

Reshaping Clinical Pediatric Dentistry in Post-Covid Era

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ABSTRACT

Background: The emergence of the novel coronavirus disease (COVID-19) has led to a global pandemic and one of the most significant challenges to the healthcare professionals, particularly to dental healthcare professionals. The clinical manifestations among children appear to be milder yet varied, which are still being collated. The purpose of this essay is to report current data on the paediatric population afflicted with COVID-19 and highlight considerations for dentists providing care for children during this pandemic and the changing perception of Paediatric Dental Practice.

Keywords: Pediatric dentistry, post, Oral hygiene practices.

INTRODUCTION

“COVID-19 will reshape our world. We don’t know when the crisis will end. But we can be sure that by the time it does, our world will look very different.”- Joseph Borrell.

In December 2019, the novel virus SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) appeared, causing the coronavirus disease (COVID-19). The emerging virus, resulted in a global pandemic and was 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 Emergency Committee. The case detection rate is changing daily and can be tracked in almost real time.¹

Today in India, the gap between recovered cases and active cases seems to be increasing. The death count in India is 64,469 whereas the recovery count

is 2.77 million for 3.62 million active cases. India appears to be holding its own, in the battle of effective management among the vast populace during the COVID -19 pandemic. Community transmission is the third of the four stages of the spread of an infectious disease. The first is travel history, the second-local transmission, the third is community transmission, and the fourth is epidemic. India currently is in community transmission phase (ICMR).

Available reports to date show that COVID-19 seems to be uncommon among children. Possible reasons are that children have fewer outdoor activities and undertake less international travel, making them less likely to contract the virus. The number of pediatric patients may increase in the future and a lower number of pediatric patients at the beginning of a pandemic do not necessarily

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mean that children are less susceptible to the infection. In fact, infants can be infected by SARS-CoV-2. As with people of other ages, the impact of the new coronavirus on children also depends on their health. Those children with poorer immunity due to deficiencies might be more at risk of developing a more severe infection should they get the virus. The data on this front in India isn't very encouraging.

PREVALENCE:

As of August 2020, the COVID-19 pandemic has resulted in 52 million cases and 844K deaths worldwide. Data from China suggest that pediatric COVID-19 cases might be less severe than cases in adults and those children might experience different symptoms than do adults.

The reason behind the lower prevalence of COVID-19 among children compared to adults is still unclear. Latest studies suggest that less exposure, less vigorous immune response, and incomplete functionality of Angiotensin-Converting Enzyme II (ACE2) in children – as the potential receptor for SARS-CoV-2 – are responsible for the significantly fewer severe cases in children.²

The largest pediatric review of 2143 children, described that 13% of virologically confirmed children were asymptomatic. This makes epidemiological inference problematic since asymptomatic children are less likely to be tested and may still contribute to transmission. In addition, a significant proportion of children can also have co-infections with other viruses, and the detection of SARS-CoV-2 may therefore be clinically insignificant. It has been proposed that the outcome for some children may be worse due to exposure to antenatal smoking and obesity.³

Another theory that has been postulated is the protective role of Bacillus Calmette-Guerin (BCG)

vaccine in COVID-19. BCG vaccination has been associated with heterologous immunity to other pathogens, potentially by a phenomenon called 'trained immunity' involving innate cells such as macrophages, monocytes and epithelia. Trials are underway to understand if BCG vaccination may offer protection against COVID-19.⁴

ETIOLOGY:

The four human coronaviruses including- 229E, OC43, NL63, and HKU1 are prevalent and typically cause common cold symptoms in immune-competent individuals. SARS-CoV which causes SARS, has a unique pathogenesis because it causes both upper and lower respiratory tract infections.⁵

The genome sequence of 2019-nCoV is about 89% identical to bat SARS-like-CoV and 82% identical to human SARS-CoV. It has been reported that 2019-nCoV uses the same cell entry receptor, ACE2, to infect humans, as SARS-CoV, so clinical similarity between the two viruses could be expected, particularly in severe cases.⁶

