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## Teach your children well

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This perspective looks at the importance of providing parents with the information they need to make informed decisions about their children's health, and particularly of encouraging parents to teach their children health-related practices that help prevent illness and injury; it is the viewpoint of a grandparent who is also a children's doctor.

In their song 'Teach your children well' Crosby, Stills, Nash and Young wrote [1]:

"Teach your children well...  
And feed them on your dreams...  
And know they love you.  
And you of tender years  
Can't know the fears that your elders grew by.  
And so, please help them with your youth.  
They seek the truth before they can die.  
Teach your parents well...  
And feed them on your dreams...  
And know they love you."

As in the words of this song, there is universal recognition that a central role for parents is to teach their children. In the animal kingdom the immediate survival of those newly born depends on what they learn from their mothers, and the continued wellbeing of young animals depends on how well they go on to learn from the herd as a whole. Yet, among humans, a large proportion of our children worldwide suffer ill health and have poor quality of life because of conditions that could be prevented, even though much valuable prevention can be achieved by health promotion, including where parents pass on essential knowledge and teach their children healthy practices that can benefit them in their daily lives.

Promoting health involves three main strategies:

1. Providing information
2. Making use of technology
3. Using rules and laws

We can look at immunization for examples of such strategies. Information is shared by health care providers when we give advice to parents, as well as when we teach children. In the context of immunization, such advice is shared in many ways, including when we deliver well-child preventive care, or are involved in campaigns to promote awareness of the need for and benefits of immunization. The primary aim is to promote health by increasing the number of children in a community who are protected against common childhood infectious diseases.

Technology is made use of in various ways, e.g. to combine multiple vaccines into one single dose, remove impurities from vaccines and make their administration as painless and problem free

as possible. We also rely on communication technology such as TV and radio to educate and inform parents, and social media are increasingly used as a source of information.

Rules and laws are made where necessary to enforce health-driven action. Examples of legislation include those put in place in the USA during the 2019 measles outbreaks; one required all parents of school age children to either produce proof of immunization against measles or to keep their children home from school, and another ordered unimmunized adults to get immunized within 48 hours or face fines as the situation was classified as a 'state of emergency'. The rationale for legislative action that mandates immunization is the concept known as 'herd immunity' (HI); also called herd effect or social, community or population immunity, this is a form of indirect protection from infectious disease that occurs when a large percentage of a population is immune to an infection, as this provides an environment where there is a high measure of protection for individuals who are not immune [2].

The term 'herd immunity' was first used almost 100 years ago but remains the fundamental principle behind today's immunization programs. HI recognizes the statistical probability that the greater the proportion of individuals in a community who are immune, the smaller the probability becomes that those who are not immune will come into contact with an infectious individual. In a practical sense, when the majority of the 'herd' are immune, this means that the natural progression of infection from an infected person to someone vulnerable to infection is disrupted, which stops or slows the spread of disease. An example of the problem when the opposite is true and the 'herd' has low immunity, is that a man infected with measles in New York state in the current US outbreak travelled to the neighbouring state of Wisconsin where he is believed to be the source for 41 new cases.

There is a large body of literature which shows that immunization programs are the most effective way to prevent infectious diseases on a broad scale. Since immunization has become available countless children's lives and massive amounts of money have been saved by preventing diseases like polio, diphtheria tetanus and smallpox [3, 4], and measles immunization is estimated by WHO to have saved more than 20 million lives since the year 2000 alone. The global relevance of promotion of vaccination is also emphasized by the central place of immunization in the policies of the World Health Organization, and the fact that agencies such as the Gates Foundation consistently list advances in the formulation and availability of agents used to protect children among their top funding priorities.

Yet recent lessons from the measles outbreak in the USA, and data from WHO reporting that in the first three months of 2019 the incidence of measles worldwide has tripled compared with the same time last year, indicate that herd immunity has fallen to a low enough level for infection to be able to spread. Lower immunization rates mean many more children are now vulnerable, even in countries like the USA and Thailand where immunization rates traditionally were high. Because measles is one of the most contagious viruses around, the rise in the number of cases may also reflect the increasingly interconnected nature of our world to some degree. But nothing about this virus has changed; it has not mutated to become more infectious or more dangerous, which means the answers to the problem of increased infection rates are entirely human.

