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REPERCUSSION OF THE COVID-19 IN PEDIATRIC DENTISTRY

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SUMMARY

After approximately a year since the SARS-CoV-2 pandemic has emerged, numerous studies have shown how it impacted the world of pediatric dentistry.

This study aims to put into light these impacts on the pediatric dentist as well as the children and caregivers; and also show how the pediatric dentist adapted and improved its work in order to still be able to treat the child patient.

During COVID-19 pandemic, a drastic decrease of treatments performed in pediatric dentistry took place due to lockdown and regulations established by most countries around the world. To this decrease was added an apparent shift of the treatments themselves, focusing more on emergencies rather than elective treatments. The pediatric dentist had to adapt to the changes brought by the pandemic by establishing and following a strict protocol in order to avoid any risk of contamination. This pandemic also highlighted many social and economical discrepancies, as some population around the world did not have the means or simply access to the same level of care.

RESUMEN

Después de casi un año desde que surgió la pandemia del SARS-CoV-2, numerosos estudios han demostrado cómo esta enfermedad impactó al mundo de la odontología pediátrica.

Este trabajo pretende poner en evidencia estos impactos y mostrar cómo el dentista pediátrico adaptó y mejoró su trabajo para poder seguir tratando al paciente infantil; por otro lado del campo pediátrico, pretende ver los impactos en los niños y sus cuidadores.

Durante la pandemia COVID-19, una disminución drástica de los tratamientos realizados en odontología pediátrica tuvo lugar debido al cierre y las regulaciones establecidas por la mayoría de los países en todo el mundo. A esta disminución se sumó un aparente cambio de los propios tratamientos, centrándose más en las emergencias que en los tratamientos electivos. El dentista pediátrico tuvo que adaptarse a los cambios provocados por la pandemia estableciendo y siguiendo un protocolo estricto para evitar cualquier riesgo de contaminación. Esta pandemia también puso de relieve muchas discrepancias sociales y económicas, ya que algunas poblaciones de todo el mundo no tenían los medios o simplemente no tenían acceso al mismo nivel de atención.

ABBREVIATIONS

AAPD : American Academy of Pediatric Dentistry

ACD : Austrian Chamber of Dentists

ADA : American Dental Association

A.I.I. : Airborne Infection Isolation

CT : Computerized Tomography

ICTV : International Committee on Taxonomy of Viruses

MERS : Middle East Respiratory Syndrome

RNA : Ribonucleic Acid

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

WHO : World Health Organization

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INTRODUCTION

On March 11, 2020, in China, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease (COVID-19) outbreak was brought to attention and avowed a pandemic by the World Health Organization (WHO) (1).

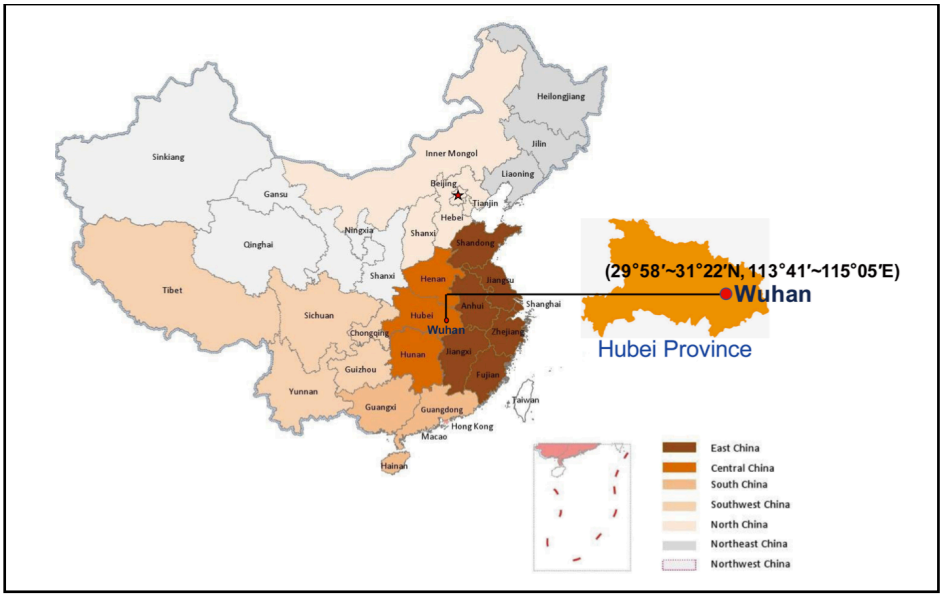


Figure 1 : Geographic location of Wuhan, Hubei Province in China (1)

In December 2019, in Wuhan city (China) (Fig1), a cluster of pneumonia patients with an unidentified cause was discovered (2). Since then, across China, it was noted more than 80,000 laboratory confirmed cases that were the results of outbreaks and sporadic human infections (update on March 23, 2020). Via numerous analysis, this unidentified pneumonia was thought to be due to a novel coronavirus (CoV) (3), named SARS-CoV-2 by the International Committee on Taxonomy of Viruses (ICTV) on February 11, 2020 (4).

Coronaviruses are a family of viruses that normally affect only animals, but this is not the case for the more recent forms like the SARS-CoV-2.

Several coronaviruses cause respiratory infections that can be classified from the common cold to more serious illnesses such as the Middle East respiratory syndrome (MERS), declared in 2012, and severe acute respiratory syndrome (SARS), which was discovered in 2002 (5).

These previous illnesses have permitted a better understanding of the pathogenesis and epidemiology of the current SARS-Cov-2, as well as scientific advancements that allowed the development of therapeutics to treat viral infection (1).

The SARS-CoV-2 coronavirus, also named « novel zoonotic disease » is lightly different from the others because it causes respiratory problems that mostly produce mild symptoms, but in some cases, it can lead to death (6). As no specific treatments have been developed to control the disease, the COVID-19 pandemic is posing a great danger for global public health (1). The pediatric dentists are playing crucial roles in the health care system by sustaining the management of emergency dental situations whilst taking particular measures to practice global infection control (7).

The SARS-CoV-2 epidemic is constantly diffusing, and this virus presents a great threat to public health. However, the knowledge about this virus also evolves quickly. At the beginning of 2020, it was completely unknown, but the scientific community has managed to develop tests for its diagnosis. “Since the 31st of December 2019 and as of week 2021-13, 131 639 092 cases of COVID-19 (following the applied case definitions and testing strategies in the affected countries) have been reported, including 2 857 866 deaths” (8).

Worldwide, this virus represents the most significant challenge to the healthcare profession of the XXI century. Indeed, it resulted in many consequences in the economic, political, social and psychological level and a race has begun to quickly stop the progression of this virus and learn how to identify it and as a final step develop a vaccine. Taking into account clinical manifestations, blood tests, and chest X-rays, this disease was diagnosed as virus-induced pneumonia by clinicians (1).

1. Description of the virus

The CoVs family is a class of enveloped RNA viruses (Fig 2). This type of viruses can lead to respiratory, enteric, hepatic, and neurologic diseases (9,10). The diameter of virus particle is around 60 to100 nm and seems round or oval (11).

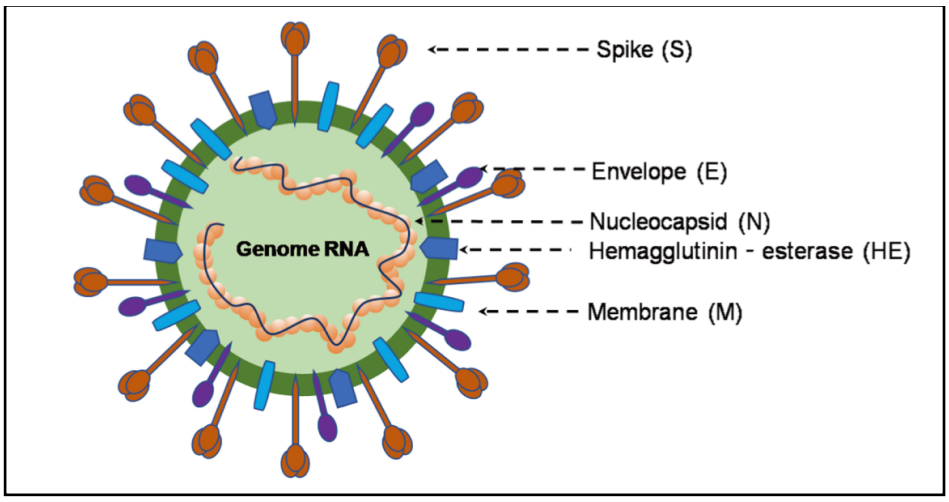


Figure 2 : The β-coronavirus particle (1)

The SARS-CoV-2 cannot resist to UV or temperatures above 56°C for longer than 30min; it is also susceptible to most disinfectants like diethyl ether, 75% ethanol, chlorine, peracetic acid, and chloroform (11).

The scientific community also related that the SARS-CoV-2 was more commonly found on plastic and stainless steel when compared to surfaces like copper and cardboard"; also the detection of viable virus was made up to 72h after contact with these surfaces (1).

2. Manifestation and prevalence of COVID-19

The investigation of 1324 laboratory confirmed cases of SARS-Cov-2 demonstrated a high prevalence of fever (87.9%) and cough (67.7%) as common symptoms while diarrhea was infrequent. Moreover, ICU patients suffered lymphopenia in 82.1% of cases (12). After defining the virus, retracing its steps and analyzing the symptomatology of patients suffering from SARS-Cov-2, it is important to establish its different routes of transmission as well as the susceptibility of group population in order to better understand its virulence.

Presently, the main routes of transmission are considered to be respiratory droplets and contact transmission. In some recent reports a detection of SARS-CoV-2 was possible in the stool and urine of laboratory confirmed patients, which imply a possible risk of fecal–oral transmission (11), however the transmission of the virus via food consumption was not confirmed.

Also, no evidence highlighted the transmission of SARS-CoV-2 through aerosols, during pregnancy (from mother to baby) or while delivering (1).

Generally, when talking about emerging infectious diseases, there is no preference of race and/or age regarding the susceptibility of the population. However, it was observed a predominance of contamination in mainland China for the 30~65-year-old population, which accounted for 71.45% of cases while in children under 10-years-old that number drastically dropped to 0.35% (12).

Elderly people and individuals presenting underlying systemic disorders like asthma, diabetes, cardiovascular diseases, and cancer could be more susceptible to SARS-CoV-2 (38,39). Among risk factors that could increase mortality after infection by the virus, smoking and obesity are the main ones (13,14). Furthermore, this “high-risk” population (elderly, etc.), and patients family members are in close contact with patients or sub-clinically symptomatic infected individuals, which shows why this topic is important for odontopediatricians, and healthcare professionals, because a large part of the population is either at risk of getting infected or transmitting the virus (15).

3. Detection of the SARS-CoV-2 virus

After highlighting the different symptoms and performing a thorough medical history, clinicians will use three main diagnostic tools to confirm or discard the possible viral infection (1): Nucleic acid test, Serologic diagnosis and imaging technology (16-21). However, using these tests on children is challenging because of their age and unwillingness to cooperate. New salivary test have been successfully used on children and disabled people to allow them to be diagnosed (22).

- Nucleic Acid Test

Viral diagnostics is one prime tool of our armamentarium in the battle against SARS-CoV-2. The availability of diagnostic tests allowing the detection of the viral sequence by RT-PCR form part of this armamentarium (16). However, the ability of nucleic acid tests to yield false negatives represent the main concern as to the accuracy of this diagnostic tool (17).

- Serologic Diagnosis

It has been demonstrated that patients infected by the COVID-19 possess acute serological responses (18). And relevant detection reagents were put in place when united with technologies such as the immunochromatography or colloidal gold (19, 20).

- Imaging Technology

In clinical practice chest radiographs or CTs are a significant diagnostic instrument used in patient with SARS-CoV-2 infection.

Similar characteristics, like bilateral distribution of patchy shadows and ground glass opacity, appeared on CT images of a large number of COVID-19 cases (21).

Although both the scientific community and healthcare professionals have these diagnostic tools at hand, it was reported that some patients or people could be asymptomatic. It is the case for the majority of children without serious illness, they tend to present milder symptoms than adults. Children with comorbidities could be at a higher risk to be affected. It is important to remember that, nowadays, the children's place in the study of the SARS-CoV-2, is still unknown.

This part raises several questions like their ability or not to spread disease; the necessity to vaccinate them, and if so at what age (23). This lack of knowledge has a significant impact in the world and, more particularly, in Dentistry.

Indeed, the biological risk is higher in a dental setting; a really short distance separates the patient from the dental health care professional. The environment or equipment could be infected at any time during the treatment with “the patient cough, sneeze or while undergoing procedures with ultrasonic, high-speed instruments or air-water syringe will all result in an aerosol, droplet, spatter, salivary secretions, debris or blood.“ (24). This complex situation has led the dentist to limit or postpone treatments and non-emergency health care appointments.

Furthermore, different quarantines imposed in the majority of different states in the world, have allowed a decrease in the progression of the virus and new cases. In last months, the implementation of strict health rules made possible the routine and emergency dental care (such as discomfort, pain, swelling, infection, traumatic dental injuries, etc.) (25).

This review will focus on understanding all these parameters in order to put in evidence the impact of COVID-19 on the field of pediatric dentistry in its entire entity: the health professionals as well as the patients and their families.

OBJECTIVES

The focus of this work will be put on identifying the different changes in pediatric dentistry that can be observed since the beginning of 2020. Five parts will divide the approach to this subject, reporting in each part in which way the pedodontics is impacted.

The focus will be put on the reorganization of the dental setting due to the major exposition of dental team to COVID-19, with precise devotion to the new dental practice protocol, widely recognized around the world.

A particular interest will be paid, as a first step, to how the dental providers, the child as patient and his caregivers can be affected by this new way of life. As a second step, the new patient management with care delivery will be analyzed. It aims to see how the children's oral health care was affected, taking into account some limitations from all the information which may have been made.

Finally, it will be interesting to highlight what is considered as a solution for certain: the vaccine.

This work aims to constantly oppose by comparison the previous field of pediatric dentistry before the outbreak of SARS-CoV-2 with the one present nowadays and how the pediatric clinicians will constantly adapt by modifying his approach and his working style.

1) Deal and learn from the threat of COVID-19 in pediatric dentistry around the world, regarding past experiences before the pandemic.
2) Highlight some preventive measures in dental practice by assessing the operator and the child patient health protection during the new COVID-19 emergency by considering past experiences.
3) Study how the pediatric dental provider has been affected regarding his work, depending on different dental systems.
4) Study how the children have been affected regarding their oral health
5) Identify the caregiver's attitude and perception
6) To present a global perspective and identifying different challenges about the repercussion of Covid-19 on the treatment protocols of Pediatric Dentistry.
7) Explore the various strategies and the vaccine as a solution.

METHODOLOGY

The aim of this work is to establish all types of repercussions at different scales in pediatric dentistry.

Electronic databases such as PubMed, Google Scholar, and Medline were used to search journals and scientific valid publications since the beginning of the Coronavirus pandemic (depending on the location) in January/February 2020 to nowadays, well as virology, cellular biology, microbiology, epidemiology, pathogenesis, pediatric dental care and psychosocial textbooks.

As the subject is based on recent events, it was judged necessary to provide the most up-to-date information and policy changes as they unfold.

Searches were made using the Boolean technique, words and phrases searched for included the following keywords:

« COVID », « COVID-19 », « Coronavirus », « Coronavirus pandemic », « dentistry», « oral health », « COVID » AND « dental guidelines », « pedodontics », « covid-19 » and « pediatric dentistry», « Impact of covid-19 » and « pediatric dentistry », « psychology and covid-19 », « children » and « covid-19 », « dental care » and « covid-19 ».

Inclusion criteria:

Language: English, Italian, Turk, Spanish, French, Portuguese.

Year of publication: from February 2020 to Nowadays

Species: Humans

-Children from 0-17 y.o

-Dentists and all professional dental health care

-Parents with children

Type of sources: Scientific articles, journals

Type of studies: Prospectives and retrospectives studies, systematic review, meta-analysis, Randomized Controlled Trials, cohort studies, case reports, bibliographic and analytical review.

Exclusion criteria:

- Full-text not certified
- Double publications
- Abstracts only
- Adult dentistry

No location limits (in the whole world) were applied during the screening phase of the scientific articles.

DISCUSSION OF RESULTS

1. Changes in pediatric dental settings due to COVID-19

Patient and dental health care professional are more susceptible to be infected by the virus, in a dental setting, because of the short distance separating them (25). As explained above, the environment or equipment could be quickly infected. Indeed, the most common ways of transmission of COVID-19 are contact transmission (contact with different membranes of mouth, nose and eyes), direct transmission (inhalation of droplets when coughing or sneezing) and air-borne spread (using low or high speed handpieces), even many hours or days later (26). Furthermore, the different surfaces of plastic, metal or glass at ambient temperature for about 7 to 9 days can lead to a viral transmission (27).

This complex situation has led the dentist to limit or postpone treatments and non-emergency health care appointments.

From March 2020 to April 2020, depending on the location, different quarantines were imposed in the world, so only the emergency dental care were prioritized. Following this period of quarantine, around June 2020, a decrease in the progression of the virus and a reduction of new cases was observed. Consequently, it was noticed an increase in the routine dental treatments.

During the Coronavirus pandemic, some studies have reported the standard operating protocol to manage the adult patients (28), but the various writings accessible, do not clarify the recommendations to be followed by the pediatric dentists while managing the pediatric population. The importance of staying up to date with the current evidence is undeniable for improving patient management and to keep safe.

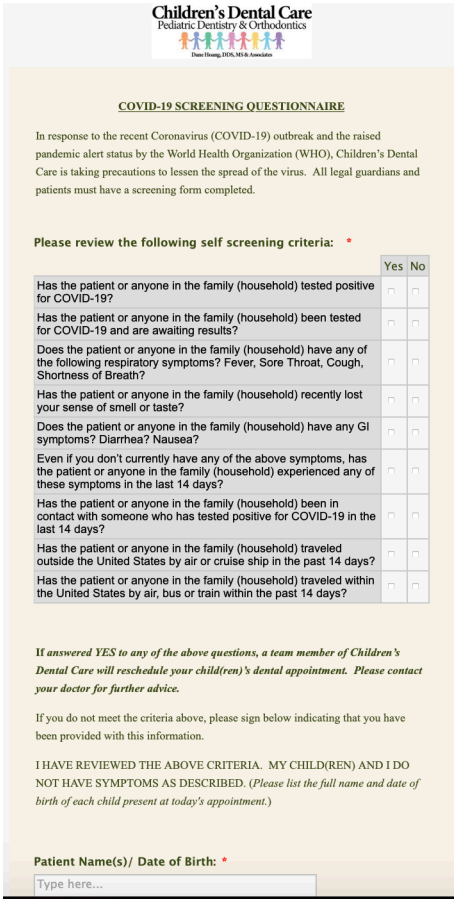
In any case, children as adults can be infected by the SARS-CoV-2 virus, even if severe cases of COVID-19 are far less counted (29). In that way, dentists have to be more cautious and the precautions taken in dental setting are approximately the same for adult dentistry as for pediatric dentistry.

First of all, the body temperature should be measured for everyone entering the dental office, using infra-red thermometers, including the dental staff members.
Everyone should wear a mask and are requested to apply an alcoholic solution on hands and wash their hands with soap and water for the dental practitioners, between every patient. In addition to the mask, each dental practitioner should wear personal protective equipment, with eyewear or face shields, gloves, caps, surgical clothes, shoe-cover (30).

These measures were implemented in the new protocols, even if they were already used before the COVID-19 pandemic, to clean and disinfect the clinical setting before and after every patient, including everything we have to touch as the door handles, lamps, keyboard, desks, screens, etc.

The installation of Portable high-efficiency particulate air (HEPA) filters with acceptable filtration rate in a strategic place, could be envisaging by some dentists to control the operatory airflow (25).
Facing of urgent cases who are maybe positive to airborne infections, it is recommended to use Airborne infection isolation (A.I.I).

All of these measures should become systematic. (31, 32) In pediatric dentistry, the legal caregiver of the child should answer the questions on child health status (32).



Children's Dental Care
Pediatric Dentistry & Orthodontics
Diane Hoang, DDS, MS & Associates

COVID-19 SCREENING QUESTIONNAIRE

In response to the recent Coronavirus (COVID-19) outbreak and the raised pandemic alert status by the World Health Organization (WHO), Children's Dental Care is taking precautions to lessen the spread of the virus. All legal guardians and patients must have a screening form completed.

Please review the following self screening criteria: *

	Yes	No
Has the patient or anyone in the family (household) tested positive for COVID-19?	☐	☐
Has the patient or anyone in the family (household) been tested for COVID-19 and are awaiting results?	☐	☐
Does the patient or anyone in the family (household) have any of the following respiratory symptoms? Fever, Sore Throat, Cough, Shortness of Breath?	☐	☐
Has the patient or anyone in the family (household) recently lost your sense of smell or taste?	☐	☐
Does the patient or anyone in the family (household) have any GI symptoms? Diarrhea? Nausea?	☐	☐
Even if you don't currently have any of the above symptoms, has the patient or anyone in the family (household) experienced any of these symptoms in the last 14 days?	☐	☐
Has the patient or anyone in the family (household) been in contact with someone who has tested positive for COVID-19 in the last 14 days?	☐	☐
Has the patient or anyone in the family (household) traveled outside the United States by air or cruise ship in the past 14 days?	☐	☐
Has the patient or anyone in the family (household) traveled within the United States by air, bus or train within the past 14 days?	☐	☐

If answered YES to any of the above questions, a team member of Children's Dental Care will reschedule your child(ren)'s dental appointment. Please contact your doctor for further advice.

If you do not meet the criteria above, please sign below indicating that you have been provided with this information.

I HAVE REVIEWED THE ABOVE CRITERIA. MY CHILD(REN) AND I DO NOT HAVE SYMPTOMS AS DESCRIBED. (*Please list the full name and date of birth of each child present at today's appointment.*)

Patient Name(s)/ Date of Birth: *

Type here...

Figure 3: COVID-19 screening questionnaire for pediatric clinic (34)

The appointments are reorganized: only the child go into the dental operatory without their parent. To avoid this, it could be interesting to have pediatric patients take tests to assure they there are COVID-19 free before the start of any dental procedure. However, Peng *et al*. showed in their study that there is a high rate of false-negative and that it will be complicated to realize these tests in a dental facility and also on children that will not always cooperate (30, 33).

For children able to spit, it will be recommended to give him a mouth rinse with 0.5%–1% hydrogen peroxide, as « it has non-specific virucidal activity against coronaviruses » (35).

If the social distancing protocol of 6 feet or 2 meters of separation between the individuals could not be respected in the waiting area of the pediatric clinic, then patients and their caregivers have the possibility to wait either in their respective vehicles or simply outside the dental clinic in order to be contacted to attend their appointment (25).

2. Impact of COVID-19 on the oral health care system

i) Pediatric dental health care workers

The place of dentistry is recognized unanimously to be on the front-line against the actual worldwide circulating virus (27). Especially treating children is a concrete challenge to pediatric dentists because of the chance to have unidentified SARS-CoV-2 carriers. This complex situation requires continuously rolling updates on the recommendations, particularly with children. Dentists of the Austrian Society of Pediatric Dentistry have replied to an online survey, with data reported from May 27 to June 30,2020; to evaluate their « knowledge, perception and attitude regarding COVID-19 ». Females are predominant in pediatric dentistry, and in this case, they represent 93 % of 58 participants. Most of those research participants from Vienna, work in private practice (39%), then University (6%). They have, from 1 to 34 years, of dental practice experience in pediatric dentistry (36).

