longitudinal aspect of these issues within the context of oral health care providers. One is a qualitative longitudinal study by Beaton et al., 2022, [73] focusing on the COVID-19-associated psychological impacts on dental trainees and primary dental care staff in Scotland. Participants were asked about the COVID-19 associated impacts including emotional exhaustion, the impact of the pandemic on their work and training, adapting to new protocols, and about their overall health and well-being weekly from June 2020 to December 2020. Upon trajectory analysis, the authors described that the participants worried about their future careers and finances, experienced hardship in adapting to new working environments and safety protocols. They were also concerned about the impact of COVID-19 on their patients' dental treatments and overall well-being. An in-depth analysis of their responses revealed that the high uncertainties and worry related to their training and career collectively took an emotional toll on the participants [73].

The other longitudinal study is the first and only quantitative longitudinal study to consider multiple time points to describe COVID-19-associated psychological outcomes among oral health care providers was conducted by Eldridge et al. (2022) in the US oral health care workers during the COVID-19 pandemic [74]. Dentists and dental hygienists answered monthly questionnaires about their anxiety and depression, with dentists answering for almost year from June 2020-May 2021, and dental hygienists from September 2020 till May 2021. Participants responded their anxiety and depression using the instruments Generalized Anxiety Disorder-2

and Patient Health Questionnaire-4 (PHQ-4), respectively, and their responses were categorized into presence or absence of symptoms. Findings of the study revealed that both anxiety and depression changed over time, with more participants being anxious than depressed, and increased rates of anxiety and depression among dental hygienists in comparison to dentists. The rate of anxiety among dentists decreased but with a peak in November 2020, where 17% dentists reported anxiety symptoms, and decreased to 12% by May 2021. Dental hygienists started the survey in September 2020 and showed decrease in rates with a similar peak of 28% in November 2020 and gradually decreased to 12% by May 2021. Depressive symptoms in both the groups were higher in December 2020, with 17% in dental hygienists and 10% in dentists, but decreased to 8% by May 2021. Overall, 17.7% of oral health care providers reported anxiety symptoms, 10.7% reported depressive symptoms, and 8.3% reported both [74]. This study highlighted the crucial time related changes in anxiety levels, but the response rate of this study was only 6.7%. The authors of this study also did not quantify the amount of anxiety experience among the oral healthcare providers, and only reported the number of participants experiencing anxiety and depression over time by categorizing scores above 3 on both scales as positive for the symptom and negative otherwise. They have drawn interesting conclusions by comparing two groups, dentists and dental hygienists; however, dental hygienists joined the study much later, so the study could not capture a one-year difference in anxiety levels among both these groups. It would have been interesting to see such comparisons among other oral health care providers, like the dental assistants, support staff, and dental and dental hygiene trainees, since they work in similar environments. To my knowledge, there are no longitudinal studies quantifying the pandemic associated anxiety levels among oral health care providers over multiple time points.

The effects of COVID-19 pandemic on oral healthcare providers' anxiety levels are highly significant and consistent with the reports observed during the past pandemics; however, we do not have a measured value of the amount of anxiety oral health care providers experience, and how it changes with time.

When focusing on the pandemic-associated anxiety and the changes that come with it, it is essential to acknowledge that educational institutions underwent significant changes to cope with the pandemic. While it may be easier to imagine a 2-week vacation or remote studying, an entire year or more of remote teaching and learning with no social interactions and inability to work on specific projects on-site could be a few of the many reasons to cause anxiety among

those both teaching and learning in educational institutions. In the upcoming sections, I will focus on COVID-19-anxiety broadly in educational institutions. After this, I will focus more specifically on COVID-19 anxiety in dental schools, a high-risk environment, which includes oral healthcare workers (dentists and clinical staff), dental trainees, non-clinical academic staff, and support staff. Finally, I will elaborate on how anxiety could play a role in the lives of dental trainees, academic staff, and support staff in Canadian dental schools.

2.5.4 COVID-19 Anxiety in education institutions

By March 2020, over 100 countries closed schools and educational institutions, thus affecting over 80% of the world's student population [75, 76]. The pandemic increased anxiety and stress levels for people in educational institutions, caused by various factors such as fear of contracting the virus, uncertainties about their academic growth and future, social isolation due to virtual teaching and learning, changes in routine, and financial concerns. This was confirmed in a study in Texas universities, where 71% of students reported heightened stress and anxiety due to COVID-19 [77]. The pandemic significantly impacted education institutions in Texas, with campuses closing in March 2020 and moving to virtual classrooms, followed by a stay-at-home order by the Texas government in April [77]. Similar patterns of closure of educational institutions were observed in various parts of the world, including canceling conferences, workshops, sports, and other activities around the same time to curb the spread of the COVID-19 infection [75].

Both teachers and students need sound technical skills, a proper setup with a reliable internet connection, and a computer or laptop with the necessary software to adapt to the virtual world. Although online learning is not a new concept for many, technical challenges, difficulties in concentrating or delivering online classes, and social isolation due to lack of personal contact are plausible when virtual courses occur over long-term. In a comparison study drawn from the pre and during-pandemic mental and social well-being among Swiss University college students [78], the levels of anxiety, depression, and loneliness increased during the pandemic in comparison to before the pandemic. Physical and social isolation, lack of peer communication, and emotional support played a crucial role in negative mental health trajectories [78]. Female students also appeared to have poor mental health trajectories than male students when controlling for confounders [78]. Furthermore, travel restrictions and the closure of campuses could potentially negatively affect the mental health of the students. International students faced difficulties in traveling back to their families which would have

caused them to feel anxious about their well-being [75]. In addition, the closure of campuses and on-campus jobs could have also resulted in financial constraints among students.

While most of the pandemic-related studies on university students focused on undergraduate students, graduate students equally experienced disruption in their research activities and collaborations. According to the executive summary by NORC (2021), a research organization at the University of Chicago, 67% of the STEM research slowed down or was suspended [79]. In fact, graduate students in various disciplines experienced poor mental health outcomes such as fear, anxiety, and depressive symptoms [80, 81] during the COVID-19 pandemic.

Therefore, it is clear that educational institutions can cause high anxiety levels among students and academic staff, regardless of their field of study. However, it is also essential to consider the challenges of those set in fast-paced and intense curriculum environments, such as dental schools. As COVID-19 spreads through droplet infection, various aerosol generating procedures performed during dental treatments can make dental offices a high-risk environment. Students and employees working in these high-risk educational institutions may experience additional anxiety during infectious disease pandemics.

2.5.5 COVID-19 Anxiety in dental schools

The dental school curriculum is highly competitive and demanding, where students and academic staff strive to achieve academic excellence. Dental school trainees have been experiencing higher levels of anxiety even before the pandemic set in. Multiple studies show that dental students have elevated stress and anxiety compared to other health faculties, including medical students, due to academic pressure, competitiveness, and workload [82-84]. In most dental school curricula worldwide, students have an initial 2 years of coursework on medical and dental subjects and then the next 3 or 4 years of clinical training where they are involved in treating patients and providing treatments. Such transition phases from coursework to clinical training during the third year of dentistry are also marked as highly anxious periods among some dental trainees [85].

When the COVID-19 pandemic hit, dental training was affected significantly. As the pandemic started in March 2020, most dental schools suspended their clinical and laboratory activities in accordance with government policies to prevent the spread of the infection. A few months later, given the essential nature of simulation and clinical training for dental students, dental school clinics and laboratories were re-opened with strict, new infection-control protocols.

Interruption of clinical training and then resumption under very difficult circumstances, can be challenging for the students who would not feel confident enough to practice when they graduate. In a cross-sectional study conducted to evaluate the impact of suspension of clinical activities due to COVID-19 on dental trainees' self-confidence across 9 different Italian dental schools, 93.3% of the participants believed that suspension of clinical training caused a serious discontinuity in their training progress [86] and affected their self-confidence [87]. Similar experiences were shared by dental students in Jordan [87] and Romania [88], where participation in distance learning and confidence in clinical skills decreased during the COVID-19 pandemic.

In a meta-analysis focusing on prevalence of anxiety among dental students including studies from December 2019 to August 2021, 35% of dental students had symptoms of anxiety [89]. High levels of anxiety among dental students can also potentially affect their academic performance and ability to treat the patients once the restrictions are lifted.

In addition to the dental students, employees, including academic staff and support staff, would also have had to quickly adapt to changing work environments and newer technologies, along with financial concerns due to clinic closures and fear of being infected. Academic and administrative staff had to switch to online teaching platforms and work harder to engage the students [90]. Teaching clinical subjects online would be even more challenging, as instructors would need to incorporate clinical aspects of laboratory and patient training in their online curriculum. Along with academic staff, the mental health outcomes of those who support the oral health care providers, such as reception desk staff, dental assistants, and laboratory workers, might also have adverse impacts during the pandemic. Support staff, be they involved in direct or indirect patient care, share very similar work environments as dentists, dental hygienists or dental trainees. In the context of a dental school, support staff not only support oral health care providers and patients, but also students and professors in an academic environment. This can add an additional layer of complexity in their work. As dental schools are a high-pressure environment for both students and faculty, support staff may have had to manage both students and academic staff, while ensuring smooth functioning of various academic and patient related processes, along with the struggles of the pandemic. In this context, it is essential to acknowledge the impact of the pandemic on the mental health of those working as academic and support staff.

To understand the timeline, in 2020, the COVID-19 outbreak disrupted clinical and routine activities, leading to a sudden shift to remote teaching and learning. This change, coupled with uncertainties surrounding the pandemic, increased stress, anxiety, and feelings of isolation as we saw in studies mentioned above. In 2021, the ongoing nature of the pandemic, prolonged periods of isolation, remote learning fatigue, and academic pressures likely contributed to further declines in mental health among students. However, by late 2021-2022, there was a gradual return to in-person learning as restrictions eased in certain regions. While this reintroduced social interactions, it also could have presented challenges in readjusting to prepandemic routines. Additionally, there may have been a resurgence of fear related to the risk of infection, contributing to COVID-19-associated anxiety among students.

Overall, it is evident that COVID-19 has significantly impacted the anxiety levels of people from various backgrounds, including oral healthcare providers and university students. The pandemic caused sudden and unexpected changes, which could have increased anxiety levels among dental school trainees and employees. However, to date, we do not understand how anxiety plays a role among support staff like administrative staff, receptionists, and auxiliary dental staff, given that they share an environment very similar to dentists and dental trainees. Moreover, to better understand the anxiety experience due to a constantly changing infectious disease outbreak, we need to study the population over a period. Very few studies have tried to capture the anxiety experience over time among oral health care providers or university students, and none have focused on Canadian dentists, dental trainees, or university students over time. By understanding the COVID-19- associated anxiety, we will have evidence about the anxiety levels which can be used to create support systems.
3. RATIONALE

The COVID-19 pandemic has been significantly and adversely impacting the lives of people worldwide since its onset in 2019. COVID-19 is highly infectious and spreads through droplet infection. Healthcare workers and, more specifically, oral healthcare providers are considered to be in a high-risk category because of the nature of their work, such as close contact with patients' mouths and aerosol-generating treatment procedures. Considering COVID-19's nature of spread, infectivity, replication number, and associated mortality and morbidity rates, public health agencies worldwide imposed various rules and regulations to curd the infection spread. Some include social distancing, masking mandates, travel restrictions, and vaccinations. Various health and safety policies were also recommended for high-risk category professions, such as oral health care providers, who suspended routine dental treatments and only performed emergency procedures.

Fear of being infected or potentially infecting friends, family, and colleagues, and sudden changes and unexpected changes in the routine, like social distancing and remote working, could have severe mental health outcomes among people. In addition to oral health care providers, even those attending universities had to adapt to remote learning and social isolation. Dental schools are a highly competitive environment in themselves. Dental and dental hygiene trainees have critical practical years where they train while treating patients, and graduate students work on their research projects in laboratories or collaborative environments. Due to the pandemic, students training to be oral health care professionals and graduate students had to adapt to social distancing and remote learning and lost months of clinical practice. Alongside students, academic and support staff share a similar work environment and have had to cope with teaching and working online and suspend clinical and in-person research activities and collaborations.

Such changes occurring over a short period due to an infectious disease pandemic and the added complexity of being in a high-stress educational institution can cause severe anxiety among people experiencing and navigating through it. We need studies to understand the COVID-19-associated impacts on those studying and working in educational institutions in an occupational group hotspot, i.e., dental and dental hygiene students, faculty, and support staff in dental schools. However, we do not yet have a study focusing on the anxiety levels of these groups over a prolonged period of time. As the epidemiological situation of any infectious disease outbreak or a global pandemic like COVID-19 is constantly changing and evolving with time,

more longitudinal studies are needed to understand the changes in anxiety levels, if any, and the factors associated with it. As of February 2023, we only have one longitudinal study focusing on dentists and dental hygienists in the US, describing the prevalence of anxiety in these groups over one year. However, they did not describe the levels of anxiety described by these groups nor compare these groups over the entire study duration. To understand and improve the mental health outcomes of dental school students, we need to know the anxiety levels between these groups and the associated factors to develop interventions to support these groups. In a country like Canada, where 15% of all adults (18 and above) screen positive for generalized anxiety disorder [35], those in the high-risk group might have significantly higher anxiety levels.

The psychological well-being of those providing oral care to patients is essential; however, as seen in the literature review, there needs to be more research on the COVID-19-associated mental health outcomes among Canadian dental professionals, students, and staff to date. The present prospective cohort study aims to bridge this knowledge gap by addressing the COVID-19-associated anxiety among oral healthcare providers (dental students, staff, and faculty) across ten Canadian dental schools. This study would act as a crucial step in formulating interventions and policies to maintain the psychological well-being of those working in a dental school setting and potentially improve the mental wellness services and counseling for these populations, especially those handling patients regularly. Moreover, lessons learned from this study can be applied well beyond these specific groups to other cohorts of students, professors/teachers, and support staff in similar settings in universities and colleges across Canada and elsewhere.

4. STUDY AIMS AND OBJECTIVES

The overarching aim of this study is to understand the COVID-19-associated anxiety (C19A) among dental trainees, including undergraduates, graduates, residents, and employees, including faculty and support staff, across Canadian dental schools over a one-year duration. This can be done by observing the participant's anxiety scores over time to understand how different groups responded to the COVID-19 pandemic and if certain groups of people tend to have higher anxiety cumulatively throughout the study duration than other groups in the dental school cohort.

Specific objectives of this project are:

- To describe the level of COVID-19-associated anxiety (C19A) among students, academic staff, and support staff across all Canadian dental schools between April 2021-April 2022.
- 2. To assess the differences in COVID-19-associated anxiety levels among the students and employees, which includes both academic staff and support staff throughout the study duration.

5. METHODOLOGY

This section describes the methodology of the longitudinal cohort study addressing our study objectives. This project is part of a larger cohort study whose primary aim was to describe the COVID-19 infection rates among the participants in Canadian dental schools. Data for our research objectives comes from this larger cohort study.

5.1 Study Design

This project follows a longitudinal cohort study design over a span of one year. The literature review shows that most studies that aimed to capture COVID-19 or pandemic-related anxiety followed a cross-sectional study design. While cross-sectional studies provide valuable insights into the population anxiety at one time, this study design cannot explain the more complex long-term effects of anxiety nor detect the changes in the characteristics of the population on a group or individual level. However, with longitudinal studies, understanding the population changes over time along with the rapidly changing pandemic characteristics, such as the rise and fall of different COVID-19 variants, becomes easier.

5.2 Study Population

The study population comprises students, faculty, and support staff registered or employed in Canadian dental schools. Canada has a total of 10 dental schools located in 9 cities across 7 provinces (Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia). The study participants are broadly students, academic staff, or support staff registered or employed in these dental schools. The eligibility criteria include the following:

- (i) Undergraduate students, such as dental and dental hygiene trainees, residents, Masters or Ph.D. graduate students, or post-doctoral students enrolled at these dental schools at the time of participant recruitment.
- (ii) Dental faculty employed at these dental schools, primarily research and teaching or clinical faculty.
- (iii)Support staff employed at these dental schools, including dental assistants, dental hygienists, sterilization technicians, receptionists, and other office staff.

Different groups of participants from the schools were considered in the study as the anxiety experience of each of these groups is likely to be different due to their clinical experience, differing roles, sex, and age brackets, among others. Moreover, a student with a primary objective of obtaining clinical training would have a different anxiety experience than an academic staff primarily involved in remote research work. For example, during the lockdowns and practice restrictions, there would have been groups of dental students who would have stayed at their homes, learning the subjects online. In contrast, other groups of trainees in other provinces would have been able to practice in simulation laboratories or even treat patients. Furthermore, some graduate dental students focusing on research that could be managed remotely would have had no trouble progressing in their research work. However, for other graduate students working in laboratories or with patients, the closure of laboratories or clinics during the pandemic could have slowed their progress or, even worse, abruptly ended. Even among the faculties and support staff, some would have been able to carry on their work with very little change, such as those providing administrative support through computer networks or research faculties working on data, while other clinicians would be practicing in a high-risk environment such as a dental office treating patients. Thus, our study population is representative of the roles performed in a typical dental school in Canada and North America.

5.3 Ethical Considerations:

The principal investigator of this project was affiliated with the Faculty of Dental Medicine and Oral Health Sciences at McGill University in Quebec province, Canada. Therefore, ethics was obtained from the McGill University IRB review board (IRB Review Number was A12-M69-20B/(20-12-047)). It was then obtained from all the other 9 participating universities across Canada.

To ensure the security of the data, all participants had a password-protected entrance to the online survey collecting data, and the survey and data were all in a firewall-protected server at McGill University. Participants were assigned unique identification tokens rather than their names to identify their data to ensure confidentiality. To prevent potential conflict among professors running the project at each school and participants, only a designated research staff member at each university site, who was not in conflict with the participants (i.e., the designate was not a faculty member overseeing students or a clinical manager overseeing clinician participants), communicated directly with participants. Access to the deidentified dataset was provided only to those performing analyses. Informed consent materials ensured that participants were fully aware of potential risks, particularly safeguarding the privacy and potential conflicts of interest with researchers in dual teaching or management positions.

5.4 Recruitment Strategy

The participant recruitment began towards the end of March 2021 (29th March 2021) and until the end of April 2021. A total of 6,839 people, which included 3,189 (46.6%) trainees, 2,698 (39.5%) faculty, and 952 (13.9%) support staff, were sent electronic invitations to participate in this study. All these potential participants received invitations through the leadership of the dental schools using department listserves. These electronic invitations were linked to a password-protected database, where the participants could read and confirm their consent with their signatures. Once participants consented to participate in the study, they were prompted to begin answering the study questionnaire. A total of 600 participants signed the consent form and agreed to participate in the study at the end of the recruitment period. Among these 600 participants, 84 responded to the questionnaire for the first time by end of March (29th), 434 in April and 82 in May of 2021.

5.5 Data Collection

Data were collected electronically using a self-reported questionnaire. A self-reported questionnaire is one where the participants respond without an interviewer or examiner observing or influencing them. Participants responded to the questionnaire every month, with 12 responses in one year, from March-April 2021, until the end of April-May 2022. The self-reported questionnaire included baseline questions collected only once in the first month and follow-up questions collected monthly for over 12 months.

All the participants were divided into 3 sub-cohorts randomly, and each cohort was given a time frame of 2 weeks, during which they could respond to the questionnaire. Once the 1st cohort filled out the questionnaire, the research assistants would close their questionnaire and open it for the 2nd cohort for another 2 weeks. The 3rd cohort would answer in the following 2 weeks. So, for each follow-up, including the baseline, data were collected over 6 weeks. This process ensured ease of tracking the participant responses.