CHARACTERISTICS OF HUMAN CORONAVIRUS ⁷

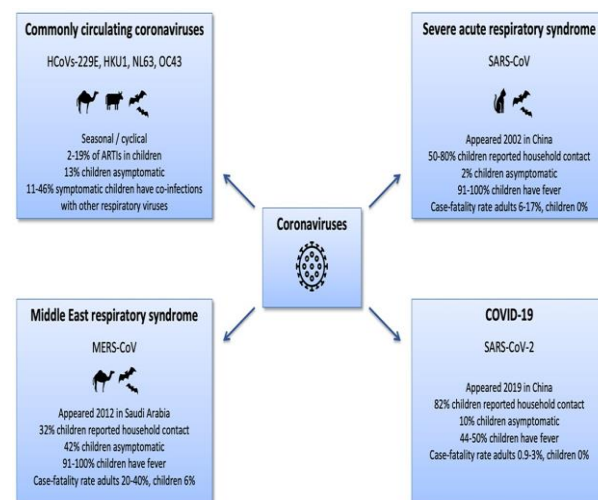


Fig 1: Various Human Coronaviruses.

Table 1: Characteristics of Human Coronaviruses and Covid-19.

	Commonly circulating HCoVs	Covid-19
Prevalence	Brazil: 5%, China: 2%, France: 6%, Hong Kong: 4%, Israel: 10%, Nepal: 8%, United Kingdom: 5%, United States: 19%	Unknown
Mean reproductive number		Wuhan: 2.7 (2.5–3.9) (as of February 2020) 3.2 (2.0–2.6)–3.6 (2.9–4.4) (as of January 2020)

Zoonotic origin	Bats (NL63, 229E) Dromedary camels (229E) Cattle (OC43)	Pangolin suspected but unproven
Outbreak extent and numbers (adults and children)	Unknown	102 countries infections 3584 deaths
Transmission in children	Unknown	82% household contacts
Incubation period	2-5 days	5-6 days (range 2-14 days)
Serial interval mean	Unknown	8 days
Shedding duration	6 days (3-10 days) in children in day care	Unknown
Asymptomatic proportion of children	13% asymptomatic	9%-11% asymptomatic
Clinical features in children	Fever, rhinitis, conjunctivitis, otitis, pharyngitis, laryngitis, headache, bronchitis, bronchiolitis, wheezing, asthma exacerbations, pneumonia, gastrointestinal symptoms, febrile seizures, neurologic disseminated	Fever (44%-50%), cough (38%), rhinitis, fatigue, headache, diarrhoea, dyspnoea, cyanosis, poor feeding
Laboratory findings in children	Not reported	Normal or reduced WBC Decreased neutrophil & lymphocyte count Abnormal liver function tests Increased lactate dehydrogenase
Imaging findings in children	Not reported	Chest CT: bilateral multiple patchy, nodular ground-glass opacities, infiltrating shadows in different zones of lung
Diagnostics (adults and children)	Multi- or multiplex RT-PCR or RNA sequencing on nasopharyngeal or oropharyngeal swabs, sputum, endotracheal aspirate or bronchoalveolar lavage Monoplex RT-PCR on stool (not routine)	RT-PCR or sequencing of RNA sequencing from naso-oropharyngeal swabs, sputum, endotracheal aspirate or bronchoalveolar lavage Serology only when RT-PCR not available
Case-fatality rate in adults	Sporadic cases reported in immunosuppressed adults	0.9-3%
Case-fatality rate in children	Unknown	0%

Risk Factors Associated with Pediatric Dental Treatment:

An evolutionary view of Pediatric dentistry in India, with a tactical plan for 2020 should be the platform for oral health into the next decade. The policymakers, should outline newer goals of the contemporary practice protocols for pediatric oral health services in India.

The prolonged incubation period (2-14 days) and because children can be asymptomatic or present

with mild, non-specific symptoms, all child patients and parents should be considered as potential carriers of COVID-19 unless proven otherwise. COVID-19 disease can be transmitted through direct and indirect contact, mainly via respiratory droplets and splatter from saliva and blood through contact with mucous membranes and contaminated fomites. This predisposes dental professionals to potentially high-risk situations. Many dental treatments are aerosol generating procedures (AGPs), which have been associated with the transmission of acute respiratory infections.⁸

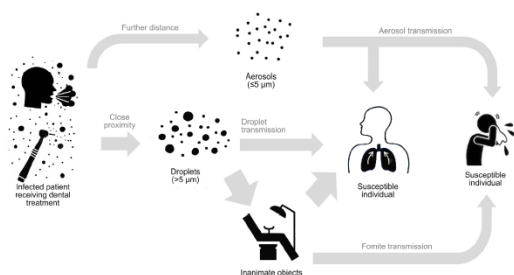


Fig 2: Transmission of virus in Dental setting.