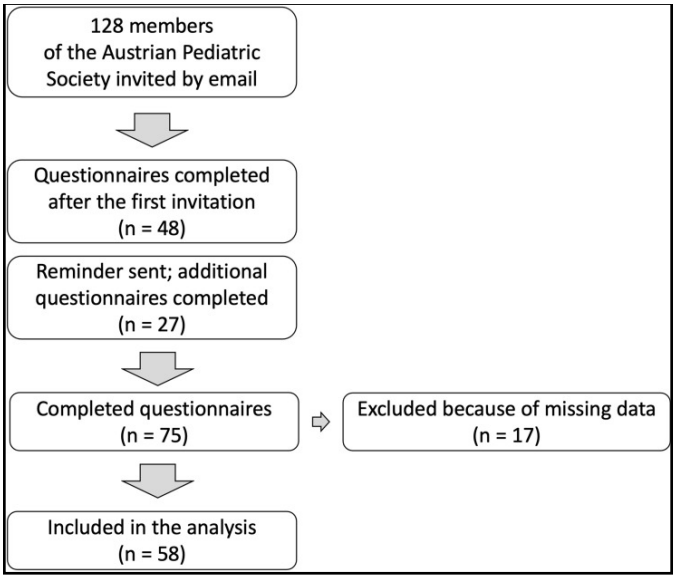


Figure 4 : Process of the cross-sectional study in Austria (36)

Concerning the knowledge, firstly they are interrogated about the scientific name of the virus responsible of the pandemic, of its symptoms, of the various mode of transmission. They also asked about the incubation period of 14 days, really important to know when it is allowed to treat safely even if the patient does not present symptoms anymore, according to the World Health Organization (WHO). Indeed, a wide majority are aware of the last literature from official sources like by the Organizations of the Federal government (86%) and followed by the Austrian Chamber of Dentists (69%). The numbers are more or less the same in the others countries of Europe, like in Italy, as it is supported by De Stefani *et al.* (37), except of ill-informed Jordanians dentists, who does not know the different symptoms (38).

Those same studies cited above, focus about the perception of the SARS-CoV-2 infection by pediatric dentists. Depending on the article, either in Europe or out of Europe, like Jordan, observed almost similar results and rated the virus moderately dangerous.

Despite the willingness of dentists to be up to date on recent news and also participating in informational meetings, only 27% of those dentists feel themselves prepared for the pandemic (37). It is clearly exposed that only one third of dentists felt a little confidence for the future management of this COVID-19 virus. In these studies of Putrino *et al.* and the Austria one, it was explained by the predominance of private practitioners in the trainings meetings of COVID-19 crisis (37, 38).

As it is demonstrated, the dentists surgeons, with hygienists and dental assistants are mostly vulnerable, in front of the high risk of exposure facing the difficulty to encounter a positive child. At the psychological level, the impact is not negligible. Indeed, the fear to be exposed while performing the treatments, among pediatrics dentists is high (37).

Furthermore, their sales and morale have been significantly impacted. In France, a study sifts through the doubts and hopes of several hundred representatives of 7 health professions (39). This year 495 of them were interviewed from 16 September to 19 October 2020 via the internet, including 71 dental surgeons. 76% of colleagues therefore indicate that their turnover is “sustainably impacted by the crisis” compared to 61% on average for the other health professions surveyed patient. Logical point of view, since dental offices closed during confinement. Just over one in two practitioners (56%) see their morale “as a health professional” drop (58% overall).

However, 3 out of 4 practitioners appreciated the popular support movement and half (54%) felt “supported by their insurance company.” 41% are satisfied with the government’s management of the crisis and 51% are “ready to face a new wave”. The survey was conducted just before the new lockdown in November.

More globally, and despite the health crisis, practitioners remain “globally” satisfied with their profession: at 73% against 79% in 2019. 89% say they are even “proud” to work in this profession, which is very stimulating on a daily basis (69%). They were only 84% and 60% respectively a year ago. Nine out of ten (89%) are proud to practice Liberal, which is 12% better than in 2019. And 82% believe they are making “a real contribution to society”.

The only downsides are the administrative and budgetary constraints, which are so pervasive that practitioners “no longer feel like they are really doing their job” (73%), but also the idea that the job pays little in relation to the workload (45%) and the desire to “changing jobs, doing something else” which, while still a very small minority, is growing by 7 percentage points over a year and well ahead of other health professionals (19% on average).

Many dental professionals believe that organizational consequences will be observed when this health crisis is going to be resolved. Indeed, it will be necessary to manage a probable saturation of the healthcare system, due to the delays in care caused by the epidemic situation. Here again, it will be necessary to know how to keep from this crisis management lessons for the profession, both at the level of the organization and professional practices, and specifically at the level of protective measures.

It is important to start learning to work with the respect of all these instructions because it will be probably, for the coming years, part of the future dentistry (38, 39).

ii) The child as patient and his caregiver influenced by COVID-19 pandemic

It is troublesome to assess the impact of the pandemic on public health to date, even if several appointments, examinations, and dental care were postponed during the first lockdown. In the United States, parents are already troubled regarding the impact of SARS-CoV-2 on the oral health of their kids, who could also be affecting from the delay by practitioners throughout this unsure time (32, 40).

A survey directed by Mott Poll, in the University of Michigan Medical Center, is composed of 1,882 parents with at least one kid aged three to eighteen, a nationwide sampling. The belief that the pandemic has made it more complicated for kids to get preventive dental care is shared by one parent out of three (41).

To avoid dental caries from the onset of their first teeth, the sooner the better, and also to guarantee the greater preventive treatments: regular tooth brushing and revisions every six months for kids is widely advised by The American Academy of Pediatric Dentistry (AAPD). Their ultimate goal is the sensitization of children and their caregivers to having greater oral hygiene. The pandemic has significantly delayed dental care in most countries of the globe.

Out of ten parents, six affirmed trying to continue preventive dental care of their children during the COVID-19 outbreak. Among this part, almost a quarter said they have experienced delays in getting an appointment. A percentage of 7% parents, faced the challenge of being managed to have a single appointment. Among the replies of the contestants: in one hand, dental facilities closed and, in another hand, the willingness of dental health professionals to treat uniquely urgent dental care. However, one third of parents who replied honestly to postponed dental appointments voluntarily due to the increasing anxiety to be infected. They see the dental setting as unsafe environments (14%) or unsure environment (19%). The remaining participants (67%) are parents who consider the fact to bring his kid to visit the dentist is safe.

Dentistry is an area that has always had a very anxiety-provoking effect on its patients. It is a hard task to provide dental care in children patients during a period of social restrictions, in addition to the normal fear of the dentist. The fear of pain increases with the actual circumstances. The absence of the caregiver could be a reason for this, absence of all the techniques of desensitization as "tell-show-do, positive reinforcement or other behavioral techniques » (41).

The new safety measures have probably worsened the perception of health workers, even if other techniques are still able to use to manage the distress level.

Indeed, the use of personal protective equipment (PPE) affects the visibility of the dentist’s face, so it makes it difficult to build a relationship of trust with the children patient and potentially exacerbate the difficulty to decrease the dental anxiety (42).

Unfortunately, how to treat the dental children patient in a safe way while managing his fears is still not already resolved.

Another repercussion of the COVID-19 is this role in exacerbating economic dissemblance between several homes around the world, until it is affecting the access to dental healthcare (40).

Before the beginning of the health crisis, disparities in health insurance were certainly presents and now they have continuously and quickly grown with the pandemic. The study highlight the difficulty to get an appointment when kids are from low-income family, and during the pandemic, these disparities were accentuated (40).

Among all the children who received Medicaid, which is not accepted by all dental practicionners, 15% of their caregivers said they are unable to get an appointment for preventive dental care, compared to 4% of those receiving private dental insurance. Clark *et al.* underlines the fact that children who are already troubled to know a dental practitioner outside of the pandemic, to keep their children's teeth in good health, had to deal with the reduction of some preventive dental cares in public dental clinics or school throughout the health crisis (40).

An improved oral hygiene?

An enhancement in kid's oral hygiene during the COVID-19 pandemic is observed by the parents. « Frequent brushing (16%), flossing (11%), or mouthwash (9%), but also a lower consumption of sugary beverages (15%) » are the habits improved more reported (40).

Among one third of children's parent with medicaid, another third without any dental coverage and one fifth with private insurance, there are more than 1 in 4 parents (28%) who noted a new good oral hygiene habit in their children.

In order to obtain a better oral hygiene at home and sensitize children and parents, the use of a "social" advanced stage where pediatric dental specialists can share and spread behavioral instructions to ensure a good oral environment and consequently, avoid harmful situations regarding the stomatognathic system (43).

To achieve all these objectives, sensitize adults before children is usually the strategy adopted, parents need to be aware about what their children are eating, and they should learn what types of foods are more carioprotective and less cariogenic food. Moreover, during the COVID-19 outbreak, children did not go to school or kindergartens, spend most of their time at home without physical activity, with an absence of contact with other kids. The different changes in daily routine for many homes showed a positive correlation between children's wellbeing and COVID-19 pandemic, increasing their anxiety level and could lead to severe mental issues for pediatric patients and their parents (44). To avoid urgent dental care because of big pains, it is really useful to decrease the consumption of sugar in all its aspects, in fact they can cause tooth erosion and decrease the resistance of enamel tissue to cariogenic bacteria because of sugar is composed mainly by acid. Using fluoride rinse more often is highly recommended to keep their kids' teeth healthy (40, 42).

The general anxiety created by the COVID-19 pandemic has likely influenced circadian clock and family routine, until disrupting the sleep time. Bad behavior that are often adopted by parents to encourage child sleep, like wrong eating habits in the night, should be avoided (40, 44).

3. Urgent care and non-emergency treatments in pediatric dentistry during COVID-19

To start this part of the topic regarding the impact of the pandemic on the dental treatments performed in pediatric dentistry, different studies respectively carried out in Saudi Arabia, Brazil, the United Kingdom, USA, India and Italy were carried out.
During the outburst of the SARS-CoV-2 pandemic (between March and April of 2020) the children's urgent dental needs were worsened due to the temporary suspension of pediatric dental emergency management. The studies listed above demonstrated a drastic decrease of all elective treatment in the child patient during pandemic outburst when compared to the same period before the SARS-CoV-2 pandemic. To evaluate the repercussions of this decrease of treatment on the field of pediatric dentistry two studies were highlighted in this work.

The first one is a study conducted in India and aimed to show the impact of COVID-19 pandemic on the pediatric dental treatments, by comparison to the ones carried out in 2019 before the outbreak. In a hospital located in Tamil Nadu (South India), data of all the pediatric dental cases were inspected from March-July of 2019 and 2020 (45).

After triage, patients were labelled and mentioned as dental emergency, urgent dental care, other urgent dental care and routine/non-urgent dental care (46). The process was realized based on ADA guidelines (47).

Procedures were classified into emergency, restorative, preventive and elective procedures based on the type of treatment performed, and the same classifications were applied to compare the parental treatment's preferences between March-July 2019/2020 in order to determine the existence of a correlation (46).

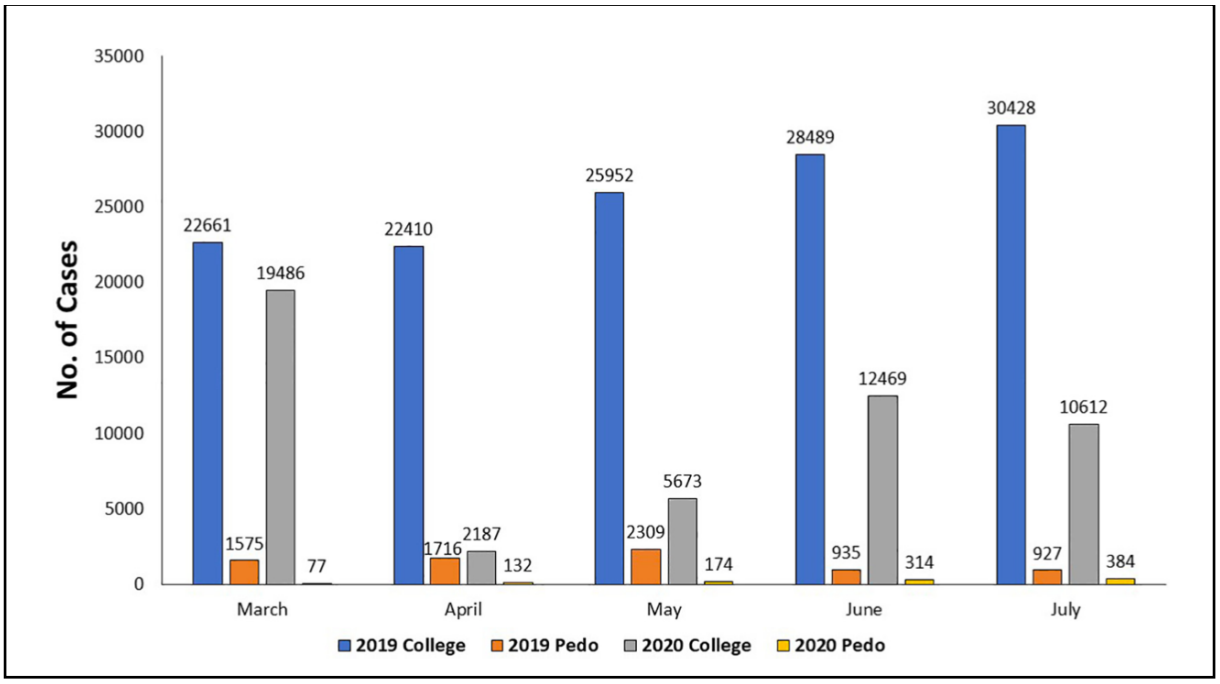


Figure 5: Dental and pediatric cases performed from March to July in 2019/2020 (46)

From March to July 2020, during COVID-19 lockdown, a total of 31 427 patients were treated whereas at the same period in 2019, 129 940 cases were assisted with dental treatment. More importantly, a decrease in pediatric cases was noted in the same hospital during the pandemic lockdown when compared to 2019 (46).

Indeed, while a total of 7462 children were treated in 2019, this number dropped to 1081 child patients in the lockdown period (Figure 5).

In figure 5, this trend of decrease regarding pediatric treatments is confirmed. Indeed, on 11 198 child patients treated, only 1509 were performed in 2020. Moreover, the two main treatments performed during the pandemic were sealants and emergency extractions that respectively accounted for 285 and 267 of cases (48).

Last but not least, root canal treatment of permanent teeth were five times higher in 2019 than 2020 and pulpectomies number dropped times eight when compared to 2019 (46).

Another parameter highlighted in this study was the parental preference of treatment. As it happened, from March to July 2019 and 2020 this parameter was assessed using the ratio of emergency, restorative, preventive, and elective procedures performed in those particular years (49). It was interestingly noted that during lockdown 42% of parents predominantly sought restorative care as 24.4% of them requested preventive ones (49). Another discovery was the parents appeal to complete all procedures in order to avoid any future diseases for their children during the pandemic (49).

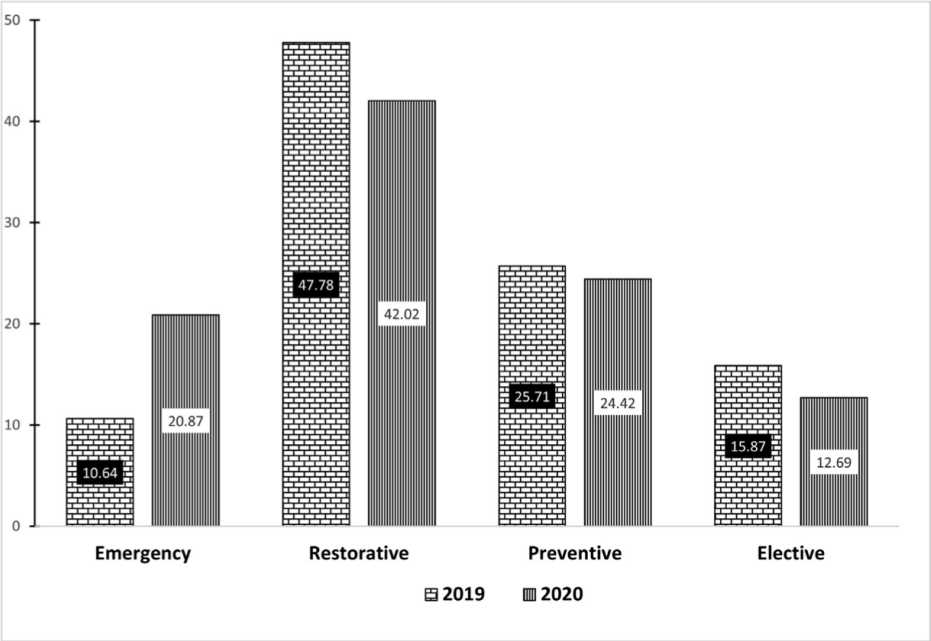


Figure 6: Dental procedures comparison between March-July 2019/2020 (46)

Figure 6 is a comparison of different pediatric dental procedures performed between March and July 2019 and 2020.

What emerges at first sight, is that the trend regarding treatments in 2019 and 2020 was similar: indeed, restorative treatments prevailed both in 2019 (47.78%) and 2020 (42.02%), followed by preventive ones with 25.71% in 2019 and 24.42% in 2020 (46). However, it is interesting to note that when talking about emergency treatment the trend is now reversed with a 20.87% in 2020 while only 10.64% in 2019 (46).

What is showed here is that in 2019 the least treatments performed were the emergency ones while in 2020 the least ones were the elective. During the pandemic, pediatric physicians had to focus more on treating emergencies because they were not able to detect or treat cases upstream of the emergency itself.

Categories	Procedures performed	2019	2020
Emergency	Extraction	750	267
	Opening Of Pulp Chamber To	253	44
	Relive Pressure/Pain,	8	1
	Draining Of Abscess	2	1
	Stabilizing Fracture/Bleeding	4	2
	Splinting of teeth following	6	1
	trauma	8	3
	Biopsy		
	Suture Removal		
Restorative	Pulpectomy	1268	163
	Pulpotomy	83	10
	pulp capping	159	19
	stainless steel crowns	929	58
	Strip crowns	317	45
	Composite restorations (only	548	86
	decay not aesthetic)	883	158
	Glass ionomer cement	26	12
	restorations (GIC)	381	78
	Silver diamine fluoride	34	3
	application.		
	Root Canal Treatment		
	Apexification		
Preventive	Preventive Resin Restorations	616	90
	Pit and fissure sealants	790	195
	Fluoride Varnish	278	30
	Fluoride Gel	615	11
	Space Maintainer	193	41
Elective	Scaling	1251	152
	Orthodontic appliance	112	15
	Aesthetic Procedures	175	24
Total		9689	1509

Figure 7: Pediatric dental procedures classified based on nature of treatment performed in 2019 and pandemic lockdown 2020 (46)

This figure completes the one seen above and describes the various treatments performed under each category during 2019/20. It is noted that in the emergency category, the main procedure performed was the extraction (46).

Finally, the prevalence of emergency treatment during the pandemic, which accounted for 21% of cases, was higher than during 2019 (11%). This higher tendency could be attributed to the effect of lockdowns and government regulations to stem the progression of the virus, which created a lack of oral care providers for children (46).

In total, during the SARS-CoV-2 pandemic, as part of emergency pain management: 242 extractions, 163 pulpectomies, 61 root canal treatments, 44 access openings and 10 pulpotomies were performed in Tamil Nadu's hospital; whereas dental procedures regrouping pulpectomy, pulpotomy and non-surgical root canal treatment were considered non-urgent dental care during the pandemic (45).

The second relevant study was carried out in Brazil, and it was able, by analyzing Brazilian national public health system, to show a decrease in pediatric treatments performed for the same periods before and during the pandemic (50).

To do so, the authors used two time points: the first being February 2020, when the first case of COVID-19 was described in Brazil; the second was April which corresponds to the period of exponential growth of the outbreak. These 2 time points, together with months from April to May of 2020 were compared with the respective ones in 2019 (51).

Thereby, a 66% reduction was observed on pediatric treatments performed regarding the first COVID-19 case (51). Similar results were noticed in restorative, tooth extraction and endodontics. Intriguingly when considering the period of exponential growth of the infection in April 2020, a drastic reduction of 89% in pediatric dentistry procedures was spotted (51).

Pediatric procedures performed in public service came close to a full shutdown when the study was done comparing April and May from 2020 to the corresponding months in 2019 (51). For all procedures, identical findings were observed (51).

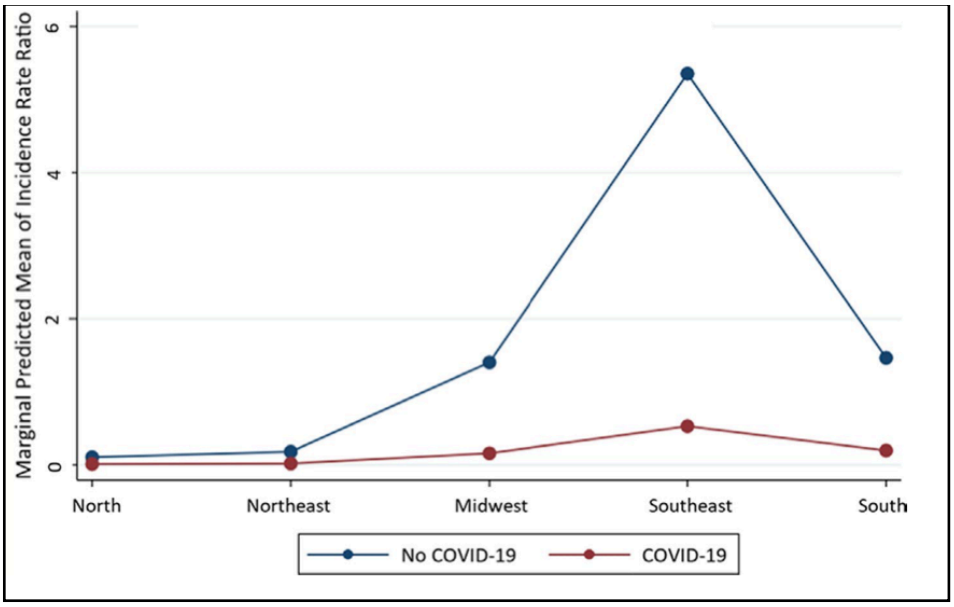


Figure 8: Total pediatric procedures performed in the Brazilian National Public Health System according to the COVID-19 pandemic and Brazilian regions (51)

The overall findings of this research is that the SARS-CoV-2 pandemic had a strong and negative effect on the pediatric treatments performed in the Brazilian Public Health System, especially when the pandemic began to develop exponentially (51).

Similarly, this decline has been found in all procedures, and these findings are the result of social isolation, quarantine, and health and sanitary guidelines to limit dental care practices, thus aiming to prevent spreading of the disease (51).

While the decline was important given the start of the pandemic, the reduction in treatments was drastic as the pandemic began to grow exponentially (51).

The observed decline in pediatric procedures was even more significant when the months of April and May, when the pandemic was spreading out of control, were compared to the same ones of 2019 (51).

The decrease in pediatric care was also different among the regions of Brazil, with a greater decrease in the Southeast Region (Figure 8).

However, the sudden and continuous interruption of dental care could increase the already overloaded demand and in the future, overwhelm the services (52).

4. Birth of a preventive pediatric dentistry during COVID-19

SARS-CoV-2 pandemic did not only have negative outcomes; Chi *et al*. have demonstrated that conventional drilling of tooth decay in children could be replaced by preventive measures. This replacement has for goal to avoid risk of contamination by aerosols. The authors used sealants, silver diamine fluoride as preventive measures to avoid tooth decays advancement in primary dentition; another conservative approach used was the direct placement of a crown without drilling the decay or reshaping the tooth thus avoiding any aerosols and also less time-consuming and more cost-effective (53).