Data were collected online through the 'LimeSurvey' (Limesurvey GmbH. / LimeSurvey: An Germany. Source survey tool /LimeSurvey GmbH, Hamburg, URL Open *http://www.limesurvey.org*) and 'Qualtrix' (Qualtrics, Provo. UT. URL: https://www.qualtrics.com/) platforms. Participants were able to create their login and password for the system and were able to complete questionnaires using any of their devices.

5.6 Study Instrument

The study questionnaire was available to the participants in both English and French. The questionnaire was organized into 10 Sections. Questions in the first 4 sections were only collected once for a participant at baseline, while questions from section 5 onwards were collected every month until the end of the study, April-May 2022. [Appendix 1]

- (i) Section 1: Contact information which included name, phone number and email address, and the province of residence.
- Section 2: Socio-demographic characteristics and health status including age, sex at birth, gender, ethnicity, education level, shared residence or living alone, habit history, weight and height, presence of diseases or chronic conditions, and medication use.
- (iii) Section 3: Work information which included primary work roles and tasks engaged in dental school, and full or part-time employment status, workplace setting, and students' study year.
- (iv) Section 4: Potential for exposure which could be attributed to travel, shared accommodation, social interaction or contact with an infected individual.

The questionnaire also included the following questions, which were collected at baseline and subsequently every month until the end of the study, April 2022. [Appendix 1]

- Section 5: COVID-19 tests and symptoms, which included frequency, type, and results of COVID-19 testing, presence or absence of COVID-19 symptoms, and taking off from work.
- (vi) Section 6: Activities, comprising data on outdoor activities, the purpose of outdoor travel, work setting, provision of in-person dental care, handling of human tissue or prosthetics, if any.
- (vii) Section 7: In-person dental care episodes, constituting frequency, type of treatment (e.g., aerosol-generating procedures), number of patients treated; involved in COVID-19 positive patient care, personal protective equipment usage, and Infection Prevention and Control (IPC) checklist adherence.
- (viii) Section 8: Co-Workers, including the number of co-workers, frequency of coworkers developing symptoms or testing positive, and the possibility of getting infected in the shared workspace.
- Section 9: Vaccination status included type, date, and number of vaccine doses received.

(x) Section 10: COVID-19 Anxiety which collected participant's anxiety experience on the 9-item validated COVID-19 Anxiety Syndrome Scale (C19ASS) and additional 6 items related to fear and worry associated due to COVID-19 [33].

5.7 Description of Variables

5.7.1 Outcome evaluation

Participants answered the questionnaire about their anxiety experience in the last section (Section 10) of the questionnaire, which contained a total of 15 items. Among these questions, only the first 9-items comprising the COVID-19 Anxiety Syndrome Scale (C19ASS) [33] were validated for Canadian dental schools. Therefore, only the 9-item C19ASS is considered for the outcome evaluation for this project.

The C19ASS has two domains, avoidance (3 items) and perseverance (6 items), related to the COVID-19 anxiety syndrome. The items are framed as statements to which the participants responded on a five-point Likert-type scale to indicate their level of agreement ("0. Not at all", "1. Rarely, less than a day or two", "2. Several days", "3. More than 7 days", and "4. Nearly every day"). The statements referred to participants' ways of dealing with the coronavirus (COVID-19) threat. As there were 3 items in the Avoidance domain, and each item could have a score from 0-4, participants had a total avoidance score between 0-12. Similarly, for 6 items related to Perseveration, participants scored between 0-24, bringing the overall total C19ASS score between 0 and 36. C19ASS demonstrated acceptable levels of reliability and validity in developing a COVID-19 anxiety syndrome, thus improving the understanding of COVID-19 anxiety and functional impairment.

5.7.2 Primary variable influencing the outcome

<u>Role of the participant</u> in dental schools: Participants were asked to report their primary role at the dental schools. The options given for the participants to choose from were dental student, dental hygiene student, resident (general practice resident or resident in specialty training), a graduate student in MSc or Ph.D. program focused on research training (i.e., not clinical or professional training), academic staff, support staff (e.g., administrative staff, clinical staff, laboratory staff), and others. For this project, participants' roles were categorized broadly into 3 groups.

- a. Students, which included dental students, dental hygiene students, residents, graduate students
- b. Academic staff included those who answered as academic staff.
- c. Support staff included those who answered as support staff and "others" in their primary role in the questionnaire. To understand the participants who reported as "Others" in their primary role, their responses on other variables related to their work, even though not directly related to the aims of this project, were analyzed. Their responses to a question related to workplace setting showed that these participants worked at the reception, campus laboratories or offices (including receptions and offices), in clinical spaces in private clinics, or at home. Based on their workplace setting, they performed an important role, not as a trainee or academic staff, because they would have mentioned it otherwise; they were included in the support staff category.

5.7.3 Confounding variables influencing the outcome

- i. Provision of in-person dental care: Participants were asked to report if they provided in-person dental care the previous month. Participants were then categorized based on their responses into binary yes or no categories. Hence, at each follow up, they could either provide a yes or a no, making this variable dynamic with time.
- ii. Presence of chronic conditions: Participants were asked to report if they had medical conditions based on a given list of conditions such as obesity, cancer, diabetes, HIV/ other immune deficiency, asthma, chronic lung disease, chronic liver disease, a chronic blood disorder, chronic kidney disorder, chronic neurological impairment, organ or bone marrow transplant, heart condition, high blood pressure, and other comorbidities. Against each of these conditions, participants had to choose between yes, no, or unknown. For this study, all the participants who had at least one of these conditions were marked as having a chronic condition, and those replying no or unknown were grouped as those individuals not having a chronic condition.
- iii. Vaccination status: Participants were asked to report the number of vaccination doses they took, one dose, two doses, or more than two doses. Based on this, those with two or more doses were grouped as fully vaccinated and with one dose as a single dose vaccinated. As time progressed, more participants took two and multiple doses of vaccinations and were grouped into the appropriate category of fully vaccinated accordingly. Hence, this variable is also dynamic with time.

- iv. Dental school province: Participants reported the name of their dental school province. The 10 Canadian dental schools were located across 7 provinces in Canada, namely British Columbia (n=62), Manitoba (n=58), Nova Scotia (n=74), Ontario (n=163), Quebec (111), Saskatchewan (73), and Alberta (48). There were more participants in Ontario and Quebec than others, and 3 dental schools in Quebec alone, so the province variable was modified to reduce longitudinal analyses' model complexities. The province variable was combined into the following 3 categories:
 - a. Quebec (n=111)
 - b. Ontario (n=163)
 - c. All other provinces (n=315)
- v. Living arrangement: Participants were asked if they shared their residence with anyone else, be it friends, family, or roommates. For this study, the participants were grouped into binary categories, those that lived alone and those who shared residence with friends, family, or roommates. As living alone can cause feelings of loneliness [91, 92], dividing participants into binary categories was considered to see if living alone or with someone affected their anxiety score.
- vi. Sex at birth: Participants were asked to report their sex at birth from options like female, male, prefer not answering, and prefer to self-describe. Due to a very low number of people reporting 'prefer not answering,' only males and females were considered in longitudinal statistical analyses for the appropriateness of the statistical analyses.
- vii. Age: Participants reported their age in years. The age variable was used as a continuous variable in the longitudinal statistical analyses.

Most of the confounding variables did not change with time as participant responses were fixed. However, two confounding variables, participation in dental care and vaccination status was dynamic with time, allowing the participants to change their responses at each follow up.

5.8 Data Analyses

All statistical analyses were conducted using the R Statistical language (version 4.1.1; R Core Team, 2021) on Windows 10 x64 (build 19044), using the packages report (version 0.5.7; Makowski D et al., 2023) [93]

5.8.1 Descriptive Analyses

Descriptive analyses were conducted to describe the population sample characteristics and distribution. As the participant recruitment started by end of March (29th March), those recruited in March were included in April 2021's category for analyses. The variables included were the participant's role in dental schools, age distribution, sex at birth, provision of in-person dental care, province location of the dental school, vaccination status, presence of chronic conditions, and living alone or in a shared accommodation. To address the project's first aim of describing the levels of C19ASS avoidance and perseveration distribution among students, academic staff, and support staff, the C19ASS avoidance and perseveration distributions among these groups were also described using line graphs. Frequencies and percentages were used to describe the categorical variables. Mean, Standard Deviation (SD), Median, and Inter-Quartile Range (IQR) were used to describe continuous variables.

5.8.2 Longitudinal statistical analyses

A linear mixed effect model was used to address the project's second aim of investigating whether there were differences in anxiety levels among students and employees across the one-year study duration.

Data from the same participants were collected 12 times in one year, making the data correlated. Traditionally, Repeated measures ANOVA (RM-ANOVA) have been used for analyzing correlated observations and differences in the groups. However, RM-ANOVA cannot consider both item level and participant level variability together [94], due to which within-person variability is lost, leading to reduced statistical power [94, 95]. Another limitation of RM- ANOVA is that the entire case is deleted if a single observation is missing. In other words, if one observation out of 12 were missing, none of the other 11 observations would be considered in the model. This is called listwise deletion, which would substantially reduce the sample size and further reduce the statistical power and cause high standard errors [94]. Finally, RM-ANOVA does not accept continuous predictors in the model. Their final output does not give a direction or magnitude of the effect, just whether the effect is significant among the groups analyzed [94].

In this project, a Linear Mixed Effect model (LMER) was used to overcome the drawbacks of RM-ANOVA while analyzing correlated data. LMER is a mixed model that can be used for correlated data while simultaneously considering the within and across participants and items [94]. LMER does not perform listwise deletion and handles the missing data well. For example, if one observation is missing, other observations of the same participant will be included in the

model. In a longitudinal study, this ensures that the rich participant data is preserved while analyzing. Finally, as opposed to RM-ANOVA, the LMER model allows both continuous and categorical variables as predictors in the model.

Therefore, LMER with a random intercept model was considered appropriate for this study as the dependent variable (C19ASS scores) is continuous, allowing for multiple continuous or categorical independent variables adjustment in the model. The random intercept was used to see the participants' inter-individual differences in anxiety scores.

A random intercept linear mixed effects regression model can be denoted as [96]:

$$Y_{ij} = \beta_0 + \beta_1 \cdot x_{ij} + v_i + \varepsilon_{ij}$$

For $i \in \{1, \dots, n\}$ and $j \in \{1, \dots, mi\}$, where

 $v_{ii} \in R$ is the response for j-th measurement of i-th subject

 $\beta_o \in R$ is the fixed intercept for the regression model

 $\beta_1 \in R$ is the fixed slope for the regression model

 $x_{ij} \in R$ is the predictor for j-th measurement of i-th subject

- v_{i} ind $N(0, \sigma_{v}^{2})$ is the random intercept for the i-th subject
- ε_{ii} iid $N(0, \sigma_{\varepsilon}^2)$ is a Gaussian error term

In our study, participants' C19ASS anxiety scores were the dependent variable, and the role of the participants was the primary exposure of interest. The following section discusses how the model was developed for this analysis.

5.8.3 Developing the LMER model

To understand the relationship between roles of the participants and their anxiety scores, the *lme4* package (Bates, Maechler & Bolker, 2015) was used. Upon understanding the non-linear relationship between the role of the participant and their anxiety scores over time from the descriptive plots, time was modelled as a function of cubic B-spline. A spline is a piecewise polynomial function that is connected at specific junctions or "knots" [97]. B-Splines ('Basis-splines') use a set of basis functions to create a smooth curve that fits the data. They are used

to model non-linear relationships between a predictor variable and an outcome variable, and the shape of the curve is determined by the position of the knots. The bs() function from the "Splines" (R Core team 2021) package was used with default 3-degree (cubic) spline. The default bs() creates two boundary knots and one interior knot at the median of the number of days the study was conducted [98].

For the outcome variable of anxiety scores, the C19ASS scores were divided into two domains, avoidance (scores 0-12) and perseveration (0-24) anxiety scores and modelled separately. They were modelled separately because the avoidance and perseveration models were considered to fit the data better because they had lower Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) scores than the model with total C19ASS scores. AIC and BIC scores were also checked to confirm the model fit when time was modelled linearly versus as a function of cubic spline, and the latter fit the data better with lower AIC and BIC scores.

Initially, a crude model was developed to observe the association between the avoidance and perseveration anxiety scores with the roles of the participants. After which, covariates were added into the model to observe the adjusted model effects.

The fixed effects in the model included roles of the participants, provision of in-person dental care, presence of chronic conditions, province of their dental school, vaccination status, living alone or in a shared residence, age and sex. As random intercept, by-participant was used to observe individual level differences in anxiety experience. Time was incorporated as a continuous variable which was measured as the number of days since the study began.

The fitted model could be written as:

Avoidance model:

 $lmer(avoidance \ score \ \sim \ bs(Days) + Role + Dental \ care + Sex + Age + Chronic$ $conditions + Province + Vaccination \ status + Living \ alone \ or \ shared \ accommodation$ +(1/participant)

Perseveration model:

 $lmer(perseveration \ score \ \sim \ bs(Days) + Role + Dental \ care + Sex + Age + Chronic \\ conditions + Province + Vaccination \ status + Living \ alone \ or \ shared \ accommodation \\ + (1/participant)$

5.8.4 Model Assumptions

The lmer model follows certain assumptions such as normality (residuals of the model should be normally distributed), homoscedasticity (variance of the residuals should be across all levels of the predictor variables), independence (residuals of the model should be independent of each other), linearity (relationship between the predictor variables and the outcome variable should be linear), absence of influential data points and multicollinearity among the predictor variables.

The normality of the residuals was checked by plotting QQ plots and histograms of the models' residuals. Homoscedasticity and linearity were checked using residuals vs. fitted plots. The independence assumption was violated due to correlation, i.e., multiple responses per participant, and this was solved by including participants as the random intercept in the model. Variance Inflation Factor (VIF) was used to check for multicollinearity among the predictor variables. Finally, a residual vs. leverage plot was created to check for influential data points in the models.

5.9 Missing Data

Of the 600 participants reported at the baseline, 587 (~98%) participants reported their primary roles, and only these were included in the statistical analyses. For the C19ASS avoidance and perseverance scores, a participant's score was only included in the lmer model if they answered all the questions corresponding to avoidance (3) and perseverance (6). Rather than assuming a 0 for the unanswered question, this approach was used to avoid underestimating the anxiety scores.

5.10 Sampling Strategy

As this project was part of a larger project whose principal aim was to investigate COVID-19 infection rates in students, faculty, and staff across all 10 Canadian dental schools for one year, the sample size estimate for that project was 800. The sample recruited was 600, and over the year-long period of the study and had sufficient power to conduct the analyses. As the data for this project came from the larger project, there could be a possibility of type 2 errors. However, conducting a separate power analysis for this sub study would not be meaningful as the C19ASS currently does not have a defined effect size, and the clinical meaningful difference in the anxiety scores is unclear.

5.11 Feasibility

This study is part of a larger cohort observational study whose main objective was to assess the infection rates and immune response to COVID-19 in Canadian dental schools. This main project has received funding from the CITF (COVID-19 Immunity Task Force), which also covers this project on the stress and anxiety experience at the dental school populations.

6.1 Descriptive Statistics

6.1.1 Participant characteristics

A total of 600 participants were recruited in the study at baseline in April 2021-May 2021. After recruitment, participants responded to the questionnaire every four weeks until March or April 2022. Figure 6.1 depicts the number of participants who responded to the study questionnaire at baseline and then at follow-ups 1-11, during the period April 2021 to April 2022.



Figure 6.1 Participant response rate at each follow up

Participant response rate at each follow up

Demographic details and participant characteristics at baseline are presented in Table 6.1. Among the 600 recruited at baseline, 587 (~98%) participants reported their primary roles in dental schools. Of all the participants, 175 (~30%) were academic staff, 315 (~54%) were students, and 97 (~17%) were support staff. The median ages of academic staff, students, and support staff were 51, 24, and 47 years, respectively. A higher percentage of women was observed in all three groups, 61% academic staff, 69% students, and 87% support staff. Among the students' group, 74% were dental students, 11.7% were dental hygiene students, 8.6% were graduate students, and 5.7% were residents. Of those who provided dental care, 50.9% were academic staff, 54.3% were students, and 30.9% were support staff. About 28% of academic staff, 14% of students, and 38% of support staff reported suffering from chronic conditions. The provinces with the highest proportion of participants were Ontario with ~25% of academic staff and ~35% of students and Quebec with ~17% of support staff. Most participants reported having taken only one dose of vaccination (49% academic staff, 47% students, and 42% support staff). Regarding residence, 15% of academic staff, 27% of students, and 10% of support staff lived alone and did not share their accommodation with family or roommates.

	Academic staff	Students	Support Staff
Participant characteristics	(N=175)	(N=315)	(N=97)
Age			
Median [Min, Max]	51.0 [24.0, 88.0]	24.0 [19.0, 56.0]	47.0 [18.0, 74.0]
Q1-Q3	41 - 57	23 - 28	36 - 54
Missing	1 (0.6%)	1 (0.3%)	0 (0%)
Sex at Birth			
Female	107 (61.1%)	217 (68.9%)	84 (86.6%)
Male	67 (38.3%)	98 (31.1%)	13 (13.4%)
Prefer not answering	1 (0.6%)	0	0
Primary Role in Dental School			
Academic staff	175 (100%)	-	-
Dental students	-	233 (74.0%)	
Dental hygiene students	-	37 (11.7%)	-
Graduate students(MSc/PhD; non-clinical)	-	27 (8.6%)	-
Residents(general /speciality)	-	18 (5.7%)	-
Support Staff	-	-	97 (100%)
Provision of dental care			
Yes	89 (50.9%)	171 (54.3%)	30 (30.9%)
No	86 (49.1%)	140 (44.4%)	66 (68.0%)
Missing	0	4 (1.3%)	1 (1.0%)
Chronic Conditions			
Yes	49 (28.0%)	45 (14.3%)	37 (38.1%)
No	125 (71.4%)	270 (85.7%)	60 (61.9%)
Missing	1 (0.6%)	0	0
Dental school province			
Ontario	43 (24.6%)	109 (34.6%)	10 (10.3%)
Quebec	36 (20.6%)	58 (18.4%)	16 (16.5%)
Others	96 (54.9%)	148 (47.0%)	71 (73.2%)
Vaccination status in March-April 2021			
One dose	85 (48.6%)	149 (47.3%)	41 (42.3%)
Two doses	29 (16.6%)	16 (5.1%)	17 (17.5%)
Missing	61 (34.9%)	150 (47.6%)	39 (40.2%)
Living alone/shared accommodation			

Table 6.1 Participant characteristics at baseline						
Participant characteristicsAcademic staff (N=175)Students (N=315)Sup (N=						
Alone	27 (15.4%)	84 (26.7%)	10 (10.3%)			
With house/roommates/family	146 (83.4%)	230 (73.0%)	86 (88.7%)			
Missing	2 (1.1%)	1 (0.3%)	1 (1.0%)			

Vaccination doses among the participants changed with time. The number of people taking two doses of vaccination increased as time progressed (Table 6.2). At baseline (April-May 2021), 62 participants (10%) had two doses of vaccination, which rose to 92% in September-October 2021, and then to 93% in March-April 2022.