Simply put, rates of child immunization are falling worldwide, leading to a rise in the number of individuals vulnerable to infection, which in turn increases morbidity and mortality from measles, and also from other diseases usually controlled by vaccinations. So, as health care providers, we need to understand the reasons why immunization rates are falling and be looking to find creative solutions we can apply in the communities we live in. As discussed in a recent editorial in this journal, for people in many countries there are important cultural and religious beliefs that influence their decisions about immunization [5]. While this applies to some extent in North America, US parents' reasons mainly range from fear of possible dangers from vaccines to ambivalence about the need to immunize their children [6]. But whatever the reason, it is easy to have negative feelings towards such parents, but in reality, we must remember that the most fundamental of reasons that drive decision making by parents applies, namely the desire to protect their children.

It is important for us to understand that parents in the USA today are from a generation which has had almost no first-hand experience of the ravages that childhood infectious diseases can cause. This also applies to many parents in Europe but is probably a surprise to many of you reading this in other countries. Another big issue globally is that mis-information about vaccines and immunization is a growing problem, largely because more and more parents choose to rely on their own research

conducted through social media, where, as we all know, the information available ranges from excellent to wrong, with much in between that can be confusing, or in the worst cases is deliberately misleading. A 2015 survey in Canada on attitudes toward vaccines indicated more than one in four Canadians are hesitant or misinformed about vaccines [7]. This is a clear lesson that we all need to be part of the promotion of preventive health when it comes to immunization, and in particular must take every opportunity to provide parents who do not know the benefits with the facts they need and answers to questions they need answered.

Most countries provide recommendations and a schedule for childhood immunizations - these are updated regularly and so we need to be aware of what our national immunization schedules for children are. But, in spite of vaccines being readily available in most parts of the world and generally accepted as safe and effective in preventing disease, debate continues about their necessity, efficacy, and safety. It has also been identified that reluctance to immunize in the USA and Europe is occurring as part of a growing lack of trust in health care professionals; this lack of trust is seen as a consequence of parents turning more and more these days to social media as their resource of choice for health care decision making.

So how should we go about discussing these issues with parents? Several national and international agencies provide useful recommendations including the US Center for Disease control (CDC) [8, 9]; issues to consider include:

1. The general benefits of immunization
2. The specific benefits of an individual vaccine
3. An honest assessment of the general effects and potential risks associated with any vaccine
4. An evidence-based description of risks of the disease the vaccine prevents against including complications
5. An objective and non-judgemental review of possible consequences of refusing the vaccine
6. A summary of the recommendations from government and local health authorities about the vaccine
7. Details of any follow up required and if the immunization requires a series of further doses
8. Simple measures that can be used to make the process of immunization as painless and problem free for the child as possible. For example, giving a dose of pain killer / anti-inflammatory medication at the time the injection is given.
9. Information about signs or symptoms of common side effects and complications, and what to do if these signs/symptoms occur.

We must always remember the ethics of health promotion, especially where immunization is concerned. Ethical questions play an increasingly part these days in our dealings with patients and especially where we are giving advice to parents about the health of their children. Of course, our approach and advice are intended to be the best for those we care for, but we must understand that what we are presenting to parents is our own point of view, and that some parents may have strong views of their own, even if these are based more on personal experience, traditional beliefs or local opinion than the scientific evidence that we rely on as the basis for our advice.

There is always an ethical question around how we weight the negative effects of parents not following advice. As in the CDC guidelines, we must be honest, used an evidenced-based approach and be objective and non-judgemental in what we say, but that does not require us to understate risks of a bad outcome for an unimmunized child. With measles, children can die from associated pneumonia or be left brain damaged by encephalitis. We must avoid blame and guilt but do have a responsibility to weight what we say so that individual parents understand clearly that there are potential risks and consequences if they do not follow advice and government recommendations and policies.

When thinking about the ethics of immunization I am always reminded about how far we have come in respecting the rights of those that we care for, and ensuring that that they are fully informed about the benefits and risks of care we offer. Also, that today we increasingly rely on the ethics committees at institutions such as our universities and hospitals to provide guidance and rules for us to follow, especially when we involve families in research. In this context I wonder how many of you have thought about the ethics of what Dr. Jenner did when he set out to prove the benefits of vaccination

against smallpox?