5. Vaccine: A concrete solution?

Dental care providers play a relevant role in the importance of vaccination in order to control this pandemic. As healthcare providers, it is very important for the dental team to know all the relevant facts about the vaccination and the current pandemic, and to remain aware about the different adverse effects, different stages of vaccination and the benefits of immunization.

Now, dentists can be vaccinated but the remaining professionals in the dental team, as hygienists, dental assistant are not reported.

It is considered as good news for the health care professionals but the recent emergence of new coronaviruses strains that are described as more-contagious in many areas of the world, tend to present a loss of efficacy of these vaccines along the time. The last information updated about this new variant is this widely detection in Brazil (54).

However, the rapid authorization of Pfizer Vaccine against COVID-19 which is considered as the best vaccine for the moment, do not resolve the lack of doses at European level. The importance to rapidly vaccinate as many people as possible is undeniable to contemplate probably a return to normalcy (55).

A study supervised by Drs Yang and Zhao revealed the reason of the lower incidence of cases of SARS-CoV-2 in pediatric patients. Indeed, they present more IgG than adolescents or adults, which allow them to decrease the risk of developing severe symptoms. However, for those same reasons previously cited, children still represent a dangerous way to transmit the virus (56).

For the moment, concerning the different vaccines, there are no trials on children under 6 years old for ethical and safety reasons. Oxford/Astrazeneca is the only one who started trials in phase II on February 2021 for children from 6 to 17 years old. Pfizer and Moderna started trials for children from 12 to 15 and 17 years old respectively. Pfizer is the only one injecting children with the vaccine from 12 years old and no secondary effects was reported until today (57).

Therefore, for now fighting this infection by vaccinating the whole population does not completely resolve the issues at hand, but it is on a good path to a return to normal life.

CONCLUSION

The current pandemic of COVID-19 mainly influenced pediatric dentistry in a negative way, with many children who were left without dental treatment. This decrease in treatments was either due to economic reasons, as well as a high level of anxiety developed by parents and/or dentists towards the risk of infection which in part led to the closing of many dental clinics all around the world. Fortunately, the majority of health professionals, especially dentists, quickly became aware of the risk of being infected in their workplace. For the most part, despite a chaotic start due to a lack of means and general knowledge of the virus, they were able to update and prepare themselves progressively, in order, at least, to be able to treat dental emergencies despite elective treatments. Through the various means of communication, dental prevention is at its highest level.

On the children's side, an improvement of the dental hygiene was noted by the parents, despite a disturbed rhythm for a majority of them.

Today, the more in-depth knowledge of the pandemic allows a slight return to normal, with the reopening of several pediatric dentists to also treat non-emergency dental care. As it is notified, COVID-19 pandemic has brought many problems, for which, many have not yet been resolved; but on the other hand it allowed the birth of a pediatric dentistry turned on prevention and on more conservative treatments.

However, the myth of Dentist being synonymous of pain has not decreased, and it will certainly not improve for coming years with all the mandatory sanitary measures in dental setting.

Will all this in mind, it is only natural to wonder if a future dentistry is being set up? How to treat the child, while being safe, in an even more reassuring atmosphere than before? And will Pediatric dentists consider it as the new challenge?

RESPONSIBILITY

This work is important because it is explaining the impacts of a new disease on the pediatric dentistry, and also how health professionals have adapted and faced these new challenges. It also allowed to put in evidence the « positive » aspects of the COVID-19 pandemic on the pediatric dentistry: Indeed, pediatric dentists had to adapt to this new situation and find new ways to treat their patients; they focused more on developing preventive measures and found out that some treatments were actually not recommended and that dentists were to prompt to drill cavities and fill them with composite, but we discovered that some materials like silver diamine fluoride could slow down the advance of caries and even treat them. Also, this work has gathered in one place all the relevant information regarding the management of this infectious disease. Indeed, during this pandemic, pediatric dentists have put in place numerous measures and developed new protocols to prevent any contamination. It is crucial to remind that this virus and its consequences are still not fully understood and that this paper has permitted to show that a lot of decisions have been made and which ones brought positive outcomes to the challenges faced.

Therefore, by investigating the literature related to the impact of COVID-19 pandemic on pediatric dentistry, this work provides grounds for dental and oral healthcare workers to allow a better understanding of the impact of the pandemic.

Finally, this work raises and answers different questions related to what opportunities emerged from this disaster. Indeed, this pandemic could allow the birth of a oral healthcare system that works and is accessible to all. A system that supports the most vulnerable and that is focused on prevention and that not only works for children but also for practitioners.

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ANNEXES

viruses

MDPI

Review

Virology, Epidemiology, Pathogenesis, and Control of COVID-19

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Abstract: The outbreak of emerging severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease (COVID-19) in China has been brought to global attention and declared a pandemic by the World Health Organization (WHO) on March 11, 2020. Scientific advancements since the pandemic of severe acute respiratory syndrome (SARS) in 2002~2003 and Middle East respiratory syndrome (MERS) in 2012 have accelerated our understanding of the epidemiology and pathogenesis of SARS-CoV-2 and the development of therapeutics to treat viral infection. As no specific therapeutics and vaccines are available for disease control, the epidemic of COVID-19 is posing a great threat for global public health. To provide a comprehensive summary to public health authorities and potential readers worldwide, we detail the present understanding of COVID-19 and introduce the current state of development of measures in this review.

Keywords: SARS-CoV-2; COVID-19; epidemiology; pathogenesis; therapeutics

1. Introduction

At the end of 2019, a cluster of pneumonia patients with an unidentified cause emerged in Wuhan, Hubei Province, China [1]. Since then, outbreaks and sporadic human infections have resulted in more than 80,000 laboratory confirmed cases (update on March 23, 2020) across mainland China. Through the analysis of sequence, this unidentified pneumonia was considered to be caused by a novel coronavirus (CoV) named 2019-nCoV [2]. Subsequently, the World Health Organization (WHO) announced a standard format of Coronavirus Disease-2019 (COVID-19), according to its nomenclature, for this novel coronavirus pneumonia on February 11, 2020 [3]. On the same day, the International Committee on Taxonomy of Viruses (ICTV) named this novel coronavirus as SARS-CoV-2 [4]. So far, the SARS-CoV-2 infection is still spreading, and this virus poses a serious threat to public health, though joint prevention and quarantine mechanisms in almost all provinces of mainland China have been confirmed to be enacted. Due to a lack of specific antiviral treatments and pressure of clinical treatment, thousands of severe cases have died every day worldwide. In this review, we discuss the virology, clinical and molecular epidemiology, diagnosis, pathogenesis, and potential therapeutics for treatment of this infection.

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Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia

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ABSTRACT

BACKGROUND

The initial cases of novel coronavirus (2019-nCoV)–infected pneumonia (NCIP) occurred in Wuhan, Hubei Province, China, in December 2019 and January 2020. We analyzed data on the first 425 confirmed cases in Wuhan to determine the epidemiologic characteristics of NCIP.

METHODS

We collected information on demographic characteristics, exposure history, and illness timelines of laboratory-confirmed cases of NCIP that had been reported by January 22, 2020. We described characteristics of the cases and estimated the key epidemiologic time-delay distributions. In the early period of exponential growth, we estimated the epidemic doubling time and the basic reproductive number.

RESULTS

Among the first 425 patients with confirmed NCIP, the median age was 59 years and 56% were male. The majority of cases (55%) with onset before January 1, 2020, were linked to the Huanan Seafood Wholesale Market, as compared with 8.6% of the subsequent cases. The mean incubation period was 5.2 days (95% confidence interval [CI], 4.1 to 7.0), with the 95th percentile of the distribution at 12.5 days. In its early stages, the epidemic doubled in size every 7.4 days. With a mean serial interval of 7.5 days (95% CI, 5.3 to 19), the basic reproductive number was estimated to be 2.2 (95% CI, 1.4 to 3.9).

CONCLUSIONS

On the basis of this information, there is evidence that human-to-human transmission has occurred among close contacts since the middle of December 2019. Considerable efforts to reduce transmission will be required to control outbreaks if similar dynamics apply elsewhere. Measures to prevent or reduce transmission should be implemented in populations at risk. (Funded by the Ministry of Science and Technology of China and others.)

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BRIEF REPORT

A Novel Coronavirus from Patients with Pneumonia in China, 2019

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SUMMARY

In December 2019, a cluster of patients with pneumonia of unknown cause was linked to a seafood wholesale market in Wuhan, China. A previously unknown betacoronavirus was discovered through the use of unbiased sequencing in samples from patients with pneumonia. Human airway epithelial cells were used to isolate a novel coronavirus, named 2019-nCoV, which formed a clade within the subgenus sarbecovirus, Orthocoronavirinae subfamily. Different from both MERS-CoV and SARS-CoV, 2019-nCoV is the seventh member of the family of coronaviruses that infect humans. Enhanced surveillance and further investigation are ongoing. (Funded by the National Key Research and Development Program of China and the National Major Project for Control and Prevention of Infectious Disease in China.)

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Emerging and reemerging pathogens are global challenges for public health.[1] Coronaviruses are enveloped RNA viruses that are distributed broadly among humans, other mammals, and birds and that cause respiratory, enteric, hepatic, and neurologic diseases.[2,3] Six coronavirus species are known to cause human disease.[4] Four viruses — 229E, OC43, NL63, and HKU1 — are prevalent and typically cause common cold symptoms in immunocompetent individuals.[4] The two other strains — severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV) — are zoonotic in origin and have been linked to sometimes fatal illness.[5] SARS-CoV was the causal agent of the severe acute respiratory syndrome outbreaks in 2002 and 2003 in Guangdong Province, China.[6-8] MERS-CoV was the pathogen responsible for severe respiratory disease outbreaks in 2012 in the Middle East.[9] Given the high prevalence and wide distribution of coronaviruses, the large genetic diversity and frequent recombination of their genomes, and increasing human–animal interface activities, novel coronaviruses are likely to emerge periodically in humans owing to frequent cross-species infections and occasional spillover events.[5,10]

In late December 2019, several local health facilities reported clusters of patients with pneumonia of unknown cause that were epidemiologically linked to a seafood and wet animal wholesale market in Wuhan, Hubei Province, China.[11] On December 31, 2019, the Chinese Center for Disease Control and Prevention (China CDC) dispatched a rapid response team to accompany Hubei provincial and Wuhan city health authorities and to conduct an epidemiologic and etiologic investigation. We report the results of this investigation, identifying the source of the pneumonia

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The species *Severe acute respiratory syndrome-related coronavirus*: classifying 2019-nCoV and naming it SARS-CoV-2

Coronaviridae Study Group of the International Committee on Taxonomy of Viruses*

The present outbreak of a coronavirus-associated acute respiratory disease called coronavirus disease 19 (COVID-19) is the third documented spillover of an animal coronavirus to humans in only two decades that has resulted in a major epidemic. The *Coronaviridae* Study Group (CSG) of the International Committee on Taxonomy of Viruses, which is responsible for developing the classification of viruses and taxon nomenclature of the family *Coronaviridae*, has assessed the placement of the human pathogen, tentatively named 2019-nCoV, within the *Coronaviridae*. Based on phylogeny, taxonomy and established practice, the CSG recognizes this virus as forming a sister clade to the prototype human and bat severe acute respiratory syndrome coronaviruses (SARS-CoVs) of the species *Severe acute respiratory syndrome-related coronavirus*, and designates it as SARS-CoV-2. In order to facilitate communication, the CSG proposes to use the following naming convention for individual isolates: SARS-CoV-2/host/location/isolate/date. While the full spectrum of clinical manifestations associated with SARS-CoV-2 infections in humans remains to be determined, the independent zoonotic transmission of SARS-CoV and SARS-CoV-2 highlights the need for studying viruses at the species level to complement research focused on individual pathogenic viruses of immediate significance. This will improve our understanding of virus–host interactions in an ever-changing environment and enhance our preparedness for future outbreaks.

Upon a viral outbreak, it is important to rapidly establish whether the outbreak is caused by a new or a previously known virus (Box 1), as this helps decide which approaches and actions are most appropriate to detect the causative agent, control its transmission and limit potential consequences of the epidemic. The assessment of virus novelty also has implications for virus naming and, on a different timescale, helps to define research priorities in virology and public health.

For many human virus infections such as influenza virus[1] or norovirus[2] infections, well-established and internationally approved methods, standards and procedures are in place to identify and name the causative agents of these infections and report this information promptly to public health authorities and the general public. In outbreaks involving newly emerged viruses, the situation may be different, and appropriate procedures to deal with these viruses need to be established or refined with high priority.

Here, we present an assessment of the genetic relatedness of the newly identified human coronavirus[3], provisionally named 2019-nCoV, to known coronaviruses, and detail the basis for (re)naming this virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which will be used hereafter. Given the public interest in naming newly emerging viruses and the diseases caused by these viruses in humans, we will give a brief introduction to virus discovery and classification — specifically the virus species concept — and the roles of different bodies, such as the World Health Organization (WHO) and the International Committee on Taxonomy of Viruses (ICTV), in this process. We hope this will help readers to better understand the scientific approach we have taken to arrive at this name, and we will also discuss implications of this analysis and naming decision.

Classifying and naming viruses and virus species

Defining the novelty of viruses is one of the topics that virus classification deals with. The classification of RNA viruses needs to consider their inherent genetic variability, which often results in two or more viruses with non-identical but similar genome sequences being regarded as variants of the same virus. This immediately poses the question of how much difference to an existing group is large enough to recognize the candidate virus as a member of a new, distinct group. This question is answered in best practice by evaluating the degree of relatedness of the candidate virus to previously identified viruses infecting the same host or established monophyletic groups of viruses, often known as genotypes or clades, which may or may not include viruses of different hosts. This is formally addressed in the framework of the official classification of virus taxonomy and is overseen and coordinated by the ICTV[4]. Viruses are clustered in taxa in a hierarchical scheme of ranks in which the species represents the lowest and most populous rank containing the least diverged groups (taxa) of viruses (Box 2). The ICTV maintains a Study Group for each virus family. The Study Groups are responsible for assigning viruses to virus species and taxa of higher ranks, such as subgenera, genera and subfamilies. In this context they play an important role in advancing the virus species concept and highlighting its significance[5].

Virus nomenclature is a formal system of names used to label viruses and taxa. The fact that there are names for nearly all viruses within a species is due to the historical perception of viruses as causative agents of specific diseases in specific hosts, and to the way we usually catalogue and classify newly discovered viruses, which increasingly includes viruses that have not been linked to any known disease in their respective hosts (Box 1). The WHO, an agency of the United Nations, coordinates international public health activities aimed at combating, containing and mitigating the consequences of communicable diseases—including major virus epidemics—and is responsible for naming disease(s) caused by newly emerging human viruses. In doing so, the WHO often takes the traditional approach of linking names of specific diseases to viruses (Box 1) and

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REVIEW

The emergence of SARS, MERS and novel SARS-2 coronaviruses in the 21st century

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Abstract
At the beginning of the 21st century, a new deadly infectious disease known as severe acute respiratory syndrome (SARS) was recognized as a global public health threat. Subsequently, ten years after the initial SARS cases occurred in 2002, new cases of another atypical respiratory disease caused worldwide concern. This disease became known as Middle East respiratory syndrome (MERS) and was even more lethal than SARS. Currently, history has repeated itself with the emergence of a new Chinese epidemic at the end of 2019. For this respiratory disease, called COVID-19, a novel coronavirus (SARS-CoV-2) was identified as the etiologic agent. In sum, SARS, MERS and COVID-19 are caused by recently discovered coronaviruses that cause flu-like illnesses, but with a clinical outcome that tends to be more severe. As a result of the current importance of coronaviruses in global public health, we conducted a review to summarize and update, above all, the epidemiological historical aspects of the three major diseases in humans caused by coronaviral infection.

Introduction

Prior to the 21st century, coronaviruses (CoVs) were considered pathogens of great relevance in veterinary medicine but with a reduced impact on human health [1–4]. However, a greater global concern for CoVs in human health began with the epidemic of severe acute respiratory syndrome (SARS) in 2002-2003 and Middle East respiratory syndrome (MERS) in 2012 [5–8]. In addition, at the end of December 2019, another CoV outbreak emerged, again causing global concern in human public health [9–13].

The family *Coronaviridae* includes enveloped viruses with a positive-sense, single-stranded RNA genome of approximately 30 kb in size. Consequently, they have the largest genomes of RNA viruses. Based on their antigenic and genetic properties, CoVs are organized into four genera: *Alphacoronavirus*, *Betacoronavirus*, *Gammacoronavirus*, and *Deltacoronavirus*. SARS-CoV and MERS-CoV belong to the genus *Betacoronavirus* [14, 15]. Recently, full-genome sequencing and phylogenetic analysis of the novel SARS-CoV-2 (previously known as 2019-nCoV) grouped it in the same genus [16, 17].

Four main proteins are encoded by the coronaviral genome: spike (S), envelope (E), membrane (M) and nucleocapsid (N). Each protein plays an individual role in the structure of the viral particle, but they are also involved in other functions of the replication cycle [14, 15]. For more details, see Fig. 1 and the supplementary file.

CoVs infect birds (γ- and δ-CoVs) and several species of mammals (mainly α- and β-CoVs), including humans [14, 15, 18]. A review of recent sequences in databases has shown that all human CoVs are of animal origin [19–23]. SARS-CoV-2, SARS-CoV, MERS-CoV, HCoV-229E and HCoV-NL63 probably originated from bats, whereas HCoV-OC43 and HKU1 probably originated from rodents [23, 24]. It is important to highlight that bats, which are considered the primordial hosts, can have different viral populations in the same species, facilitating recombination and the emergence of new variants [22, 25]. These new variants are capable of infecting intermediate hosts, and the combination of deletion

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COVID-19: a novel zoonotic disease caused by a coronavirus from China: what we know and what we don't

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At the end of December, 2019, a new disease of unknown aetiology appeared in Wuhan, China. It was quickly identified as a novel betacoronavirus, and related to SARS-CoV and a number of other bat-borne SARS-like coronaviruses. The virus rapidly spread to all provinces in China, as well as a number of countries overseas, and was declared a Public Health Emergency of International Concern by the Director-General of the World Health Organization on 30 January 2020. This paper describes the evolution of the outbreak, and the known properties of the novel virus, SARS-CoV-2 and the clinical disease it causes, COVID-19, and comments on some of the important gaps in our knowledge of the virus and the disease it causes. The virus is the third zoonotic coronavirus, after SARS-CoV and MERS-CoV, but appears to be the only one with pandemic potential.

An outbreak of cases of pneumonia of unknown aetiology in the city of Wuhan in Hubei Province, China, was announced and notified to the World Health Organization (WHO) by the Wuhan Municipal Health Commission on 31 December 2019[1]. The outbreak was linked epidemiologically to the Hua Nan seafood and wet animal wholesale market in Wuhan, and the market was subsequently closed on 1 January 2020. A week later, on 7 January, the isolation of a previously unknown betacoronavirus was reported as the aetiological agent.

Wuhan is a city of 11 million inhabitants and is a major transport hub, and over the ensuing weeks the virus spread to other provinces in China and later to an increasing number of other countries. This spread prompted the WHO Director-General to establish an Emergency Committee (EC) under the International Health Regulations (IHR). The EC recommended that the outbreak constituted a public health emergency of international concern at its meeting on 30 January[2]. In so doing, the Committee believed that it was still possible to interrupt virus spread, provided that countries put in place strong measures to detect disease early, isolate and treat cases, trace contacts, and promote social distancing measures commensurate with the risk.

The city of Wuhan was placed in quarantine by the Chinese Government on 23 January, stopping all rail, road and air transport out of the city. The quarantine was subsequently extended to a further 17 cities in Hubei Province, affecting over 57 million people, which was particularly challenging as it came two days before the Chinese New Year, the most important festival in the country, and traditionally the peak traveling season. Since then there have been increasing measures to control and manage the epidemic within China, and the introductions of numerous travel restrictions by other countries that either have had cases or are trying to prevent entry.

Early events in determining the identity and origin of the novel coronavirus

Whole virus genome sequences were obtained either directly from patient samples or from cultured viruses from a number of patients hospitalised with pneumonia in Wuhan, showing that the aetiological agent was a betacoronavirus belonging to a new clade in

PERSPECTIVE

COVID-19 Considerations in Pediatric Dentistry

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Abstract: *One of the most important current medical concerns across the globe is the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, which has been designated by the World Health Organization as a novel viral pneumonia named coronavirus disease 2019 (COVID-19). COVID-19 has substantially affected all aspects of human lives and forced most people to self-quarantine themselves and stay home in order to remain safe. As pediatric dentists as a part of the health care system deferring elective procedures, we are obliged to manage emergency situations such as cellulitis, severe tooth pain, and dental trauma. Therefore, we need to beware of the symptoms and risks of the emerging disease and, accordingly, change the policies in our offices to minimize the risk of transmission while checking up and treating our patients in the safest possible way.*

Knowledge Transfer Statement: *This article aims to acquaint clinicians treating pediatric patients with COVID-19 hazards and delineate the steps required for minimizing cross-infection in case of providing emergency treatment to children in dental offices.*

Keywords: coronavirus, virology, dental care for children, infection control, transmission, dental practice management

Coronavirus disease 2019 (COVID-19), designated as a pandemic disease, has globally affected many countries (World Health Organization 2020). Yet, no one can precisely predict when a definitive drug therapy and/or vaccine will be available. Pediatric dentists play pivotal roles in the health care system by continuing to manage emergency dental situations while taking special measures to practice universal infection control. The common transmission routes of this novel virus include direct transmission through coughing, sneezing, and droplet inhalation as well as contact transmission via oral, nasal, and eye mucous membranes (National Center for Immunization and Respiratory Diseases 2020). Eye (conjunctival) exposure has also been declared as another way through which the virus enters the body (Lu et al. 2020). Airborne transmission of COVID-19 through aerosols produced in medical procedures is another probable route of transmission that could be very urgent in dental procedures (Wax and Christian 2020). The incubation period has been reported to be 1 to 14 d, although there are some reports showing that even those without symptoms during the incubation period can spread the virus (Guan et al. 2020; Huang et al. 2020).

Latif Panahi et al., in a systemic review study of 14 full-text articles regarding clinical features of COVID-19 infection in newborns and pediatrics, showed that children with this infection can be completely asymptomatic or have mild and moderate symptoms. Ogimi et al. (2019) showed that young age, especially younger than school age; underlying disease; and immunosuppression are predictors of disease severity. Clinical manifestation of COVID-19 infection in children include fever, dry cough, fatigue, symptoms of upper respiratory tract infection (runny nose), and gastrointestinal symptoms (anorexia, diarrhea, nausea, and vomiting) (Panahi et al. 2020). The most common symptoms are fever and dry cough, and unlike adults, inferior respiratory tract (portion of the larynx below the vocal folds, trachea, bronchi and bronchioles) infection rarely occurs in children (Wu and McGoogan 2020; Zhou et al. 2020). According to the report on 10 children affected by COVID-19 in China, symptoms in children were nonspecific,

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Situation updates on COVID-19
Latest situation update for the EU/EEA
Latest situation update worldwide
Weekly country overview
Weekly maps in support of the Council Recommendation
Weekly surveillance report
Vaccine rollout overview
Download COVID-19 datasets

COVID-19 situation update worldwide, as of week 16, updated 29 April 2021

ECDC switched to a weekly reporting schedule for the COVID-19 situation worldwide and in the EU/EEA and the UK on 17 December 2020. Hence, all daily updates have been discontinued from 14 December. ECDC will publish updates on the number of cases and deaths reported worldwide and aggregated by week every Thursday. The weekly data will be available as downloadable files in the following formats: XLSX, CSV, JSON and XML.