Table 6.2 Vaccination trend over time								
Vaccination Doses	April-May 2021 (N=600)	September-October 2021 (N=423)	March-April 2022 (N=334)					
One dose	275 (46%)	21 (5.0%)	13 (3.9%)					
Two doses	62 (10.3%)	388 (91.7%)	311 (93.1%)					
Missing	263 (43.8%)	14 (3.3%)	10 (3.0%)					

Chi-squared test was used to analyze the participant characteristics at baseline and follow-up (Table 6.3), with statistical significance determined using a p-value threshold of less than 0.05. Notably, several participant characteristics demonstrated statistically significant differences between the study's beginning and end. There was a notable decrease in the proportion of students (0.54 to 0.44), accompanied by a corresponding increase in the proportion of employees (0.46 to 0.56). The distribution of participants from different provinces exhibited significant differences, as the proportion from Ontario decreased while the proportions from other provinces increased. Finally, regarding vaccination status, a significant decrease was observed in the proportion of participants with one dose, while the proportion with two doses exhibited a significant increase.

Table 6.3: Comparison of participant characteristics at baseline and end of the study						
Participant characteristics Proportion at Proportion at P-Value Baseline Follow-up 11 P-Value						
Age						
18-24 (n=174)	0.29	0.27				
25-34 (n=174)	0.29	0.24	0.05			

Table 6.3: Comparison of participant characteristics at baseline and end of the study						
Participant characteristics	Proportion at Baseline	Proportion at Follow-up 11	P-Value			
35-44 (n=64)	0.11	0.09				
45-54 (n=95)	0.16	0.21				
>55 (n=83)	0.14	0.19				
Sex at Birth						
Female	0.70	0.72				
Male	0.30	0.28	0.71			
Prefer not answering	0.001	0.003				
Primary Role in Dental School						
Students	0.54	0.44	-0.01			
Employees	0.46	0.56	<0.01			
Provision of dental care						
Yes	0.50	0.55	0.17			
No	0.50	0.45				
Chronic Conditions						
Yes	0.22	0.23	0.82			
No	0.78	0.77	0.82			
Dental school province						
Ontario	0.28	0.16				
Quebec	0.19	0.23	<0.01			
Others	0.53	0.61				
Vaccination status in March-April 2021						
One dose	0.82	0.04	<0.01			
Two doses	0.18	0.96				
Living alone/shared accommodation						
Alone	0.21	0.19				
With house/roommates/family	0.79	0.81				

6.1.2 Anxiety trend among the participants

Table 6.3 presents the C19ASS avoidance and perseverance mean and standard deviation among different participant groups in April 2021 and April 2022. All the groups showed a decrease in anxiety as time progressed, with higher avoidance and perseverance anxiety scores in April 2021 compared to April 2022.

Table 6.4 C19ASS scores based on Participant Characteristics							
Categories		Mean (SD) sco	ores in April	Mean (SD) sco	Mean (SD) scores in April		
		2021		2022			
		Avoidance	7.3 (3.2)	Avoidance	2.6 (3.0)		
Pole	Student	Perseverance	12.6 (5.3)	Perseverance	7.7 (6.6)		
		Avoidance	6.1 (3.6)	Avoidance	3.5 (3.5)		
	Employee	Perseverance	11.4 (5.7)	Perseverance	7.6 (6.1)		
	18-24	Avoidance	7.2 (3.3)	Avoidance	2.4 (3.0)		
A		Perseverance	12.7 (5.3)	Perseverance	6.8 (6.7)		
Age	25-34	Avoidance	7.2 (3.2)	Avoidance	3.4 (3.3)		
		Perseverance	12.1 (5.0)	Perseverance	8.2 (6.6)		
	35-44	Avoidance	6.2 (3.6)	Avoidance	2.9 (3.1)		
		Perseverance	11.0 (6.1)	Perseverance	4.9 (3.8)		
	45-54	Avoidance	5.9 (3.7)	Avoidance	2.6 (3.0)		
		Perseverance	11.9 (5.6)	Perseverance	7.3 (5.3)		
	>55	Avoidance	6.0 (3.8)	Avoidance	4.5 (3.9)		
		Perseverance	11.0 (6.2)	Perseverance	9.5 (7.0)		
		Avoidance	6.9 (3.3)	Avoidance	2.8 (3.1)		
~	Female	Perseverance	12.3 (5.4)	Perseverance	7.5 (6.2)		
Sex	Male	Avoidance	6.2 (3.7)	Avoidance	3.5 (3.5)		
		Perseverance	11.5 (5.6)	Perseverance	7.4 (6.4)		
	Yes	Avoidance	6.6 (3.4)	Avoidance	3.3 (3.1)		
Dental care		Perseverance	12.5 (5.2)	Perseverance	8.9 (6.6)		
provision	No	Avoidance	6.8 (3.5)	Avoidance	3.0 (3.5)		
		Perseverance	11.5 (5.8)	Perseverance	6.3 (5.6)		
	Yes	Avoidance	6.9 (3.5)	Avoidance	2.4 (2.5)		
Chronic conditions		Perseverance	11.8 (5.7)	Perseverance	7.6 (5.0)		
		Avoidance	6.7 (3.5)	Avoidance	3.3 (3.4)		
	No	Perseverance	12.0 (5.5)	Perseverance	7.6 (6.5)		
		Avoidance	7.4 (3.3)	Avoidance	4.1 (4.0)		
	Ontario	Perseverance	13.3 (5.5)	Perseverance	10.3(5.9)		
Dental school		Avoidance	5.9 (3.5)	Avoidance	2.5 (3.1)		
province	Quebec	Perseverance	10.4 (5.9)	Perseverance	6.3 (6.2)		
		Avoidance	6.7 (3.5)	Avoidance	3.2 (3.0)		
	Others	Perseverance	11.9 (5.3)	Perseverance	7.4 (6.3)		
		Avoidance	6.8 (3.4)	Avoidance	4.8 (4.3)		
Vaccination doses	One dose	Perseverance	12.6 (5.4)	Perseverance	9.2 (6.2)		
		Avoidance	5.9 (3.6)	Avoidance	3.0 (3.3)		
	I wo doses	Perseverance	11.2 (5.5)	Perseverance	7.6 (6.4)		
	Living alone	Avoidance	7.2 (3.5)	Avoidance	3.7 (3.4)		
Accommodation	Ŭ	Perseverance	12.3 (5.8)	Perseverance	8.9 (6.8)		
		Avoidance	6.6 (3.4)	Avoidance	3.0 (3.3)		

With	roommates/	Perseverance	11.9 (5.4)	Perseverance	7.3 (6.2)
family					

Both students and employees followed a similar trend with a decrease in mean anxiety as time progressed, with a slight peak in January 2022. Students had higher avoidance (mean (SD) =7.3 (3.2)) and perseverance anxiety (mean (SD) =12.6 (5.3)) than employees (avoidance mean (SD)= 6.1(3.6) and perseverance mean (SD) = 11.4 (5.7)) in April 2021. In contrast, in April 2022, students had lower avoidance (mean (SD)=2.6(3.0)) than employees (mean (SD) = 3.5 (3.5)), and perseverance means were similar in both groups (students' mean (SD)=7.7 (6.6)), and employees mean (SD) = 7.6 (6.1)) (Figure 6.2)

Figures 6.3 to 6.9 describe the mean and standard deviation of C19ASS avoidance and perseverance scores on other participant characteristics such as age, sex, participation in dental care, vaccination dose, alone or shared residence, and province location. The anxiety trend is similar across all the groups, with mean anxiety decreasing with time, with a similar peak around January 2022.

The mean avoidance anxiety scores in April 2021 were higher in females, participants between the ages 18-34, participants who did not participate in dental care, with one dose of vaccination, with chronic conditions, and who lived alone. In addition, avoidance anxiety was higher in Ontario province, followed by all other areas except Quebec, which had the lowest anxiety. Trends in these groups were similar in April 2022, except for those without chronic conditions and employees, who had higher anxiety.

Similarly, the mean perseverance anxiety scores were higher in females, ages 18-24, participants who provided dental care, with one dose of vaccination, without chronic conditions, and who lived alone and in the province of Ontario. Perseverance anxiety followed a similar trend for all categories in April 2022.



Figure 6.2a Avoidance anxiety categorized by participants' role in dental school

Figure 6.2b Perseverance anxiety categorized by participants' role in dental school



Perseverance anxiety categorized by role



Figure 6.3 Avoidance (top) and perseverance (bottom) anxiety based on age





Anxiety scores [Mean(+/-1 SD)] categorized by sex

Figure 6.5 Avoidance (top) and perseverance (bottom) anxiety based on participation in dental care



Figure 6.6 Avoidance (top) and perseverance (bottom) anxiety based on whether participants have chronic conditions



Anxiety scores [Mean(+/-1 SD)] categorized by presence of chronic condition

Figure 6.7 Avoidance (top) and perseverance (bottom) anxiety scores based on vaccination dose



Figure 6.8 Avoidance (top) and perseverance (bottom) anxiety scores based on dental school province location



Anxiety scores [Mean(+/-1 SD)] categorized by dental school province

Figure 6.9 Avoidance (top) and perseverance (bottom) anxiety scores based on accommodation status



Anxiety scores [Mean(+/-1 SD)] categorized by accommodation status

6.3 Linear mixed-effects analyses

Linear mixed effects modeling was performed to investigate the associations between the avoidance and perseverance anxiety scores with the roles of the participants and a set of confounding variables while accounting for the correlation among repeated measures within the same participant over time.

Two separate models were developed for the avoidance and perseverance anxiety scores, and both models met the assumptions of the linear mixed effects model. The residuals of both avoidance and perseverance models were normally distributed. Visual inspection of residual plots did not reveal any obvious deviations from homoscedasticity. As anxiety scores were non-linearly associated with time, time was modelled as a cubic spline. The Variance Inflation Factor showed the absence of multicollinearity among the predictor variables in both models.

The C19ASS was modelled separately as avoidance and perseverance scores rather than total C19ASS scores because avoidance and perseverance scores separately fit the data better, with lower AIC and BIC values. Further, when the time was fitted using a cubic spline, the model had lower AIC and BIC values than when the time was modelled linearly. Table 6.4 presents

the AIC and BIC	values t	for the total	C19ASS,	the two	divided	domain	models,	time as	linear
and time as cubic	e spline i	n the mode	1.						

Table 6.5 AIC and BIC values for model selection							
Models	AIC	BIC					
Total C19ASS model	25831.76	25926.82					
Avoidance models	Avoidance models						
Linear time model	19084.70	19167.25					
Cubic spline time model	18972.04	19067.29					
Perseveration models							
Linear time model	23355.36	23437.85					
Cubic-spline time model	23218.65	23313.84					

Table 6.5 presents the crude and adjusted mean structure of the fixed effects in the avoidance and perseverance model. The table does not present the values of the coefficient and confidence intervals of confounding factors included in the model to prevent the Table 2 fallacy [99]. Time was negatively associated with both avoidance and perseverance anxiety in crude and adjusted models, such that as time since the start of the study increased, avoidance and perseverance anxiety scores decreased. Avoidance and perseverance anxiety scores were higher in students by 0.43 and 0.85 points, respectively in comparison to employees when adjusted for age, sex, presence of chronic conditions, province, vaccination status, and living status (β (avoidance) = 0.43, CI = [-0.31, 1.17] and β (perseverance) = 0.85, CI = [-0.47, 2.17]). The random effects indicated moderate variability among the participants, with a variance and standard deviation of 6.95 and 2.64, respectively in the avoidance model and 22.52 and 4.75 respectively in the perseverance model.

Table 6.6 Crude and Adjusted Avoidance and Perseveration Models					
	Crude Avoidance model	Adjusted Avoidance model	Crude Perseveration model	Adjusted Perseveration model	
Coefficients	Estimates (95% C.I.)	6Estimates (95% C.I.)	⁶ Estimates (95% C.I	l.) Estimates (95% C.I.)	
Days[1st degree]	-5.36 (-6.00 , -4.71)	-5.03 (-5.92 , -4.13)	-8.60 (-9.66 , -7.55)	-9.13 (-10.62 , -7.65)	
Days[2nd degree]	-2.57 (-3.08 , -2.07)	-1.70 (-2.26 , -1.15)	-1.51 (-2.34 , -0.69)	-0.76 (-1.69 , 0.17)	
Days[3rd degree]	-4.34 (-4.79 , -3.88)	-3.99 (-4.58 , -3.40)	-6.18 (-6.92 , -5.44)	-6.39 (-7.37 , -5.41)	
Role [Students]	0.63 (0.17 , 1.09)	0.43 (-0.31 , 1.17)	0.54 (-0.29 , 1.36)	0.85 (-0.47 , 2.17)	
Random Effects					
	Crude Avoidance	Fitted Avoidance	Crude Perseveration	Fitted Perseveration	
σ^2	3.98	3.71	10.58	10.18	
$ au_{00}$	7.13 subject	6.95 subject	23.28 subject	22.52 subject	
Std. Dev.(τ ₀₀)	2.67	2.64	4.86	4.75	
ICC	0.64	0.65	0.69	0.69	
Ν	577	529	577	530	
Model fit					
Observations	4662	4231	4632	4213	
$\begin{array}{c} Marginal \\ Conditional \\ R^2 \end{array} /$	0.098 / 0.677	0.114 / 0.692	0.046 / 0.702	0.084 / 0.715	
AIC	21162	18972	25661	23218	

 σ^2 - Within-person residual variance/ Residual variance

 τ_{00} . Between-person variance (Intercept of the Random effects)

ICC-Intraclass-Correlation Coefficient Proportion of variance explained by between-person differences.

N- Number of participants

AIC- Akaike information criterion

Std Dev- Standard Deviation

Crude model- lmer(anxiety score ~ bs(Days) +Role+ (1|participant)

 $\label{eq:adjusted} \begin{array}{l} Adjusted model- lmer(anxiety score ~ bs(Days) + Role + Dental care + Sex + Age + Chronic conditions + Province + Vaccination status + Living alone or shared accommodation +(1|participant) \end{array}$

The marginal effect of time on anxiety (Figure 6.10) depicts the non-linear relation of the anxiety scores with time. The initial steep decline represents the avoidance and perseverance anxiety scores decreasing rapidly with time, followed by a less steep plateau, where the anxiety scores did not change by a significant amount. This is again followed by another steep curve, which shows that anxiety decreased again at a more rapid rate.



Figure 6.10a Marginal Effect of Time on Avoidance Scores

Figure 6.10b Marginal Effect of Time on Perseverance Score



7. DISCUSSION

7.1 Summary of the results

7.1.1 Effect of Time on Anxiety Levels

This prospective cohort study was conducted to describe the level of avoidance and perseverance anxiety due to the COVID-19 pandemic in Canadian dental schools' cohorts over a year from April 2021-April 2022. In addition, it investigated if there were differences in COVID-19-associated anxiety among the students and employees training or working in these Canadian dental schools during the study period. As the epidemiological situation of any infectious disease outbreak or a global pandemic like COVID-19 changes constantly and evolves with time, longitudinal studies are needed to understand the changes in anxiety levels, if any, and the factors associated with those changes. Therefore, this longitudinal study over a period of one-year was conducted to improve the understanding of how participants in a Canadian dental school cohort experienced COVID-19-associated anxiety.

Our study results show that avoidance and perseverance anxiety in the cohort decreased progressively from the beginning of the study in April 2021 to the end of the study in April 2022, with a slight peak in mean anxiety scores in January 2022. This trend of decreasing avoidance and perseverance anxiety over time, with a peak in January 2022, was similar across all the groups, regardless of their sex at birth, role in dental school, participation in dental care, suffering from a chronic condition, vaccination doses, living alone or in a shared residence or the dental school province location.

Possible reasons for the decrease in anxiety over time could be due to increased participant adaptability to the COVID-19 protocols and routines. With time, more information and research regarding the COVID-19 pandemic developed, which could have improved mental health outcomes among the study participants. Moreover, the number of incident COVID-19 cases decreased, and the overall pandemic situation improved towards mid and late 2021, although there was a significant peak in cases in December 2021 and January 2022, which rapidly fell again in February 2022 (see Figure 7.1; [100]). Dental trainees and employees could have gradually adapted to the pandemic, reducing anxiety over time. Participants' adaptability was also reflected in the marginal effects of time on the anxiety plot (Figure 6.10), wherein the initial steepness of the curve represents rapidly decreasing anxiety ratings among the participants with time. In addition, vaccination rollouts since April 2021 increased over the

months, with more participants getting their second dose of vaccination, which could also have significantly improved anxiety levels among the participants. While the anxiety reduced progressively from April 2021, participants in all groups showed an increase in anxiety in January 2022, after which it decreased again from February 2022 onwards. This sudden rise in anxiety could be attributed to the rise in the Omicron variant of COVID-19, which affected Canada in January 2022 [100] (Figure 7.1). Effects of Omicron included rising infection rates, followed by lockdowns in different provinces in Canada in different capacities [101]. The sudden rise in the number of Omicron cases could be associated with a spike in mean anxiety levels among the study population.



Figure 7.1 Number of people infected with COVID-19 each day in Canada (April 21-April 22)

According to the literature, Eldridge et al.(2022) found a decrease in anxiety with time in a longitudinal study focusing on dentists' and dental hygienists' anxiety and depression prevalence in the US in 2020-2021[102]. This study observed the prevalence of anxiety in dentists (June 2020-May 2021) and dental hygienists (September 2020-May 2022) over time. The Generalized Anxiety Disorder-2 (GAD-2) instrument was used to measure anxiety prevalence, and their results were similar to our study. It showed that the prevalence rates of anxiety decreased progressively in both groups from the beginning of their follow-up till the end of the study. Another longitudinal study conducted by Amendola et al. (2021) focusing on Generalized Anxiety Disorder among university students during the first (April 2020) and second wave (May 2020) of the COVID-19 pandemic in Switzerland showed that participants with moderate-to-severe anxiety scores on the GAD-7 scale decreased by 0.45 points between the two-time points [103].

These studies and our study observed a reduction in anxiety symptoms that aligned with the decrease in the number of newly infected cases and fatalities. However, some studies like Elmer et al, 2020 [104] and Zimmermann et al., 2020 [105] showed increased anxiety over time. Elmer et al. and Zimmermann et al. compared pre-pandemic anxiety levels to COVID-19-associated anxiety, which could be why their anxiety increased between the time points. According to another longitudinal cohort study (Li et al., 2020), during the initial pandemic phase in China, anxiety symptoms among college students increased between early February 2020 to early April 2020 [106]. The variations in these findings can be attributed to the differences in periods during which the data collection took place, the scales used to measure anxiety, COVID-19 infection rates, the development of mitigation strategies, and methodological challenges associated with each study.

7.1.2 Anxiety levels based on participant characteristics over time

Our results showed that although students had slightly higher mean avoidance and perseverance anxiety than employees from April-June 2021, this difference was not significant in our sample of participants. Moreover, our Linear Mixed Effects (LME) model showed no significant differences in avoidance and perseverance anxiety between students and employees over one year. The minimum detectable difference in the C19ASS is a 1-point difference. We found that students had 0.43 and 0.85 points higher than employees in avoidance and perseverance domains, respectively, when controlling for potential confounders, making the difference non-significant. Therefore, students and employees in our study had similar anxiety experiences overall.

Unlike our findings, a cross sectional study conducted by Odriozola et al. [107] in a Spanish university in April 2020 reported significantly higher levels of anxiety among students compared to various groups of university employees. In their study, they included students and employees of all faculties of 1 university, while our study focused on just dental faculties/schools across 10 universities in a geographically large country with different COVID-19 incidence peaks over time. This large geographic span could contribute to our study having more variation in the data. Interestingly, Odrizola et al. report similarities within department-level sub-cohorts. For example, students and workers in Engineering and Architecture faculty had lower anxiety scores than students and workers in Arts and Humanities [107]. This is similar to our results, where we highlight the anxiety experiences between

students and employees within dental schools, indicating that the academic environment and workplace can elicit comparable anxiety levels.

