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Short communication

To pollute or not to pollute? Decreasing the ecological footprint of pediatrics in the COVID-19 era

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ARTICLE INFO

Article History:
Received 27 February 2022
Accepted 10 May 2022
Available online 18 May 2022

Keywords:
Pediatrics
Sustainability
Environment
Climate crisis
COVID-19
Carbon footprint

ABSTRACT

The climate crisis impacts child health, increasing the burden of pediatric healthcare. During the COVID-19 pandemic, the ecological footprint of pediatric healthcare has significantly increased due to the use of personal protective equipment and the provision of large-scale testing and vaccination against COVID-19. The situation calls for coordinated action to make pediatric healthcare more resource-efficient. To achieve this goal, pediatricians should work together with children and parents in order to appropriately minimize the use of electricity, water, paper and plastic and promote environmental sustainability in healthcare and beyond. The present article discusses the main sources of environmental pollution in pediatric healthcare and proposes evidence-based solutions.

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Introduction

The impact of climate change on health has been increasing during the last decades. Environmental disruption has acute and chronic effects on different body systems and contributes to excess morbidity and mortality globally. Extreme temperatures, adverse weather conditions, soil and water contamination and disruption of ecosystems have been associated with water and food insecurity, physical injury and a rise in vector-borne, water, and foodborne diseases, sleep disorders, cardiovascular and respiratory conditions[1].

Children of all ages are disproportionately affected by climate change. Several features of child physiology (higher metabolic rate, lower heat adaptation capacity) in combination with their social, emotional and financial dependence on adults make them particularly vulnerable. As a matter of fact, 88% of the climate change-associated disease burden has fallen on children[2]. At the same time, extreme temperatures affect fetal growth and compromise the ability of mothers to take care of their offspring[2−4]. On these grounds, the United Nations has proclaimed the climate crisis as a child rights crisis and urged health bodies and healthcare professionals to strengthen their efforts for child health in regions affected by climate change[5]. In response to this, the World Health Organization (WHO) has created the Pediatric Environmental History, in order to assist healthcare professionals in the diagnosis and management of pediatric conditions related to the climate crisis[6].

Healthcare professionals and institutions are indeed responsible for preventing, diagnosing and managing the health sequelae of climate change in both adults and children. However, healthcare is also a major contributor to the climate crisis, given that it contributes 4.4% of global net carbon emissions[7]. During the last decade, the pediatric community has taken some important steps towards decreasing the carbon footprint of healthcare. A growing body of research in pediatrics has explored methods to decrease healthcare waste in pediatric wards and analyzed the impact of various environmental pollutants on child health and development[8,9]. Simultaneously, pediatric health bodies such as the International Society for Social Pediatrics and Child Health (ISSOP) have put considerable effort into spreading awareness about the impact of climate change on child health among pediatric healthcare professionals, stakeholders and decision-makers[10,11,12].

Unfortunately the outbreak and subsequent evolution of the COVID-19 pandemic has interfered with this effort. Since early 2020, the excessive use of personal protective equipment (PPE) in combination with large-scale testing and vaccination strategies have made healthcare more energy and carbon intensive[13]. Pediatrics does not constitute an exception to this trend. On the contrary, the need to...
perform regular tests on school-age children and the recommendation to provide COVID-19 vaccination to all children older than 5 in late 2021 have contributed to the production of a substantial amount of medical waste[14,15]. The same applies to the need to perform COVID-19 tests for children admitted to hospitals or subjected to examinations generating aerosol. To the authors’ best knowledge, the need to make pediatric healthcare - either in the community or in hospitals - more sustainable during the COVID-19 pandemic has not been sufficiently addressed. Therefore, it is important to discuss current pediatric practice from the environmental perspective and propose recommendations for more environmentally sustainable pediatric care during and beyond the COVID-19 pandemic.

Environmental sustainability challenges in pediatric healthcare in the COVID-19 era

Before the pandemic, the carbon footprint of an average outpatient consultation ranged between 4.8 and 66 kg of CO2 equivalents (CO2eq)[16,17]. The carbon footprint of hospitalization can be as high as 138 kg CO2-e per bed per day[18]. CO2eq is generated from physical and digital infrastructure, transportation of patients, personnel and materials, and consumables[19].

The main sources of the excess carbon footprint during the COVID-19 pandemic are personal protective equipment (PPE), COVID-19 tests and COVID-19 vaccines. The use of PPE and testing and the provision of vaccinations have differed across countries and time periods. However, in most countries it would be common for children to wear cloth or medical masks and undergo frequent testing in order to attend school, participate in activities, or visit healthcare facilities and receive COVID-19 vaccines[20]. Therefore, the carbon footprint of child health was increased both in community and hospital settings.