In addition, as SARS CoV-2 virus can persist on surfaces for up to 72 hours and dental settings, post-procedures are more likely to have a high number of potentially contaminated surfaces such as dental chairs, their handles, the spittoon and dental instruments, which pose several routes of transmission.¹

In a pandemic situation, we need to ponder on some points: a) even infants and toddlers who come for routine vaccinations or non-respiratory complaints can be asymptomatic carriers or in pre-symptomatic period of transmission; b) implementing source control measures like face mask and social distancing in this age group practically difficult; c) crying, a common occurrence in this age group, also increases the risk of aerosol generation and transmission; and d) proximity of these kids to caregivers and their attenders along with sustained crying either due to anxiety or fear might further increase the risk and load of aerosol.⁹

As suggested by Sabino-Silva et al. there are a minimum of three different pathways for COVID-19 to be present in saliva: from COVID-19 in the lower and upper respiratory tract, that enters the oral cavity together with the liquid droplets frequently exchanged by these organs; COVID-19 present in the blood can access the mouth via crevicular fluid; by major- and minor-salivary gland infection, with subsequent release of particles in saliva via salivary ducts.¹⁰

The pathogenic microorganisms can be transmitted in dental settings through inhalation of airborne microorganisms that can remain suspended in the air for long periods, direct contact with blood, oral fluids, or other patient materials, contact of conjunctival, nasal, or oral mucosa with droplets and aerosols containing microorganisms generated from an infected individual and propelled a short

distance by coughing and talking without a mask and indirect contact with contaminated instruments and/or environmental surfaces.¹¹

In addition, aerosols from dental devices such as high-speed dental hand-piece, ultra-sonic scalers create particles of droplets and aerosols small enough to stay airborne for an extended period before they settle on environmental surfaces or enter the respiratory tract. Thus, the 2019-nCoV has the potential to spread through droplets and aerosols from infected individuals in dental clinics and hospitals.¹¹

In view of the yet unknown increased risks posed by expected or unexpected crying of asymptomatic children in the transmission of COVID-19, it may be important to make every effort to examine a crying child with adequate precautions.¹²

Case definition for Covid 19 (as of Feb, 2020)

Children: Case definition by the National Clinical Research Centre for Child Health, Zhejiang University School of Medicine (adapted from Chen et al.)^{7, 13}

A suspected or probable case is defined as a case that meets: two clinical criteria and one epidemiologic criterion.

Clinical criteria:

1. Fever, fatigue, dry cough; some pediatric patients may have no fever
2. Patients with the following chest imaging findings: multiple small patchy shadows and interstitial changes, mostly in the lung periphery, bilateral multiple ground-glass opacity, infiltrating shadows, pulmonary consolidation on chest radiography or ground-glass opacities, bilateral segmental lung consolidation, especially in the periphery on chest CT
3. White blood cell counts are normal or decreased, or with decreased lymphocyte count

Epidemiologic criteria:

1. Travel or residence history in Wuhan City and neighbouring areas, or other areas with persistent local transmission within 14 days prior to disease onset.

2. History of contacting patients with fever or respiratory symptoms who have a travel or residence history in Wuhan City and neighbouring areas, or in other areas with persistent local transmission within 14 days prior to disease onset

3. History of contacting confirmed or suspected cases infected with SARS-CoV-2 within 14 days prior to disease onset

4. Related with a cluster outbreak: in addition to this patient, there are other patients with fever or respiratory symptoms, including suspected or confirmed cases infected with SARS-CoV-2

5. New-borns delivered by suspected or confirmed SARS-CoV-2-infected mothers

A confirmed case is defined as a case that meets any of the following criteria:

1. Throat swab, sputum, stool or blood samples tested positive for SARS-CoV-2 nucleic acid using RT-PCR

2. Genetic sequencing of throat swab, sputum, stool or blood samples being highly homologous with the known SARS-CoV-2

3. SARS-CoV-2 granules being isolated by culture from throat swab, sputum, stool or blood samples.

INFECTION CONTROLS FOR DENTAL PRACTICE^{11, 14, 15, 16}

Before Dental Treatment:

- Ensure that the Dental Health Care Personnel (DHCP) have received their seasonal flu vaccine.
- DHCP experiencing influenza-like-illness should not report to work.
- DHCP, who are of older age, have a pre-existing, medically compromised condition, pregnant, etc. are perceived to be at a higher risk.
- All DHCP should self-monitor by remaining alert to any respiratory symptoms and check their temperature twice a day.
- Providers who have recently contracted and recovered from a COVID-19 infection should be the preferred personnel providing care.

- Conduct an inventory of available PPE supplies.
- Remove magazines, reading materials, toys and other objects that may be touched by others and which are not easily disinfected.
- Print and place signage in the dental office for instructing patients.
- Schedule appointments apart enough to minimize possible contact with other patients in the waiting room.
- Prevent patients from bringing companions to their appointment, except for instances where the patient requires assistance. (ADA)

Upon patient arrival:

- Upon patient arrival, they may wait in their personal vehicle or outside the facility where they can be contacted by mobile phone when it is their turn to be seen.
- Only asymptomatic patients: be seen in dental settings.

Patient evaluation:

First of all, dental professionals should be able to identify a suspected case of COVID-19. To date that this paper was drafted, the National Health Commission of the People's Republic of China has released the 5th edition of the Guideline for the Diagnosis and Treatment of Novel Coronavirus Pneumonia. In general, a patient with COVID-19 who is in the acute febrile phase of the disease is not recommended to visit the dental clinic. If this does occur, the dental professional should be able to identify the patient with suspected 2019-nCoV infection, and should not treat the patient in the dental clinic, but immediately quarantine the patient and report to the infection control department as soon as possible.

The body temperature of the patient should be measured in the first place. A contact-free forehead thermometer is strongly recommended for the screening. A questionnaire should be used to screen patients with potential infection of 2019-nCoV before they could be led to the dental chair-side.

These questions should include the following:

Table 2: COVID-19 Screening Questions.

YES	NO	COVID- 19 Screening Questions
		In the past 14 days, have you or any household member travelled to international area or anywhere else? If so, please note location:
		In the past 14 days, have you or any household member had any contact with a known COVID-19 patient?
		Have you or any household member have a history of exposure to COVID-19 biologic material?
		Have you had any history of fever in last 14 days?
		Have you had any respiratory illness such as cough or difficulty breathing in last 14 days?
		<u>Urgent Dental Need Question:</u> Do you have uncontrolled dental or oral pain, infection, swelling or bleeding or trauma to your mouth?

If a patient replies “yes” to any of the screening questions, and his/her body temperature is below 37.3 °C, the dentist can defer the treatment until 14 days after the exposure event. The patient should be instructed to self-quarantine at home and report any fever experience or flu-like syndrome to the local health department. If a patient replies “yes” to any of the screening questions, and his/her body temperature is no less than 37.3 °C, the patient should be immediately quarantined, and the dental professionals should report to the infection control department of the hospital or the local health department.

If a patient replies “no” to all the screening questions, and his/her body temperature is below 37.3 °C, the dentist can treat the patient with extra protection measures, and avoids spatter or aerosol-generating procedures to the best. If a patient replies “no” to all the screening questions, but his/her body temperature is no less than 37.3 °C, the patient should be instructed to the fever clinics or special clinics for COVID-19 for further medical care.¹⁴

Personal Protection:

Reinforcement for good hand hygiene is of the utmost importance. A two-before and- three-after hand hygiene guideline is proposed by the infection control department of the West China Hospital of Stomatology, Sichuan University, to reinforce the compliance of hand washing.¹¹ Specifically, the oral professionals should wash their hands before patient examination, before dental procedures, after touching the patient, after touching the surroundings and equipment without disinfection, and after touching the oral mucosa, damaged skin or wound, blood, body fluid, secretion, and excreta. More caution should be taken for the dental professionals to avoid touching their own eyes, mouth, and nose.¹¹ Based on the possibility of the spread of 2019-nCoV infection, three-level protective measures of the dental professionals are recommended for specific situations.