Regarding the anxiety experience in different age groups, participants aged 18-34 had higher avoidance ratings at the beginning of the study from April-July 2021, after which there were no differences in the anxiety experience among different age groups, as with perseverance anxiety ratings throughout the study. The initial phase in avoidance ratings of higher anxiety among younger participants is consistent with anxiety prevalence among dentists and dental hygienists in the US, where younger participants (ages 26-39) had higher anxiety than older participants (ages >40) [102] . Similar findings of higher anxiety and post-traumatic stress among younger participants were reported among healthcare workers in different countries during COVID-19 [108-111]. As the majority of our sample was students, adapting to online learning and interruption of clinical practice would have negatively affected their self-confidence and ability to gain hands-on experience. Moreover, younger academic and support staff, who are still in the process of building their professional identities, would have found it challenging to deal with uncertainties surrounding the rapidly changing protocols.

In our descriptive plot based on sex at birth, females tend to have higher avoidance and perseverance anxiety across most time points during the one-year follow-up. This result is consistent with previous studies [102, 104, 112-114]. However, some studies conducted prior to mid-2020 did not find differences in anxiety scores based on sex [105, 106, 115], and this may be attributed to the infodemic during that period, which could have resulted in a similar psychological impact in both sexes in response to a novel situation.

Regarding the participants who provided dental care and those who did not, their avoidance and perseverance anxiety ratings also shared a similar pattern across the time with little difference. We thought it essential to consider those who participated in providing dental care for patients versus those who did not, as studies have highlighted poor mental health outcomes in healthcare workers who provided direct patient care during infectious disease outbreaks [116-118].

In past studies, individuals experiencing one or more chronic conditions such as cancer [119], diabetes [120], cardiovascular conditions [121], asthma [121], or with multiple comorbidities [122] were associated with higher anxiety symptoms during the COVID-19 pandemic. However, in our study, the anxiety experiences of participants with and without chronic

conditions were similar across time. This could be due to the higher levels of psychological resilience among those with chronic conditions, enabling them to cope effectively with the challenges posed by their condition and academic demands. Moreover, it is possible that participants with chronic conditions in dental schools have more awareness about their condition and actively manage it through medical care and self-care practices.

Regarding participants' anxiety ratings based on vaccination doses, participants with one vaccination dose had higher anxiety at the beginning and the end of the study. However, it is essential to note that the differences were small and varied over time. The percentage of participants with two doses of vaccination grew consistently, accounting for 91.7% in September-October 2021 and 93% in March-April 2022; thus, factors other than vaccination could have contributed to the variations observed between vaccination doses and anxiety ratings over time. Our results are consistent with previous studies, where stress and anxiety levels among individuals post vaccination decreased in comparison to their pre-vaccination levels [123, 124].

For the provincial location of the dental schools, participants working in dental schools in Ontario experienced the highest levels of avoidance and perseverance anxiety, while those in Quebec had the lowest anxiety throughout the study duration. All other Canadian provinces combined had anxiety ratings between the levels observed in Ontario and Quebec. Each province in Canada has its own regulatory bodies responsible for dental licensure and practice. Possible reasons for the differences in anxiety ratings between the provinces could be variations in practice restrictions for trainees and employees, differences in COVID-19 guidelines, and the impact of COVID-19. Ontario province had imposed more practice restrictions for trainees and employees [125], for example insisting on the use of closed operatories for aerosol-generating procedures, potentially leading to increased anxiety among students and employees in the two dental schools located in Ontario due to reduced clinical practice. Furthermore, Ontario had a higher COVID-19 incidence compared to Quebec province [126], which may have also contributed to higher anxiety ratings among the participants.

In our study, we observed little difference in anxiety ratings between those living alone and those living with friends/family or roommates. We included this as an important participant characteristic because living alone has been associated with common mental disorders in previous studies [127-129]. Living alone can cause feelings of loneliness among the

participants [127], primarily because of the lockdowns, quarantine measures, and travel restrictions due to the COVID-19 pandemic, which could potentiate anxiety.

Overall, based on the results, we found that mean avoidance and perseverance anxiety ratings were similar across most participant characteristics and decreased with time. The commonality in anxiety experiences among the study participants, both dental school trainees and employees, is not surprising, given their shared work and study environment and their adherence to the rules and regulations imposed by their dental schools, universities, regulatory authorities and provincial governments. It is important to note that we observed moderate variability among participants in their anxiety scores at each follow-up, as indicated by the variance and standard deviation observed in our LME models. Additionally, it is crucial to acknowledge that there might be unmeasured confounding effects that were not accounted for in our analyses. For instance, various studies have reported higher stress and anxiety levels among dental students, even in pre-pandemic times [130-133]. In a study on Malaysian dental students, senior dental students reported higher anxiety and stress levels than junior dental students [132]. Similar findings were also reported in other studies across different countries. In Saudi Arabia, third-year dental students had the highest performance pressure, fourth and fifth-year students had the more clinical requirements, and overall, students perceived high stress across all 5 years of their dental education due to the workload [133]. Similarly, a mixed methods study on Canadian dental students reported that dental students in clinical years had concerns about patient treatment. Fourth-year dental students and residents reported future plans as an added stressor. These studies show that stress and anxiety were prevalent among dental students in many countries before the pandemic. These findings emphasize the complexity of anxiety experiences in this population and the need for further research to understand better and address the multifaceted factors influencing anxiety in dental school settings.

Finally, it is essential to acknowledge that we used C19ASS, a scale specific to measuring COVID-19-associated anxiety among the participants, which has not been used in other studies focusing on pandemic-associated anxiety levels. Therefore, these comparisons should be interpreted with caution as the C19ASS specifically focuses on fears and worries associated with the risk of contracting the virus, while the causes of anxiety in other studies not using C19ASS could have stemmed from other potential external factors such as government restrictions, financial difficulties, or social isolation due to the pandemic. Thus, the

interpretation of comparisons between our study and others should be done carefully, considering these differences in anxiety measurement.

7.1.3 C19ASS: Scale and Considerations

The scale we used to measure anxiety is the COVID-19 Anxiety Syndrome Scale (C19ASS), which was developed very early in the pandemic in 2020 [33]. Specifically, the scale includes items that assess avoidance behavior, worry and rumination, threat monitoring, and physiological symptoms of anxiety related to COVID-19. This scale was developed in the US general population for measuring COVID-19 anxiety (C19A) and was validated to be used in Canadian dentists in both English and French [38]. However, we do not know about this scale's sensitivity when comparing different groups of participants, as this is the first study utilizing the C19ASS to compare different groups of participants' anxiety levels longitudinally. Furthermore, we do not know the size of a clinically meaningful difference in scores on the C19ASS scale. Although we can define a 1-point difference as the minimum detectable difference as the scale has a Likert response from 0-36 points, we do not have studies defining what size of difference between groups or size of change within groups over time is "clinically" important or meaningful. In our study using C19ASS, we found no significant differences in C19A across participant characteristics such as sex, role, and participation in dental care, suggesting these factors are not related to the C19A in our sample of Canadian dental school cohort. This would mean that these groups had no systemic differences that would affect their anxiety scores differently. However, this does not mean that there are no factors that could influence COVID-19-associated anxiety. As mentioned previously, various unmeasured confounding variables such as personality traits, coping mechanisms, pre-existing anxiety disorders, social support, or other life circumstances could still potentially impact anxiety levels in these groups differently. To our knowledge, this is the first, and perhaps the only, study describing anxiety levels for the COVID-19 pandemic for one year, which also compared the anxiety across different groups, including students, academic staff, and support staff. Future research to investigate the relationship between certain personality traits, such as neuroticism or conscientiousness, and C19ASS scores would provide valuable insight into the factors that predict C19A and future infectious disease outbreaks.

7.2 Methodological Considerations

7.2.1 Strengths of the study
During an infectious disease outbreak, such as the COVID-19 pandemic, epidemiological considerations change rapidly, such as the emergence of different virus strains, seasonal variations in infection rates and government policies and interventions to combat these challenges. In such a scenario, understanding mental health outcomes in populations requires study designs that can capture the time-related effects of the pandemic on people experiencing it. This study follows a prospective longitudinal study design, which makes it possible to observe the participants' anxiety over a one-year period, making it one of the most important strengths of this study.

Secondly, this study had groups of individuals performing various roles in dental school environments, which were important to investigate during the pandemic, such as dental trainees and employees and those working in a range of clinic settings or at home. Different groups of participants enabled comparing their anxiety levels, which can further improve the understanding of how certain groups cope with anxiety in the context of a global pandemic, thereby enabling the development of mitigation strategies for future situations, when other infectious disease outbreaks or similar "emergency" situations occur.

Thirdly, a validated and reliable COVID-19 anxiety syndrome scale was used to record the anxiety experience of participants. This scale is specifically designed to capture COVID-19-associated anxiety, with questions focusing on avoidance and perseverance behaviors. The scale has been validated for the Canadian dentists in the community in both English and French, making it an appropriate scale to measure anxiety in the dental school population in Canada.

Finally, to utilize the rich longitudinal data, a linear mixed effects model with random intercept was used. This is a robust statistical methodology that considered a one-year time duration, potential confounders as well as participant level randomness in the same analyses, to analyze differences in anxiety levels between employees and students. This approach handles missing data without deleting a participant because they are missing data at one follow-up data collection point. In other words, if a participant does not respond for just one follow up, only the missed follow up data will be left out, and their data from other follow ups will be used for the analyses. In a longitudinal study, where participants miss a few follow ups, this plays an important role in improving the statistical power of the analyses.

To date, this is the first, and perhaps the only, study describing anxiety levels for the COVID-19 pandemic for one year, which also compared the anxiety across different groups, including students, academic staff, and support staff. Moreover, anxiety ratings recorded at approximately monthly intervals, a total of 12 times, which provides a more precise description of changes in anxiety levels among participants compared to if they were followed up every 6 months or just at the beginning and the end of one year.

7.2.2 Limitations of the study

While the present study gives valuable insights, it is essential to acknowledge some of its limitations. A convenience sampling strategy was used to recruit the participants enrolled or employed in Canadian dental schools who volunteered to participate in the study. As participants enrolled based on their willingness and accessibility, this may have led to selection bias in the sample, with participant characteristics and anxiety experience not reflective of the broader dental school community. However, we have a fairly representative sample, with around 62% females, which is similar to the proportion of females in dental schools in Canada.

Another important methodological consideration is that there is currently no evidence about the C19ASS score's clinical significance. While this study shows that students had higher anxiety than employees by 0.43 points in the avoidance factor and 0.85 in the perseverance factor, this difference's clinical meaningfulness is unknown. Although a 1-point difference in the scale is the minimum detectable difference in the C19ASS (as it is a likert scale), currently there is no literature on how much the actual difference in the C19ASS's scores would make it a clinically relevant difference in an individual's anxiety experience. While it was beyond this project's scope, further research is warranted to understand the C19ASS scale's clinical significance for better interpretation of studies using the C19ASS scale.

Another limitation common to all cohort studies is loss to follow-up. In this study, some participants were lost to follow-up every month, and at the end of the study, 44.3% (266 out of 600) participants were lost to follow-up compared with the baseline. There were significant differences between the proportion of participants at baseline and the end of the study based on participants' primary role in the dental schools, dental school province, and vaccination status (Table 6.3). The proportion of students at the end of the study decreased, accompanied by a corresponding increase in the number of employees. This could have affected the findings at the end of the study, where employees had slightly higher avoidance anxiety than students. However, it is important to note that the greater decline in anxiety levels among students is anticipated. This can be attributed to the fact that several students who enrolled in April 2021

were in their final years, and subsequently finishing their programs and graduating by the end of the study. Consequently, it is more likely for these students to discontinue their participation in the study. Regarding the distribution of participants from different provinces, although the proportion of participants from Ontario dental schools decreased, their anxiety ratings were consistent throughout the one-year duration. This suggests that the decrease in the proportion of participants from Ontario did not affect the overall anxiety levels of the participants belonging to Ontario province. Finally, regarding vaccination status, as expected, a significant decrease was observed in the proportion of participants with one dose, while the proportion with two doses rose significantly.

An important consideration in this study is the issue of missing data. It was found that a considerable proportion (41.6%) of participants did not report their vaccination status at baseline (Table 6.1). There could be multiple reasons for this, including individuals choosing not to disclose their vaccination status to protect their privacy. Additionally, during the study period, which included April 2021, many participants, especially students in younger age groups, were still in the process of receiving their first dose of the vaccine. This may have contributed to the missing data on vaccination status at baseline. However, it is noteworthy that the number of participants reporting their vaccination status improved over time (Table 6.2), suggesting a potential temporal effect rather than a systematic error. As the study progressed, more participants may have received their vaccinations and subsequently provided the necessary information. On average, participants completed 338 days of follow-up, with 75% of them completing at least 200 follow-up days. This information highlights the overall compliance and engagement of the participants throughout the study, providing confidence in the reliability of the collected data.

As with any self-reported study, our data could be subject to social desirability bias. As all the participants belong to the dental school cohort, and many were in professional clinical settings, participants could fear being perceived negatively, which may lead to underreporting their anxiety experiences and underestimating their anxiety levels. However, to counter this effect, participants were well informed of the anonymity and confidentiality of their responses. Moreover, participants' anxiety was measured using a C19ASS, validated to be used in the dental schools' cohort.

Although the longitudinal analysis accounted for potential confounders in measuring differences in anxiety ratings between students and employees, several unmeasured factors,

such as income levels, living away from families, and past medical history of anxiety, personality traits, coping mechanisms and social support were not accounted for in the study could have influenced pandemic-associated anxiety. As such, participants with a diagnosed anxiety disorder might have a higher anxiety score during stressful situations like a global pandemic. Also, dental schools are inherently competitive environments with heavy course loads as well as intensive preclinical simulation laboratory learning and clinical care, and past studies have reported higher anxiety levels among dentists and dental students before the pandemic. Hence, it is difficult to establish the cause of anxiety exclusively due to the COVID-19 pandemic despite using the validated C19ASS to measure anxiety in these groups.

Finally, although the C19ASS is a mental health screening tool, it is not a diagnostic tool, and thus the results presented in this study do not reflect definitive medical diagnoses of anxiety.

7.3 Future Scope and Implications

For future research, several potential directions can be considered. A more sophisticated analyses could be undertaken to examine whether certain groups of individuals who exhibit higher and lower baseline infectious disease associated anxiety levels maintain those relatively high and low levels throughout periods of study. If so, it would then be important to identify factors associated with those with consistently high and consistently low levels of anxiety. Another important area of research in this field is to determine what size of difference in C19ASS scores is "clinically" important or meaningful, enabling more robust conclusions regarding differences observed between groups and within groups over time.

Studies have indicated that extensive exposure to media coverage and information about the pandemic can contribute to heightened anxiety related to the fear of contracting the infection. Continuous news updates and discussions surrounding COVID-19 have the potential to increase levels of worry and anxiety [134, 135]. Additionally, it is important to consider pre-existing risk factors for COVID-19 anxiety, such as individuals with pre-existing health anxiety who may be particularly susceptible to heightened fear and anxiety regarding the virus. Screening these individuals could be a valuable approach to address their specific needs and provide appropriate support [136].

Qualitative interviews represent another promising approach, allowing for a deeper understanding of how dental school environments can be equipped to better manage anxiety among those working and studying there. By incorporating these strategies in, for example, mixed methods approach, future research endeavours can enhance our understanding of anxiety dynamics in dental school cohorts and contribute to developing effective interventions and support mechanisms.

The implications of this study are significant and offer valuable insights for various stakeholders involved in dental education and practice. Firstly, the finding that anxiety increases during an infectious disease outbreak (the COVID-19 pandemic) and corresponds to a new variant outbreak (Omicron in our case), and decreases when an apparent threat is low, provides a better understanding of the stress and anxiety experiences of individuals within Canadian dental schools. In addition, the similar anxiety experiences of all the participants in a dental school cohort can inform the development of university-wide interventions and support programs for students and employees to enhance the mental health and well-being of this population. Secondly, the study's outcomes have broader implications beyond dental schools. The lessons learned, and interventions developed can serve as a blueprint for other educational institutions, professions, and even during future outbreaks or stressful situations. By addressing the stress and anxiety experienced by individuals within a similar environment, we can foster resilience, improve mental well-being, and better prepare for similar situations in the future.

8. CONCLUSION

In this study, we observed that COVID-19-associated anxiety among students and employees in Canadian dental schools decreased significantly from April 2021 to April 2022. The anxiety experience between students and employees across the time duration was similar, with no significant differences. However, we noted that females, those with one vaccination dose and participants in dental schools in Ontario had higher avoidance and perseverance anxiety ratings, although the actual size of those differences was small, raising questions over their "clinical" importance. All other participant characteristics, such as participation in dental care, living arrangements and the presence of chronic conditions, did not affect COVID-19 anxiety scores over time. Overall, all participants in our dental school cohort had similar anxiety ratings over the year period of our study. Results from this study can help develop proactive mental health interventions for students and employees in dental school cohorts and beyond to other educational institutions in other countries, should a similar infectious outbreak arise.

9. REFERENCES

- Gorbalenya, A.E., et al., *The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2.* Nature Microbiology, 2020. 5(4): p. 536-544.
- Naming the coronavirus disease (COVID-19) and the virus that causes it. 2020: World Health Organization.
- 3. Zhou, P., et al., *A pneumonia outbreak associated with a new coronavirus of probable bat origin.* Nature, 2020. **579**(7798): p. 270-273.
- Dozois, D.J.A., Anxiety and depression in Canada during the COVID-19 pandemic: A national survey. Canadian Psychology/Psychologie canadienne, 2021. 62(1): p. 136-142.
- 5. *Symptoms of COVID-19.* 2022: Centers for Disease Control and Prevention.
- 6. (WHO), W.H.O., Virtual Press Conference on COVID-19 11 March 2020. (accessed on 27 October 2020).
- 7. *Prime Minister announces new actions under Canada's COVID-19 response.* 2020.
- 8. *ADA Calls Upon Dentists to Postpone Elective Procedures*. Media Relations: American Dental Association.
- 9. Cecco, L., *Two Canadian provinces declare states of emergency as Covid-19 fears deepen*. The Guardian.
- 10. McCarten, J., *Anxiety high as Canadian schools prepare for students from COVIDravaged U.S.*, in *CBC*. Jul 20, 2020.
- 11. COVID-19 Timeline. Centers for Disease Control and Prevention.
- Ontario to expand COVID-19 vaccine eligibility to all adults by end of May. Apr 29, 2921, CBC News.
- 13. Thevenot, S., *Canadian universities to return to in-person classes this fall*, in *CIC News*. March 17, 2021.
- 14. Timeline of the COVID-19 pandemic in Canada. Wikipedia.
- Taylor-Vaisey, N., As Covid policies divide America, Ontario doubles down (again).
 January 4, 2020, Politico.
- Government of Canada announces additional easing of border measures effective April 25. April 22, 2022, Government of Canada: Public Health Agency of Canada.
- 17. Variants of the Virus. Centers for Disease Control and Prevention.