With regard to PPE, masks, respirators, gloves, gowns and body covers have been the mainstay of protection for both children and pediatric healthcare professionals[6]. One pair of rubber gloves generates approximately 0.42 kg CO2-eq. Assuming that one pediatrician provides between 15 and 20 consultations on a daily basis, the pollution caused by gloves can be calculated as 6.3–8.4 kg CO2-eq per day[21]. Simultaneously, surgical masks generate 0.05 kg CO2eq per piece from their production to their use. Approximately the same amount of CO2eq is produced by the use and the disposal of an individual N95 mask. If we estimate that patients and their parents are wearing surgical masks, total pollution from masks can reach up to 2.4 kg CO2-eq daily[22]. Enhanced PPE is used in subspecialties such as pediatric otorhinolaryngology, dentistry and pulmonology due to the high volume of aerosols produced. Similarly enhanced PPE has been deemed necessary for the protection of immunocompromised children or children with severe underlying conditions. These sectors are more PPE-intensive than general pediatric wards and outpatient pediatrics. However the latter sees a considerably higher patient volume than the former, necessitating a cumulatively high amount of PPE[23–26].

Testing needs in the community were largely covered by self- and rapid antigen tests. PCR tests were used for the confirmation of positive self- and rapid tests and for the admission of children to pediatric wards[27]. Based on data from the Environmental Protection Agency (EPA) of the United States of America (USA), it can be estimated that each test kit generates 22.5 gm of CO2eq[28]. Although the number of tests used can vary significantly, a reliable estimation of their carbon footprint can be performed based on this number.

Finally, yet importantly, full vaccination with mRNA Covid-19 vaccine produces 0.2 – 0.4 kg CO2eq. mRNA vaccines were more energy intensive than their viral vector counterparts due to the special conditions of storage. Both cold chain supply and the challenging logistics of delivering these vaccines in a short amount of time have rendered COVID-19 vaccination energy intensive[29]. However, one can assume that the excess ecological footprint of COVID-19 vaccination was countered by the decreased need for testing and hospitalization of sick children and adults infected by them.

Strategies to decrease the carbon footprint of pediatric healthcare

Child health professionals should focus on two goals in order to make their practices more environmentally sustainable. First, they should decrease the energy expenditure and carbon footprint of their practices, and secondly, they should step up as science communicators and health advocates. This bi-pronged strategy is in line with the ISSOP “Responding to the Impact of Climate Change on Children” declaration[30].

At a practice level, pediatric healthcare professionals should decrease the use of paper and plastic material. Keeping digital patient records and providing prescriptions and medical notes in soft rather than hard copies is increasingly feasible. Certainly, exceptions can be made for patients without access to devices and the internet. While PPE and consumables such as syringes, tongue depressors and oto-scope covers cannot be avoided, physicians should try to make sure that they use either recyclable plastics or recyclable alternatives, such as wood and pressurized paper. In the long run, physicians and health bodies can advocate for consumables based on bioplastics. The use of electricity also should be rationalized. Physicians can prioritize natural light in daytime and reserve light - bulbs for examination procedures and interventions. A pilot survey among pediatricians shows that although most of the respondents are using recyclable paper, glass, aluminum, and plastic, and are replacing light bulbs, still, decisions to use energy efficient computers and other devices, solar or wind energy systems, and LEED-certified buildings need to be strengthened[31].

Outside their practices, pediatric healthcare workers should adopt an environmentally sustainable lifestyle. If they minimize their electricity and water consumption at their households and make sure to recycle their household waste as well, they can set an example to their families, neighbors and local communities. On the grounds of their environmentally sustainable behavior, they can become persuasive as sustainability communicators and advocates. This role entails an informational and an active advocacy component. The former includes educating children and parents about the impact of climate change on health, encouraging them to recycle and decrease their energy consumption, and delivering informative talks in the community in coordination with local authorities. The latter encompasses local and national societies of pediatric healthcare practitioners that need to act as influencers by placing pressure on regulators and stakeholders. Effective lobbying in favor of sustainable medical waste management, integration of climate change into medical education, and environmental sustainability at a broader level needs to be based on scientific evidence about the climate crisis and its effects on child health[32]. The arguments of pediatrician advocates can become stronger if they can illustrate that in the long term, climate change can increase healthcare expenses for the treatment of minors.