With the switch from daily to weekly reporting, ECDC will shift its Epidemic Intelligence (EI) resources from case counting to signal/event detection and resume its regular EI activities, which will include COVID-19 signal and event detection and analysis but also other potential threats.

Data presented on this page are collected between Monday and Wednesday for the preceding week and published on Thursdays

CHAPTER 4

Coronavirus Pathogenesis

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Host Factors in Coronavirus Replication

Adriaan H. de Wilde, Eric J. Snijder, Marjolein Kikkert and Martijn J. van Hemert

Abstract Coronaviruses are pathogens with a serious impact on human and animal health. They mostly cause enteric or respiratory disease, which can be severe and life threatening, e.g., in the case of the zoonotic coronaviruses causing severe acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS) in humans. Despite the economic and societal impact of such coronavirus infections, and the likelihood of future outbreaks of additional pathogenic coronaviruses, our options to prevent or treat coronavirus infections remain very limited. This highlights the importance of advancing our knowledge on the replication of these viruses and their interactions with the host. Compared to other +RNA viruses, coronaviruses have an exceptionally large genome and employ a complex genome expression strategy. Next to a role in basic virus replication or virus assembly, many of the coronavirus proteins expressed in the infected cell contribute to the coronavirus-host interplay. For example, by interacting with the host cell to create an optimal environment for coronavirus replication, by altering host gene expression or by counteracting the host's antiviral defenses. These coronavirus–host interactions are key to viral pathogenesis and will ultimately determine the outcome of infection. Due to the complexity of the coronavirus proteome and replication cycle, our knowledge of host factors involved in coronavirus replication is still in an early stage compared to what is known for some other +RNA viruses. This review summarizes our current understanding of coronavirus–host interactions at the level of the infected cell, with special attention for the assembly and function of the viral RNA-synthesising machinery and the evasion of cellular innate immune responses.

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Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia (Trial Version 7)

(Released by National Health Commission & National Administration of Traditional Chinese Medicine on March 3, 2020)

Since December 2019, multiple cases of novel coronavirus pneumonia (COVID-19) have been identified in Wuhan, Hubei. With the spread of the epidemic, such cases have also been found in other parts of China and other countries. As an acute respiratory infectious disease, COVID-19 has been included in Class B infectious diseases prescribed in the Law of the People's Republic of China on Prevention and Treatment of Infectious Diseases, and managed as an infectious disease of Class A. By taking a series of preventive control and medical treatment measures, the rise of the epidemic situation in China has been contained to a certain extent, and the epidemic situation has eased in most provinces, but the incidence abroad is on the rise. With increased understanding of the clinical manifestations and pathology of the disease, and the accumulation of experience in diagnosis and treatment, in order to further strengthen the early diagnosis and early treatment of the disease, improve the cure rate, reduce the mortality rate, avoid nosocomial infection as much as possible and pay attention to the spread caused by the imported cases from overseas, we revised the *Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia (Trial Version 6)* to *Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia (Trial Version 7)*.

I. Etiological Characteristics

The novel coronaviruses belong to the β genus. They have envelopes, and the particles are round or oval, often polymorphic, with diameter being 60 to 140 nm. Their genetic characteristics are significantly different from SARS-CoV and MERS-CoV. Current research shows that they share more than 85% homology with bat SARS-like coronaviruses (bat-SL-CoVZC45). When isolated and cultured *in vitro*, the 2019-nCoV can be found in human respiratory epithelial cells in about 96 hours, however, it takes about 6 days for the virus to be found if isolated and cultured in Vero E6 and Huh-7 cell lines.

Most of the knowledge about the physical and chemical properties of coronavirus comes from the research on SARS-CoV and MERS-CoV. The virus is sensitive to ultraviolet and heat. Exposure to 56°C for 30 minutes and lipid solvents such as ether, 75% ethanol, chlorine-containing disinfectant, peracetic acid, and chloroform can effectively inactivate the virus. Chlorhexidine has not been effective in inactivating the virus.

II. Epidemiological Characteristics

1. Source of infection

Currently, the patients infected by the novel coronavirus are the main source of infection; asymptomatic infected people can also be an infectious source.

2. Route of transmission

Transmission of the virus happens mainly through respiratory droplets and close contact. There is the possibility of aerosol transmission in a relatively closed environment for a long-time exposure to high concentrations of aerosol. As the novel coronavirus can be isolated in feces and urine, attention should be paid to feces or urine contaminated environment that may lead to aerosol or contact transmission.

3. Susceptible groups

People are generally susceptible.

III. Pathological Changes

Pathologic findings from limited autopsies and biopsy studies are summarized below:

1. Lungs

Variable consolidation is present in the lungs.

The alveoli are filled with fluid and fibrin with hyaline membrane formation. Macrophages and many multinucleated syncytial cells are identified within the alveolar exudates. Type II pneumocytes show marked hyperplasia and focal desquamation. Viral inclusions are observed in type II pneumocytes and macrophages. In addition, there is

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Epidemiological and clinical features of the 2019 novel coronavirus outbreak in China

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RESEARCH ARTICLE

Single-cell RNA-seq data analysis on the receptor ACE2 expression reveals the potential risk of different human organs vulnerable to 2019-nCoV infection

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Abstract **It has been known that, the novel coronavirus, 2019-nCoV, which is considered similar to SARS-CoV and originated from Wuhan (China), invades human cells via the receptor angiotensin converting enzyme II (ACE2). Moreover, lung cells that have ACE2 expression may be the main target cells during 2019-nCoV infection. However, some patients also exhibit non-respiratory symptoms, such as kidney failure, implying that 2019-nCoV could also invade other organs. To construct a risk map of different human organs, we analyzed the single-cell RNA sequencing (scRNA-seq) datasets derived from major human physiological systems, including the respiratory, cardiovascular, digestive, and urinary systems. Through scRNA-seq data analyses, we identified the organs at risk, such as lung, heart, esophagus, kidney, bladder, and ileum, and located specific cell types (i.e., type II alveolar cells (AT2), myocardial cells, proximal tubule cells of the kidney, ileum and esophagus epithelial cells, and bladder urothelial cells), which are vulnerable to 2019-nCoV infection. Based on the findings, we constructed a risk map indicating the vulnerability of different organs to 2019-nCoV infection. This study may provide potential clues for further investigation of the pathogenesis and route of 2019-nCoV infection.**

Keywords 2019-nCoV; ACE2; single-cell RNA-seq

Introduction

On January 30, 2020, the World Health Organization (WHO) declared the novel coronavirus 2019-nCoV outbreaks that started in December 2019 in Wuhan, China as a Public Health Emergency of International Concern [1]. Experts and scientists worldwide are working rapidly to expand scientific knowledge on this new virus. In addition to respiratory symptoms, such as cough and shortness of breath, clinical manifestations including multiple organ failure were also observed, which is unusual with other coronavirus infections.

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The initial step of 2019-nCoV infection is its entrance into human cells. The analysis of Xu *et al.* [2] showed that the 2019-nCoV and the SARS-CoV share a common ancestor that resembles the bat coronavirus HKU9-1. These coronaviruses have very similar spike protein 3-D structures that are considered to have strong binding affinity to the human cell receptor, angiotensin-converting enzyme 2 (ACE2). Therefore, the cells with ACE2 expression may act as target cells and thus are susceptible to 2019-nCoV infection; such cells include type II alveolar cells (AT2) of the lungs [3]. Hence, we believe that the ACE2 expression pattern in different organs, tissues, and cell types could uncover the potential risk to 2019-nCoV infection because the target cells expressing ACE2 might permit coronavirus entry, multiplication, spread, and pathogenesis. Previously, the RNA and protein expressions of ACE2 were investigated using bulk samples from the heart, lung, kidney, and other organs. However, these bulk data only consider average expression and utterly ignore

Two Things About COVID-19 Might Need Attention

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Keywords: COVID-19, Adipose tissue, Cancer, ACE2

Abstract

The spread of 2019 novel coronavirus disease (COVID-19) throughout the world has been a severe challenge for public health. The human angiotensin-converting enzyme 2 (ACE2) has a remarkably high affinity binding to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). By the search for network database and re-analysis of pubic data, we found the level of ACE2 expression in adipose tissue was higher than that in lung tissue, which indicated the

国务院办公厅转发国家卫生健康委、人力资源社会保障部、财政部《关于改善一线医务人员工作条件切实关心医务人员身心健康若干措施》的通知

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新华社北京2月11日电 2月11日，国务院办公厅转发国家卫生健康委、人力资源社会保障部、财政部《关于改善一线医务人员工作条件切实关心医务人员身心健康若干措施》的通知（以下简称通知）。

通知指出，新冠肺炎疫情发生以来，广大医务人员积极响应党中央号召，英勇奋战在抗击疫情的最前线。当前，全国疫情防控进入关键时期，医务人员面临着工作任务重、感染风险高、工作和休息条件有限、心理压力大等困难。保护关爱医务人员是打赢疫情防控阻击战的重要保障。

通知就改善一线医务人员工作条件，切实关心医务人员身心健康提出七方面措施。一要改善医务人员工作和休息条件。加强医务人员职业暴露的防护设施建设和设备配置，重点改造医生办公室、值班室和休息室。为医务人员提供良好后勤服务，保障医务人员充足的睡眠和饮食。二要维护医务人员身心健康。合理安排医务人员作息时间。对于因执行疫情防控不能休假的医务人员，在防控任务结束后，由所在医疗卫生机构优先安排补休。允许需要紧急补充医护人员等疫情防控工作人员的相关医疗卫生机构简化招聘程序。加强医务人员个人防护，组织做好一线医务人员健康体检，最大限度减少院内感染。加强心理危机干预和心理疏导，减轻医务人员心理压力。三要落实医务人员待遇。为疫情防控一线医务人员和防疫工作者发放临时性工作补助。向防控任务重、风险程度高的医疗卫生机构核增不纳入基数的一次性绩效工资总量。开通医务人员工伤认定绿色通道。四要提高卫生防疫津贴标准。出台提高卫生防疫津贴标准的政策。对参与新冠肺炎疫情防疫人员，要及时足额发放到位。五要加强对医务人员的人文关怀。动员组织社会力量，对一线医务人员展开慰问。为一线医务人员和家属建立沟通联络渠道。对家庭困难的一线医务人员家属进行对口帮扶。六要创造更加安全的执业环境。严格落实各项安全防范措施，加大警力投入，完善问责机制，对发现有歧视孤立一线医务人员及其家属行为的，要及时进行批评教育，情节严重的依法予以处理。对伤害医务人员的，要坚决依法严肃查处。七要弘扬职业精神做好先进表彰工作。做好及时奖励和及时性表彰工作，为做好疫情防控工作增强信心、凝聚力量。

通知强调，各地卫生健康、人力资源社会保障和财政等相关部门要按照党中央、国务院决策部署，密切配合，全力做好各项工作，切实改善一线医务人员工作条件，关心医务人员身心健康，保障医务人员权益，为坚决打赢疫情防控阻击战提供有力保障。

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EZH2-mediated H3K27me3 inhibits ACE2 expression

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ABSTRACT

The outbreak of corona virus disease 2019 (COVID-19) caused by SARS-CoV-2 infection is spreading globally and quickly, leading to emerging health issues. SARS-CoV-2 enters into and infects host cells through its spike glycoprotein recognizing the cell receptor Angiotensin-converting enzyme II (ACE2). Here, we noticed that ACE2 was further enhanced by SARS-CoV-2 infection. Human germ cells and early embryos express high level of ACE2. Notably, RNA-seq result showed that reduction of H3K27me3, but not H3K4/9/36me3, led to upregulation of Ace2 expression in mouse germ cell line GC-2. In agreement with this result, we found in human embryonic stem cells that ACE2 expression was significantly increased in absence of EZH2, the major enzyme catalyzing H3K27me3. ChIP-seq analysis further confirmed decrease of H3K27me3 signal and increase of H3K27ac signal at ACE2 promoter upon EZH2 knockout. Therefore, we propose that EZH2-mediated H3K27me3 at ACE2 promoter region inhibits ACE2 expression in mammalian cells. This regulatory pattern may also exist in other human cells and tissues. Our discovery provides clues for pathogenesis and targeted drug therapy towards ACE2 expression for prevention and adjuvant therapy of COVID-19.

1. Introduction

SARS-CoV-2 causes pneumonia-associated respiratory syndrome, like coronavirus SARS-CoV and MERS-CoV [1]. An ongoing outbreak of SARS-CoV-2 started from the Huanan Seafood Wholesale Market in Wuhan, China since December of 2019. The genome sequence of SARS-CoV-2 is 89.1% identical to bat SARS-like-CoVZXC45 and 96% identical to bat CoV RaTG13, suggesting that bat is the origin of SARS-CoV-2 [2–4]. A familial cluster of pneumonia associated with the SARS-CoV-2 and a retrospective study indicated person-to-person transmission [5]. Moreover, people seem to be generally susceptible to this strongly infectious disease. WHO has listed the novel coronavirus-infected pneumonia as Public Health Emergency of International Concern (PHEIC). Cases have already been diagnosed in dozens of countries.

The genome sequence of SARS-CoV-2 is 82% identical to SARS-CoV [4]. Angiotensin converting enzyme II (ACE2) was identified as the cell entry receptor of SARS-CoV-2 to infect human, similar to SARS-CoV [6]. ACE2 belongs to the angiotensin-converting enzyme family and catalyzes the cleavage of angiotensin II into the vasodilator angiotensin 1-7. ACE2 is enriched in the epithelia of lung [7], while single-cell RNA-seq data analysis of ACE2 expression reveals potential risks of more human organs vulnerable to SARS-CoV-2 infection [8]. In reproductive system, single-cell transcriptomes of adult human testis showed high expression of ACE2 in spermatogonia, Leydig and Sertoli cells [9]. Coronaviruses are prone to mutation and recombination due to their error-prone RNA-dependent RNA polymerase (RdRP) [10], and virus variation may allow some subtypes of the virus to better bind to the receptor ACE2. Therefore, it is very important to reveal how ACE2 expression is regulated for both prevention and treatment of the infectious diseases caused by these coronaviruses in the future.

The major epigenetic markers in mammals include covalent modifications of DNA and post-translational modifications of histones. Since the N-terminal of histone is exposed to the surface of nucleosome, histone can undergo dynamic chemical modifications including methylation, acetylation, phosphorylation and ubiquitination [11]. Methylation of H3 lysine residues such as K4, K9, K27 and K36 are intensively studied because of their high correlationship with transcriptional activity. K-to-M mutants of histone H3.3 play a dominant-negative role to suppress specific histone H3 methylation and are valuable tools for screening regulatory pattern

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Article

A pneumonia outbreak associated with a new coronavirus of probable bat origin

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Since the outbreak of severe acute respiratory syndrome (SARS) 18 years ago, a large number of SARS-related coronaviruses (SARSr-CoVs) have been discovered in their natural reservoir host, bats[1–4]. Previous studies have shown that some bat SARSr-CoVs have the potential to infect humans[5–7]. Here we report the identification and characterization of a new coronavirus (2019-nCoV), which caused an epidemic of acute respiratory syndrome in humans in Wuhan, China. The epidemic, which started on 12 December 2019, had caused 2,794 laboratory-confirmed infections including 80 deaths by 26 January 2020. Full-length genome sequences were obtained from five patients at an early stage of the outbreak. The sequences are almost identical and share 79.6% sequence identity to SARS-CoV. Furthermore, we show that 2019-nCoV is 96% identical at the whole-genome level to a bat coronavirus. Pairwise protein sequence analysis of seven conserved non-structural proteins domains show that this virus belongs to the species of *SARSr-CoV*. In addition, 2019-nCoV virus isolated from the bronchoalveolar lavage fluid of a critically ill patient could be neutralized by sera from several patients. Notably, we confirmed that 2019-nCoV uses the same cell entry receptor—angiotensin converting enzyme II (ACE2)—as SARS-CoV.

Coronaviruses have caused two large-scale pandemics in the past two decades, SARS and Middle East respiratory syndrome (MERS)[8,9]. It has generally been thought that SARSr-CoV—which is mainly found in bats—could cause a future disease outbreak[10,11]. Here we report on a series of cases caused by an unidentified pneumonia disease outbreak in Wuhan, Hubei province, central China. This disease outbreak—which started from a local seafood market—has grown substantially to infect 2,761 people in China, is associated with 80 deaths and has led to the infection of 33 people in 10 additional countries as of 26 January 2020[12]. Typical clinical symptoms of these patients are fever, dry cough, breathing difficulties (dyspnoea), headache and pneumonia. Disease onset may result in progressive respiratory failure owing to alveolar damage (as observed by transverse chest computerized-tomography images) and even death. The disease was determined to be caused by virus-induced pneumonia by clinicians according to clinical symptoms and other criteria, including a rise in body temperature, decreases in the number of lymphocytes and white blood cells (although levels of the latter were sometimes normal), new pulmonary infiltrates on chest radiography and no obvious improvement after treatment with antibiotics for three days. It appears that most of the early cases had contact history with the original seafood market; however, the disease has now progressed to be transmitted by human-to-human contact.

Samples from seven patients with severe pneumonia (six of whom are sellers or deliverymen from the seafood market), who were admitted to the intensive care unit of Wuhan Jin Yin-Tan Hospital at the beginning of the outbreak, were sent to the laboratory at the Wuhan Institute of Virology (WIV) for the diagnosis of the causative pathogen (Extended Data Table 1). As a laboratory investigating CoV, we first used pan-CoV PCR primers to test these samples[13], given that the outbreak occurred in winter and in a market—the same environment as SARS infections. We found five samples to be PCR-positive for CoVs. One sample (WIV04), collected from the bronchoalveolar lavage fluid (BALF), was analysed by metagenomics analysis using next-generation sequencing to identify potential aetiological agents. Of the 10,038,758 total reads—of which 1,582 total reads were retained after filtering of reads from the human genome—1,378 (87.1%) sequences matched the sequence of SARSr-CoV (Fig. 1a). By de novo assembly and targeted PCR, we obtained a 29,891-base-pair CoV genome that shared 79.6% sequence identity to SARS-CoV BJ01 (GenBank accession number AY278488.2). High genome coverage was obtained by remapping the total reads to this genome (Extended Data Fig. 1). This sequence has been submitted to GISAID (https://www.gisaid.org/) (accession number EPI_ISL_402124). Following the name given by the World Health Organization (WHO), we tentatively call it novel coronavirus 2019 (2019-nCoV). Four more full-length genome sequences of 2019-nCoV (WIV02, WIV05, WIV06 and

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Fast Testing Only Takes 15 Minutes: Nankai University's Team Developed Antibody Test Kit for Novel Coronavirus

Feb . 19 2020

Nankai University and scientific research teams of many domestic universities and related biomedical enterprises together successfully developed IgM/IgG antibody test kit for novel coronavirus (2019-nCoV). The fast-testing card can finish the test within around 15 minutes and it also advances in its simple operation, easy reading and high sensitivity.

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Radiology

REVIEWS AND COMMENTARY • PERSPECTIVES

Chest CT Findings in 2019 Novel Coronavirus (2019-nCoV) Infections from Wuhan, China: Key Points for the Radiologist

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From the Department of Radiology, University of Wisconsin-Madison School of Medicine and Public Health, 600 Highland Ave, Madison, WI 53792. Received January 29, 2020; revision requested January 30; received February 1; accepted February 3. **Address correspondence to** the author *(jkanne@uwhealth.org)*.

Conflicts of interest are listed at the end of this article.

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A cluster of patients with an acute severe lower respiratory tract illness linked to a seafood and live animal market was reported by public health officials in Wuhan, Hubei Province, China, in December 2019 (1). Shortly thereafter, the Chinese Center for Disease Control and Prevention commenced an investigation into the outbreak. A previously unknown coronavirus (2019 novel coronavirus [2019-nCoV]) was isolated from respiratory epithelial cells in these patients (2). Initially confined to Wuhan, the infection has spread elsewhere, with 9720 confirmed cases in China and 106 confirmed cases in other countries—including six in the United States as of January 31, 2020 (3,4).

Seven coronaviruses are known to cause disease in humans (2,5,6). Two strains, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), have zoonotic origins and have been linked to outbreaks of severe respiratory illnesses in humans (6). Although 2019-nCoV, too, is believed to have a zoonotic origin, person-to-person transmission has been documented (7).

Most patients with 2019-nCoV infection present with fever (98%), cough (76%), and myalgia or fatigue (44%). Dyspnea has been reported in 55% of patients, developing in a median of 8 days after onset of initial symptoms. Six of 41 patients (15%) in the largest published cohort to date (8) died from their illness, and there are now 80 confirmed deaths (4).

Limited information exists regarding chest imaging findings of 2019-nCoV lung infection (Table). One initial report included chest radiographs of a single patient. A bedside chest radiograph obtained 8 days after symptom onset showed bilateral lung consolidation with relative peripheral sparing. A radiograph obtained 3 days later showed more extensive, basal predominant lung consolidation with possible small pleural effusions corresponding to clinical worsening (2). A second report showed CT images from a single patient who had peripheral, bilateral ground-glass opacity (9). A different report of six family members with 2019-nCoV lung infection mentions lung opacities present on chest CT scans but lacks details on pattern or distribution aside from ground-glass opacities in an asymptomatic 10-year-old boy (7). A recent cohort study of 41 patients with confirmed 2019-nCoV infection included limited analysis of chest imaging studies. All but one patient was reported to have bilateral lung involvement on chest radiographs (8). Patients admitted to the intensive care unit were more likely to have larger areas of bilateral consolidation on CT scans, whereas patients not requiring admission to the intensive care unit with milder illness were more likely to have ground-glass opacity and small areas of consolidation, the latter description suggesting an organizing pneumonia pattern of lung injury. A study of CT scans of 21 patients with 2019-nCoV infection (10) showed three (21%) with normal CT scans, 12 (57%) with ground-glass opacity only, and six (29%) with ground-glass opacity and consolidation at presentation. Fifteen patients (71%) had two or more lobes involved, and 16 (76%) had bilateral disease. Interestingly, three patients (14%) had normal scans at diagnosis. One of those patients still had a normal scan at short-term follow-up. Seven other patients underwent follow-up CT (range, 1–4 days; mean, 2.5 days); five (63%) had mild progression, and two (25%) had moderate progression.

Reported Chest CT Findings in 2019 Novel Coronavirus Infections

CT Findings	Frequency (%)
Ground-glass opacity	86
Consolidation	29
Crazy-paving	19
Linear	14
Cavitation	0
Discrete nodules	0
Pleural effusion	0
Lymphadenopathy	0
Bilateral distribution	76
Peripheral distribution	33

Note.—Data are from reference 10.

Overall, the imaging findings reported for 2019-nCoV are similar to those reported for SARS-CoV (11–13) and MERS-CoV (14,15), not surprising as the responsible viruses are also coronaviruses. Given that up to 30% of patients with 2019-nCoV infection develop acute respiratory distress syndrome (8), chest imaging studies showing extensive consolidation and ground-glass opacity, typical of acute lung injury, are not unexpected (16,17). The long-term imaging features of 2019-nCoV are not yet known but presumably will resemble those of other causes of acute lung injury.

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Letter to the Editor

Rapid Salivary Test suitable for a mass screening program to detect SARS-CoV-2: A diagnostic accuracy study

Dear Sir,

In April 2020, we published in this journal an article which highlighted the role of saliva as a reliable biological fluid to detect SARS-CoV-2.[1]

When we published the paper, Italy was on full lockdown at the peak of the COVID-19 epidemic.