- Kazdin, A.E. and A.P. Association, *Encyclopedia of psychology*. Vol. 2. 2000: American Psychological Association Washington, DC.
- Health, T.N.I.o.M. Anxiety Disorders. July, 2018 [cited 2021 June 14, 2021]; NIH Publication No. 02-3879]. Available from: https://www.nimh.nih.gov/health/topics/anxiety-disorders/.
- 20. *What's the difference between stress and anxiety?* National Institute of Mental Health.
- 21. Santomauro, D.F., et al., *Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic.* The Lancet, 2021. **398**(10312): p. 1700-1712.
- Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet Psychiatry, 2022. 9(2): p. 137-150.
- 23. Vos, T., et al., Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet, 2020. 396(10258): p. 1204-1222.
- Auerbach, R.P., et al., WHO World Mental Health Surveys International College Student Project: Prevalence and distribution of mental disorders. J Abnorm Psychol, 2018. 127(7): p. 623-638.
- 25. *Center for Collegiate Mental Health*, in 2019 Annual Report. 2019, Penn State University.
- 26. Chong, M.-Y., et al., *Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital*. The British Journal of Psychiatry, 2004. 185(2): p. 127-133.
- Wong, T.W., et al., *The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope*.
 European Journal of Emergency Medicine, 2005. 12(1).
- 28. Rubin, G.J., et al., *Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey.* BMJ, 2009. **339**: p. b2651.
- 29. Goodwin, R., et al., *Initial psychological responses to Influenza A, H1N1 ("Swine flu")*. BMC Infectious Diseases, 2009. 9(1): p. 166.
- 30. Wheaton, M.G., et al., *Psychological Predictors of Anxiety in Response to the H1N1* (*Swine Flu) Pandemic*. Cognitive Therapy and Research, 2012. **36**(3): p. 210-218.

- Bukhari, E.E., et al., Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak perceptions of risk and stress evaluation in nurses. J Infect Dev Ctries, 2016. 10(8): p. 845-50.
- 32. Wang, Z., et al., *Well-Being Reduces COVID-19 Anxiety: A Three-Wave Longitudinal Study in China.* Journal of Happiness Studies, 2021. **22**(8): p. 3593-3610.
- Nikčević, A.V. and M.M. Spada, *The COVID-19 anxiety syndrome scale:* Development and psychometric properties. Psychiatry research, 2020. 292: p. 113322-113322.
- Drake, K., COVID-19 anxiety syndrome: A pandemic phenomenon? MedicalNewsToday.
- 35. *Survey on COVID-19 and Mental Health, February to May 2021.* Statistics Canada 2021.
- Qiu, J., et al., A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. General Psychiatry, 2020. 33(2): p. e100213.
- Czeisler, M.É., Mental Health, Substance Use, and Suicidal Ideation During the COVID-19 Pandemic — United States, June 24–30, 2020. Centers for Disease Control and Prevention.
- R Seth, S.M., W Siquira, M McNally, C Quinonez, M Glogauer & PJ Allison, Validity and Reliability of the COVID-19 Anxiety Syndrome Scale in Canadian dentists. Journal of Clinical Psychology and Psychotherapy, submitted April 2023.
- 39. *COVID-19 pandemic triggers 25% increase in prevalence of anxiety and depression worldwide.* 2022: World Health Organization.
- 40. Wang, C., et al., *Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China*. International journal of environmental research and public health, 2020. **17**(5): p. 1729.
- Khattar, J., et al., Symptoms of depression and anxiety, and unmet healthcare needs in adults during the COVID-19 pandemic: a cross-sectional study from the Canadian Longitudinal Study on Aging. BMC Public Health, 2022. 22(1): p. 2242.
- 42. Psychological Impact of the COVID-19 Pandemic on Health Care Workers in Singapore. Annals of Internal Medicine, 2020. **173**(4): p. 317-320.

- 43. Ali, S., et al., *Psychological impact of the COVID-19 pandemic on healthcare workers at acute hospital settings in the South-East of Ireland: an observational cohort multicentre study.* BMJ open, 2020. **10**(12): p. e042930-e042930.
- 44. Dobson, H., et al., Burnout and psychological distress amongst Australian healthcare workers during the COVID-19 pandemic. Australasian Psychiatry, 2021. 29(1): p. 26-30.
- 45. Greene, T., et al., *Predictors and rates of PTSD, depression and anxiety in UK frontline health and social care workers during COVID-19.* European Journal of Psychotraumatology, 2021. **12**(1): p. 1882781.
- Lai, J., et al., Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA Network Open, 2020. 3(3): p. e203976-e203976.
- 47. Rossi, R., et al., Mental Health Outcomes Among Frontline and Second-Line Health Care Workers During the Coronavirus Disease 2019 (COVID-19) Pandemic in Italy. JAMA Network Open, 2020. 3(5): p. e2010185-e2010185.
- Sarapultseva, M., et al., *Psychological Distress and Post-Traumatic Symptomatology* among Dental Healthcare Workers in Russia: Results of a Pilot Study. International Journal of Environmental Research and Public Health, 2021. 18(2): p. 708.
- Mrklas, K., et al., Prevalence of Perceived Stress, Anxiety, Depression, and Obsessive-Compulsive Symptoms in Health Care Workers and Other Workers in Alberta During the COVID-19 Pandemic: Cross-Sectional Survey. JMIR Ment Health, 2020. 7(9): p. e22408.
- 50. Gamio, L. *The Workers Who Face The Greatest Coronavirus Risk*. The New York Times, 2020.
- 51. van Doremalen, N., et al., *Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1*. New England Journal of Medicine, 2020. **382**(16): p. 1564-1567.
- Amber, A., et al., *Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care.* Journal of Endodontics, 2020. 46(5): p. 584-595.
- Meng, L., F. Hua, and Z. Bian, Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. Journal of Dental Research, 2020. 99(5): p. 481-487.
- Ahmed, M.A., et al., Fear and Practice Modifications among Dentists to Combat Novel Coronavirus Disease (COVID-19) Outbreak. International Journal of Environmental Research & Public Health [Electronic Resource], 2020. 17(8): p. 19.

- 55. Cleveland, J.L., et al., *Transmission of blood-borne pathogens in US dental health care settings: 2016 update.* The Journal of the American Dental Association, 2016.
 147(9): p. 729-738.
- 56. Alene, M., et al., *Serial interval and incubation period of COVID-19: a systematic review and meta-analysis.* BMC Infectious Diseases, 2021. **21**(1): p. 257.
- 57. COVID-19 for health professionals: Transmission.
- Barabari, P. and K. Moharamzadeh, Novel Coronavirus (COVID-19) and Dentistry–A Comprehensive Review of Literature. Dentistry Journal, 2020. 8(2): p. 53.
- Ather, A., et al., *Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care.* Journal of Endodontics, 2020. 46(5): p. 584-595.
- Ahmed, M.A., et al., *Fear and Practice Modifications among Dentists to Combat Novel Coronavirus Disease (COVID-19) Outbreak*. International journal of environmental research and public health, 2020. 17(8): p. 2821.
- 61. Peng, X., et al., *Transmission routes of 2019-nCoV and controls in dental practice*. International Journal of Oral Science, 2020. **12**(1): p. 9.
- 62. Estrich, C.G., et al., *Estimating COVID-19 prevalence and infection control practices among US dentists*. The Journal of the American Dental Association, 2020. 151(11): p. 815-824.
- Kluytmans-van den Bergh, M.F.Q., et al., Prevalence and Clinical Presentation of Health Care Workers With Symptoms of Coronavirus Disease 2019 in 2 Dutch Hospitals During an Early Phase of the Pandemic. JAMA Network Open, 2020. 3(5): p. e209673-e209673.
- 64. Lai, X., et al., Coronavirus Disease 2019 (COVID-2019) Infection Among Health Care Workers and Implications for Prevention Measures in a Tertiary Hospital in Wuhan, China. JAMA Network Open, 2020. 3(5): p. e209666-e209666.
- Puia, S., et al., Assessment of SARS-CoV-2 infection-in dentists and supporting staff at a university dental hospital in Argentina. Journal of Oral Biology and Craniofacial Research, 2021. 11(2): p. 169-173.
- 66. Madathil, S., et al., *The incidence of COVID-19 among dentists practicing in the community in Canada: A prospective cohort study over a 6-month period.* The Journal of the American Dental Association, 2022. **153**(5): p. 450-459.e1.
- 67. Rock, L.D., et al., *COVID-19 incidence and vaccination rates among Canadian dental hygienists*. Can J Dent Hyg, 2022. **56**(3): p. 123-130.

- Lee, S.-H., et al., Facing SARS: psychological impacts on SARS team nurses and psychiatric services in a Taiwan general hospital. General Hospital Psychiatry, 2005.
 27(5): p. 352-358.
- 69. Elham Essa, B., et al., *Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak perceptions of risk and stress evaluation in nurses.* The Journal of Infection in Developing Countries, 2016. **10**(08).
- 70. Consolo, U., et al., *Epidemiological Aspects and Psychological Reactions to COVID-*19 of Dental Practitioners in the Northern Italy Districts of Modena and Reggio *Emilia.* International Journal of Environmental Research and Public Health, 2020.
 17(10): p. 3459.
- Shetty, A., et al., *The psychological impact of the COVID-19 pandemic on dental healthcare professionals*. Journal of International Oral Health, 2020. 12(8): p. 98-105.
- 72. Vergara-Buenaventura, A., M. Chavez-Tunon, and C. Castro-Ruiz, *The Mental Health Consequences of Coronavirus Disease 2019 Pandemic in Dentistry*. Disaster Medicine & Public Health Preparedness, 2020. 14(6): p. e31-e34.
- Beaton, L., et al., Longitudinal online diaries with dental practitioners and dental care professionals during the COVID-19 pandemic: A trajectory analysis. Frontiers in Oral Health, 2022. 3.
- Fldridge, L.A., et al., US dental health care workers' mental health during the COVID-19 pandemic. The Journal of the American Dental Association, 2022. 153(8):
 p. 740-749.
- 75. Sahu, P., Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff. . Cureus 2020. 12(e7541).
- 76. COVID-19 Educational disruption and response. UNESCO
- Son, C., et al., *Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study.* J Med Internet Res, 2020. 22(9): p. e21279.
- Elmer, T., K. Mepham, and C. Stadtfeld, *Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland*. PLoS One, 2020. 15(7): p. e0236337.
- 79. Debra W. Stewart, A.K.D., James R. Neumeister, Erin Knepler, Karen Grigorian, and Abrea Greene, *Graduate schools respond toCOVID-19: Promising pathways to innovation and sustainability in STEM education.* NORC, 2021.

- Allen, H.K., et al., Substance use and mental health problems among graduate students: Individual and program-level correlates. Journal of American College Health, 2022. 70(1): p. 65-73.
- Kee, C.E., *The impact of COVID-19: Graduate students' emotional and psychological experiences*. Journal of Human Behavior in the Social Environment, 2021. **31**(1-4): p. 476-488.
- Schmitter, M., et al., *Chronic stress in medical and dental education*. Medical Teacher, 2008. **30**(1): p. 97-99.
- 83. Myers, H.L. and L.B. Myers, '*It's difficult being a dentist': stress and health in the general dental practitioner*. British Dental Journal, 2004. **197**(2): p. 89-93.
- Alhajj, M.N., et al., *Perceived sources of stress amongst dental students: A multicountry study*. European Journal of Dental Education, 2018. 22(4): p. 258-271.
- 85. Naidu, R.S., et al., *Sources of Stress and Psychological Disturbance Among Dental Students in the West Indies.* Journal of Dental Education, 2002. **66**(9): p. 1021-1030.
- 86. Francesca, Z., et al., *Clinical activities suspended: How the COVID-19 affected the self-confidence of Italian dental students.* Eur J Dent Educ, 2023.
- 87. Hattar, S., et al., Impact of COVID-19 pandemic on dental education: online experience and practice expectations among dental students at the University of Jordan. BMC Med Educ, 2021. 21(1): p. 151.
- Iosif, L., et al., *Self-Perceived Impact of COVID-19 Pandemic by Dental Students in Bucharest*. International Journal of Environmental Research and Public Health, 2021.
 18(10).
- Santabarbara, J., et al., *Prevalence of Anxiety in Dental Students during the COVID-*19 Outbreak: A Meta-Analysis. International Journal of Environmental Research and Public Health, 2021. 18(20): p. 10978.
- 90. Iyer, P., K. Aziz, and D.M. Ojcius, *Impact of COVID-19 on dental education in the United States*. Journal of Dental Education, 2020. **84**(6): p. 718-722.
- 91. Xu, J. and L. Zhang, *The effect of living alone on the mental health of the economically active floating population during the COVID-19 pandemic*. Front Public Health, 2022. 10: p. 931425.
- 92. Kikuchi, H., et al., Persistence of Mental Health Deterioration Among People Living Alone During the COVID-19 Pandemic: A Periodically-repeated Longitudinal Study. J Epidemiol, 2022. 32(7): p. 345-353.
- 93. Team, R.C., *R Statistical language*. 2021.

- Brown, V.A., An Introduction to Linear Mixed-Effects Modeling in R. Advances in Methods and Practices in Psychological Science, 2021. 4(1): p. 2515245920960351.
- 95. Barr, D.J., *Analyzing 'visual world' eyetracking data using multilevel logistic regression*. Journal of Memory and Language, 2008. **59**(4): p. 457-474.
- 96. Helwig, N.E., *Linear Mixed-Effects Regression*. University of Minnesota (Twin Cities).
- Gauthier, J., Q.V. Wu, and T.A. Gooley, *Cubic splines to model relationships* between continuous variables and outcomes: a guide for clinicians. Bone Marrow Transplantation, 2020. 55(4): p. 675-680.
- 98. Perperoglou, A., et al., *A review of spline function procedures in R*. BMC Medical Research Methodology, 2019. **19**(1): p. 46.
- 99. Westreich, D. and S. Greenland, *The Table 2 Fallacy: Presenting and Interpreting Confounder and Modifier Coefficients*. American Journal of Epidemiology, 2013.
 177(4): p. 292-298.
- 100. IHME. *COVID-19 Projections*. [cited 2023 17th May 2023]; Available from: <u>https://covid19.healthdata.org/canada?view=cumulative-deaths&tab=trend</u>.
- 101. Kanishka Singh, K.S.O. Canada's Ontario province announces curbs to prevent spread of Omicron 'tsunami'. 2022 22 May 2023]; Available from: <u>https://www.reuters.com/world/americas/canadas-ontario-province-announces-curbs-prevent-spread-omicron-tsunami-2022-01-03/</u>.
- 102. Eldridge, L.A., et al., United States Dental Health Care Workers' Mental Health During the COVID-19 Pandemic. American Dental Hygienists' Association, 2022.
 96(4): p. 9-19.
- 103. Amendola, S., et al., A Longitudinal Study on Generalized Anxiety Among University Students During the First Wave of the COVID-19 Pandemic in Switzerland. Frontiers in Psychology, 2021. 12.
- 104. Elmer, T., K. Mepham, and C. Stadtfeld, Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. PLOS ONE, 2020. 15(7): p. e0236337.
- 105. Zimmermann, M., et al., *Modifiable risk and protective factors for anxiety disorders among adults: A systematic review.* Psychiatry Research, 2020. **285**: p. 112705.
- Li, Y., et al., Mental Health Among College Students During the COVID-19 Pandemic in China: A 2-Wave Longitudinal Survey. Journal of Affective Disorders, 2021. 281: p. 597-604.

- Odriozola-González, P., et al., *Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university*. Psychiatry Research, 2020. 290: p. 113108.
- 108. Abdulah, D.M. and A.A. Mohammed, *The consequences of the COVID-19 pandemic* on perceived stress in clinical practice: experience of doctors in Iraqi Kurdistan. Romanian journal of internal medicine, 2020. 58(4): p. 219-227.
- 109. Al Mahyijari, N., A. Badahdah, and F. Khamis, *The psychological impacts of COVID-*19: a study of frontline physicians and nurses in the Arab world. Irish journal of psychological medicine, 2021. **38**(3): p. 186-191.
- 110. Arafa, A., et al., Depressed, anxious, and stressed: What have healthcare workers on the frontlines in Egypt and Saudi Arabia experienced during the COVID-19 pandemic? Journal of affective disorders, 2021. 278: p. 365-371.
- Badahdah, A., et al., *The mental health of health care workers in Oman during the COVID-19 pandemic*. International Journal of Social Psychiatry, 2021. 67(1): p. 90-95.
- 112. Naser, A.Y., et al., Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: A cross-sectional study. Brain and Behavior, 2020. 10(8): p. e01730.
- Wang, C. and H. Zhao, *The Impact of COVID-19 on Anxiety in Chinese University* Students. Frontiers in Psychology, 2020. 11.
- Toufexis, D.J., K.M. Myers, and M. Davis, *The effect of gonadal hormones and gender on anxiety and emotional learning*. Hormones and Behavior, 2006. **50**(4): p. 539-549.
- Cao, W., et al., *The psychological impact of the COVID-19 epidemic on college students in China*. Psychiatry Research, 2020. 287: p. 112934.
- Sarapultseva, M., et al., Psychological Distress and Post-Traumatic Symptomatology Among Dental Healthcare Workers in Russia: Results of a Pilot Study. Int J Environ Res Public Health, 2021. 18(2).
- 117. Denning, M., et al., Determinants of burnout and other aspects of psychological wellbeing in healthcare workers during the Covid-19 pandemic: A Multinational Cross-Sectional Study. Medrxiv ss, 2020. 1: p. 31.
- 118. Brooks, S.K., et al., A Systematic, Thematic Review of Social and Occupational Factors Associated With Psychological Outcomes in Healthcare Employees During

an Infectious Disease Outbreak. Journal of Occupational and Environmental Medicine, 2018. **60**(3): p. 248-257.

- Ayubi, E., S. Bashirian, and S. Khazaei, Depression and Anxiety Among Patients with Cancer During COVID-19 Pandemic: A Systematic Review and Meta-analysis. J Gastrointest Cancer, 2021. 52(2): p. 499-507.
- 120. Alessi, J., et al., Mental health in the era of COVID-19: prevalence of psychiatric disorders in a cohort of patients with type 1 and type 2 diabetes during the social distancing. Diabetol Metab Syndr, 2020. 12: p. 76.
- 121. Sayeed, A., et al., Mental Health Outcomes of Adults with Comorbidity and Chronic Diseases during the COVID-19 Pandemic: A Matched Case-Control Study. Psychiatr Danub, 2020. 32(3-4): p. 491-498.
- 122. Wong, S.Y.S., et al., Impact of COVID-19 on loneliness, mental health, and health service utilisation: a prospective cohort study of older adults with multimorbidity in primary care. Br J Gen Pract, 2020. **70**(700): p. e817-e824.
- 123. Al-Amer, R., et al., Emotional Reaction to the First Dose of COVID-19 Vaccine: Postvaccination Decline in Anxiety and Stress among Anxious Individuals and Increase among Individuals with Normal Prevaccination Anxiety Levels. Journal of Personalized Medicine, 2022. 12(6): p. 912.
- 124. Zheng, Y.-B., et al., *COVID-19 Vaccine-Related Psychological Stress Among General Public in China*. Frontiers in Psychiatry, 2021. **12**.
- 125. kawarthaNOW, Ontario dentists urged to cancel non-emergency services in response to COVID-19 pandemic. Keep it in the Kawarthas, 2020.
- 126. COVID-19 daily epidemiology update. 2022: Government of Canada.
- 127. Jacob, L., J.M. Haro, and A. Koyanagi, *Relationship between living alone and common mental disorders in the 1993, 2000 and 2007 National Psychiatric Morbidity Surveys.* PLOS ONE, 2019. 14(5): p. e0215182.
- Harrison, J., et al., Social determinants of GHQ score by postal survey. J Public Health Med, 1999. 21(3): p. 283-8.
- Joutsenniemi, K., et al., *Living arrangements and mental health in Finland*. J Epidemiol Community Health, 2006. 60(6): p. 468-75.
- 130. Elani, H.W., C. Bedos, and P.J. Allison, *Sources of stress in Canadian dental students: a prospective mixed methods study.* J Dent Educ, 2013. **77**(11): p. 1488-97.
- 131. Elani, H.W., et al., A systematic review of stress in dental students. J Dent Educ, 2014. 78(2): p. 226-42.