Child health professionals can use anticipatory guidance techniques to improve the outcomes of their campaigns. This approach already has been widely used in primary prevention with healthcare professionals, children and parents agreeing on a plan of behavioral change (nutrition, exercise, less time spent in front of the computer) in the course of repeated visits. Along the same lines, pediatric healthcare professionals can couple patients’ education on climate change with a set of goals for the children and the families. Such goals can include the number of times that the child and the family recycled, switched off unnecessary electrical devices, or conserved water in a given amount of time. Within weeks or months, children and their families can assimilate environmentally sustainable behavior. The same applies to informative talks delivered in the community. By the end of the talk or the training session, the speaker needs
to agree with the audience on an action plan for environmentally responsible behavior for the sake of child health and observe its implementation. To date, the effectiveness of health literacy and advocacy campaigns has been debated[33]. Therefore, it lies upon academic child health professionals to monitor these interventions, appraise their outcomes, and strive for continuous improvement.

Well-child visits consist of a multi-dimensional approach to child health, including growth and development, nutritional status, sleep pattern, immunization, general health status and screening of the environmental exposures [32]. Environmental exposure screening includes second-hand smoking, indoor furry pets, residential air systems, drinking water, sun exposure, noise and radon levels [33]. The health consequences of the climate crisis, mitigation and adaptation strategies should be added to routine environmental exposure screening. Pediatricians should explain the hazards related to extreme weather events, aero-allergens, air quality changes and vector-borne diseases and empower families to safeguard their offsprings’ health with environment-oriented lifestyle modifications [12] These include recycling, rational use of electricity (switching off the lights during the day and bedtime, unplugging electrical devices when not used) and prioritization of sustainable transportation (active and public transportation, reducing unnecessary flights) [34].

In such a manner, pediatric healthcare professionals can couple health monitoring and promotion. In time, children and their families can assimilate environmentally sustainable behavior. This goal can be further supported by organizing informative events about pediatric health and the environment at the community level. While the effectiveness of such health literacy campaigns remains debated [12], merging anticipatory guidance during well-child visits with community action is worth attempting and assessing.

Simultaneously pediatric health bodies should become more actively involved in environmental health. Local and national societies of pediatric healthcare practitioners need to act as pressure groups to regulators and stakeholders. Effective lobbying in favor of sustainable medical waste management, integration of climate change into medical education and environmental sustainability at a broader level needs to be based on scientific evidence about the climate crisis and its effects on child health[35]. The arguments of pediatricians - advocates can become stronger if they can illustrate that in the long-term climate change can increase healthcare expenses for the treatment of minors. For this reason, it is also important to be active at the community level. This pertains to educating children and parents about the impact of climate change on health and encouraging them to recycle and decrease their energy consumption, delivering informative talks in the community in coordination with local authorities.

Discussion and conclusion

Overall, it appears that the COVID-19 situation has increased the carbon footprint of pediatric care. COVID-19 tests, vaccines and PPEs are essential for safe and effective pediatric healthcare and their recommended use cannot be decreased for the sake of potential environmental benefit. Alternative models of care such as telemedicine are subject to limitations - particularly when it comes to acute or complicated cases. While replacing the existing PPE, testing and vaccination kits with recyclable materials or bioplastics would be beneficial, this is a rather unrealistic goal in the near future.

To counter the ecological footprint of COVID-19 friendly pediatric care, it is high time to consider rationalizing the use of energy and disposable materials in traditional pediatric healthcare practices. These include the use of electricity, water, paper and plastic and the patient documentation and prescription systems. Making these practices “greener” at large is promising, but it cannot be achieved unless healthcare professionals commit to this change of paradigm. Simultaneously, children and parents need to become engaged in this cause, by means of environmental health oriented patient education and anticipatory guidance.

This approach is ambitious and subject to the potential lack of motivation and coordination between the involved parties. It does not address directly the COVID-19 associated excess ecological footprint, and one could argue that anticipating the end of the pandemic and the subsequent decrease in the usage of PPE, testing and vaccines would suffice. Nonetheless, using the pandemic as an opportunity to promote a “green” paradigm change in pediatrics can lead to long-term benefit. In contrast to the COVID-19 pandemic, the climate crisis
is not expected to become “endemic”. Its consequences on individual and public health are only expected to become more and more pervasive.

Certainly this vision needs to be supported by further research and coordinated action in pediatrics and in other fields of healthcare.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Author Contributions: Conception/Design of Study- Y.G., C.T., A.E.; Data Acquisition- Y.G., C.T., A.E.; Data Analysis/Interpretation- Y.G., C.T.; Drafting Manuscript- Y.G., C.T.; Critical Revision of Manuscript- Y.G., C.T., A.E., P.P.; Final Approval and Accountability- Y.G., C.T., A.E., P.P.

Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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