Then, on June 3rd, 2020, the Italian government started the so-called "Phase 2", which included the re-opening of working and social activities. In this framework, the issue of how to identify the asymptomatic individuals who, unwittingly, can spread SARS-CoV-2 infection and pose a threat to the public health has been raised worldwide.[2] It is now imperative to guarantee the health and safety of the people called back to work, and to create a safety protocol in commercial and meeting spaces, which means preventing infected people from causing new epidemic outbreaks.

For this purpose, a well-established mass screening program is required to meet several needs: first, it should provide the result in a few minutes, it should be easily delivered on the territory, it should be performed in a simple way also by non-medical healthcare professionals, and eventually it should be non-invasive, repeatable and reliable.

To date, the diagnosis of SARS-CoV-2 infection is made by identifying the viral RNA in samples collected through a nasopharyngeal swab or other respiratory samples.[3] This technique, however, has several limitations for its application in a mass screening, among which the most important ones are the time necessary for the diagnosis, the crowding of those centers appointed to analyze the specimens, and the non-negligible risk of viral transmission to the healthcare workers.[4]

The use of saliva as a diagnostic sample has several advantages, since it can be easily provided by the patient and it does not require specialized personnel for its collection.[5] After these considerations, we conducted a diagnostic accuracy study to validate the use of a *Rapid Salivary Test* (*RST*) as a point-of-need antigen test suitable for a mass screening program.

Subjects who underwent the nasopharyngeal swab procedure for the diagnosis of SARS-CoV-2 infection were consecutively recruited in three independent medical areas in our hospital: the COVID-19 wards (inpatients, with the exclusion of those subjects admitted to the Intensive Care Unit), the Emergency Room (patients at high risk of disease) and the area for the healthcare workers (subjects at low risk of disease). At the same time of the nasopharyngeal swab procedure in the morning, each recruited subject provided a salivary sample of about 1 mL by the drooling technique.[6]

The RST consisted of an antigen test based on a customized Lateral flow assay (LFA) kit which was used to detect the presence of the virus in the saliva by identifying the viral Spike protein (Fig. 1).

The nasopharyngeal swab was analyzed by independent blinded clinicians through real-time reverse transcription (rRT)-PCR accordingly to the International guidelines.[7] In addition, the salivary sample collected for the RST was also examined by rRT-PCR to provide data about the presence of the virus in the saliva and to better analyze any discrepancy between the results of the RST and the nasopharyngeal swab.

A total number of 122 patients were recruited in this study (*Fig. S1 – STARD flow diagram, Appendix*). The mean age was 53.5 +/- 19.8 years, and there was a M:F = 1:2 ratio (*Table S1, Appendix*). Three subjects were excluded from the analysis because their RST failed and was not repeated. Thus, 119 subjects were included into the analysis. The results are reported in Table 1a. The sensitivity of the RST was 0.93 (95% CI: 0.77–0.99), while its specificity was apparently low, i.e., 0.42 (95% CI: 0.32–0.53). There were not differences between the recruited subgroups or among the asymptomatic and symptomatic individuals.

One hundred fourteen subjects had their salivary sample also analyzed by rRT-PCR (Table 1b). A very striking feature was observed when comparing the results of the salivary rRT-PCR with those of the nasopharyngeal swab in the subjects who had been previously classified as false negatives and false positives with the RST (*Fig. S2a, Appendix*). The two subjects who were classified as false negatives tested also negative by salivary rRT-PCR, thus the viral RNA was not detected in the saliva.

Startingly, 57% of the false positive cases had their saliva positive also when analyzed with rRT-PCR, which means that the virus was actually present and that the nasopharyngeal swab was less sensitive in these cases. These discrepancies between the salivary rRT-PCR and the nasopharyngeal swab were also confirmed by sequencing a sample of the positive specimens (*Fig. S3, Table S2, Appendix*). There were no differences in the viral load values among RST True positive (median value: 472 copies/μl, IQR: 145–975) and False positive subjects (median value: 371 copies/μl, IQR: 149–727; Kruskal–Wallis test $p = 0.6$) nor between asymptomatic or symptomatic individuals (median values: 480 vs 195 copies/μl, respectively; Kruskal–Wallis test $p = 0.6$) (*Fig. S2b, Table S3, Appendix*).

In our study we recorded a high sensitivity (i.e., 93%) and a mediocre specificity (i.e., 42%) of the RST.

These results were explained by two reasons. Firstly, the specificity suffered the fact that the majority of the presumed false positive individuals with the RST were rather positive also by salivary rRT-PCR, giving reason to the index test. Therefore, their nasopharyngeal swab (i.e., reference standard) provided a false negative result. Secondly, a certain degree of difficulty in reading the strip was reported by the observers, especially for low-intensity signals. In these cases, the observers tended to overestimate the positivity of

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EDITORIAL

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Coronavirus disease (COVID-19): Characteristics in children and considerations for dentists providing their care

Abstract

The emergence of the novel virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causing coronavirus disease (COVID-19) has led to a global pandemic and one of the most significant challenges to the healthcare profession. Dental practices are focal points for cross-infection, and care must be taken to minimise the risk of infection to, from, or between dental care professionals and patients. The COVID-19 epidemiological and clinical characteristics are still being collated but children's symptoms seem to be milder than those that adults experience. It is unknown whether certain groups, for example children with comorbidities, might be at a higher risk of more severe illness. Emerging data on disease spread in children, affected by COVID-19, have not been presented in detail. The purpose of this article was to report current data on the paediatric population affected with COVID-19 and highlight considerations for dentists providing care for children during this pandemic. All members of the dental team have a professional responsibility to keep themselves informed of current guidance and be vigilant in updating themselves as recommendations are changing so quickly.

1 | INTRODUCTION

At the beginning of 2020, the novel virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) appeared, causing the coronavirus disease (COVID-19). The emerging virus has resulted in a global pandemic declared a Public Health Emergency of International Concern (PHEIC) by the World Health Organization (WHO) Director-General on the recommendation of the International Health Regulations (2005) Emergency Committee.[1] The case detection rate is changing daily and can be tracked in almost real time.[2] As of 31 March 2020, 19:50 hours (Central Standard Time), the number of confirmed cases was 857 487 and reported deaths were 42 106 with 169 418 recovered patients.[2] The first case of a dentist being tested positive for COVID-19 was reported on 23 January 2020 at the Department of Preventive Dentistry in the Wuhan University Dental Hospital. Eventually, the transmission of disease to eight other oral healthcare professionals was identified.[3] The characteristics of epidemiological spread and clinical manifestations of COVID-19 in children have not yet been thoroughly elucidated. This article reports current data on the paediatric population affected with COVID-19 and emphasises the importance of following locally, regionally, and nationally relevant safety measures to protect dental care professionals as well as the child patient, whilst providing clinical care for the obviously affected children and those potential carriers of the infection. We emphasise that, in a rapidly changing pandemic landscape, practitioners must actively, regularly seek and use reputable and reliable sources of information on managing child patients that are appropriate for their own region and circumstances.

2 | COVID-19

2.1 | Clinical characteristics of COVID-19 in children

The clinical symptoms of COVID-19 are still being documented and collated, although the majority of affected patients exhibit symptoms including a dry cough which is usually accompanied by fever.[4] Difficulty in breathing, fatigue, and other less typical symptoms can also occur.[5,6] Signs and symptoms include different stages as asymptomatic, mild, moderate, severe, and critical.[7] Children tend to present with similar but milder symptoms to adults. To date, 3092 paediatric cases have been reported to have tested positive, and 1412 children were suspected of having been infected with COVID-19. A survey of 1391 children in China found 171 (12.3%) cases tested positive for SARS-CoV-2.[8] An analysis of more than 2000 child patients with suspected or confirmed COVID-19 in Hubei, China, found that over 90% presented as asymptomatic or with mild to moderate symptoms.[9] A summary of paediatric cases reported

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Review

COVID-19 and paediatric dentistry- traversing the challenges. A narrative review

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ABSTRACT

The coronavirus disease (COVID-19) pandemic has become a major global public health emergency with a focus on preventing the spread of this virus for controlling this crisis. A dental setting is at a high risk of cross infection amid patients and dental practitioner's owing to the spread of infection via droplets suspended in the air by infected symptomatic or asymptomatic subjects. This review article informs about measures which reduce facility risk, manage symptomatic patients and protect personal health care and management with reference to paediatric dentistry.

1. Background

The COVID-19 pandemic has had a significant impact on dentistry. Recommendations have therefore been revised in response to this pandemic to respond to the unique changes for dental settings. They inform about the resumption of non-emergency dental care during COVD-19, facility and equipment, sterilization and disinfection protocols, provision of care to both COVID-19 positive and negative patients and recommendations on Paediatric Dentistry to minimize risk to patient and dental healthcare personnel (DHCP) [1–4].

2. Risk of infection in a dental setting

Exposure to biological risk in a dental setting is a hazard to the patients, doctors, hygienists and assistants. When patients cough, sneeze or undergo procedures with ultrasonic, high speed instruments or air water syringe it results in aerosol, droplet, spatter, salivary secretions, debris or blood. This environmental spatter travels over a short distance, settles down quickly and contaminates the air, floor, operatory surface, medical supplies, devices, equipment, apparatus, dental health care professional and the patient. A salivary gland could be a major viral source enabling the transmission of COVID-19 by asymptomatic infections originating from infected saliva. Aerosols are liquid and solid particles (<50 μm diameter) suspended in air for protracted periods. Splatter is a mixture of air, water and/or solid substances (50 μm–7 mm in diameter). They may be contaminated with bacteria, virus and fungi hence pose a health risk to the DHCP. SMs offer around 80% filtration rate and good protection for elective dentistry in normal healthy patients. The COVID-19 measures around 120 nm (0.12 μm) and aerosol particle sizes range from 3 to 100 nm hence FFP3 respirator offers a filtration rate of 99% of all particles measuring up to 0.6 μm [5,6].

The routine aerosol generating procedures are not designed to offer protection against transmission of pathogens and the standard protective measures do not offer adequate effectiveness against patients generating aerosol in the incubation period, are unaware of the infection or conceal information regarding their infection [5,6]. Dental healthcare personnel (DHCP) are all paid and unpaid persons serving in dental healthcare settings with a potential for direct or indirect exposure to patients or infectious materials (body substance, contaminated medical supplies, devices, equipment, environmental surfaces, air). A DHCP is placed in the very high exposure risk category by OSHA via high potential for exposure to known or suspected viral sources for COVID-19 during specific dental procedures [5–7].

The risk of SARS-CoV-2 transmission via aerosols generated during dental procedures cannot be eliminated when practicing in the absence of Airborne Precautions (airborne infection isolation rooms or single-patient rooms, respiratory protection program, N95 respirators). It is vital to reduce the risk of infections in a dental setting by Infection control measures since unrecognized asymptomatic and pre-symptomatic infections have a likelihood of transmission in healthcare

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Communication

COVID-19 Disease in Children: What Dentists Should Know and Do to Prevent Viral Spread. The Italian Point of View

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Abstract: Coronavirus disease 2019 (COVID-19) has spread rapidly across the globe, becoming a major public health challenge not for China only, but also for countries around the world. Despite worldwide efforts to contain viral spread, the outbreak has not been stopped yet. Among healthcare personnel, dentists seem to be at elevated risk of exposure to COVID-19. This risk is even more serious in pediatric dentistry, since affected children, frequently, present an asymptomatic, mild or moderate clinical viral infection and, therefore, they may play a major role in community-based COVID-19 transmission. To date, despite no universal guidelines are available for dental procedures in pediatric dentistry during COVID-19 outbreak, routine dental practice should be postponed and only severe dental emergencies must be treated. In the case of a dental emergency, involving a pediatric patient, dentists should be aware of which recommended management protocol can be adopted during the practice to protect patient health, to safeguard their-self and to prevent viral transmission. The aim of this paper is to provide clinical recommendations, presenting a needed tool for dentists to allow a valid and safe how-to-do protocol. Pediatric dentists should keep a high level of awareness to help patients, minimize risk and prevent viral spread.

Keywords: COVID-19; pediatric dentistry; children; oral health; viral spread prevention

In December 2019, a new type of coronavirus that causes pneumonia was first detected in Wuhan, China [1]. It was firstly known as 2019 novel coronavirus (2019-nCoV) [2–4]. On 11 February 2020, the International Committee on Taxonomy of Viruses referred to a new coronavirus capable of infecting humans as SARS-CoV-2 [5]. On the same time, the World Health Organization declared that the official name of the disease caused by this virus is COVID-19 [6].

Coronavirus disease 2019 (COVID-19) has spread rapidly across the globe, becoming a major public health challenge not for China only, but also for countries around the world [7]. In Italy, the outbreak is particularly dramatic: the first person-to-person transmission was reported on 21 February 2020, and led to an infection sequence that caused the greatest number of deaths in the world [8–10] until 11 April 2020, when US overtook Italy with highest coronavirus deaths. Nevertheless, Italy still remains the first country in Europe for number of deaths due to coronavirus infection.

Despite worldwide efforts to contain viral spread, the outbreak has not been stopped yet. In adults, signs and symptoms of COVID-19 may appear two to 14 days after exposure and can include: fever,

Comment: While this study provides helpful clinical information to assist emergency physicians in identifying potential COVID-19 patients, we must understand the limitations. Most significantly, this was only a very small portion of the overall sample size of confirmed COVID-19 patients. Additionally, be cautious in directly applying these results to patients in the United States as populations may differ.

☐ DRIVE-THROUGH SCREENING CENTER FOR COVID-19: A SAFE AND EFFICIENT SCREENING SYSTEM AGAINST MASSIVE COMMUNITY OUTBREAK.

Kwon KT, Ko JH, Shin H, et al. *J Korean Med Sci*. Published online March 16, 2020. doi: https://doi.org/10.3346/jkms.2020.35.e123.

The current Coronavirus Disease 2019 (COVID-19) pandemic has necessitated the testing of significant numbers of patients. Modeled after those used during a previous bioterrorism disaster and influenza pandemic, the authors present a descriptive report of their drive-through screening center and processes.

The authors recommend use of a large parking lot geographically removed from large population centers. Additionally, they recommend either a tent or temporary building to be used for work space and shelter from weather. They utilized a four-step process: Entrance → Registration → Examination → Specimen collection → Instructions → Exit. Patients do not leave their cars during this process. To minimize contact and preserve personal protective equipment (PPE), communication is performed either by mobile phone or electronic medical record whenever possible. Temperature is obtained with a contactless thermometer. If the physician strongly suspects COVID-19 during the examination step, the patient is transported to a designated hospital after specimen collection. Test specimens were collected with the car window opened the minimum amount necessary and car ventilation mode on internal circulation. Patients are provided with information about obtaining test results, home quarantine, and anticipatory guidance.

Healthcare workers (HCWs) who had direct contact with patients wore the following PPE: N95 respirator, eye shield/face shield/goggles, hooded coverall/gown, and inner and outer gloves. To decrease viral spread and minimize the possibility of specimen contamination, HCWs wore two gowns and two pairs of gloves for patients who required testing; the external gloves/gown were removed and hands disinfected after each patient contact. The authors reported that this process took approximately ten minutes per test, allowing them to screen 100 people per day with a staff of 4-8 HCWs. This is estimated to be 1/3 the amount of time that a typical screening process would take.

The authors recommended rotating staff every 1-2 hours if possible, and to ensure that no HCW wore an N95 respirator for longer than four consecutive hours. They also noted the need to be cognizant of relevant environmental issues, such as hot/cold weather, etc., and to adapt the working environment accordingly. Lastly, there must be adequate communication with the public regarding the limitations of the screening center to minimize the number of people who may attempt to use this resource inappropriately. They recommend considering a similar process for other uses such as medication distribution or vaccine administration.

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Comment: While not a typical research manuscript we would select for Abstracts, this article describes a non-novel approach to a novel viral pandemic. The drive-through screening process has a number of advantages as outlined above, especially as centers begin seeing higher numbers of potential COVID-19 patients. It is important to consider and plan for the unintended consequences of such a program, including how HCWs will handle unexpectedly ill patients and patients arriving by alternative transportation (bike, walking, public transportation). Healthcare leaders considering a drive-through screening option should also consider the heightened emotions and fear that are present during epidemic/pandemic conditions and plan for security accordingly.

☐ EPIDEMIOLOGICAL CHARACTERISTICS OF 2143 PEDIATRIC PATIENTS WITH 2019 CORONAVIRUS DISEASE IN CHINA.

Dong Y, Mo X, Hu Y, et al. *Pediatrics*. 2020; doi: 10.1542/peds.2020-0702.

Novel coronavirus (SARS-CoV-2, which causes COVID-19) is a pandemic with many countries employing massive public health responses. Little is known about the severity of illness in the pediatric population. This study sought to identify demographic information and severity of disease in pediatric patients with COVID-19.

This was a retrospective study conducted on patients less than 18 years who were suspected or confirmed to have COVID-19 and were reported to the Chinese Centers for Disease Control (China CDC). Children were considered high risk and suspected if they had positive exposure to an endemic area or a confirmed case of COVID-19. High suspicion also included those with fever, respiratory symptoms, digestive symptoms, or fatigue, normal or low white blood cell count and increased C-reactive protein, or abnormal chest radiography, or those at lower risk for whom influenza or other respiratory illnesses were ruled out. Confirmed cases were defined as having a nasopharyngeal swab or blood sample positive via PCR or a genetic sampling of respiratory secretions or blood consistent with SARS-CoV-2. Once identified, patients were categorized by severity of disease using clinical features as well as laboratory and radiographic findings. Severity categories included asymptomatic (no symptoms but positive test), mild (mild respiratory symptoms and normal lung exam), moderate (pneumonia, fever, and cough but without hypoxemia or respiratory distress), severe (above symptoms as well as oxygen saturation less than 92% and respiratory distress), or critical disease (acute respiratory failure, acute respiratory distress syndrome, shock, or other life-threatening organ dysfunction).

There were 2143 patients included who were suspected (65.9%) or confirmed (34.1%) to have COVID-19. Median age was 7 years (IQR 2-13) and the majority (56.6%) were male. The median time from onset of symptoms to presentation

2019-nCoV transmission through the ocular surface must not be ignored

Chaolin Huang and colleagues[1] reported the epidemiology, symptoms, and treatment of patients infected by the 2019 novel coronavirus (2019-nCoV) in Wuhan, China. As ophthalmologists, we believe that transmission of 2019-nCoV through the eyes was ignored.

On Jan 22, Guangfa Wang, a member of the national expert panel on pneumonia, reported that he was infected by 2019-nCoV during the inspection in Wuhan.[2] He wore an N95 mask but did not wear anything to protect his eyes. Several days before the onset of pneumonia, Wang complained of redness of the eyes. Unprotected exposure of the eyes to 2019-nCoV in the Wuhan Fever Clinic might have allowed the virus to infect the body.[2]

Infectious droplets and body fluids can easily contaminate the human conjunctival epithelium.[3] Respiratory viruses are capable of inducing ocular complications in infected patients, which then leads to respiratory infection.[4] Severe acute respiratory syndrome coronavirus (SARS-CoV) is predominantly transmitted through direct or indirect contact with mucous membranes in the eyes, mouth, or nose.[5] The fact that exposed mucous membranes and unprotected eyes increased the risk of SARS-CoV transmission[4] suggests that exposure of unprotected eyes to 2019-nCoV could cause acute respiratory infection.

Thus, Huang and colleagues[1] should have analysed conjunctival scrapings from both confirmed and suspected 2019-nCoV cases during the onset of symptoms. The respiratory tract is probably not the only transmission route for 2019-nCoV, and all ophthalmologists examining suspected cases should wear protective eyewear.

We declare no competing interests.

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Review

Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents

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SUMMARY

Currently, the emergence of a novel human coronavirus, SARS-CoV-2, has become a global health concern causing severe respiratory tract infections in humans. Human-to-human transmissions have been described with incubation times between 2-10 days, facilitating its spread via droplets, contaminated hands or surfaces. We therefore reviewed the literature on all available information about the persistence of human and veterinary coronaviruses on inanimate surfaces as well as inactivation strategies with biocidal agents used for chemical disinfection, e.g. in healthcare facilities. The analysis of 22 studies reveals that human coronaviruses such as Severe Acute Respiratory Syndrome (SARS) coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus or endemic human coronaviruses (HCoV) can persist on inanimate surfaces like metal, glass or plastic for up to 9 days, but can be efficiently inactivated by surface disinfection procedures with 62–71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite within 1 minute. Other biocidal agents such as 0.05–0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate are less effective. As no specific therapies are available for SARS-CoV-2, early containment and prevention of further spread will be crucial to stop the ongoing outbreak and to control this novel infectious thread.

Introduction

A novel coronavirus (SARS-CoV-2) has recently emerged from China with a total of 45171 confirmed cases of pneumonia (as of February 12, 2020) [1]. Together with Severe Acute Respiratory Syndrome (SARS) coronavirus and Middle East Respiratory Syndrome (MERS) coronavirus [2], this is the third highly pathogenic human coronavirus that has emerged in the last two decades. Person-to-person transmission has been described both in hospital and family settings [3]. It is therefore of utmost importance to prevent any further spread in the public and healthcare settings. Transmission of coronaviruses from contaminated dry surfaces has been postulated including self-inoculation of mucous membranes of the nose, eyes or mouth [4,5], emphasizing the importance of a detailed understanding of coronavirus persistence on inanimate surfaces [6]. Various types of biocidal agents such as hydrogen peroxide, alcohols, sodium hypochlorite or benzalkonium chloride are used worldwide for disinfection, mainly in healthcare settings [7]. The aim of the review was therefore to summarize all available data on the persistence of all coronaviruses including emerging SARS-CoV and MERS-CoV as well as veterinary coronaviruses such as transmissible gastroenteritis virus (TGEV), mouse hepatitis virus (MHV) and canine coronavirus (CCV) on different types of

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REVIEW ARTICLE

Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care

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SIGNIFICANCE

Dental care providers need to be aware and prepared for tackling any impending infectious disease challenge as might be the case in the current outbreak of SARS-CoV-2 transmission and its associated coronavirus disease, which can be life-threatening to susceptible patients.

ABSTRACT

The recent spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its associated coronavirus disease has gripped the entire international community and caused widespread public health concerns. Despite global efforts to contain the disease spread, the outbreak is still on a rise because of the community spread pattern of this infection. This is a zoonotic infection, similar to other coronavirus infections, that is believed to have originated in bats and pangolins and later transmitted to humans. Once in the human body, this coronavirus (SARS-CoV-2) is abundantly present in nasopharyngeal and salivary secretions of affected patients, and its spread is predominantly thought to be respiratory droplet/contact in nature. Dental professionals, including endodontists, may encounter patients with suspected or confirmed SARS-CoV-2 infection and will have to act diligently not only to provide care but at the same time prevent nosocomial spread of infection. Thus, the aim of this article is to provide a brief overview of the epidemiology, symptoms, and routes of transmission of this novel infection. In addition, specific recommendations for dental practice are suggested for patient screening, infection control strategies, and patient management protocol. This review was last updated on March 27, 2020. *(J Endod 2020;46:584–595.)*

KEY WORDS

Coronavirus; COVID-19; dental; endodontics; severe acute respiratory syndrome coronavirus 2; SARS-CoV-2

The outbreak of coronavirus disease 2019 (COVID-19) in the area of Wuhan, China, has evolved rapidly into a public health crisis[1] and has spread exponentially to other parts of the world (Fig. 1)[2]. The novel coronavirus belongs to a family of single-stranded RNA viruses known as *Coronaviridae*[3]. This family of viruses are known to be zoonotic or transmitted from animals to humans. These include severe acute respiratory syndrome coronavirus (SARS-CoV), first identified in 2002, and the Middle East respiratory syndrome coronavirus (MERS-CoV), first identified in 2012[4]. There is strong evidence that this novel coronavirus has similarity to coronavirus species found in bats and potentially pangolins, confirming the zoonotic nature of this new cross-species viral-mediated disease[5,6]. As the published genome sequence for this novel coronavirus has a close resemblance with other beta-coronaviruses such as SARS-CoV and MERS-CoV, the Coronavirus Study Group of the International Committee on Taxonomy of Viruses has given it the scientific name SARS-CoV-2, even though it is popularly called the COVID-19 virus[7,8]. On January 30, 2020, the World Health Organization (WHO) declared the rampant spread of SARS-CoV-2 and its associated disease (COVID-19) a public health emergency with a currently known overall mortality rate to be as high as 3.4%[9,10]. According to the WHO situation report (March 27, 2020) update on COVID-19, there have been more than 500,000 reported cases and 23000 deaths worldwide[11] and this number continues to increase (Fig. 1). Therefore, measures for prevention, identification, and management must be in place for appropriate mitigation of further spread.