- 132. Shamsuddin, K., et al., *Correlates of depression, anxiety and stress among Malaysian university students*. Asian J Psychiatr, 2013. **6**(4): p. 318-23.
- Al-Sowygh, Z., et al., *Perceived causes of stress among Saudi dental students*. King Saud University Journal of Dental Sciences, 2013. 4: p. 7–15.
- 134. Al-Amad, S.H. and A. Hussein, Anxiety among dental professionals and its association with their dependency on social media for health information: insights from the COVID-19 pandemic. BMC Psychology, 2021. 9(1): p. 9.
- 135. Taylor, S., et al., COVID stress syndrome: Concept, structure, and correlates. Depress Anxiety, 2020. 37(8): p. 706-714.
- 136. Asmundson, G.J.G. and S. Taylor, *How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know.* J Anxiety Disord, 2020. **71**: p. 102211.

10. APPENDIX-I

10.1 IRB approval letter



Faculty of Faculté de Medicine and médecine et des Health Sciences sciences de la santé 3855 Promenade Sir William Osler #633 Montreat, QC H3G 1Y6

3855 Promenade Sir William Osler #633 3855, Promenade Sir William Osler #633 T: (514) 398-3124 Montreal, QC H3G 1Y6

December 21, 2020

Dr. Paul Allison Faculty of Dentistry 2001 McGill College – Suite 500 Montreal, Quebec H3A 1G1

RE: IRB Review Number: A12-M69-208 / (20-12-047)

COVID-19 experience in Canadian dental schools

Dear Dr. Allison,

Thank you for submitting the above-referenced study for an ethics review.

As this study involves no more than minimal risk, and in accordance with Articles 2.9 and 6.12 of the 2nd Edition of the Canadian Tri-Council Policy Statement of Ethical Conduct for Research Involving Humans (TCPS 2 2018) and U.S. Title 45 CFR 46, Section 110 (b), paragraph (1), we are pleased to inform you that approval for the study and consent form (December18, 2020) was provided by an expedited/delegated review on December 21, 2020, valid until December 20, 2021. The study proposal will be presented for corroborative approval at the next meeting of the Committee.

The Faculty of Medicine and Health Sciences Institutional Review Board (IRB) is a registered University IRB working under the published guidelines of the Tri-Council Policy Statement 2, in compliance with the Plan d'action ministériel en éthique de la recherche et en intégrité scientifique (MSSS, 1998), and the Food and Drugs Act (17 June 2001); and acts in accordance with the U.S. Code of Federal Regulations that govern research on human subjects (FWA 00004545). The IRB working procedures are consistent with internationally accepted principles of good clinical practice.

The Principal Investigator is required to immediately notify the Institutional Review Board Office, via amendment or progress report, of:

Any significant changes to the research project and the reason for that change, including an
indication of ethical implications (if any);

Serious Adverse Effects experienced by participants and the action taken to address those effects;

Any other unforeseen events or unanticipated developments that merit notification;

 The inability of the Principal Investigator to continue in her/his role, or any other change in research personnel involved in the project;

A delay of more than 12 months in the commencement of the research project, and;

Termination or closure of the research project.

The Principal Investigator is required to submit an annual progress report (continuing review application) on the anniversary of the date of the initial approval (or see the date of expiration).

The Faculty of Medicine and Health Sciences IRB may conduct an audit of the research project at any time.

If the research project involves multiple study sites, the Principal Investigator is required to report all IRB approvals and approved study documents to the appropriate Research Ethics Office (REO) or delegated authority for the participating study sites. Appropriate authorization from each study site must be obtained before the study recruitment and/or testing can begin at that site. Research funds linked to this research project may be withheld and/or the study data may be revoked if the Principal Investigator fails to comply with this requirement. A copy of the study site authorization should be submitted the IRB Office.

It is the Principal Investigator's responsibility to ensure that all researchers associated with this project are aware of the conditions of approval and which documents have been approved.

The McGill IRB wishes you and your colleagues every success in your research.

Sincerely,

Robaks Mr. Palmore

Roberta Palmour, PhD Chair Institutional Review Board

cc: Dr. S. Baillet, Associate Dean, Research Medicine A12-M69-20B / (20-12-047)

10.2 IRB approval letter-Annual renewal letter



 Faculty of
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Tél/Tel: (514) 398-3124

December 13, 2022

Dr. Paul Allison Faculty of Dental Medicine and Oral Health Sciences 2001 McGill College – Suite 500 Montreal, Quebec H3A 1G1

RE: IRB Study Number A12-M69-20B (20-12-047) COVID-19 experience in Canadian dental schools

Dear Dr. Allison,

Thank you for submitting an application for Continuing Ethics Review for the above-referenced study.

The study progress report was reviewed and Full Board re-approval was provided on December 12, 2022. The ethics certification renewal is valid from December 19, 2022 to December 18, 2023. The status of your renewal submission including documents can be accessed on eRAP.

Investigators are reminded of the requirement to report all McGill IRB approved study documents to the Research Ethics Offices (REOs) of participating study sites, if applicable. Please contact the individual REOs for instructions on how to proceed. Research funds may be withheld and / or the study's data may be revoked for failing to comply with this requirement.

Should any modification or unanticipated development occur prior to the next review, please notify the IRB promptly. Regulation does not permit the implementation of study modifications prior to IRB review and approval.

Regards,

Robak M. Palmore

Roberta M. Palmour, PhD Chair Institutional Review Board

cc: A12-M69-20B (20-12-047)

10.3 Consent Form

COVID-19 experience in Canadian dental schools

Principal investigator: Dr. Paul Allison, Faculty of Dentistry, McGill University Co-Investigators: Drs. Mary McNally and Leigha Rock, Faculty of Dentistry, Dalhousie University Dr. Aimee Dawson, Faculté de médecine dentaire, Université Laval Dr. Felix Girard, Faculté de médecine dentaire, Université de Montréal Dr. Sreenath Madathil, Faculty of Dentistry, McGill University Drs. Michael Glogauer and Carlos Quinonez, Faculty of Dentistry; and Drs. Olga Rojas and Jennifer Gommerman, Faculty of Medicine, University of Toronto Dr. Sharat Pani, Schulich School of Medicine and Dentistry, Western University Dr. Robert Schroth, Dr Gerald Niznick College of Dentistry, University of Manitoba Dr. Walter Siqueira, College of Dentistry, University of Alberta Dr. Mario Brondani, Faculty of Dentistry, University of British Columbia

Purpose of the study: The primary purpose of the study is to estimate the incidence rate of COVID-19 among trainees (including undergraduate and graduate students and residents), professors and support staff in Canadian dental schools. On top of this, we wish to investigate how sociodemographic factors, work-related placement and tasks and use of infection control protocols and equipment may be related to risk of COVID-19 infection among study participants. Finally, among those who do test COVID-19 positive and among those receiving a vaccine against COVID-19, we aim to investigate their immune response through saliva and dried blood tests.

Description of the research: The study will follow a group of trainees, professors and support staff in Canadian dental schools for 12 months. First, participants will be invited to complete an online baseline survey. Three domains of information will be collected at this stage: i) Socio-demographics and illnesses you may currently have or have had in the past; ii) details of work performed in the previous week; and iii) symptoms related to COVID-19 and infection status. After this initial survey, participants will be invited to the follow-up phase of the study. For the follow-up phase, we will contact participants every 4 weeks to complete an online survey related to work performed and COVID-19 infection status and symptoms. In addition, for those participants who volunteer to do so, we will collect a sample of your saliva each month. The reason for collecting saliva from participants is to verify whether any participants have symptom-free COVID-19 disease.

If I participate in this study, what will be involved? Participating in this study means that you are willing to complete an online baseline survey (approx. 15-20 mins) and then complete another online survey (approx. 5-10 mins) every 4 weeks for the next 12 months. In addition, participants who agree to do so will be asked to provide a sample of their own saliva every 4 weeks for 12 months. To enable you to do this, we will provide participants with a simple saliva sample collection kit and ask you to bring it to the study research assistant at your dental school on the next occasion you are coming to work in the dental school facility linked to the dental school. The analysis of the saliva will be performed at no cost to you. You will be informed of the results of the saliva test as soon as we have them.

If at any stage in the study period, you test positive for COVID-19, whether through a test performed outside the study in a community setting or through a test performed in this study, we will ask you to provide three additional saliva samples plus dried blood samples over the month following that positive test. If the study test is positive or you self-report in the monthly questionnaire that you are positive, the study research assistant at your dental school will contact you to organize these three additional saliva and dried blood sample collections. They will be within a few days of knowing of the COVID-19 positive test and then 2 weeks and 6 months later. We will also ask you to complete a short online questionnaire concerning your symptoms at the same times as these follow-up saliva and dried blood samples.

Also, if at any stage during the study you receive a vaccine, we will ask you to provide three additional saliva samples plus dried blood samples over the month following the first vaccine you receive. The study research assistant at your dental school will contact you to organize these additional saliva and dried blood sample collections. They will be within a few days of receiving a vaccine and then 2 weeks and 6 months later. We will also ask you to complete a short online questionnaire concerning your experience with the vaccine at the same times as these follow-up saliva and dried blood samples.

The saliva and dried blood sample collections are both done by participants themselves at home or in any other convenient, private site. If you agree to participate in the collection of saliva and/or dried blood samples, you will be provided with home collection kits for both samples. The collection of saliva involves dipping a collection tube into your mouth. The collection of a dried blood sample involves a pinprick of the tip of one of your fingers to collect a very small amount of blood. For both sample collections, those who agree to participate in this element of the study will receive full instructions on how to do this and will be trained by the research assistant at your dental school for the first time you perform these tasks.

If one of your study saliva tests is COVID-19 positive or if you self-report being COVID-19 positive due to a test performed outside the study, we will not inform anybody else. We will not inform anybody at your dental school. We will however, provide you with information on the best courses of action if you are COVID-19 positive.

It is important to understand that if you participate in this study, you must at all times continue to follow the COVID-19 related protocols at your dental school, university and with your provincial licensing body if you are a licensed practitioner. If you need a COVID-19 test independent of this research project because you have symptoms, or have been in close contact with someone diagnosed with COVID-19 or any other appropriate reason, you need to proceed with a test in your local community health centre as advised by your local public health authority. The saliva test in our research study is not a replacement for such routine tests, it is in addition. We are performing saliva tests as part of the study to identify symptom-free cases of COVID-19.

Potential harms, discomforts or inconveniences: The only potential discomfort you may suffer in this study goes with the collection of the dried blood sample, for which there is a small pin prick sensation. Apart from this, there is no risk associated with participating in this study. It involves no treatment or procedures that can cause harm or injuries.

Potential benefits: The results from the study will help better understand the risk of COVID-19 among trainees, professors and support staff in Canadian dental schools and may inform protocols and guidelines in the future. It will also enable us to investigate the immune response of people infected with COVID-19 and of those receiving a vaccine against COVID-19 during the study. We plan on performing interim analyses of the data every few months and will inform all participants if we see infection rates among participants that are different from the infection rates in the general community. We will also inform participants if we observe that certain work practices are associated with an

increase or decrease in risk for infection. We will also be informing dental schools of the overall results, including these interim analyses, in case they need to change their guidelines. We will however only inform dental schools or others of overall results. No information about any individual participant will be shared with anyone.

Confidentiality: We assure you that all information gathered during the course of this research project will be kept confidential. Although the invitation to participate in this study was sent to you be the leadership of your dental school, they do not know and will not know who is participating in the study. When you register and consent to participate and then complete study questionnaires, all the data is stored in a password-protected server at McGill University. Only Dr. Allison, the lead investigator in this project, Drs. Glogauer, Rojas and Siquiera, who will oversee the analyses of saliva samples, and the research assistants working on the project at each dental school will have access to the information you provide, which will be stored in a firewall-protected server at McGill University. Other investigators will only have access to de-identified data for the purpose of analyses. All the data will be identified through a code number.

If a saliva sample you provide is positive for COVID-19, the research assistant at your dental school will inform you as soon as possible. We will however, not inform anybody else. We will not inform anybody at your dental school. We will however, provide you with information on the best courses of action if you are COVID-19 positive.

The results of the research will be published in scientific journals in an anonymous form. De-identified data (after removing any identifiable information) will be shared with researchers across the world through Canadian open data repositories such as the Federal Research Data Repository. This is the norm with the agency funding this project, the COVID-19 Immunity Task Force (<u>https://www.covid19immunitytaskforce.ca</u>) which is a Canadian federal government agency, as well as for other agencies such as the Canadian Institutes of Health Research (<u>https://cihr-irsc.gc.ca/e/193.html</u>).

Participation and withdrawal: Participation in this research project is entirely voluntary. You are free to withdraw from this research project at any time you want to. Should you decide to withdraw from this study, after completing the online questionnaire, you may send a request to <u>paul.allison@mcgill.ca</u>, and we will delete your data immediately.

Further information: If you would like to have more information or have any questions related to this study, please do not hesitate to contact the project leader, Dr. Allison. For any questions regarding your rights as a research participant, please contact the Ms. Ilde Lepore (ilde.lepore@mcgill.ca) who is Ethics Officer at the Faculty of Medicine and Health Sciences, McGill University.

Dr. Paul Allison Faculty of Dentistry, McGill University 2001 McGill College Avenue, Suite 500 Montreal, QC, H3A 1G1 Tel: 514 398 6324 Email: paul.allison@mcgill.ca

Consent

I have carefully read the above and understand this agreement. I consent to participate in this study, which involves the regular collection of data through online questionnaires, plus saliva samples that will be sent to laboratories for analyses. I do not waive any of my rights by signing this consent.

- I do not consent to participate in this study
- I consent to participate in this study
 - o I consent to completing online questionnaires in this study
 - o I consent to the collection of saliva samples for this study
 - o I consent to the collection of dried blood samples for this study

10.4 Study Questionnaire

BASELINE QUESTIONNAIRE

Section 1. Contact information

The contact information you provide, on this page, will be kept confidential and will only be used for the purpose of communicating matters pertinent to this study.

1. Please enter your contact information

Please write your answer(s) here:

First name: _____

Family name / Surname:	
------------------------	--

Phone: _______Please **do not** use country code or leave spaces for your phone number. Example: **5141238888**

E-mail address: _____

2. Please provide the first three digits of the postal code plus the province of your residence: Please write your answer(s) here:

Postal Code (e.g., A1A) _____ Province _____

Section 2. Demographics & Current health status

3. How old are you?

Your answer must be between 18 and 99 Only an integer value may be entered in this field.

Please write your answer here: _____years

4. What was your assigned sex at birth?

Choose one of the following answers Please choose **only one** of the following:

- Female
- Male

5. What is your sex now?

Choose one of the following answers Please choose **only one** of the following:

- Female
- Male
- Prefer to self-describe: ______
- Prefer not to answer

6. What is your gender/how do you currently identify?

Please choose **all** that apply:

- Agender
- Genderqueer
- Gender fluid
- Man
- Non-binary
- Questioning or unsure
- Transgender
- Trans man
- Trans woman
- Woman
- Prefer to self-describe: ______
- Prefer not to answer

7. How would you describe your ethnicity?

Please choose **all** that apply:

- White (Caucasian)
- Indigenous person
- South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
- Chinese
- Black
- Filipino
- Latin American

- Arab
- Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai, etc.)
- West Asian (e.g., Iranian, Afghan, etc.)
- Korean
- Japanese
- Prefer to self-describe: ______
- Prefer not to answer

8. Please indicate which group best describes you:

Only answer this question if the following condition is met: Answer was "Indigenous person", to question 7.

• Status First Nations

- Non-status First Nations
- Inuit
- Metis
- Other indigenous
- Prefer not to answer

9. What is the highest level of education you have completed?

Please choose **only one** of the following:

- Less than high school graduation
- High school graduation
- Trade certificate, vocational school, or apprenticeship training
- Non-university certificate or diploma from a community college, cegep etc.
- University bachelor's degree (such as DDS, DMD, RDH)
- University graduate degree (such as a masters or doctorate)
- Prefer not to answer

10. How many people (including yourself) live at your residence?

Please write your answer here: _____

11. How many bedrooms at your residence?

Please write your answer here: _____

12. How many bathrooms at your residence?

Please write your answer here: _____

13. What is your current weight?

Please write your answer here: _____kg or pounds

14. What is your current height?

Please write your answer here: ______feet/inches or metres

15. Do you currently have a family physician/primary care provider?

- Yes
- No
- Don't know

16. Did you get a flu shot in fall 2020?

- Yes
- No
- Don't know

17. Do you currently smoke tobacco?

Please choose **only one** of the following:

- No
- Yes, less than daily
- Yes, daily

18. Do you currently use e-cigarettes (vape)?

Please choose **only one** of the following:

- No
- Yes, less than daily
- Yes, daily

19. Have you ever been diagnosed by a physician with one of the following disease(s)/condition(s)?

Please choose the appropriate response for each item: (Yes/No/Unknown):

	Yes	No	Unknown
Obesity			
Cancer			
Diabetes			
HIV/other immune deficiency			
Asthma (requiring medication)			
Chronic lung disease (non-asthma)			
Chronic liver disease			
Chronic blood disorder			
Chronic kidney disease			
Chronic neurological impairment/disease			
Organ or bone marrow replacement			
Heart condition			
High blood pressure			

20. Do you have any other disease/condition?

Please write your answer here: _____

21. Are you currently taking any prescribed medication?

Please choose **only one** of the following:

- Yes
- No

22. If yes to question 22, what medication(s)

Please write your answer here: ____

23. Are you currently pregnant?

Please choose **only one** of the following:

- Yes
- No
- Unknown

24. If yes to question 23, please specify trimester:

Please choose **only one** of the following:

- First trimester
- Second trimester
- Third trimester

25. If yes to question 23, what is the estimated delivery date?

Answer must be greater or equal to today

Please enter a date:

Section 3: Work Information

26. Please indicate the dental school at which you work/study?

Please choose **only one** of the following:

- Dalhousie University
- Université Laval
- Université de Montréal
- McGill University
- University of Toronto
- Western University
- University of Manitoba
- University of Saskatchewan
- University of Alberta
- University of British Columbia

27. What is your primary role in the dental school at which you work/study?

Please choose **only one** of the following:

- Dental student
- Dental hygiene student
- Resident (general practice resident or resident in specialty training)
- Graduate student in MSc or PhD program focused on research training (i.e. not clinical or professional training)
- Academic staff
- Support staff (e.g. administrative staff, clinical staff, laboratory staff)
- Other _____
- **28.** How many different settings do you work in each week ("settings" refers to places like at home, in a clinic, in a campus office, in a laboratory. Also, you may work in two different clinics or two different offices. So, for example, if you work at home and work at one clinic, that is two settings; if you work in a private clinic and dental school clinic, that is also two settings; if you work in the dental school clinic and two private clinics, that is three settings)?

Please choose **only one** of the following:

- One per week
- Two per week
- Three per week
- More than three per week

29. What type of settings do you work in each week (using the same definition of settings as in question 28)?

Please choose **all** that apply:

- At home
- In a campus office (including an office linked with a clinic e.g. a reception area)
- In a campus clinic
- In a campus laboratory
- In a private clinic

- In a hospital clinic
- Other _____

30. What year of studies are you in?

Only answer this question if the following conditions are met:

Answer was "Dental student", "Dental hygiene student", "Resident" or "Graduate student in MSc or PhD program focused on research training" to question 27 (What is your primary role in the dental school at which you work/study?)