(1) Primary protection (standard protection for staff in clinical settings). Wearing disposable working cap, disposable surgical mask, and working clothes (white coat), using protective goggles or face shield, and disposable latex gloves or nitrile gloves if necessary.

(2) Secondary protection (advanced protection for dental professionals). Wearing disposable doctor cap, disposable surgical mask, protective goggles, face shield, and working clothes (white coat) with disposable isolation clothing or surgical clothes outside, and disposable latex gloves.

(3) Tertiary protection (strengthened protection when contact patient with suspected or confirmed 2019-nCoV infection). Although a patient with 2019-nCoV infection is not expected to be treated in the dental clinic, in the unlikely event that this does occur, and the dental professional cannot avoid close contact, special protective outdoor is needed. If protective outdoor is not available, working clothes (white coat) with extra disposable protective clothing outside should be worn. In addition, disposable doctor cap, protective goggles, face shield, disposable surgical mask, disposable latex gloves, and impermeable shoe cover should be worn.¹¹

The Splurge of Child Innovators that demonstrate wisdom beyond their years and solutions for safety enumerated here:



HT Photo (The wristband)

Fig 3: Reminder Wristband.

Maharashtra teen invents wristband from scrap to keep coronavirus at bay; proposal sent to PM Modi, ICMR

The wristband was made out of scrap collected from his house. Harsh put together a buzzer, switch, button cell, tilt sensor, aluminium foil, plastic tubing and other materials to create the device.

Updated: Apr 25, 2020 15:55 IST

By Ram Parmar, Hindustan Times Mumbai

Fig 4: Wonder-Mask.

West Bengal school girl invents 'Wonder Mask' to fight Covid-19

Digantika Bos, a school-girl in Burdwan district of West Bengal has invented a ne scientific mask, that will keep the doctor and nurses safe from the coronavirus with a higher degree of protection.

Fig 5: Heading missing

Clinical techniques: ^{16, 17}

- Ask accompanying persons/ parents to leave operatory
- Use 1.5% hydrogen peroxide or 0.2% Povidone as a pre/during/post procedural mouth rinse
- May use extra-oral dental radiographs
- Reduce aerosol production as much as possible;

- Prioritize the use of hand instrumentation.
- Use rubber dams
- Use a 4-handed technique for controlling infection.
- Anti-retraction functions of hand-pieces may provide additional protection against cross-contamination.
- Use of high-volume evacuators
- Use resorbable sutures
- Minimize the use of a 3-in-1 syringe
- Disinfectants (hypochlorite, ethanol) in the hand-piece and 3-in-1 syringe water supplies

Interstice of patients^{16, 17}

- Clean [PPE] with soap and water, or if visibly soiled, clean and disinfect reusable facial protective equipment (e.g., clinician and patient protective eyewear or face shields) between patients.
- Non-dedicated and non-disposable equipment (e.g., hand-pieces, dental x-ray equipment, dental chair and light) should be disinfected according to manufacturer's instructions. Hand-pieces should be cleaned to remove debris, followed by heat-sterilization after each patient.
- Routine cleaning and disinfection procedures (e.g., using cleaners and water to pre-clean surfaces prior to applying an EPA-registered, hospital-grade disinfectant to frequently touched surfaces or objects for appropriate contact times as indicated on the product's label) are appropriate for SARS-CoV-2 in healthcare settings, including those patient-care areas in which aerosol-generating procedures are performed.
- Surfaces such as door handles, chairs, desks, elevators, and bathrooms should be cleaned and disinfected frequently.

Disinfection of the clinic settings¹⁷

Dental institutions should take effective and strict disinfection measures in both clinic settings and public area. The clinic settings should be cleaned and disinfected in accordance with the Protocol for the Management of Surface Cleaning and Disinfection of Medical Environment released by the National Health Commission of the People's Republic of China. Public areas and appliances

should also be frequently cleaned and disinfected, including door handles, chairs, and desks. The elevator should be disinfected regularly. People taking elevators should wear masks correctly and avoid direct contact with buttons and other objects.