Given the widespread transmission of SARS-CoV-2 and reports of its spread to health care providers[4,12], dental professionals are at high risk for nosocomial infection and can become potential carriers of the disease. These risks can be attributed to the unique nature of dental interventions, which include aerosol generation, handling of sharps, and proximity of the provider to the patient's oropharyngeal region. In addition, if adequate precautions are not taken, the dental office can potentially expose patients to cross contamination. As the understanding of this novel disease is evolving, dental

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REVIEW ARTICLE

Diagnosis, treatment, and prevention of 2019 novel coronavirus infection in children: experts' consensus statement

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Abstract
Since the outbreak of 2019 novel coronavirus infection (2019-nCoV) in Wuhan City, China, by January 30, 2020, a total of 9692 confirmed cases and 15,238 suspected cases have been reported around 31 provinces or cities in China. Among the confirmed cases, 1527 were severe cases, 171 had recovered and been discharged at home, and 213 died. And among these cases, a total of 28 children aged from 1 month to 17 years have been reported in China. For standardizing prevention and management of 2019-nCoV infections in children, we called up an experts' committee to formulate this experts' consensus statement. This statement is based on *the Novel Coronavirus Infection Pneumonia Diagnosis and Treatment Standards (the fourth edition)* (National Health Committee) and other previous diagnosis and treatment strategies for pediatric virus infections. The present consensus statement summarizes current strategies on diagnosis, treatment, and prevention of 2019-nCoV infection in children.

Background

In December, 2019, a cluster of pneumonia cases, who were later proven to be caused by a novel coronavirus (named as "2019-nCoV"), emerged in Wuhan City, Hubei Province, China. By January 30, 2020, 9692 confirmed cases and 15,238 suspected cases have been reported around 31 provinces and cities in China. Among the confirmed cases, 1527 were severe cases, 171 had recovered and been discharged at home, and 213 died. Twenty-eight confirmed cases aged from 1 month to 17 years had been reported in China [1].

Coronavirus (CoV) belongs to the *Coronaviridae* family, *Nidovirales* order. CoVs are divided into four genera: α-, β-, γ-, and δ-coronavirus. α- and β-coronaviruses only infect mammals, whereas γ- and δ-coronaviruses mainly infect birds, with a few infecting mammals. Human CoVs include α-coronaviruses (229E and NL63), β-coronaviruses (OC43 and HKU1), the Middle East respiratory syndrome-related coronavirus (MERS-CoV), severe acute respiratory syndrome-related coronavirus (SARS-CoV), and 2019-nCoV. The 2019-nCoV belongs to the β-coronavirus genus [2], which includes bat-SARS-like (SL)-CoVZC45, bat-SL-CoVZXC21, SARS-CoV, MERS-CoV, and 2019-nCoV. Current studies have revealed that 2019-nCoV may originate from wild animals, but the exact origin remains unclear.

2019-nCoV infected patients are the main infection sources. However, we also should attach importance to asymptomatic cases which may play a critical role in the

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REVIEW ARTICLE OPEN

Transmission routes of 2019-nCoV and controls in dental practice

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A novel β-coronavirus (2019-nCoV) caused severe and even fetal pneumonia explored in a seafood market of Wuhan city, Hubei province, China, and rapidly spread to other provinces of China and other countries. The 2019-nCoV was different from SARS-CoV, but shared the same host receptor the human angiotensin-converting enzyme 2 (ACE2). The natural host of 2019-nCoV may be the bat *Rhinolophus affinis* as 2019-nCoV showed 96.2% of whole-genome identity to BatCoV RaTG13. The person-to-person transmission routes of 2019-nCoV included direct transmission, such as cough, sneeze, droplet inhalation transmission, and contact transmission, such as the contact with oral, nasal, and eye mucous membranes. 2019-nCoV can also be transmitted through the saliva, and the fetal–oral routes may also be a potential person-to-person transmission route. The participants in dental practice expose to tremendous risk of 2019-nCoV infection due to the face-to-face communication and the exposure to saliva, blood, and other body fluids, and the handling of sharp instruments. Dental professionals play great roles in preventing the transmission of 2019-nCoV. Here we recommend the infection control measures during dental practice to block the person-to-person transmission routes in dental clinics and hospitals.

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INTRODUCTION

An emergent pneumonia outbreak originated in Wuhan City, in the late December 2019[1]. The pneumonia infection has rapidly spread from Wuhan to most other provinces and other 24 countries[2,3]. World Health Organization declared a public health emergency of international concern over this global pneumonia outbreak on 30th January 2020.

The typical clinical symptoms of the patients who suffered from the novel viral pneumonia were fever, cough, and myalgia or fatigue with abnormal chest CT, and the less common symptoms were sputum production, headache, hemoptysis, and diarrhea[4–6]. This new infectious agent is more likely to affect older males to cause severe respiratory diseases[7,8]. Some of the clinical symptoms were different from the severe acute respiratory syndrome (SARS) caused by SARS coronavirus (SARS-CoV) that happened in 2002–2003, indicating that a new person-to-person transmission infectious agent has caused this emergent viral pneumonia outbreak[8,9]. Chinese researchers have quickly isolated a new virus from the patient and sequenced its genome (29,903 nucleotides)[10]. The infectious agent of this viral pneumonia happenening in Wuhan was finally identified as a novel coronavirus (2019-nCOV), the seventh member of the family of coronaviruses that infect humans[11]. On 11th February 2020, WHO named the novel viral pneumonia as "Corona Virus Disease (COVID19)", while the international Committee on Taxonomy of Viruses (ICTV) suggested this novel coronavirus name as "SARS-CoV-2" due to the phylogenetic and taxonomic analysis of this novel coronavirus[12].

CHARACTERISTICS OF 2019 NOVEL CORONAVIRUS

Coronaviruses belong to the family of *Coronaviridae*, of the order *Nidovirales*, comprising large, single, plus-stranded RNA as their genome[13,14]. Currently, there are four genera of coronaviruses: α-CoV, β-CoV, γ-CoV, and δ-CoV[15,16]. Most of the coronavirus can cause the infectious diseases in human and vertebrates. The α-CoV and β-CoV mainly infect the respiratory, gastrointestinal, and central nervous system of humans and mammals, while γ-CoV and δ-CoV mainly infect the birds[13,17–19].

Usually, several members of the coronavirus cause mild respiratory disease in humans; however, SARS-CoV and the Middle East respiratory syndrome coronavirus (MERS-CoV) explored in 2002–2003 and in 2012, respectively, caused fatal severe respiratory diseases[20–22]. The SARS-CoV and MERS-CoV belong to the β-CoV[23,24]. 2019-nCoV explored in Wuhan also belongs to the β-CoV according to the phylogenetic analysis based on the viral genome[10,11]. Although the nucleotide sequence similarity is less than 80% between 2019-nCoV and SARS-CoV (about 79%) or MERS-CoV (about 50%), 2019-nCoV can also cause the fetal infection and spread more faster than the two other coronaviruses[7,9,11,25–27]. The genome nucleotide sequence identity between a coronavirus (BatCoV RaTG13) detected in the bat *Rhinolophus affinis* from Yunnan Province, China, and 2019-nCoV, was 96.2%, indicating that the natural host of 2019-nCoV may also be the *Rhinolophus affinis* bat[11]. However, the differences may also suggest that there is an or more intermediate hosts between the bat and human. A research team from the South China Agricultural University has invested more than 1 000 metagenomic samples

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Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine

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Abstract

The epidemic of coronavirus disease 2019 (COVID-19), originating in Wuhan, China, has become a major public health challenge for not only China but also countries around the world. The World Health Organization announced that the outbreaks of the novel coronavirus have constituted a public health emergency of international concern. As of February 26, 2020, COVID-19 has been recognized in 34 countries, with a total of 80,239 laboratory-confirmed cases and 2,700 deaths. Infection control measures are necessary to prevent the virus from further spreading and to help control the epidemic situation. Due to the characteristics of dental settings, the risk of cross infection can be high between patients and dental practitioners. For dental practices and hospitals in areas that are (potentially) affected with COVID-19, strict and effective infection control protocols are urgently needed. This article, based on our experience and relevant guidelines and research, introduces essential knowledge about COVID-19 and nosocomial infection in dental settings and provides recommended management protocols for dental practitioners and students in (potentially) affected areas.

Keywords: virology, infection control, dental public health, dental education, transmission, dental practice management

Introduction

On January 8, 2020, a novel coronavirus was officially announced as the causative pathogen of COVID-19 by the Chinese Center for Disease Control and Prevention (Li et al. 2020). The epidemics of coronavirus disease 2019 (COVID-19) started from Wuhan, China, last December and have become a major challenging public health problem for not only China but also countries around the world (Phelan et al. 2020). On January 30, 2020, the World Health Organization (WHO) announced that this outbreak had constituted a public health emergency of international concern (Mahase 2020). The novel coronavirus was initially named 2019-nCoV and officially as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of February 26, COVID-19 has been recognized in 34 countries, with a total of 80,239 laboratory-confirmed cases and 2,700 deaths (WHO 2020b).

Due to the characteristics of dental settings, the risk of cross infection may be high between dental practitioners and patients. For dental practices and hospitals in countries/regions that are (potentially) affected with COVID-19, strict and effective infection control protocols are urgently needed. This article, based on our experience and relevant guidelines and research, introduces the essential knowledge about COVID-19 and nosocomial infection in dental settings and provides recommended management protocols for dental practitioners and students in (potentially) affected areas.

What Is COVID-19?

Viral Etiology

According to recent research, similar to SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV), SARS-CoV-2 is zoonotic, with Chinese horseshoe bats (*Rhinolophus sinicus*) being the most probable origin (Chan et al. 2020; Lu et al. 2020) and pangolins as the most likely intermediate host (The Chinese Preventive Medicine Association 2020).

Epidemiologic Characteristics

Mode of Transmission. Based on findings of genetic and epidemiologic research, it appears that the COVID-19 outbreak

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REVIEW ARTICLE

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Do we know the diagnostic properties of the tests used in COVID-19? A rapid review of recently published literature

Vivienne C. Bachelet

Abstract

COVID-19 has brought death and disease to large parts of the world. Governments must deploy strategies to screen the population and subsequently isolate the suspect cases. Diagnostic testing is critical for epidemiological surveillance, but the accuracy (sensitivity and specificity) and clinical utility (impact on health outcomes) of the current diagnostic methods used for SARS-CoV-2 detection are not known. I ran a quick search in PubMed/MEDLINE to find studies on laboratory diagnostic tests and rapid viral diagnosis. After running the search strategies, I found 47 eligible articles that I discuss in this review, commenting on test characteristics and limitations. I did not find any papers that report on the clinical utility of the tests currently used for COVID-19 detection, meaning that we are fighting a battle without proper knowledge of the proportion of false negatives that current testing is resulting in. This shortcoming should not be overlooked as it might hamper national efforts to contain the pandemic through testing community-based suspect cases.

Introduction

At the end of 2019, the world was made aware of a lethal new strain of coronavirus—later to be called SARS-CoV-2—that was causing death and disease in large segments of the Chinese population, mainly in the city of Wuhan. By March 11, 2020, the World Health Organization was declaring that the disease caused by this novel virus, COVID-19, was a pandemic. At the time this article is being written, nearly three million cases of COVID-19 and over 200 000 deaths have been reported worldwide. A systematic review found that for 656 patients, the main manifestations of COVID-19 include fever, cough, and dyspnea, and 32.8% present acute respiratory distress syndrome, 20.3% of cases require intensive care unit, and 6.2% will develop shock[1].

This enormous burden on our hospital systems has led to aggressive strategies aimed at mitigating or suppressing the spread of the virus in the general population, the intensity of which has been strikingly disparate among the affected countries[2],[3]. Regardless of the strategies deployed by national and local governments, the more successful ones rely on laboratory testing and subsequent isolation of suspect cases. According to the World Health Organization, laboratory "testing for COVID-19 is critical to tracking the virus, understanding epidemiology, informing case management, and to suppressing transmission" (see Technical Guidance). However, information on which tests the different countries are using to detect cases and conduct epidemiological surveillance is not readily available. Even less information is available on the properties of the diagnostic tests currently deployed in the field, and press reports have referred to the problem of false-negative results[4].

We are still in the process of understanding SARS-CoV-2. Long incubation time may be responsible for the rapid dissemination and infectivity of this strain of coronavirus[5]. However, this was rebutted by a recent analysis on a larger dataset of patients that found no statistically significant differences in the mean incubation time for SARS-CoV, MERS-CoV, and SARS-CoV-2[6]. Also, many asymptomatic individuals have tested positive for SARS-CoV-2[7]. Statistical modeling on the Diamond Princess cruise ship found that 17.9% (95% confidence interval: 15.2% to 20.2%) of individuals who tested positive for SARS-CoV-2 were asymptomatic, but this could be an underestimation given that not all passengers were tested[8]. Conversely, a high false-negative rate of nucleic acid test for SARS-CoV-2 has been reported for the most used diagnostic tool for COVID-19 screening—the reverse-transcription polymerase chain reaction (RT-PCR) assay using oropharyngeal swab samples[9],[10],[11],[12]. In a letter to the editor, an author describes a case of three consecutive samples negative for the SARS-CoV-2 nucleic acid, which was finally confirmed as COVID-19 pneumonia based on the chest computed tomography scan showing the typical ground-glass opacification and a fourth RT-PCR test with a positive result[13]. Thus, many reports are now advising that the diagnosis of COVID-19 should include computed tomography images together with PCR testing in highly suspect cases[14],[15].

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ORIGINAL RESEARCH

COVID-19 Pandemic and Its Impact on Pediatric Dentistry in Austria: Knowledge, Perception and Attitude Among Pediatric Dentists in a Cross-Sectional Survey

This article was published in the following Dove Press journal:
Journal of Multidisciplinary Healthcare

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Introduction: The Novel Coronavirus Disease (COVID-19) outbreak is affecting people worldwide. Given the frequent production of aerosols, dentists are a high-risk group for infection. The aim of this study was to assess the knowledge, perception and attitude regarding COVID-19 among pediatric dentists in Austria.

Methods: An online survey was distributed among the 128 pediatric dentists that are members of the Austrian Society of Pediatric Dentistry. The questionnaire was divided into three sections: 1) dentists' demographic characteristics, 2) general knowledge and attitude, 3) COVID-19 with a focus on pediatric dentistry.

Results: Seventy-five dentists replied; 58 questionnaires could be included in the analysis (93.1% female). Pediatric dentists were found to have good general knowledge of COVID-19. However, only 10% had attended training or lectures and 36.2% rated their role in teaching patients about COVID-19 as being very significant. At the beginning of the outbreak, 78.6% only offered emergency services. Currently, only 10.3% of the dentists work without FFP2/3 mask when producing aerosols.

Discussion: Austrian pediatric dentists were aware of the general aspects of COVID-19. Those, who had their practice open mostly followed national and international recommendations given and only offered emergency visits.

Keywords: COVID-19, pandemic, infection, pediatric dentist, infection control

Introduction

At the beginning of 2020, the World Health Organization (WHO) confirmed that a novel coronavirus caused a respiratory disease in people living in Wuhan, Hubei, China.[1] First called nCoV-2019[2] and now named SARS-CoV-2,[3] the virus has spread globally within a few months and has resulted in pandemic disease.[4] In Austria, the first two positive cases of COVID-19 were officially detected on February 25. These were a 24-year-old man and woman, both traveling from Lombardy, Italy, to Austria. Starting on 16 March 2020, nationwide restrictive measures were ordered by the Austrian government including a curfew. Ten days later, the highest number of confirmed coronavirus infection cases within a single day was recorded during this first wave. The peak of active, confirmed cases was observed at the beginning of April in Austria. From then on, the number of confirmed coronavirus cases decreased till July. Until mid-April, public life

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Article

COVID-19 Outbreak Perception in Italian Dentists

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Abstract: The aim of this study is an evaluation of the Italian dentists' knowledge regarding COVID-19 and their perception of the risks associated with COVID-19, their attitude in resuming their activities, and how they judge the institutional intervention on a health and economic basis. Methods: This research evaluated Italian dentists from 11 to 18 April 2020, using a questionnaire submitted via Google Forms (Alphabet, Mountain View, CA, USA). It consisted of different investigations about sociodemographic aspects, profession-related characteristics, knowledge about COVID-19 infection transmission modalities, symptoms, and attitude in treating potentially infected patients. Statistical analysis was performed using the Pearson chi^2 test and Student t-test. The α-level was fixed at $p = 0.05$. All data were analyzed with STATA 16 (StataCorp LP, College Station, TX, USA). Results: 1500 dentists (664 men and 836 women) completed the questionnaire. The majority of respondents declared having been trained in infection prevention procedures (64.3%) but not specifically to prevent the spread of COVID-19 (48.7%). A total of 57.2% declared that they were not trained sufficiently to restart working after lockdown, with a significantly higher prevalence (Pearson chi^2 test, $p < 0.001$) among women (62.3%) than men (50.9%). Conclusion: Italian dentists were informed correctly on the mode of transmission but partially missed COVID-19 symptoms. Dentists considered the virus infection highly dangerous, and they were not confident in being able to work safely. The lack of precise operating guidelines creates uncertainties on infection control measures and appropriate personal protective equipment (PPE) use. The participants revealed apprehension for their health and the current and future economic situation of their practices.

Keywords: COVID-19; SARS-CoV-2; dentistry; questionnaire; infection control

1. Introduction

Coronavirus disease 2019 (COVID-19) is a pandemic disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which is spreading worldwide. The epidemic started in December 2019 in the city of Wuhan, China. The World Health Organization (WHO) declared it a pandemic on 11 March 2020 [1]. Italy has been one of the first and most hit European countries since the end of February, and it has had more than 170,000 cases and more than 20,000 deaths [2,3]. The prime minister declared a period of lockdown in accordance with the Italian National Institute of Health, with regional administrations trying to limit the spread of the disease, identify suspected cases, and activate quarantine measures [4–6].

Concerning dental practices, dentists were asked to limit their activities to non-deferrable urgent care such as pulpitis, abscess, and broken removable prosthesis [7]. The Centers for Disease Control and Prevention (CDC), the American Dental Association (ADA), and the World Health Organization (WHO) recommended practice guidelines for dental clinicians to control the COVID-19 infection [8–11]. These recommendations include the use of personal protective equipment (PPE) such as FPP2 and FPP3 for aerosol-producing procedures, single-use protective clothing, protective eyewear, frequent

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Dentists' Awareness, Perception, and Attitude Regarding COVID-19 and Infection Control: Cross-Sectional Study Among Jordanian Dentists

Yousef Khader, SCD, Mohannad Al Nsour, PhD, [...], and Bara' Abdallah AlShurman, MSc

Additional article information

Abstract

Background

Despite the availability of prevention guidelines and recommendations on infection control, many dental practices lack the minimum requirements for infection control.

Objective

This study aimed to assess the level of awareness, perception, and attitude regarding the coronavirus disease (COVID-19) and infection control among Jordanian dentists.

Methods

The study population consisted of dentists who worked in private clinics, hospitals, and health centers in Jordan. An online questionnaire was sent to a sample of Jordanian dentists in March 2020. The questionnaire was comprised of a series of questions about dentists' demographic characteristics; their awareness of the incubation period, the symptoms of the disease, mode of transmission of COVID-19 and infection control measures for preventing COVID-19; and their attitude toward treating patients with COVID-19.

Results

This study included a total of 368 dentists aged 22-73 years (mean 32.9 years, SD 10.6 years). A total of 112 (30.4%) dentists had completed a master or residency program in dentistry, 195 (53.0%) had received training in infection control in dentistry, and 28 (7.6%) had attended training or lectures regarding COVID-19. A total of 133 (36.1%) dentists reported that the incubation period is 1-14 days. The majority of dentists were aware of COVID-19 symptoms and ways of identifying patients at risk of having COVID-19, were able to correctly report known modes of transmission, and were aware of measures for preventing COVID-19 transmission in dental clinics. A total of 275 (74.7%) believed that it was necessary to ask patients to sit far from each other, wear masks while in the waiting room, and wash hands before getting in the dental chair to decrease

Article court

Soins bucco-dentaires et épidémie de Coronavirus COVID-19

Oral care and the Coronavirus COVID-19 epidemic

Damien Offner[1, 2], Elisabetta Merigo[1, 3], Delphine Tardivo[1, 4], Catherine-Isabelle Gros[2], Laurence Lupi[1, 3], Anne-Marie Musset[1, 2]

Résumé

L'épidémie au Coronavirus SARS-CoV-2 (maladie COVID-19) a débuté en décembre 2019 en Chine, puis a progressé très rapidement en France. Elle a eu pour conséquences la mise en place de mesures nationales telles que le confinement de la population, mais aussi une désorganisation du système de santé et notamment concernant les soins bucco-dentaires. Ceux-ci sont, en effet, générateurs d'aérosols qui peuvent être chargés en particules virales, et constituer à ce titre une voie de contamination majeure par le virus. À la demande de la Conférence des Doyens des Facultés d'Odontologie, le Collège National des Chirurgiens-Dentistes Universitaires en Santé Publique (CNCDUSP) a constitué un groupe de travail, afin d'émettre des recommandations pour les soins bucco-dentaires dans le contexte d'épidémie au COVID-19, au vu des risques spécifiques auxquels les praticiens sont confrontés. Eu égard à la méconnaissance des spécificités de la pratique de la chirurgie dentaire dans le monde médical et auprès des décideurs, et compte tenu de la rapidité de la mise en place des mesures nationales de lutte contre l'épidémie, les recommandations du CNCDUSP ont dû être élaborées rigoureusement et rapidement avant de pouvoir être diffusées à la profession. Elles tiennent compte des données épidémiologiques liées au virus, des spécificités des soins bucco-dentaires, et proposent ainsi des mesures de protection pour les professionnels de la chirurgie dentaire.

L'adaptation nécessaire de l'offre de soins en période d'épidémie permettra certainement de tirer des enseignements de cette crise sanitaire.

Mots-clés : Chirurgie dentaire ; Covid-19 ; Coronavirus ; Hygiène ; Masque ; Aérosol.

Abstract

The COVID-19 Coronavirus epidemic started in December 2019 in China, and progressed very quickly in France. Its consequences were the implementation of national measures such as the containment of the population, but also a disorganization of the healthcare system, in particular concerning oral care. Indeed, dental procedures produce aerosols which can be loaded with viral particles, and as such, constitute a major contamination route by the virus. At the request of the Conference of Deans of the Faculties of Odontology, the National College of University Dentists in Public Health (CNCDUSP) set up a working group in order to issue recommendations for oral care in the context of the COVID-19 epidemic, given the specific risks faced by practitioners. Considering the lack of awareness of the specifics of dentistry in the medical world and among decision-makers, and given the speed with which national measures to fight the epidemic were implemented, the recommendations of the CNCDUSP had to be drawn up rigorously and quickly before being released to the profession. They take into account epidemiological data related to the virus, the specificities of oral care, and thus propose protective measures for dental surgery professionals.