Please choose **only one** of the following:

- First
- Second
- Third
- Fourth
- Fifth
- Sixth or more

31. Which of the following best describes the work you are doing on a weekly basis as a trainee?

Only answer this question if the following conditions are met:

Answer was "Dental student", "Dental hygiene student", "Resident" or "Graduate student in MSc or PhD program focused on research training" to question 27 (What is your primary role in the dental school at which you work/study?)

Please choose **all** that apply:

- Academic studies/course work or research work at home
- Laboratory work on campus
- Clinical work in campus clinic
- Clinical work in a hospital setting
- Clinical work in another community setting

32. What are your main roles at the dental school?

Only answer this question if the following conditions are met:

Answer was "Academic staff" or "Support staff" to question 27 (What is your primary role in the dental school at which you work/study?) Please choose **all** that apply:

- Clinical teacher
- Non-clinical teacher
- Researcher
- Academic administration
- Clinical support staff
- Laboratory support staff
- Office support staff
- Other _____

33. How many days per week do you work for the dental school? Only answer this question if the following conditions are met:

Answer was "Academic staff" or "Support staff" to question 27 (What is your primary role in the dental school at which you work/study?)

Please choose **only one** of the following:

- Five
- Four
- Three
- Two
- One
- Less than one

34. Which of the following best describes the work you are doing on a weekly basis <u>at the</u> <u>dental school</u>:

Only answer this question if the following conditions are met:

Answer was "Academic staff" or "Support staff" to question 27 (What is your primary role in the dental school at which you work/study?)

Please choose **all** that apply:

- Academic or administrative work at home
- Academic or administrative work on campus
- Laboratory work on campus
- Laboratory work in a hospital setting
- Clinical work on campus
- Clinical work in a hospital setting
- Other ____

35. When you are <u>not working</u> for the dental school, which of the following best describes the activities you are engaged in on a weekly basis?

Only answer this question if the following conditions are met:

Answer was "Four", "Three", "Two", "One" or "Less than one" to question 33 (Which of the following best describes the amount of time per week you work for the dental school?) Please choose **all** that apply:

- I am at home not working for money
- Paid work at home
- Administrative work in a private office setting
- Administrative/office work in a hospital setting
- Laboratory work in a private laboratory setting
- Laboratory work in a hospital setting
- Clinical work in a private clinic setting
- Clinical work in a hospital setting
- Other _____

36. Is the clinic, the office, the laboratory or other place where you worked <u>most of the time</u> <u>over the past week</u>:

Please choose **only one** of the following:

- Open [no walls between dental chairs, office desks or laboratory work spaces]
- Semi-open [some areas are open to each other while others have walls or other barriers separating them]
- Closed concept [all areas are separated by walls]

- I worked at home most of the time
- Other _____

Section 4: Potential for exposure

37. Since January 2020, have you travelled and stayed overnight outside the province where you currently live?

Please choose **only one** of the following:

- Yes
- No

38. If yes, please specify how many times?

Please write your answer here: _____

39. If yes, please specify where?

Please choose **all** that apply:

- NFL
- NS
- NB
- PEI
- QC
- ON
- MB
- SK
- AB
- BC
- NUN
- NWT
- YU
- USA
- Other(s) _____

40. Have you shared a living space/residence with someone (family or other), in the past 2 weeks?

Please choose **only one** of the following:

- Yes
- No

41. Did any of the people you shared a living space/residence with attend school, college or university in-person or go to work, in the past 2 weeks?

Please choose **only one** of the following:

- Yes
- No

42. Did any of the people you shared a living space/residence with have a positive test for COVID-19, in the past 2 weeks?

Please choose **only one** of the following:

- Yes
- No
- Unknown

43. Did any of the people you shared a living space/residence with have any symptoms that made you suspect they have COVID-19, in the past 2 weeks? *

Please choose **only one** of the following:

- Yes
- No
- Unknown

44. In past 2 weeks, have you attended a health care facility (other than the clinics you provide care) for yourself or with someone else?

Please choose **only one** of the following:

- Yes
- No

45. In past 2 weeks, have you attended any private gatherings with a person or persons who do not live at your residence?

Please choose **only one** of the following:

- Yes
- No

46. In past 2 weeks, have you attended any public gatherings/events with 10 or more people? Please choose **only one** of the following:

- Yes
- No

47. Have you ever worked at a facility which knowingly cares for COVID-19 patients? Please choose **only one** of the following:

- Yes
- No

48. Have you ever provided any form of service for people with COVID-19?

Choose one of the following answers Please choose **only one** of the following:

- Yes
- No
- Unknown

FOLLOW-UP QUESTIONNAIRE

Section 5: COVID-19 Tests and symptoms

(Questions 49 to 53 to be asked once only, as part of the baseline questionnaire. Remaining questions to be asked each month)

49. Have you been tested for COVID-19, other than as part of this project?

Please choose **only one** of the following:

- Yes
- No

50. If yes to question 49, how many times have you been tested?

Please write your answer here:

51. If yes to question 49, what were the dates of the test(s)?

- 1st test date ____
- (if applicable) 2nd test date _____
- (if applicable) 3rd test date ______
- (if applicable) 4th test date _____
- Other test dates ______

52. If yes to question 49, what were the results of the test(s)?

- 1st test: positive _____; negative _____; don't know/waiting for the result _____
- 2nd test: positive _____; negative _____; don't know/waiting for the result _____
- 3rd test: positive _____; negative _____; don't know/waiting for the result _____
- 4th test: positive _____; negative _____; don't know/waiting for the result _____
- Other tests: positive _____; negative _____; don't know/waiting for the result _____;

53. If yes to question 49, please specify the type of test(s) you have had?

Please choose **all** that apply:

- Nasopharyngeal swab sample and PCR based test
- Nasopharyngeal swab sample and antigen test
- Nasopharyngeal swab sample BUT not sure if PCR or antigen test
- Saliva sample (other than the test performed in this project) and PCR based Test
- Saliva sample (other than the test performed in this project) and antigen Test
- Saliva sample (other than the test performed in this project) BUT not sure if PCR or antigen test
- Serum sample (Blood) and antibody testing
- Other: ____
- Don't know

54. <u>In the last month</u> have you been tested for COVID-19, other than as part of this project? Please choose **only one** of the following:
- Yes
- No

55. If yes to question 54, what were the results of the test(s)?

Please choose **only one** of the following:

- Positive
- Negative
- Don't know/waiting for the result

56. In last month, have you experienced any COVID-19-related symptoms?

Please choose **only one** of the following:

- Yes
- No

If the answer to this question is no, please go directly to question 58

57. If you answered yes to question 56, in last month, have you experienced any of the following symptoms

Please choose the appropriate response for each item:

Symptom	No	Yes	If yes, date of onset (day/month)	If yes, duration (days)
Fever				
Sore throat				
Runny nose				
Shortness of breath				
Chills				
Vomiting				
Nausea				
Diarrhoea				
Headache				
Rash				
Conjunctivitis				
Muscle aches				
Joint aches				
Nosebleed				
Fatigue				
General malaise				
Loss of appetite				
Loss of smell /altered sense of smell				
Loss of taste / altered sense of taste				
Any other symptoms – list				
•				
•				

58. <u>In the last month</u>, have you stopped working for any reason (i.e. taken at least 1 day off work)?

Please choose **only one** of the following:

- Yes
- No

59. If you answered yes to question 58, how many days did you stop working?

Please write your answer here: _____

60. <u>If you answered yes to question 58</u>, what was the reason you stopped working? Please choose **all** that apply:

- I had symptoms suggesting COVID-19
- I had been in contact with someone diagnosed with COVID-19
- I had been in contact with someone suspected of having COVID-19
- I tested positive for COVID-19
- I was ill with a condition other than COVID-19
- I took time off for reasons other than illness
- Other_____

These questions are about your activities in the last month.

61. During this period of the last month, did you spend most of your waking time at home? Please choose **only one** of the following:

- Yes
- No

62. During the last month, how many times did you leave your home?

Please choose **only one** of the following:

- Never
- Once
- Twice
- 3 to 5 times
- 6 to 10 times
- More than 10 times

63. During the last month, if you left home, what was the purpose?

Please choose **all** that apply:

- To go to work/university
- To do shopping (Including shopping for groceries)
- To engage in physical activity in indoor settings (e.g., gym, sports, dancing)
- To engage in outdoor physical activity
- To engage in wellness or lifestyle services (e.g., spa, hair or nail saloons)
- To visit family or friends indoors
- To visit family or friends outdoors
- To visit family or friends in a residence or long-term care facility
- Other:_____

64. During the last month, in what sort of setting did you work? *

- I worked at home
- I worked in an office on my own
- I worked in an office with other people
- I worked in a classroom, library or other large non-clinic, non-laboratory space
- I worked in a reception area greeting patients for a clinic
- I worked in a laboratory on my own
- I worked in a laboratory with other people
- I worked in the clinical space of a private clinic (i.e. worked in the space providing care for patients, not the reception area or other office space)
- I worked in the clinical space of a large open clinic in a dental school or hospital setting
- I worked in a closed clinical space in a dental school or a hospital setting
- Other _____

65. During the last month, did you provide or accompany somebody else providing any form of in-person dental care (including consultations)?

Please choose **only one** of the following:

- Yes
- No
- 66. During the last month, did you handle any human tissue material (e.g. a saliva or blood sample) or any item that had been in contact with a human (e.g. a prosthetic device or impression)

Please choose **only one** of the following:

- Yes
- No

Section 7: In-person dental care episodes

This section refers to the in-person care you provided or participated in (for example, as an assistant) during the last month.

67. During the last month how often did you provide or participate in in-person dental care? Please choose **only one** of the following:

- I did not provide any in-person dental care (If this is your response, go to section 8, question 84)
- One day per week or less
- Two-three days per week
- Four-five days per week

68. During the last month, during the days you provided or participated in in-person dental care, approximately how many patients did you see per day (e.g. 10 patients per day)?

Your answer must be at least 1 and should be a whole number.

Please write your answer here: _____

69. During the last month, during the days you provided or participated in in-person dental care, approximately <u>how many patients per day required an aerosol-generating procedure</u> (e.g. 10 patients per day)?

Only a whole number may be entered in this field. If none, enter "0".

Please write your answer here: _____

70. During the last month did you provide any in-person dental care for COVID-19 positive patients?

Please choose **only one** of the following:

- Yes
- No

71. If you answered yes to question 70, for how many COVID-19 positive patients?

Your answer must be at least 1. Only a whole number may be entered in this field.

Please write your answer here: _____

72. During the last month did any of the patients you cared for, have any symptoms that made you suspect they are infected with COVID-19?

Please choose **only one** of the following:

- Yes
- No

73. If you answered yes to question 72, how many patients?

Your answer must be at least 1. Only a whole number may be entered in this field.

Please write your answer here: _____

74. Please specify the types of in-person dental care you provided during the month:

Please choose **all** that apply:

- Advice and education only
- Tooth extraction
- Radiographs
- Examination and evaluation
- Scaling with hand instruments
- Scaling with ultrasonic scaler
- Abscess drainage
- Mineralized tissue removal with handpiece
- Adjustment of prosthesis or orthodontic appliance
- Pulp removal
- Provision of a prescription for a painkiller
- Provision of a prescription for an antibiotic
- Provision of a prescription for another medication
- Other: _____

75. Please specify the types of facial protection you used at the <u>dental school or hospital clinic</u> where you provided or participated in care during the last month

Please choose **all** that apply:

Please choose the appropriate response for each item:

	For all	For AGPs	For non-	For none
	procedures	only	AGPs only	
Routine surgical mask				
N-95 [or higher] mask				
Eye-glasses or goggles				
Facial visor				
Other form of hood or complete head coverage				

*AGP = aerosol-generating procedure

76. Please specify the types of facial protection you used at the <u>private clinic</u> where you provided or participated in care <u>the most</u> during the last month

Please choose **all** that apply:

Please choose the appropriate response for each item:

For all	For AGPs	For non-	For none
procedures	only	AGPs only	
	For all procedures	For all proceduresFor AGPs only	For all proceduresFor AGPs onlyFor non- AGPs onlyImage: Constraint on the second seco

*AGP = aerosol-generating procedure

77. Did you use any other form of facial covering during the provision of in-person care during this period?

Please choose **only one** of the following:

- No
- Yes (Please specify below)
- Make a comment on your choice here:______

(Questions 78 and 81 will be asked at baseline only. Questions 79, 80, 82 and 83 will be asked each month)

78. From the list below, please choose the Infection Prevention and Control (IPC) procedures and amenities in-place at the <u>dental school or hospital clinic</u> where you provided or participated in care during the last month:

- Separate entrance and exit doorways
- Screening or interviewing patients before appointment for COVID-19 related symptoms
- Screening or interviewing staff members for COVID-19 related symptoms
- Checking the temperature of the patients using a thermometer before the appointment
- Checking the temperature of the staff members at least once a day using a thermometer
- Insisting or encouraging patients to wear masks or face covering
 - At all times
 - Only in the waiting area
 - o Only in areas close to where dental care is provided
- Disinfecting of surfaces frequently touched by patients (e.g., doorknobs, switches)
 - After every patient
 - More than once per day but not after every patient
 - Once a day only
 - \circ Never
- Preprocedural mouthwash rinse
- Installation of special air filtering or purification unit
- Use of extra oral aerosol suction device during procedures
- Installation of physical barriers in areas of frequent staff-patient interaction (e.g., plexiglass frames)
- Plan in place for contact tracing in case of an outbreak at your clinic
- Other:_____
- 79. Have the Infection Prevention and Control (IPC) procedures and amenities in-place at the <u>dental school or hospital clinic</u> where you provided or participated in care changed during the last month
- No
- Yes
- 80. <u>If you answered yes to question 79</u>, what new IPC measures have been added or removed?

Measure	Added	Removed
Separate entrance and exit doorways		

Screening or interviewing patients before appointment for COVID-19			
related symptoms			
Screening or interviewing staff members for COVID-19 related symptoms			
Checking the temperature of the patients using a thermometer before			
the appointment			
Checking the temperature of the staff members at least once a day using			
a thermometer			
Insisting or encouraging patients to wear masks or face covering			
 At all times 			
 Only in the waiting area 			
 Only in areas close to where dental care is provided 			
Disinfecting of surfaces frequently touched by patients (e.g., doorknobs,			
switches)			
 After every patient 			
 More than once per day but not after every patient 			
 Once a day only 			
o Never			
Preprocedural mouthwash rinse			
Installation of special air filtering or purification unit			
Use of extra oral aerosol suction device during procedures			
Installation of physical barriers in areas of frequent staff-patient			
interaction (e.g., plexiglass frames)			
Plan in place for contact tracing in case of an outbreak at your clinic			
Other:			

81. From the list below, please choose the Infection Prevention and Control (IPC) procedures and amenities in-place at the <u>private clinic</u> (if more than one respond concerning the private clinic where you worked the most during the past month) where you provided or participated in care during the last month:

- Separate entrance and exit doorways
- Screening or interviewing patients before appointment for COVID-19 related symptoms
- Screening or interviewing staff members for COVID-19 related symptoms
- Checking the temperature of the patients using a thermometer before the appointment
- Checking the temperature of the staff members at least once a day using a thermometer
- Insisting or encouraging patients to wear masks or face covering
 - o At all times
 - Only in the waiting area
 - \circ $\,$ Only in areas close to where dental care is provided
- Disinfecting of surfaces frequently touched by patients (e.g., doorknobs, switches)
 - After every patient
 - More than once per day but not after every patient
 - Once a day only
 - o Never
- Preprocedural mouthwash rinse
- Installation of special air filtering or purification unit
- Use of extra oral aerosol suction device during procedures

- Installation of physical barriers in areas of frequent staff-patient interaction (e.g., plexiglass frames)
- Plan in place for contact tracing in case of an outbreak at your clinic
- Other:_____
- 82. Have the Infection Prevention and Control (IPC) procedures and amenities in-place at the private clinic (if more than one respond concerning the private clinic where you worked the most during the past month) where you provided or participated in care changed during the last month
- No
- Yes
- 83. If you answered yes to question 82, what new IPC measures have been added or removed?

Measure	Added	Removed
Separate entrance and exit doorways		
Screening or interviewing patients before appointment for COVID-19		
related symptoms		
Screening or interviewing staff members for COVID-19 related symptoms		
Checking the temperature of the patients using a thermometer before		
the appointment		
Checking the temperature of the staff members at least once a day using		
a thermometer		
Insisting or encouraging patients to wear masks or face covering		
 At all times 		
 Only in the waiting area 		
 Only in areas close to where dental care is provided 		
Disinfecting of surfaces frequently touched by patients (e.g., doorknobs,		
switches)		
 After every patient 		
 More than once per day but not after every patient 		
 Once a day only 		
o Never		
Preprocedural mouthwash rinse		
Installation of special air filtering or purification unit		
Use of extra oral aerosol suction device during procedures		
Installation of physical barriers in areas of frequent staff-patient		
interaction (e.g., plexiglass frames)		
Plan in place for contact tracing in case of an outbreak at your clinic		
Other:		

This section refers to the work you may have performed in a laboratory (e.g. a research laboratory, a preclinical/simulation laboratory or a dental prosthetics laboratory) during the last month.

84. <u>During the last month</u> how often did you work in a laboratory of any sort (e.g. a research laboratory, a preclinical/simulation laboratory or a dental prosthetics laboratory)?

Please choose **only one** of the following:

- Never (If this is your response, go to the next section)
- One day per week or less
- Two-three days per week
- Four-five days per week

85. During the last month, what sort of laboratory did you work in?

Please choose **all** that apply:

- A research laboratory
- A simulation/preclinical laboratory
- A dental prosthetics laboratory
- Another form of laboratory

86. Please specify the types of facial protection you used at the <u>dental school laboratory you</u> <u>worked in most of the time in the past month</u>

Please choose **all** that apply:

Please choose the appropriate response for each item:

	For all	For some	For none
	procedures	procedures	
Routine surgical mask			
N-95 [or higher] mask			
Eye-glasses or goggles			
Facial visor			
Other form of hood or complete head coverage			

87. From the list below, please choose the Infection Prevention and Control (IPC) procedures and amenities in-place at the <u>dental school laboratory</u> where you worked most during the last month:

- Separate entrance and exit doorways
- Screening or interviewing patients before appointment for COVID-19 related symptoms

- Screening or interviewing staff members for COVID-19 related symptoms
- Checking the temperature of the patients using a thermometer before the appointment
- Checking the temperature of the staff members at least once a day using a thermometer
- Insisting or encouraging patients to wear masks or face covering
 - At all times
 - Only in the waiting area
 - \circ $\,$ Only in areas close to where dental care is provided
- Disinfecting of surfaces frequently touched by patients (e.g., doorknobs, switches)
 - After every patient
 - o More than once per day but not after every patient
 - Once a day only
 - o Never
- Preprocedural mouthwash rinse
- Installation of special air filtering or purification unit
- Use of extra oral aerosol suction device during procedures
- Installation of physical barriers in areas of frequent staff-patient interaction (e.g., plexiglass frames)
- Plan in place for contact tracing in case of an outbreak at your clinic
- Other:___

88. Have the Infection Prevention and Control (IPC) procedures and amenities in-place at the <u>dental school laboratory</u> where you where you worked most changed during the last month

- No
- Yes

89. If you answered yes to question 88, what new IPC measures have been added or removed?

Measure	Added	Removed
Separate entrance and exit doorways		
Screening or interviewing patients before appointment for COVID-19		
related symptoms		
Screening or interviewing staff members for COVID-19 related symptoms		
Checking the temperature of the patients using a thermometer before		
the appointment		
Checking the temperature of the staff members at least once a day using		
a thermometer		
Insisting or encouraging patients to wear masks or face covering		
 At all times 		
 Only in the waiting area 		
 Only in areas close to where dental care is provided 		
Disinfecting of surfaces frequently touched by patients (e.g., doorknobs,		
switches)		
 After every patient 		
 More than once per day but not after every patient 		
 Once a day only 		
o Never		
Preprocedural mouthwash rinse		

Installation of special air filtering or purification unit	
Use of extra oral aerosol suction device during procedures	
Installation of physical barriers in areas of frequent staff-patient	
interaction (e.g., plexiglass frames)	
Plan in place for contact tracing in case of an outbreak at your clinic	
Other:	

The questions in this section refer to your work with co-workers during the last month.