Filter of contaminated air in the clinical setup could be done with High vacuum evacuator

Management of medical waste¹⁷

The medical waste (including disposable protective equipment after use) should be transported to the temporary storage area of the medical institute timely. The reusable instrument and items should be pre-treated, cleaned, sterilized, and properly stored in accordance with the Protocol for the Disinfection and Sterilization of Dental Instrument released by the National Health Commission of the People's Republic of China. The medical and domestic wastes generated by the treatment of patients with suspected or confirmed 2019-nCoV infection are regarded as infectious medical waste. Double-layer yellow colour medical waste package bags and "gooseneck" ligation should be used. The surface of the package bags should be marked and disposed.

When Going Home After a Workday

DHCPs should change from scrubs to personal clothing before returning home. Upon arriving home, DHCPs should take off shoes, remove and wash clothing [separately from other household residents], and immediately shower.

PEDIATRIC DENTAL PROTOCOL- EMERGENCY TREATMENT

All pediatric dentistry providers should have adequate knowledge, skill, and proficiency to provide safe, effective, and evidence-based oral health care for children. They should promote collective reception of anticipatory guidance and preventive oral health care in a dental home beginning no later than age one. The barriers to access and quality care should be recognized and addressed.¹⁸

The AAPD recommends that to start seeing children with compromised immune illness or with complex medical care needs back in the dental offices, protocols and referral sources should be prepared

with hospital protocols readily available. Consultation with the child's physician about the safety of being seen in the dental office or consideration should be given to hospital-based dental clinics if available. Additionally, special consideration should be given to the timing of the appointment in the schedule (1st appointments or special hours/days). If possible, consider building a room that meets hospital standards for infection control and air turnover.^{19,20}

Treatment of Emergency Cases: Dental emergencies can occur and exacerbate in a short period and therefore need immediate treatment.

If a carious tooth is diagnosed with symptomatic irreversible pulpitis, pulp exposure could be made with chemo-mechanical caries removal under rubber dam isolation and a high-volume saliva ejector after local anesthesia; then, pulp devitalization can be performed to reduce the pain. The filling material can be replaced gently without a devitalizing agent later according to the manufacturer's recommendation.²¹

A patient who has a spontaneous toothache because of a cracked tooth without dental decay, and a high-speed hand-piece has to be used to access cavity preparation. Given that the patient wants to retain the tooth, she should be scheduled as the last patient in the day to decrease the risk of nosocomial infection. After treatment, environmental cleaning and disinfection procedures must be followed.²¹

Alternatively, patients could be treated in an isolated and well-ventilated room or negatively pressured rooms if available for suspected cases with COVID-19.

Post-operative Instructions for Patients:

In light of the controversy regarding whether ibuprofen should be used for patients with a COVID-19 infection, it is recommended to use ibuprofen as normally indicated when managing any type of pain.²²

Post-COVID-19 era clinical recommendations: ²⁰

- ***Behaviour management:*** Restless, crying children spread more aerosol compared to calm children. The added anxiety might have as a result of the dental healthcare providers having

face mask. Whenever possible, it is helpful to put this protective equipment on while the child is watching, and while we explain to them in simple terms, the value and use of this equipment. Another suggestion is to have a pin or a sticker that can be disinfected easily with the health provider's photograph displayed over. The AAPD recommends delaying seeing pediatric patients who require physical behaviour management, considering treating patients while on parent's lap with parent wearing a mask and having passed negative screening criteria, dedicating special hours in the day for such patients.

- *Prevention:* Patient-centred enhanced prevention plans tend to be more effective. Therefore, it is only logical to prioritise and emphasise all oral health preventive and therapeutic measure during this time.
- *Biological Caries management Techniques*
- *Sealants and ART*
- *Interim therapeutic restorations (ITR)*
- *Hall technique*
- *Silver diamide Fluoride (SDF)*

CONCLUSION

As Marie Curie aptly said, "Nothing in life is to be Feared, only to be understood. Now is the time to understand more so we may fear less." Hence, clarity about the implications of potential transmission of the (SARS)-CoV-2 virus in a Pediatric clinical setup is essential. It is also obligatory to strike a balance between the safety of the healthcare professionals with optimum dental care to the patients. A constant upgrade, clinical modifications implemented, Tele-dentistry, virtual educational programs would train dentists for the changing perceptions in the pediatric dental setup- a *New Normal*.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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