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EDITORIAL

Vaccine hesitancy and unfalsifiability

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Editor's note: In this issue's new A Safer Dental Visit feature published in collaboration with OSAP, The Safest Dental Visit titled "Managing Measles in Dental Practice: A Forgotten Foe Makes a Comeback," on page 558, Sara C. Gordon, DDS, MSc, FRCD(C), FDS-RCS(Edin), and Noni E. MacDonald, MD, MSc, FRCP(C), discuss what dentists can do to ensure that the risk of measles transmission is as low as possible in their dental offices.

Much has been said, debated, and written about the purported association between the measles, mumps, and rubella (MMR) vaccine and the development of autism. The initial report by Wakefield and colleagues¹ in 1998, claiming the MMR vaccine caused autistic behavior, resulted in a rise in vaccine hesitancy (varying degree of acceptance) to outright refusal of state-recommended childhood immunization schedules and a subsequent decline in the number of immunized children.

Geographical clusters of endemic measles and pertussis, or whooping cough, outbreaks ensued in areas with a high prevalence of parents or guardians who refused to have their children vaccinated.^{2,3} Wakefield and colleagues' article¹ eventually was retracted because it was deemed scientifically and ethically flawed because of deliberate fraudulent conduct, and Andrew J. Wakefield's, MB, medical license later was revoked.^{4,5} Investigators in several subsequent studies have not been able to show any association between the MMR vaccine and autism.^{6,7} However, despite scientific evidence to the contrary, vaccine hesitancy persists. There are excellent reviews in which the authors discuss reasons for this worrisome trend.^{8,9} Reasons include social media and Internet influences, knowledge and attitudes, distrust in health systems, disapproval of governmental oversight—but probably most important, the inability to separate evidence from emotive anecdotes.

All states, except Mississippi and West Virginia, allow religious and philosophical vaccination exemptions, and 19 states allow exemptions solely based on philosophical or personal beliefs.¹⁰ Temporary or permanent medical exemptions are permitted in all states and include exemptions for children with immunodeficiencies, children with allergies to the vaccine or its components, or children who already have developed natural immunity. State requirements for immunization are linked to a child's entry into the school system. Interestingly, significant differences are evident when comparing exemption rates between private and public schools.

Results from a study in 2014 showed more than double the overall exemption rate in private schools than in public schools (4.25% versus 1.91%), with similar differences noted for medical (0.58% versus 0.34%), religious (2.09% versus 0.83%), and personal belief (6.10% versus 2.79%) exemptions.¹¹ These data correlate with those of other studies in which the investigators characterized infants who did not receive routine vaccination as being more likely to be male, be white, have 4 or more siblings, and live in households with married parents who are college educated and have an annual income of \$75,000 or greater than are vaccinated children.¹²

Observed rising incidence rates of some vaccine-preventable diseases, such as pertussis, can be explained by disease-reporting bias and the lack of lifelong, or waning, immunity from natural infections and vaccines.² Increased awareness of the disease may result in more reported cases, and, unfortunately, reduced vaccine effectiveness and duration of protection with the now more commonly used acellular pertussis vaccine than with whole-cell vaccine have contributed to more cases of pertussis.¹³

The increased incidence of measles may be due to other causes. The introduction of an effective vaccine in 1963 resulted in measles being declared eliminated in the United States in 2000, yet a dramatic resurgence of cases now is being reported.¹⁴ In 2014, the Centers for Disease Control and Prevention documented almost 650 new cases, and from January 1, 2015, to April 24, 2015, 166 cases from 19 different states have been reported already.³ Many of the outbreaks emanate from imported cases in which infected travelers from other countries in the world brought the disease to the United States.

However, the intentional delay or refusal to vaccinate children because of ideological beliefs promulgates the spread of this disease, particularly in

communities with low immunization rates. An unfortunate consequence of increased numbers of unvaccinated people in specific or clustered communities is the decline in herd immunity.

Herd immunity usually refers to maintaining a minimal proportion of immune people to susceptible people to minimize periodic epidemic outbreaks of vaccine-preventable diseases.¹⁵ When the prevalence of vaccinated or immune people falls below a certain threshold, epidemics may arise. The vaccination rate to achieve herd immunity for measles may be in excess of 95%.¹⁶

It is sometimes amusing to hear how celebrities are asked about their views on biomedical topics, such as alternate cancer therapies or immunization. The amusing part is to wonder why we would assume that a movie actor would be versed in scientific facts, reasoning, and thinking—and why we actually would care about what the actor thinks about scientific issues. This does not mean he or she does not possess the necessary capabilities to attain scientific knowledge and argue science matters. It only means that he or she may not have the knowledge necessary to understand what the latest scientific findings might be. Mostly, nonscientists latch on to a certain view, not realizing that, at least among biomedical sciences, dramatic changes occur over short time spans. The not-so-amusing part is how some celebrities, politicians, and other nonmedically trained people are given great media exposure even when their views and beliefs may result in harm.

The problem with belief systems is that they include elements of unfalsifiability—elements that cannot be tested and proved false.¹⁷ Unfortunately, many of us crave an explanation or justification for why bad things happen. When solid scientific rationales or evidence are not available, we often blame unexplainable health outcomes on perceived nefarious reasons, or we

create a fictional scientific rationale. It is easier to believe that a vaccine caused autism than to accept that we may not have an explanation for the cause of this condition.

As oral health care professionals, we treat oral diseases, but we also are considered respected and trusted resources in our communities on broader health issues. Although almost three-quarters of parents trust vaccine safety information provided to them by their children's pediatrician, only one-quarter of parents have confidence in the same type of information when provided by other health care professionals.¹⁸

Interestingly, the same level of trust given to nonpediatricians, one-quarter, also is awarded to celebrities. Collecting immunization data from all patients provides the opportunity to initiate a conversation with parents who may be vaccine hesitant about the risks and benefits of vaccination. Regrettably, challenging the belief systems of staunch supporters of absolute vaccination refusal may not be successful and actually may strengthen their resolve.

I do not know the reason for autism or other conditions blamed on immunization, but I do know that lack of immunization may result in the reemergence of diseases that we thought we had conquered. Becoming a knowledgeable resource on health issues that affect our communities, such as the benefits and harms of vaccination, will go a long way toward allaying the fear of the unknown and increase the already high respect we have earned from our patients. ■

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