The necessary adaptation of the healthcare system during an epidemic will certainly make it possible to learn lessons from this health crisis.

Keywords: *Dentistry; Covid-19; Coronavirus; Hygiene; Mask; Aerosol.*

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C.S. MOTT CHILDREN'S HOSPITAL
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NATIONAL POLL ON CHILDREN'S HEALTH

Mott Poll Report

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Pandemic-posed Challenges to Children's Oral Health

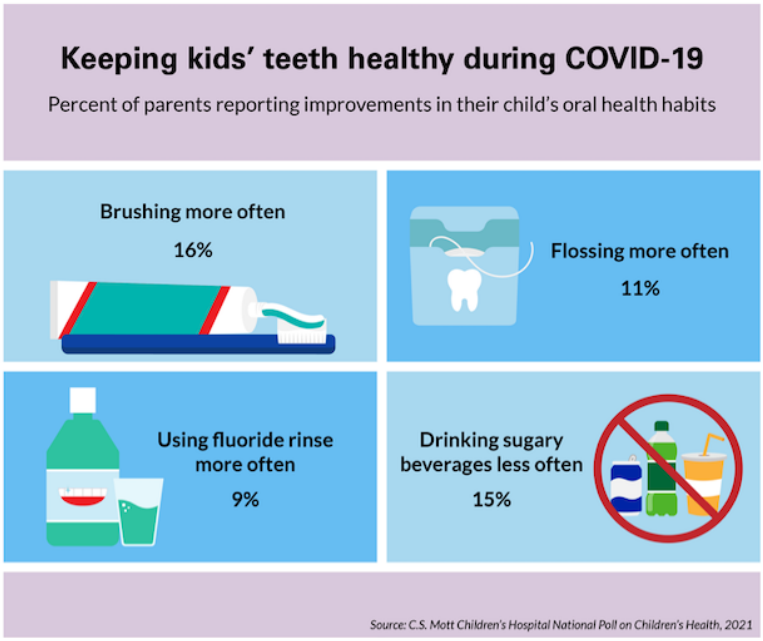
Preventive dental care, or dental check-ups, include cleaning and examining teeth for decay or cavities. It is recommended that children get regular preventive dental care to ensure teeth are healthy and to promptly address any dental problems. However, some dental offices have changed their operations to limit the spread of COVID-19. The C.S. Mott Children's Hospital National Poll on Children's Health asked a national sample of parents about getting preventive dental care for their children age 3-18 years during the pandemic.

Sixty percent of parents have tried to get preventive dental care for their child since the pandemic started. In most cases parents say they got an appointment, 69% in the usual timeframe and 24% after a delay; 7% of parents say they were unable to get an appointment. More parents of children with Medicaid dental coverage (15%) say they were unable to get an appointment, compared to those with private dental insurance (4%) or no coverage (5%).

Forty percent of parents have not tried to get preventive dental care for their child since the pandemic started. Among this group, most cite COVID-related reasons: 40% do not want to risk getting exposed, while 23% say the dentist office was closed or only seeing urgent patients. Other parents say they did not call for an appointment because their child was not due for dental care (23%) and/or was not having any dental problems (28%). Cost is the reason for 1 in 4 parents of children with no dental insurance, but not for those with Medicaid or private dental coverage.

Most parents (67%) believe it is safe for their child to get dental care right now, while 14% feel it is not safe and 19% are unsure. One-third of parents (32%) feel COVID-19 has made it harder to get preventive dental care for their child.

Parents report changes to improve their child's oral health habits during the pandemic, including more frequent brushing (16%), flossing (11%) and use of fluoride rinse (9%), and less drinking of sugary beverages (15%). Overall, 28% of parents say their child has made at least one positive change, including more parents of children with Medicaid (37%) or no dental coverage (32%) compared to private dental insurance (24%).



Report Highlights

1 in 3 parents say COVID-19 has made it hard to get dental care for their child.

Children with Medicaid dental coverage have had more problems getting a preventive dental appointment.

1 in 4 parents say their child's oral health habits have improved during the pandemic.

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Application of Behavior Management Techniques for Paediatric Dental Patients by Tanzanian Dental Practitioners

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Abstract: *Background*: Management of children's behavior is an integral component of pediatric dental practice. *Objective*: To investigate the oral health care providers' awareness, use and factors for choice of behavior management techniques when attending paediatric dental patients. *Methods*: A cross-sectional study among dental practitioners in Dar es Salaam, Tanzania. Data collection was done through interview using a structured questionnaire. The recorded information included: awareness and application of behavior management techniques (BMT) when attending a child dental patient, factors influencing choice of a particular technique, socio-demographics, level of professional training, working experience and facility profile. Using SPSS program version 18, frequency distributions and cross tabulations analyses were performed. *Results*: 74 dental practitioners participated in the study, of whom 49 (66.2%) were males and 44 (59.5%) were graduates. Most participants were aware of the behavior management techniques, ranging from 100% for Tell-Show-Do to 86% for distraction. A small proportion (9.5%) reported to have adequate skills, all of them were graduates. The use of universally accepted BMTs was reported by 65% of experienced practitioners, 61% of graduates, 59% of those reporting to have received formal training and all of those reporting to have fair/inadequate skills to apply BMTs (p= 0.01). *Conclusion*: Most participants were aware of BMTs, although few acknowledged having adequate skills to apply the techniques. They use BMTs during treatment of paediatric dental patients and their choice of the technique is mainly influenced by children's factors.

Keywords: Awareness, behavior management techniques, paediatric, practitioners, professional training, Tanzania.

INTRODUCTION

Management of children's behavior is an integral component of pediatric dental practice [1]. It is as fundamental to the successful treatment of children as are hand piece skills and knowledge of dental materials in dental practice [2] and it is achieved through application of various Behavior Management Techniques (BMTs). BMTs are a set of procedures aimed at enhancing the child's useful coping skills, achieve complete willing and acceptance of dental care, and ultimately reduce the child's perception that the dental situation is overwhelming or dangerous [1]. In other words, the techniques are employed by dental practitioners in attending a child dental patient so as to establish communication, alleviate fear and anxiety, facilitate delivery of quality dental care, build a trusting relationship between dentist, child, and parent, and promote the child's positive attitude towards oral/dental health and oral health care thus cope with and be willing to undertake dental treatment procedures [3-5].

Approaches for behavioural management changed considerably during the second half of the 20th century, with an increasing emphasis on communication and empathic skills [6]. They have been codified into professionally derived guidelines [7]. To date, a wide variety of behavior management techniques are available to dental practitioners [8, 9], namely; tell-show-do, desensitization, modeling, positive reinforcement, voice control, distraction, parental presence/absence, restrain/protective stabilization, non verbal communication, hand-over-mouth, sedation and general anaesthesia.

Behavior management techniques have been classified as pharmacological as opposed to non pharmacological, communicative (communication and communicative guidance) versus advanced behavior guidance techniques and universally accepted against non-universally accepted ones, as well as informal and common sense techniques *versus* formal relaxation techniques [1, 10]. The classification into universally and non-universally applied techniques was used during analysis and reporting in this article.

Different authors have reported application of BMTs in different countries/societies. In the United States, Carr and Wilson [8] reported that the Southeastern US dentists used less aversive techniques and reported a marked reduction in the use of the hand over mouth exercise. A survey among active members of the American Academy of Pediatric Dentistry residing in the U.S. and Canada showed that only a minority used hand-over-mouth and active immobilization of sedated patients. No significant differences by groups were seen in respect to the use of most basic behavior management techniques. Significant differences by sex and age were seen for the use of non-verbal communication and advanced

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Article

Children's Dental Anxiety during the COVID-19 Pandemic: Polish Experience

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Abstract: Dental fear and anxiety is a significant issue that affects pediatric patients and creates challenges in oral health management. Considering that the coronavirus disease 2019 (COVID-19) pandemic, along with its associated sanitary regime, social distancing measures and nationwide quarantines, could itself induce public fears, including in children, it is of great interest to explore whether this situation and the necessity of reorganizing dental care could potentially affect the emotional state of pediatric patients facing a need for urgent dental intervention. The present study assessed the emotional state of children ≤ seven years old (n = 25) requiring dental healthcare during a nationwide quarantine in Poland, as well as the anxiety levels of their caregivers. The Faces Anxiety Scale was adopted, and the evaluation was independently performed by the dentist, caregivers and children themselves. The level of anxiety in caregivers was also measured. As demonstrated, children requiring dental intervention during the nationwide quarantine did not reveal a significantly higher anxiety level as compared to the age- and indication-matched pre-pandemic control group (n = 20), regardless of whether their emotional state was evaluated by the dentist, caregivers, or by themselves. However, the share of children scoring the lowest anxiety level in all assessments was smaller in the pandemic group. Boys in the pandemic group had a higher anxiety level, as indicated by a caregiver assessment, and displayed a negative correlation with age in all three types of evaluation. Moreover, caregiver anxiety levels were higher in the pandemic group as compared to the pre-pandemic subset and revealed stronger correlations with the dental anxiety in children. The results suggest that the reorganization of oral healthcare under the pandemic scenario did not have a profound effect on children's dental anxiety. Nevertheless, findings in young boys highlight that they may be more vulnerable and require special care to mitigate their anxiety and decrease the risk of dentophobia in the future—these observations must be, however, treated with caution due to the small sample size and require further confirmation. Moreover, it is important to reassure caregivers of the safety of the dental visit during the pandemic to minimize the effect of their own anxiety on dental fears in children.

Keywords: COVID-19; SARS-CoV-2; dental care; children; dentist-patient relation; pandemic

1. Introduction

The outbreak of the novel coronavirus disease COVID-19 in December 2019 that spread across the Asian continent and eventually turned into a pandemic [1,2] created numerous challenges in health care sectors unrelated to the management of infectious diseases, including dentistry [3–7]. Following the confirmation of the first case in an increasing number of countries, the physical infrastructure, including entire hospitals, hospital wards, beds and technical equipment, had to

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Paediatric Oral Health during and after the COVID-19 Pandemic

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Abstract

Background: During the period of health emergency linked to the current COVID-19 pandemic, the paediatric dentists' management of oral health problems in children must have as primary objective the control of the spread of the disease according to specific protocols aimed at minimizing the risk of viral transmission.

Aim: This paper examines the possible clinical conditions that may require intervention by the paediatric dentist, distinguishing clinical situations that fall into the category of paediatric dental emergencies from conditions of oral pathologies that normally do not represent an emergency. The definition of rigorous and highly effective infection control protocols in the dental settings must therefore be complemented by the development and strengthening of remote communication techniques with the parents, who must be adequately educated on preventive and palliative measures for the management of their children's oral health, with the aim of postponing clinical attendance to when the circumstances become favourable.

Conclusions: The experience gained with these approaches and models of treatment, where remote interaction techniques play a central role, will hone the communication skills of the paediatric dentist and will retain its usefulness even at the end of the current emergency period.

KEYWORDS

COVID-19 pandemic, oral health prevention, paediatric dentistry

1 | INTRODUCTION

Prevention of oral health in children represents the gold standard towards which health professionals specialized in paediatric dentistry should always be oriented. This is even more true in times of health emergency such as the one we are going through today in which the WHO first declared the COVID-19 epidemic a Public Health Emergency of International Concern[1] and then recognized it as a pandemic.[2]

It is precisely during the COVID-19 epidemic period that an adequate management of the oral health of children becomes of crucial importance by implementing specific protocols relating both to the pathologies of the oral cavity that normally do not represent an emergency and to those clinical situations that fall within the category of paediatric dental emergencies.

In both conditions, the main objective is to limit the spread of the epidemic and the onset of cross-infections. Therefore, not only are rigorous and highly effective infection control protocols urgently needed in the dental environments of the regions affected by COVID-19, but it is also essential to work on remote communication and education aimed at maintaining the oral health of children.

2 | COVID-19 RISK FACTORS ASSOCIATED WITH PAEDIATRIC DENTAL TREATMENT

Genetic and epidemiological research reports that the COVID-19 epidemic started with a single transmission

CE is a certified tutor of the Prechtl General Movement Assessment.
PBM declares no competing interests.

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Protecting the psychological health of children through effective communication about COVID-19


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The attention of the world is rightly focused on measures to mitigate the transmission and economic effect of the 2019 novel coronavirus disease (COVID-19) pandemic. In this rapidly changing situation, media and social conversations are entirely dominated by the outbreak, and children are exposed to large amounts of information and high levels of stress and anxiety in the adults around them. Simultaneously, children are experiencing substantial changes to their daily routine and social infrastructure, which ordinarily foster resilience to challenging events.[1] Parents would do anything to protect their children from distress and might avoid talking about difficult feelings and events. However, research shows that even children as young as 2 years are aware of the changes around them.[2] Children's understanding evolves throughout childhood and adolescence. Thus, when adults talk to children, the information provided needs to take into account the child's age and level of understanding. Sensitive and effective communication about life-threatening illness has major benefits for children and their family's long-term psychological wellbeing.[2]

Children need honest information about changes within their family; when this information is absent, children attempt to make sense of the situation on their own.[3] Consideration of the child's developmental stage is crucial to ensure that communication is effective and neither underestimates or overestimates their understanding.[4] Communicating with younger children should not solely rely on simplification of the language or concepts used, but must also take into account children's comprehension of illness and causality. Between the ages of approximately 4 and 7 years, understanding is substantially influenced by magical thinking, a concept that describes a child's belief that thoughts, wishes, or unrelated actions can cause external events—eg, an illness can be caused by a particular thought or behaviour. The emergence of magical thinking occurs around the same time children are developing a sense of conscience, while still having a poor understanding of how illness is spread. Adults need to be vigilant that children are not inappropriately blaming themselves or feeling that the illness is a punishment for previous bad behaviour.[5] Therefore, listening to what children believe about COVID-19 transmission is essential; providing children with an accurate explanation that is meaningful to them will ensure that they do not feel unnecessarily frightened or guilty.

The uncertainty about the personal and global effects of COVID-19 is creating great concern, in addition to the specific psychological effect of quarantine.[6] Adults' preoccupation with the implications of COVID-19

SCIENTIFIC RESEARCH REPORT

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Epidemiology of dental caries among adolescents in Tamil Nadu, India

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Objective: Economic and dietary changes in the Indian state of Tamil Nadu have led to compromised oral health status of the adolescent population. Adequate epidemiological data are not available to address the prevention or treatment needs in this region of India. The aim of this study was to measure the prevalence and severity of dental caries among adolescents of Tamil Nadu, a southern state of India. **Methods:** The study sample included 974 adolescent school students (12–15 years of age) from both rural and urban areas of Tamil Nadu, India. The decayed, missing and filled teeth (DMFT) index of these students was measured using the World Health Organization oral health survey method, in a quantitative cross-sectional study. **Results:** The oral health survey indicated that the prevalence of dental caries among adolescents in rural and urban areas of Tamil Nadu was 61.4%, with an average DMFT score of 2.03. Multiple regression analyses indicated factors such as gender, mother's education, type of school and caste as significant predictors of dental caries. **Conclusion:** Female gender, Scheduled Caste and Tribes attending public schools in rural areas were identified as the more vulnerable populations to be affected by dental caries. Oral health policies should be targeted to these adolescent populations in the Tamil Nadu region.

Key words: Prevalence of dental caries, severity of dental caries, Thanjavur, Chennai, oral health survey

INTRODUCTION

The prevalence of dental caries is increasing in developing countries, such as India, because of economic growth and changes in dietary habits. In India, community-based dental-caries prevention has only recently become a priority. The 2002–2003 National Oral Health Survey conducted by the Dental Council of India indicated a dental decay prevalence of 49.8% and a mean decayed, missing and filled teeth (DMFT) index of 2.5 among 12-year-old subjects and of 3.4 among 15-year-old subjects[1]. The World Health Organization (WHO) and the Government of India conducted a more recent multicentric study (in 2007) comparing oral health-care needs in different states of India, but the state of Tamil Nadu was not included in that study.[2] Both private and Government-funded dental university hospitals, which provide free or inexpensive dental treatment, are clustered in urban areas. In addition, under the 'rural healthcare scheme', 22% of primary health centres provide emergency treatment, scaling, filling and extraction, free of charge to all age groups, by a qualified dentist.[3] However, oral health services are not provided in 78% of primary health centres located in rural areas where 65% of the total Tamil Nadu population live.[4]

Numerous studies have been conducted in different districts of Tamil Nadu[5–7] but baseline data were not adequately reported for either the rural or the urban adolescent population, and data were not available on the distribution of dental caries among different caste categories for the adolescent population. Currently, the Tamil Nadu State Government is in the process of developing and strengthening oral health strategies, which includes the addition of dental services to the primary health-care centres in Tamil Nadu. Hence, if this population-based approach to improving the oral health status of Tamil Nadu is to be evidence informed, there is an urgent need to collect baseline and benchmarking data for this purpose.

The primary aim of this study was to determine the prevalence and severity of dental caries among the Tamil Nadu adolescent population to help inform the implementation of effective intervention and oral

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Original article

Pediatric dental emergency management and parental treatment preferences during COVID-19 pandemic as compared to 2019

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ABSTRACT

Pediatric dental emergency management were temporarily suspended during the COVID-19 pandemic, which worsened urgent dental needs. This retrospective study investigated the management of pediatric emergencies during COVID-19 lockdown and the trends in parental preferences from March to July in 2019 and 2020. Pediatric dental emergencies managed during pandemic was collated, procedures were categorized (emergency, restorative, preventive, elective) and trends in parental treatment preference was compared from March-July 2019/2020. Bivariate analysis was performed using fisher-exact test and statistical significance was set at 5%. Total 1081 children were treated during COVID-19 lockdown, and 1509 procedures were performed, of which 20.8% were emergency, 42% restorative, 24.4% preventive, 12.6% elective. In 2019, 7462 children were treated; and except for emergency (10.6%), other procedures were comparable to 2020. Extractions (267) predominated in 2020 followed by sealants (195); but in 2019, pulectomy (1268), scaling (1251) were predominant. None of the residents who performed aerosol procedures got infected with COVID-19 during the lockdown. Emergency dental needs among pediatric patients were very high during the COVID-19 pandemic in South India, and there was not much change in the trend in parental treatment preference in 2019 and 2020. Further, aerosol procedures did not increase the risk of COVID-19 during the pandemic provided proper universal precautions were followed.

1. Introduction

Corona virus disease 2019 (COVID-19) has crippled health care delivery throughout the globe. Pediatric patients pose unique challenge during the pandemic as they don't understand the basic tenets of COVID-19 safety protocols such as social distancing and personal hygiene measures. Routine dental care was the worst affected among all services, and almost all the countries had posed severe restrictions towards dental procedures generating aerosol, fearing the spread of COVID-19. Indian government enforced national lockdown from the third week of March until June 2020, and the government of Tamil Nadu extended the state lockdown until July 2020 to prevent the spread of COVID-19 pandemic. By July 31, India had a total of 1,695,988 confirmed cases of COVID-19, and 35,747 individuals had succumbed to the virus (https://coronavirus.jhu.edu/map.html).

Impact of COVID-19 on children has been mild and pediatric cases in India have been relatively low (Balasubramanian et al., 2020). As of June 5, only 1506 cases below the age of 12 were reported in Tamil Nadu and in October, the cases had risen to 25,073 (https://www.thehindu.com/news/national/tamil-nadu/covid-19-cases-continue-to-fall-in-tamil-nadu/article32896602.

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What Constitutes a Dental Emergency?

ADA

The ADA recognizes that state governments and state dental associations may be best positioned to recommend to the dentists in their regions the amount of time to keep their offices closed to all but emergency care. This is fluid situation and those closest to the issue may best understand the local challenges being faced.

DENTAL EMERGENCY

Dentists should use their professional judgment in determining a patient's need for urgent or emergency care.

Dental emergencies are potentially life threatening and require immediate treatment to stop ongoing tissue bleeding, alleviate severe pain or infection, and include:

- Uncontrolled bleeding
- Cellulitis or a diffuse soft tissue bacterial infection with intra-oral or extra-oral swelling that potentially compromise the patient's airway
- Trauma involving facial bones, potentially compromising the patient's airway

Urgent dental care focuses on the management of conditions that require immediate attention **to relieve severe pain and/or risk of infection and to alleviate the burden on hospital emergency departments. These should be treated as minimally invasively as possible.**

- Severe dental pain from pulpal inflammation
- Pericoronitis or third-molar pain
- Surgical post-operative osteitis, dry socket dressing changes
- Abscess, or localized bacterial infection resulting in localized pain and swelling
- Tooth fracture resulting in pain or causing soft tissue trauma
- Dental trauma with avulsion/luxation
- Dental treatment required prior to critical medical procedures
- Final crown/bridge cementation if the temporary restoration is lost, broken or causing gingival irritation
- Biopsy of abnormal tissue

Other urgent dental care:

- Extensive dental caries or defective restorations causing pain
  - Manage with interim restorative techniques when possible (silver diamine fluoride, glass ionomers)
- Suture removal
- Denture adjustment on radiation/ oncology patients
- Denture adjustments or repairs when function impeded
- Replacing temporary filling on endo access openings in patients experiencing pain
- Snipping or adjustment of an orthodontic wire or appliances piercing or ulcerating the oral mucosa

DENTAL NON EMERGENCY PROCEDURES

Routine or non-urgent dental procedures includes but are not limited to:

- Initial or periodic oral examinations and recall visits, including routine radiographs
- Routine dental cleaning and preventive therapies
- Orthodontic procedures other than those to address acute issues (e.g. pain, infection, trauma) or other issues critically necessary to prevent harm to the patient
- Extraction of asymptomatic teeth
- Restorative dentistry including treatment of asymptomatic carious lesions
- Aesthetic dental procedures

Updated 3/30/21

FOR THE LATEST UPDATES, VISIT ADA.ORG/VIRUS

Johns Hopkins Center for Health Security, Baltimore, MD, USA (AC); and Academy of Postgraduate Education, Federal Medical Biological Agency of Russia, Moscow, Russia (MB)

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Urgent dental care for patients during the COVID-19 pandemic

During the initial phase of a pandemic, when a vaccine is not available, personal protective equipment (PPE)[1] plays a major part in disease control. Dental and oral surgery procedures using drills or ultrasonic devices cause aerosol release, and routine dentistry has therefore been suspended in several countries, including the UK, to reduce virus transmission. There is an urgent need for organised emergency dental care delivered by teams provided with appropriate PPE.[2] This also allows for redistribution of PPE to urgent care when there is inevitably an initial shortage and distribution challenge.

Timely and major reorganisation of dental care services is challenging. Early management of acute dental emergencies is important to avert patients from Accident and Emergency services and to avoid hospital admissions. One concern is that with the suspension of routine dental care, more patients than usual could need admission for the management of acute dental infections that threaten the airway and require intensive care.

Patients with substantial swellings can progress to life-threatening emergencies, which can increase risks in the setting of reduced health-care availability. For such patients, extractions of the causative pathogenic teeth should be prioritised over restorative rescue, and input from dedicated oral surgery and oral and maxillofacial services and close follow-up should be instigated as locally appropriate. This approach has many benefits, including stewardship of antimicrobials, but is a deviation away from routine dentistry that should be thoroughly discussed with patients. Decisions on undertaking treatment should therefore be made with appropriate patient consent. Clinicians might wish to follow up patients digitally (eg, through video calls), if appropriate, to ensure patient safety, but also to minimise repeated patient contact.

Testing for coronavirus disease 2019 (COVID-19) in dental professionals should be undertaken with the same high priority as that of medical health-care workers in hospitals. The risk of a dental practitioner being positive for COVID-19 and potentially infecting patients attending emergency dental services should not be underestimated. Proactive and preventive measures need to be established as mainstay protocol to contain the spread of the virus.