90. During the last month, when you were working at the dental school or at a setting linked to the dental school (e.g. hospital or university laboratory), approximately how many other people were working with you in the same room/space (office, laboratory, clinic)? Please choose only one of the following:

- None
- 1-3
- 4-10
- 11-20
- More than 20
- 91. During the last month, as far as you are aware, did any of the people working with you in the same room/space <u>at the dental school or at a setting linked to the dental school (e.g. hospital or university laboratory)</u> have a positive test for COVID-19?

Please choose **only one** of the following:

- Yes
- No
- Unknown

92. During the last month, did any of the people working with you in the same room/space <u>at</u> <u>the dental school or at a setting linked to the dental school (e.g. hospital or university</u> <u>laboratory</u>) have any symptom which made you suspect that they have COVID-19?

Please choose only one of the following:

- Yes
- No
- Unknown

93. During the last month, <u>when you were working in a space NOT linked with the dental</u> <u>school</u> (if you regularly work in more than one setting, apart from the dental school, this is related to the setting you work in most), approximately how many other people were working with you in the same room/space (office, laboratory, clinic)?

Please choose only one of the following:

- I do not work in a space not linked with the dental school (if so, go to section 9, question 90)
- None
- 1-3
- 4-10
- 11-20
- More than 20

94. During the last month, as far as you are aware, did any of the people working with you in the same room/space you refer to in question 87 (i.e. NOT linked with the dental school) have a positive test for COVID-19?

Please choose **only one** of the following:

- Yes
- No
- Unknown

95. During the last two weeks, did any of the people working with you in the same room/space you refer to in question 87 (i.e. NOT linked with the dental school) have any symptom which made you suspect that they have COVID-19?

Please choose **only one** of the following:

- Yes
- No
- Unknown

Section 9: Vaccination

The questions in this section refer to receiving a vaccination against COVID-19.

96. Have you been vaccinated against COVID-19?

Answer 'Yes' if you have received at least one dose of the COVID-19 vaccine. <u>Note</u>: Certain types of vaccines require more than one dose to protect against COVID-19. You would have been informed at the time of vaccination if you needed a second dose.

- Yes
- No

97. How many doses of the COVID-19 vaccine have you received so far?

<u>Note:</u> Certain types of vaccines require more than one dose to protect against COVID-19. You would have been informed at the time of vaccination if you needed a second dose.

- One dose
- Two doses
- More than two doses

98. When did you receive your first dose of the COVID-19 vaccine?

Day	Month	Year

99. When did you receive your second dose of the COVID-19 vaccine?

Day	Month	Year

100. Which vaccine did you receive?

- Pfizer and BioNTech mRNA vaccine
- Moderna mRNA vaccine
- AstraZeneca Oxford vaccine
- Other ____
- Don't know

Section 10: COVID-19 Anxiety

	101. Please rate the extent to which each s	tatement	applies to	o you ove	r the last	month.
		Not at	Rarely,	Several	More	Nearly
		all (0)	less	days	than 7	every
			than a	(2)	days	day (4)
			day or		(3)	, , , ,
			two		. ,	
			(1)			
•	I have avoided using nublic transport because of		(-/			1
	the fear of contracting coronavirus (COVID-19)					
•	L have checked myself for symptoms of					
-	coronavirus (COVID 10)					
F	L have availed going out to public places (shans					
•	nave avoided going out to public places (shops,					
	parks) because of the fear of contracting					
•	I have been concerned about not having					
	adhered strictly to social distancing guidelines					
	for coronavirus (COVID-19)					ļ
•	I have avoided touching things in public spaces					
	because of the fear of contracting coronavirus					
	(COVID-19).					
•	I have read about news relating to coronavirus					
	(COVID-19) at the cost of engaging in work.					
•	I have checked my family members and loved					
	one for the signs of coronavirus (COVID-19).					
•	I have been paying close attention to others					
	displaying possible symptoms of coronavirus					
	(COVID-19).					
•	I have imagined what could happen to my family					
	members if they contracted coronavirus (COVID-					
	19).					
•	I am afraid of getting COVID-19 from a patient or					
	a co-worker					
•	I am anxious when providing treatment to					
	patients with flu like symptoms					
•	I fear that the PPE I am using may not be					
	sufficient to protect me against COVID-19					
•	I worry about how effective vaccines may be					
L	against COVID-19					
•	I worry about the side effects of vaccines against					
	COVID-19					
•	I am anxious about the new strains of COVID-19					T
	that are emerging					

101 which or ah atata nt annlias t -. r the last +h .

11. APPENDIX-II-Supplementary material

AVOIDANCE ANXIETY SCORES: MEAN (± 1 SD) Geteraring 2021 2021 2022 2022 2022													
Categories	2021-	2021-	2021-	2021-	2022-	2021-	2021-	2021-	2021-	2022-	2022-	2022-	2022-
	04	05	06	07	08	09	10	11	12	01	02	03	04
Role								•	•		•		
	6.1	5.8	4.7	3.9	3.8	4.1	3.7	3.5	3.8	4.6	3.5	3.4	3.5
Employee	(3.6)	(3.6)	(3.5)	(3.4)	(3.4)	(3.4)	(3.3)	(3.3)	(3.4)	(3.8)	(3.4)	(3.1)	(3.5)
	7.3	7.2	5.8	4.6	4.3	3.9	3.7	3.2	3.5	5.0	3.7	3.0	2.6
Students	(3.2)	(3.4)	(3.5)	(3.1)	(3.1)	(3.0)	(3.0)	(3.0)	(3.0)	(3.5)	(3.3)	(3.0)	(3.0)
Age				I					-				
	7.2	7.3	5.8	4.2	4.1	4.0	3.1	3.1	3.5	4.7	3.3	2.7	
18-24	(3.3)	(3.3)	(3.6)	(2.8)	(3.1)	(2.9)	(3.0)	(2.8)	(2.8)	(3.4)	(3.1)	(2.6)	2.4 (3)
	7.2	7.1	5.8	5.0	4.3	4.0	3.3	3.5	3.3	5.3	3.7	3.3	3.4
25-34	(3.2)	(3.2)	(3.4)	(3.3)	(3.1)	(3.0)	(2.9)	(3.1)	(2.9)	(3.6)	(3.3)	(3.2)	(3.3)
	6.2	5.8	4.3	3.9	3.8	3.9	4.0	3.8	4.2	5.4	4.2	3.5	2.9
35-44	(3.6)	(4.0)	(3.5)	(3.4)	(3.3)	(3.3)	(3.7)	(3.8)	(4.1)	(4.2)	(4.0)	(3.3)	(3.1)
	5.9	5.6	4.5	3.8	3.7	3.7	3.7	3.3	3.8	3.8	3.1	2.7	26(2)
45-54	(3.7)	(3.4)	(3.7)	(3.4)	(3.4)	(3.3)	(3.0)	(3.3)	(3.3)	(3.6)	(3.2)	(3.2)	2.0 (3)
	6.0	5.4	4.6	4.0	3.9	4.3	3.9	3.5	4.1	4.6	4.0	3.5	4.5
>55 years	(3.8)	(4.0)	(3.4)	(3.6)	(3.4)	(3.6)	(3.5)	(3.2)	(3.5)	(3.8)	(3.6)	(3.6)	(3.9)
Sex	•	•		•	•	•	•		•				

Table 1: Avoidance anxiety ratings across all the follow up months categorized by participant characteristics

Famalas	6.0	6.6	53	4.4	12	12	3.0	35	3.0	10	3.0	31	28
remaies	0.7	0.0	5.5	7.7	4.2	4.2	5.7	5.5	5.7	ч.)	5.7	5.4	2.0
	(3.3)	(3.5)	(3.5)	(3.3)	(3.2)	(3.2)	(3.1)	(3.1)	(3.2)	(3.7)	(3.4)	(3.3)	(3.1)
Males	6.2	6.2	4.9	4 (3.3)	3.5	3.4 (3)	3.2	3.1	3.1	4.2	3 (3.1)	2.2	3.5
	(3.7)	(3.7)	(3.7)		(3.2)		(3.3)	(3.2)	(3.1)	(3.6)		(2.6)	(3.5)
Participation in dental care													
	6.8	6.6	5.4	4.3	4.3	4.1	3.6	3.5	3.7	5.0	3.7	3.3	3.5
No	(3.5)	(3.6)	(3.6)	(3.3)	(3.3)	(3.3)	(3.1)	(3.4)	(3.5)	(3.8)	(3.6)	(3.5)	(3.0)
	6.6	6.4	5.0	4.2	3.6	3.9	3.7	3.3	3.6	4.4	3.5	2.9	3.3
Yes	(3.4)	(3.6)	(3.5)	(3.2)	(3.0)	(3.0)	(3.2)	(2.9)	(3.0)	(3.4)	(3.2)	(2.8)	(3.1)
Chronic conditions													
	6.7	6.7	5.4	4.3	4.1	3.9	3.6	3.5	3.5	4.8	3.5	3.5	3.3
No	(3.5)	(3.5)	(3.6)	(3.3)	(3.2)	(3.1)	(3.1)	(3.2)	(3.2)	(3.6)	(3.4)	(3.4)	(3.4)
	6.9	6.0	4.6	4.1	3.9	4.1	3.9	3.1	3.1	4.1	4.6	3.7	2.4
Yes	(3.5)	(3.6)	(3.6)	(3.3)	(3.3)	(3.3)	(3.2)	(3.1)	(3.2)	(3.2)	(3.8)	(3.4)	(2.5)
Vaccination	doses	1		4	•	•		•		•	•		
	6.8	6.8	5.3	4.8	3.5	3.0	2.8	2.1	2.1	3.3	2.9	3.5	3.7
One dose	(3.4)	(3.5)	(3.7)	(3.6)	(3.0)	(3.4)	(2.2)	(2.0)	(2.1)	(3.5)	(3.5)	(2.7)	(4.8)
	5.9	5.5	5.1	4.3	4.1	3.2	3.7	3.4	3.7	3.2	4.8	3.6	3.1
Two dose	(3.6)	(3.9)	(3.5)	(3.2)	(3.2)	(3.2)	(3.2)	(3.1)	(3.7)	(3.2)	(3.6)	(3.3)	(3.1)
Province loc	ation	•		·	•	•	•	•	•	•	•	•	·
	7.4	7.2	5.9	5.3	4.8	4.8	4.0	4.0	4.8	5.5	4.4	3.6	4.1
ON	(3.3)	(3.5)	(3.7)	(3.4)	(3.4)	(3.2)	(3.2)	(3.2)	(3.4)	(3.8)	(3.6)	(3.5)	(4.0)

	5.9	5.7	4.4	3.5	3.2	3.0	3.1	2.4	2.9	4.2	3.3	2.8	2.5
QC	(3.5)	(3.7)	(3.3)	(3.0)	(3.2)	(3.0)	(3.2)	(2.7)	(3.1)	(3.6)	(3.4)	(3.2)	(3.1)
	6.7	6.6	5.2	4.2	4.1	4.1	3.9	3.5	3.6	4.7	3.5	3.3	3.2
others	(3.5)	(3.5)	(3.6)	(3.2)	(3.1)	(3.1)	(3.1)	(3.2)	(3.1)	(3.6)	(3.3)	(3.0)	(3.0)
Living status													
Alone	7.2	6.9	6.4	4.7 (3)	4.5	4.3 (3)	3.7 (3)	3.9	3.6	5.8	4.2	3.9	3.7
	(3.5)	(3.5)	(3.4)		(3.1)			(3.1)	(3.1)	(3.7)	(3.4)	(3.2)	(3.4)
Not Alone	6.6	6.4	4.9	4.2	3.9	3.9	3.7	3.3	3.7	4.4	3.5	2.9	3 (3.3)
	(3.4)	(3.6)	(3.6)	(3.3)	(3.3)	(3.2)	(3.2)	(3.2)	(3.2)	(3.6)	(3.4)	(3.1)	

PERSEVER	PERSEVERANCE ANXIETY SCORES: MEAN (± 1 SD)												
Categories	2021-	2021-	2021-	2021-	2022-	2021-	2021-	2021-	2021-	2022-	2022-	2022-	2022-
	04	05	06	07	08	09	10	11	12	01	02	03	04
Role	1		1								1	1	1
	11.4	10.6	9.1	8.0	7.7	8.5	7.8	7.5	8.4	9.7	8.4	6.5	7.6
Employee	(5.7)	(6.1)	(5.5)	(5.8)	(5.5)	(6.1)	(5.9)	(5.8)	(6.1)	(6.1)	(6.2)	(5.7)	(6.1)
	12.6	11.5	10.2	8.3	8.7	8.6	7.8	7.4	7.3	10.3	8.0	6.6	7.7
Students	(5.3)	(5.2)	(5.8)	(5.3)	(5.9)	(5.7)	(5.7)	(5.8)	(5.9)	(6.1)	(6.4)	(5.6)	(6.6)
Age										1		1	
	12.7	11.4	10.5	8.1	8.4	8.9	8.0	7.2	7.3	10.2	7.5	6.0	6.8
18-24	(5.3)	(5.3)	(6.3)	(5.3)	(6.1)	(5.6)	(5.8)	(5.9)	(5.8)	(6.2)	(6.1)	(5.4)	(6.7)
	12.1	11.4	9.6	8.0	8.1	8.0	7.0	7.2	7.2	10.2	8.1	7.0	8.2
25-34	(5.0)	(4.7)	(4.9)	(5.1)	(5.2)	(5.6)	(5.0)	(4.9)	(5.2)	(5.8)	(5.8)	(5.1)	(6.6)
	11.0	10.4	8.7	7.6	8.0	8.1	7.6	7.6	8.2	10.4	9.1	6.0	4.9
35-44	(6.1)	(6.6)	(5.5)	(5.6)	(5.8)	(5.3)	(6.4)	(6.5)	(6.3)	(6.7)	(7.3)	(6.2)	(3.8)
	11.9	11.1	10.3	8.9	8.3	9.0	8.2	8.4	9.3	9.7	8.6	7.0	7.3
45-54	(5.6)	(5.9)	(6.0)	(6.2)	(5.6)	(6.3)	(5.8)	(5.9)	(6.6)	(6.0)	(6.2)	(6.2)	(5.3)

Table 2: Perseverance anxiety ratings across all the follow up months categorized by participant characteristics

	11.0	10.1	8.4	8.0	7.9	8.2	8.1	7.1	8.4	9.5	8.4	6.3	
>55 years	(6.2)	(7.1)	(5.3)	(5.9)	(6.0)	(6.7)	(6.4)	(5.9)	(6.6)	(6.2)	(6.6)	(5.7)	9.5 (7)
Sex													
Females	12.3	11.2	10 (5.7)	8.1	8.2	8.8	8 (5.6)	7.6	8.4 (6)	10.3 (6)	8.6	6.8	7.5
	(5.4)	(5.8)		(5.4)	(5.5)	(5.8)		(5.8)			(6.3)	(5.6)	(6.2)
Males	11.5	10.5	8.9	8.2	8.1	7.8	7.2	7 (5.7)	6.7	9.2	7.2	5.9	7.4
	(5.6)	(5.4)	(5.6)	(5.8)	(6.2)	(5.9)	(6.3)		(6.7)	(6.4)	(6.1)	(5.7)	(6.4)
Participatio	on in den	tal care											
	11.5	10.7	9.8	7.8	8.4	8.3	7.6	7.2	7.5	10.1	8.3	6.5	6.3
No	(5.8)	(5.7)	(6.1)	(5.5)	(5.8)	(6.2)	(5.6)	(5.8)	(6.2)	(6.2)	(6.5)	(5.8)	(5.6)
	12.5	11.5	9.6	8.4	7.8	8.7	7.8	7.8	8.3	9.8	8.1	6.6	8.9
Yes	(5.2)	(5.7)	(5.3)	(5.6)	(5.5)	(5.7)	(6.0)	(5.7)	(5.8)	(6.1)	(6.1)	(5.5)	(6.6)
Chronic co	nditions												
	12.0	11.2	9.8	8.2	8.4	8.5	7.8	7.5	7.8	10.1	8.1	6.6	7.6
No	(5.5)	(5.6)	(5.8)	(5.6)	(6.0)	(6.1)	(6.0)	(5.9)	(6.2)	(6.2)	(6.6)	(5.8)	(6.5)
	11.8	10.7	9.1	7.6	7.5	8.6	7.8	7.4	8.1	9.7	8.5	6.2	7.6
Yes	(5.7)	(6.0)	(5.1)	(5.0)	(4.9)	(5.2)	(5.0)	(5.4)	(5.1)	(5.9)	(5.5)	(4.8)	(5.0)
Vaccination	n doses			<u> </u>				<u> </u>		<u> </u>			

	12.6	11.5	9.7	7.9	9.0	7.2	5.8	5.7	5.7	8.6	9.2	4.9	9.2
One dose	(5.4)	(5.4)	(5.7)	(5.1)	(5.6)	(4.8)	(4.6)	(4.2)	(4.7)	(6.0)	(6.9)	(6.0)	(6.2)
	11.2	9.3	9.7	8.2	8.2	8.7	7.8	7.5	8.1	10.1	8.2	6.6	7.6
Two dose	(5.5)	(6.6)	(5.7)	(5.5)	(5.8)	(6.0)	(5.8)	(5.8)	(6.0)	(6.1)	(6.2)	(5.6)	(6.4)
Province loo	cation		1	1	1	1	1				1	1	
	13.3	12.5	11.3	9.3	9.5	9.9	8.3	8.6	9.5	11.1	9.6	8.1	10.3
ON	(5.5)	(5.9)	(6.1)	(5.8)	(6.0)	(6.1)	(5.9)	(6.1)	(6.0)	(5.9)	(6.3)	(6.1)	(5.9)
	10.4	9.1	7.8	6.1	6.6	6.2	5.8	5.4	5.9	9.5	6.2	4.8	6.3
QC	(5.9)	(5.6)	(5.7)	(4.8)	(5.7)	(5.5)	(5.3)	(5.3)	(5.6)	(6.4)	(5.6)	(4.9)	(6.2)
	11.9	11.2	9.5	8.5	8.4	8.9	8.5	7.8	8.2	9.9	8.7	6.7	7.4
others	(5.3)	(5.6)	(5.3)	(5.5)	(5.5)	(5.8)	(5.8)	(5.6)	(6.0)	(6.0)	(6.4)	(5.6)	(6.3)
Living statu	IS		1	1		1	1	1			1	1	L
Alone	12.3	11.1	10.8	8.4	8.3	8.8 (6)	7.5	7.5	8.3	10.5	8.2	7 (5.1)	8.9
	(5.8)	(5.6)	(6.5)	(5.1)	(5.6)		(5.3)	(5.6)	(5.8)	(6.2)	(6.3)		(6.8)
Not alone	11.9	11	9.4	8.1	8.2	8.5	7.8	7.5	7.9	9.8	8.3	6.4	7.3
	(5.4)	(5.7)	(5.4)	(5.6)	(5.8)	(5.9)	(5.9)	(5.8)	(6.1)	(6.1)	(6.3)	(5.8)	(6.2)