Jenner practiced medicine, and had observed like many others that young women who had become infected with cowpox from their cows they milked were protected against smallpox. His hypothesis was that cowpox not only protected against smallpox but also could be transmitted from one person to another as a deliberate mechanism of protection. To test this, he found a young dairymaid with fresh cowpox lesions on her hands, and inoculated matter from these lesions into an 8-year-old boy he knew in the village where he lived. History does not tell us what he told the boy's parents! The boy became unwell, but mildly so with developed mild fever, loss of appetite and discomfort from swelling in the axillae, and soon was much better. Later, Jenner inoculated the boy again, but this time used matter from a patient with active smallpox... (Let's not lose sight of how unlikely it would be today that an ethics committee would allow such an experiment with an infection that at the time was frequently fatal). However, as history records, the boy did not develop smallpox and so Jenner in this single case has proven his hypothesis. In a short paper submitted to the Royal society Jenner presented his findings and conclusion that protection was complete. Interestingly his paper was not accepted for publication, not on ethical grounds but probably because it was a single case report; also, Jenner was not in fact the first to suggest that infection with cowpox provided immunity to smallpox nor the first to attempt cowpox inoculation for this purpose. However. But with more data Jenner did publish his work and it is of course now regarded as the foundation for modern concepts of immunization [10].

I like to remember that there are other modern concepts about infection that most parents are happy to learn about. I talk to all parents about two of them, and use them to help parents who are reluctant to consider immunization to help develop an understanding about common infections; both how they happen and how they can be prevented. These concepts are: 1. The importance of hand washing, and, 2. The benefits of keeping teeth clean.

We all know hand washing is important as infections from smallpox to the common cold are spread by hands contaminated from contact with others who are infected, or by handling a range of infected materials including coins and bank notes; and that personal hygiene is so important to reduce transmission of gastrointestinal diseases from one person to another, especially where use of the toilet is followed by food handling.

Do you remember to explain why soap and water work? Parent and children who know why something works are far more likely to follow the advice you give than ones you just tell what to do. All soaps contain 'surfactants' that break down the protective layer on the surface of bacteria that they rely on survive; adding water then removes them from the hands. A good example of how handwashing can be promoted among school children was reported by Zhang; soap and a simple means of handwashing was made available for children in Africa to use after they had been to the toilet, the incidence of handwashing increased and the number of those reporting stomach pains was reduced; this methodology can be widely applied [11].

Parents and children know less about the importance of good oral health. Dental caries and periodontal disease have a worldwide impact on the health of children, and there is an association between bad oral health and a growing number of significant systemic conditions that manifest later in life; these include adverse pregnancy outcomes, cardiovascular disease, stroke, and type 2 diabetes [12]. Caries is regarded as the commonest preventable infectious disease affecting children, and periodontal diseases are estimated to affect up to 90% of the world's population [13]. The mechanisms that explains why this happens is that caries develop when tooth surfaces are damaged by acids produced when bacteria present in the mouth ferment carbohydrates and food debris. Periodontal disease involves chronic gum inflammation (gingivitis) which is also associated with the excessive growth of bacteria; these are what cause the breath to smell bad, but they also produce vasoactive agents called cytokines that over time damage blood vessels in the body and lead to systemic disease. Importantly, prevention is simple as tooth brushing removes food particles that allow bacteria to multiply, and less acid is produced in the mouth, so gingivitis from the formation of deposits of bacteria-containing plaque under the gums is much less, and cavity formation from weakened tooth enamel is reduced. The tooth sticks used in many cultures to clean teeth can be just as effective as tooth brushes; but both should be used after meals and especially before going to bed to clean the teeth.

Reminding parents about these two health promotion strategies and encouraging them to teach their children good habits around hand hygiene and oral health as part of a daily living, is simple and yet very important and constructive way to promote child health.

Importantly washing their hands and cleaning their teeth are two elements that enable children to contribute independently to their own health and wellbeing. Those in developing countries and from disadvantaged populations suffer disproportionately from the consequences of poor hand and oral hygiene, yet much of the primary disease and secondary pathology is preventable by simple and inexpensive measures that children can readily learn.

For this reason, this perspective emphasizes why we must always give parents the information they need to help their children be healthy and say to them, "Teach your children well."

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