We declare no competing interests.

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Cancer medicine: a missed opportunity

gawrav/Getty Images

Richard Horton's Comment on the broken promise of cancer medicine[1] inspired us to provide another perspective on the issue. Vijayalakshmi, in her 50s, and Sangeeta, in her 30s, both died in 2019 because innovative medicines were not available in India or clinical trials were unavailable. Scores of men, women, and children die every day worldwide due to lack of available treatments.[2] Access has been long debated and although India has a national cancer programme and several treatments available through insurance, care has been unaffordable because insurance does not cover all costs. As patients, we welcomed the World Health Assembly resolution on cancer prevention and control[3] and the related 2018 WHO Technical Report addressing the pricing of cancer medicines.[4]

This report[4] comprehensively addresses pricing approaches and the effects on availability and affordability of cancer treatment. It also provides an overview of financing gaps and incentives for research and development.[4] However, the report missed the opportunity to involve patients and patient organisations; although a civil society was consulted, the report was not representative of constituency. Challenges in cancer care are presented from a narrowed government's perspective, disregarding the vital role of patients, families, and carers. The report makes very important judgments, such as the value that medicines give to patients lives and the effect of extending patients' lives, without regard to patients' views.[4] Patients not only have experience with the disease, but often the best perspective on interrelated challenges of treating cancer, and their input could have helped explain the actual costs across the care continuum, from prevention to end-of-life care.

Considering that for many patients in developing countries, cancer care is still an impoverishing out-of-pocket

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CORONAVIRUS

Epidemiology and transmission dynamics of COVID-19 in two Indian states

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Although most cases of coronavirus disease 2019 (COVID-19) have occurred in low-resource countries, little is known about the epidemiology of the disease in such contexts. Data from the Indian states of Tamil Nadu and Andhra Pradesh provide a detailed view into severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission pathways and mortality in a high-incidence setting. Reported cases and deaths have been concentrated in younger cohorts than would be expected from observations in higher-income countries, even after accounting for demographic differences across settings. Among 575,071 individuals exposed to 84,965 confirmed cases, infection probabilities ranged from 4.7 to 10.7% for low-risk and high-risk contact types, respectively. Same-age contacts were associated with the greatest infection risk. Case fatality ratios spanned 0.05% at ages of 5 to 17 years to 16.6% at ages of 85 years or more. Primary data from low-resource countries are urgently needed to guide control measures.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), has spread rapidly around the world since emerging in Wuhan, China, in late 2019 (*1*). Our current understanding of COVID-19 comes largely from disease surveillance and epidemiologic studies undertaken during the early phases of the pandemic in China (*1*–*3*) and in the high-income countries of Europe (*4*, *5*) and North America (*6*–*8*). However, most confirmed cases of COVID-19 have now occurred in low- and middle-income countries (LMICs), where a substantial proportion of individuals may be at increased risk of severe outcomes and face barriers to accessing quality health services (*9*–*11*). Although multiple modeling studies have sought to assess how COVID-19 might affect individuals and communities in such settings (*12*–*14*), almost no primary studies of the transmission dynamics and clinical outcomes of COVID-19 in LMICs are available to validate these models and inform intervention strategies (*15*).

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More than 1.3 billion people are at risk of SARS-CoV-2 infection in India, where concerns over COVID-19 have prompted large-scale containment strategies at the national, state, and local levels (*16*). The country's first known COVID-19 case, documented on 30 January 2020, was an Indian national evacuated from China (*17*). Andhra Pradesh and Tamil Nadu are two states in the south of India whose 127.8 million residents collectively account for about 10% of the country's total population. Although they are not the wealthiest states in India, Andhra Pradesh and Tamil Nadu are among the states with the largest health care workforces and public health expenditures per capita, and are known for their effective primary health care delivery models (*18*–*20*). Both states initiated rigorous disease surveillance and contact tracing early in response to the pandemic. Procedures include syndromic surveillance and SARS-CoV-2 testing for all individuals seeking care for severe acute respiratory illness or influenza-like illness at health care facilities; delineation of 5-km "containment zones" surrounding cases for daily house-to-house surveillance to identify individuals with symptoms; and daily follow-up of all contacts of laboratory-confirmed or suspected COVID-19 cases, with the aim of testing these individuals 5 to14 days after their contact with a primary case, irrespective of symptoms, to identify onward transmission (*21*, *22*). We analyzed comprehensive surveillance and contact-tracing data from these programs in an effort to understand transmission dynamics and clinical outcomes of COVID-19 in South India, and to provide insights into control of SARS-CoV-2 in similar LMIC settings.

Expansion of SARS-CoV-2

In India, surveillance of COVID-19 was initiated with airport screening for severe acute respiratory infection, especially for travelers from China. Tamil Nadu further instituted thermal and clinical screening at land borders with other states on 4 March 2020. Nationwide, testing was initially prioritized for symptomatic individuals with history of travel or contact with a confirmed COVID-19 case within the previous 14 days, and was expanded to include all symptomatic individuals and asymptomatic contacts of confirmed cases in states between 20 and 28 March 2020. We detail the timeline of changes in surveillance practices at federal and state levels in the supplementary materials.

Tamil Nadu and Andhra Pradesh each recorded their first laboratory-confirmed COVID-19 cases on 5 March. Under-ascertainment of cases during March and early April was likely due to limited testing availability and testing algorithms. The proportion of tests yielding positive results peaked at 39.7% in Tamil Nadu and 33.5% in Andhra Pradesh on 30 and 31 March 2020, respectively, when the daily number of tests performed was low in the two states (range, 379 to 469 tests; Fig. 1). Throughout early April, increases in the number of tests performed daily coincided with a reduction in the proportion of tests yielding positive results. Our analyses include data collected through 1 August, at which time Tamil Nadu and Andhra Pradesh had identified 263,330 and 172,209 cases, respectively (table S1). (Because testing and contact tracing constitute routine public health activities, data collection was not governed by an institutional review board.)

The earliest clusters of locally acquired cases emerged in March in Chennai and surrounding coastal districts of eastern Tamil Nadu. Of all districts, Chennai ultimately experienced the highest cumulative incidence of COVID-19, totaling 102,199 cases (204.6 per 10,000 population) by 1 August 2020. An outbreak beginning on 28 April caused 1142 cases by 15 May in the adjoining districts of Ariyalur, Cuddalore, Perambalur, and Villuppuram in Tamil Nadu; thereafter, few cases were identified in these districts until early June (fig. S1). Although limited in March and April, incidence in southern districts of Tamil Nadu surrounding Madurai increased during June and reached rates commensurate with incidence in the northern districts of Chennai, Kancheepuram, and Tiruvallur by 1 August, with one to four new positive detections per 10,000 population daily. Similar increases in incidence occurred throughout all districts of Andhra Pradesh in June, where the numerical and geographic extent of cases remained limited during April and May despite similar levels of testing relative to Tamil Nadu.

Statewide estimates of the time-varying reproduction number R_t, describing the number of secondary infections that each infected individual would be expected to generate (*23*), declined from a range of 1.7 to 3.0 in Tamil

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SHORT COMMUNICATION

INTERNATIONAL JOURNAL OF PAEDIATRIC DENTISTRY WILEY

COVID-19 pandemic impact on paediatric dentistry treatments in the Brazilian Public Health System

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Keywords: Community paediatric dentistry, COVID-19, use of dental services

Brazil has the largest National Public Health System (SUS) in the world. The system includes free dental care, covering different specialties, including paediatric dentistry. SUS covers almost 75% of the Brazilian population throughout the country and is the only available option for the more vulnerable.[1] Brazil is currently at the epicentre of COVID-19 pandemic, with more than 2 million infected and more than 120 000 deaths to date.[2] Due to the pandemic, since dentists are professionals at higher risk of contamination and spreading the disease, following World Health Organization (WHO) recommendations, most of the dental clinics significantly reduced their activities, elective dental treatments were postponed with mainly emergency and urgent care remaining.[3] This study aimed to describe the impact of COVID-19 pandemic on the paediatric dentistry treatments offered by the Public National Systems in Brazil.

A retrospective longitudinal (from January 2019 to May 2020) ecological study was carried out using secondary data from the sources: the SUS Computer Department information systems (DATA-SUS) and the Brazilian Institute of Geography and Statistics (IBGE). The dependent variable was monthly calculated (from March of 2019 to May of 2020) as the absolute number of paediatric procedures (restoration, tooth extraction, and endodontic in the primary teeth) carried out by 10 000 inhabitants-month in the Brazilian Public Health Services (SIA-SUS). The exposure variable was the impact of the COVID-19 pandemic evaluated in different ways. Two time points were used: (a) the period of the first case described in Brazil (February 2020) and (b) the period of exponential growth (April). Also, months within the exponential growth (April and May) were compared with the respective months in 2019. The results of exponential growth were stratified by Brazilian Regions are as follow: South, Southeast, Central-west, North, and Northeast. Due to data overdispersion, a multilevel mixed-effects negative binomial regression was used to analyse the longitudinal associations between the impact of the COVID-19 pandemic and the number of dental procedures. Analyses were performed using the STATA 16.0 software (https://www.stata.com).

The sample corresponded to almost all Brazilian municipalities (5564 of 5570) with dental records on DATA-SUS. A reduction of 66% (IRR = 0.34, 95%CI 0.32-0.35) was observed on paediatric treatments performed on SUS when considering the first COVID-19 case. Similar results were observed in restorative (IRR = 0.32, 95%CI 0.31-0.33), tooth extraction (IRR = 0.36, 95%CI 0.35-0.37), and endodontics (IRR = 0.45, 95%CI 0.41-0.48). Considering the period of exponential contagion (April), a drastic reduction of 89%

PLOS ONE

RESEARCH ARTICLE

COVID-19 challenges to dentistry in the new pandemic epicenter: Brazil

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Data Availability Statement: The data underlying the results presented in the study are available at https://osf.io/dnbgs/.

Abstract

A nationwide survey of dentists was carried out in Brazil, a new pandemic epicenter, to analyze how dental care coverage has been affected in public versus private networks, changes in routine and burdens, and how local prevalence of COVID-19 affects dental professionals. Dentists were recruited via email and Instagram®. Responses to a pre-tested questionnaire were collected May 15–24, 2020. COVID-19 case/death counts in the state where respondents work was used to test associations between contextual status and decreases in weekly appointments, fear of contracting COVID-19 at work, and current work status (α = 0.05). Over 10 days, 3,122 responses were received (response rate ~2.1%) from all Brazilian states. Work status was affected for 94%, with less developed regions being more impacted. The pandemic impact on clinical routine was high/very high for 84%, leading to varied changes to clinic infrastructure, personal protective equipment use, and patient screening, as well as increased costs. COVID-19 patients had been seen by 5.3% of respondents; 90% reported fearing contracting COVID-19 at work. Multilevel models showed that greater case and death rates (counted as 1000 cases and 100 deaths per million inhabitants) in one's state increased the odds of being fearful of contracting the disease (18% and 25%). For each additional 1000 cases/100 deaths, the odds of currently not working or treating only emergencies increased by 36% and 58%. The reduction in patients seen weekly was significantly greater in public (38.7±18.6) than in private clinics (22.5±17.8). This study provides early evidence of three major impacts of the pandemic on dentistry: increasing inequalities due to coverage differences between public and private networks; the adoption of new clinical routines, which are associated with an economic burden for dentists; and associations of regional COVID-19 incidence/mortality with fear of contracting the disease at work.

Introduction

Brazil has emerged as a new COVID-19 pandemic epicenter with steadily growing caseloads. By July of 2020, Brazil was the country with the second-most cases and deaths [1]. With dentistry being a context of high contraction risk and the international supply of personal

Commentary

How COVID-19 deepens child oral health inequities

Danny A. Kalash, DMD, MPH

As COVID-19 reaches every part and level of the United States, our society's widespread inequalities will be intensely highlighted and further exacerbated. The outbreak's effect will also be acutely felt by disadvantaged and underprivileged children.[1] Those effects will prominently emerge in our oral health care system, where they will further widen glaring child oral health disparities.

Well before the pandemic, US children living in poverty and those from low-income families or racial and ethnic minorities overrepresented our national dental disease burden.[2] Caries has unfairly and unjustly persisted and concentrated among this relatively small part of the US population. And although the national prevalence of caries appears to be decreasing among all children, it continues to stagnate or worsen among this demographic.[2]

As a result of caries, children's health, development, and quality of life markedly suffer.[3] When compounded with social barriers, the chronic and cumulative consequences of child oral disease contribute to wider health inequities throughout the life course.[4]

The outbreak's effect will also be acutely felt by disadvantaged and underprivileged children. Those effects will prominently emerge in our oral health care system, where they will further widen glaring child oral health disparities.

COVID-19 PAUSES THE US ORAL HEALTH CARE SYSTEM

In March 2020, the Centers for Disease Control and Prevention recommended that all elective surgeries and nonessential medical, surgical, and dental procedures be delayed during the onset of the COVID-19 outbreak. As a result, dental clinics across the country were temporarily closed to children, triaging patients for only urgent and emergency procedures.

Although this was a necessary precaution, closures disproportionally harmed children in poverty and those from low-income families and racial and ethnic minority groups since they carry the greatest extent and severity of dental disease. In fact, these groups already represented the highest proportion of all US children with unmet dental needs.[5]

By abruptly pausing the provision of child dental care, COVID-19 adds delays to time-sensitive treatment, worsens the status of already significant caries, and further overburdens our previously strained dental safety net, including community health centers, federally qualified health centers, and hospitals. Here, the pandemic agonizingly reminds us that poor outcomes resulting from our past oral health policies and approaches will continue unless an equity and justice framework is used.

COVID-19 REVEALS HOLES IN US SOCIAL WELFARE POLICIES

Children live in families, and as families struggle through instability, it becomes increasingly difficult to maintain a child's oral health. A growing body of evidence shows a close link between a family's socioeconomic conditions and child oral health outcomes.[6] COVID-19's spread refocuses our attention to those social inequities, perpetuated by

News

Less Drilling, Less Germ Spray: Dentistry Adapts to the Covid Era

February 9, 2021
by New York Times

Ann Enkoji normally enjoys seeing her dental hygienist, but when her dentist's office in Santa Monica, Calif., canceled her cleaning visit last spring, she felt relieved.

She had been wary of keeping the appointment anyway, worried about someone else's fingers and instruments exploring her mouth at a time when more than 25,000 Americans were contracting the coronavirus daily.

"It's just too up close in that mouth-nasal region," said Ms. Enkoji, 70, a marketing design consultant based in Santa Monica.

To view the full story, please click here.

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Mott Poll Report

Pandemic-posed challenges to children's oral health

February 15, 2021 | Volume 38 , Issue 1

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SHARE REPORT

Preventive dental care, or dental check-ups, include cleaning and examining teeth for decay or cavities. It is recommended that children get regular preventive dental care to ensure teeth are healthy and to promptly address any dental problems. However, some dental offices have changed their operations to limit the spread of COVID-19. The C.S. Mott Children's Hospital National Poll on Children's Health asked a national sample of parents about getting preventive dental care for their children age 3-18 years during the pandemic.

Sixty percent of parents have tried to get preventive dental care for their child since the pandemic started. In most cases parents say they got an appointment, 69% in the usual timeframe and 24% after a delay; 7% of parents say they were unable to get an appointment. More parents of children with Medicaid dental coverage (15%) say they were unable to get an appointment, compared to those with private dental insurance (4%) or no coverage (5%).

Forty percent of parents have not tried to get preventive dental care for their child since the pandemic started. Among this group, most cite COVID-related reasons: 40% do not want to risk getting exposed, while 23% say the dentist office was closed or only seeing urgent patients. Other parents say they did not call for an appointment because their child was not due for dental care (23%) and/or was not having any dental problems (28%). Cost is the reason for 1 in 4 parents of children with no dental insurance, but not for those with Medicaid or private dental coverage.

Most parents (67%) believe it is safe for their child to get dental care right now, while 14% feel it is not safe and 19% are unsure. One-third of parents (32%) feel COVID-19 has made it harder to get preventive dental care for their child.

Parents report changes to improve their child's oral health habits during the pandemic, including more frequent brushing (16%), flossing (11%) and use of fluoride rinse (9%), and less drinking of sugary beverages (15%). Overall, 28% of parents say their child has made at least one positive change, including more parents of children with Medicaid (37%) or no dental coverage (32%) compared to private dental insurance (24%).


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ADEA Supports Prioritization of COVID-19 Vaccine for Dental Community
Sept. 8, 2020— The American Dental Education Association (ADEA) is calling for members of the dental health care team, including dental and dental allied students providing patient care, to be among those health care workers to first receive any vaccine developed for COVID-19.
In comments submitted to a committee of the National Academies of Sciences, Engineering, and Medicine, ADEA voiced its support for a draft federal plan to prioritize distribution of a vaccine.
FOR IMMEDIATE RELEASE
Contact: Kellie Bove
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"ADEA concurs with The National Academies' Committee on Equitable Allocation of Vaccine for the Novel Coronavirus recommendation that 'high-risk workers in health care facilities,' including clinicians, such as dentists and dental hygienists, need to be among the first to receive the COVID-19 vaccine," ADEA stated in its comments, which were submitted by ADEA President and CEO Karen P. West, D.M.D., M.P.H.
"Additionally, ADEA supports the Committee's recognition and inclusion of other members of the dental health care team, such as dental assistants, dental therapists and dental laboratory technicians.

JAMA Network Open

Original Investigation | Infectious Diseases

Association of Age With SARS-CoV-2 Antibody Response

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Abstract

IMPORTANCE Accumulating evidence suggests that children infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are more likely to manifest mild symptoms and are at a lower risk of developing severe respiratory disease compared with adults. It remains unknown how the immune response in children differs from that of adolescents and adults.

OBJECTIVE To investigate the association of age with the quantity and quality of SARS-CoV-2 antibody responses.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional study used 31 426 SARS-CoV-2 antibody test results from pediatric and adult patients. Data were collected from a New York City hospital from April 9 to August 31, 2020. The semiquantitative immunoglobin (Ig) G levels were compared between 85 pediatric and 3648 adult patients. Further analysis of SARS-CoV-2 antibody profiles was performed on sera from 126 patients aged 1 to 24 years.

MAIN OUTCOMES AND MEASURES SARS-CoV-2 antibody positivity rates and IgG levels were evaluated in patients from a wide range of age groups (1-102 years). SARS-CoV-2 IgG level, total antibody (TAb) level, surrogate neutralizing antibody (SNAb) activity, and antibody binding avidity were compared between children (aged 1-10 years), adolescents (aged 11-18 years), and young adults (aged 19-24 years).

RESULTS Among 31 426 antibody test results (19 797 [63.0%] female patients), with 1194 pediatric patients (mean [SD] age, 11.0 [5.3] years) and 30 232 adult patients (mean [SD] age, 49.2 [17.1] years), the seroprevalence in the pediatric (197 [16.5%; 95% CI, 14.4%-18.7%]) and adult (5630 [18.6%; 95% CI, 18.2%-19.1%]) patient populations was similar. The SARS-CoV-2 IgG level showed a negative correlation with age in the pediatric population (r = −0.45, P < .001) and a moderate but positive correlation with age in adults (r = 0.24, P < .001). Patients aged 19 to 30 years exhibited the lowest IgG levels (eg, aged 25-30 years vs 1-10 years: 99 [44-180] relative fluorescence units [RFU] vs 443 [188-851] RFU). In the subset cohort aged 1 to 24 years, IgG, TAb, SNAb and avidity were negatively correlated with age (eg, IgG: r = −0.51; P < .001). Children exhibited higher median (IQR) IgG levels, TAb levels, and SNAb activity compared with adolescents (eg, IgG levels: 473 [233-656] RFU vs 191 [82-349] RFU; P < .001) and young adults (eg, IgG levels: 473 [233-656] RFU vs 85 [38-150] RFU; P < .001). Adolescents also exhibited higher median (IQR) TAb levels, IgG levels, and SNAb activity than young adults (eg, TAb levels: 961 [290-2074] RFU vs 370 [125-697]; P = .006). In addition, children had higher antibody binding avidity compared with young adults, but the difference was not significant.

CONCLUSIONS AND RELEVANCE The results of this study suggest that SARS-CoV-2 viral specific antibody response profiles are distinct in different age groups. Age-targeted strategies for disease screening and management as well as vaccine development may be warranted.

Key Points

Question Are the quantity and quality of antibodies against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) different among children, adolescents, and young adults?

Findings In this cross-sectional study evaluating 31 426 SARS-CoV-2 antibody tests performed between April 9 and August 31, 2020, immunoglobin G levels were found to vary in different age groups, despite similar seroprevalence in the pediatric and adult patient populations. SARS-CoV-2 immunoglobin G and total antibody levels, neutralizing activity, and avidity exhibited negative correlations with age in patients aged 1 to 24 years.

Meaning This analysis revealed distinct antibody responses in different age groups, suggesting that age-targeted strategies for disease screening and management as well as vaccine development may be warranted.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

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REVIEW

COVID-19 vaccine development: a pediatric perspective

Satoshi Kamidani[a], *Christina A. Rostad*[a,b] *and Evan J. Anderson*[a,b,c]

Purpose of review
Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the novel coronavirus that causes coronavirus disease 2019 (COVID-19), has caused substantial morbidity and mortality. Operation Warp Speed aims to accelerate the development of a safe and effective vaccine by early 2021. Multiple vaccine candidates with reassuring safety and efficacy profiles have advanced to phase 3 clinical trials in adults. The purpose of this review is to describe the burden of COVID-19 in children, to update pediatricians about adult COVID-19 vaccine clinical trials, to discuss the importance of COVID-19 vaccine trials in children and to instill confidence in the established vaccine development and licensure processes.

Recent findings
Children of all ages are at risk for SARS-CoV-2 infection and severe disease manifestations. Children are also susceptible to downstream effects of COVID-19, including social isolation and interruption in education. Developing a pediatric COVID-19 vaccine could prevent disease, mitigate downstream effects and enable children to re-engage in their world.

Summary
Children could benefit both directly and indirectly from vaccination. In light of the safety and immunogenicity results from recent adult COVID-19 vaccine clinical trials, children should have the opportunity to be included in clinical trials in parallel to ongoing adult phase 3 clinical trials in a manner that is careful, methodical and transparent.

Keywords
child, COVID-19, immunization, pediatric, pediatric clinical trials, SARS-CoV-2, vaccination

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the novel coronavirus that causes coronavirus disease 2019 (COVID-19), was first reported in Wuhan, China on December 31, 2019 [1,2]. SARS-CoV-2 spread rapidly worldwide, and the WHO declared COVID-19 a global pandemic on March 11, 2020 [3]. By early October 2020, about 7,400,000 cases had been reported to the Centers for Disease Control and Prevention (CDC), including about 210,000 deaths [4]. Although physical control measures, including sheltering at home, social distancing and wearing facemasks, have been critical to delaying the spread of COVID-19, these have come at enormous economic, social and educational costs. Although much of the mortality has occurred in older adults, substantial morbidity and mortality also occur in children.

Based on the current estimates of SARS-CoV-2 transmissibility, more than 2/3 of the population must have immunity to SARS-CoV-2 before sustained transmission will cease [5,6]. As of July 2020, the estimated seroprevalence of SARS-CoV-2 in U.S. adults was only 9% [7]. The development of a safe and effective vaccine against COVID-19 is imperative to mitigate morbidity and mortality. Vaccination benefits both the individual who receives it through direct protection and the greater society through community protection (also known as indirect or herd protection).

Operation Warp Speed (OWS), a partnership between the U.S. Department of Health and Human Services, the Department of Defense, and the private sector, was established in May 2020 to accelerate the

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