




VIEWPOINT

Ethical considerations regarding the effects of climate change and planetary health on children

Phoebe CM Williams ^{1,2,3} Ben Marais,^{4,5} David Isaacs ⁴ and Anne Preisz ^{6,7,8}

¹School of Public Health, Faculty of Medicine, ²Marie Bashir Institute for Infectious Diseases and Biosecurity, The University of Sydney, ³Sydney Children's Hospital, ⁴School of Women and Children's Health, The University of NSW, ⁵The Children's Hospital at Westmead, ⁶Clinical Ethics, Sydney Children's Hospital Network, ⁷Sydney Health Ethics, University of Sydney, Sydney, New South Wales and ⁸Bioethics Department, University of Notre Dame Australia, Fremantle, Western Australia, Australia

Climate change represents one of the most significant health challenges and global inequities of our generation. As a 'wicked' problem, climate change imposes an involuntary exposure on vulnerable individuals and societies that is regressive in its nature, with those least responsible for destroying planetary health at greatest risk of suffering the direct and indirect health consequences of unabated warming of the planet. The current and future generations of children are the most vulnerable population to suffer the effects of climate change. By 2030, there will be 131 000 additional child deaths each year if climate mitigation strategies are not enacted, driven by the synergy of an increasing burden of infectious diseases, food insecurity and political instability. Over half a billion of the world's children live in areas vulnerable to extreme weather events, and there is a pressing risk that our current lack of action to mitigate and adapt to climate change will result in today's children, and future generations, being the first to have poorer physical and mental health than previous generations – creating a significant intergenerational ethical dilemma. Child health-care professionals need to advocate for policies to address climate change that consider the complex health, planetary and ethical considerations necessary to solve the most significant risk to our children's health today. Without immediate action, the health of the current and future generations of children is perilous.

There is now clear consensus that warming of the planet is indisputable, and human-generated greenhouse gas emissions cause climate change.¹ The World Health Organization estimates that by 2030, there will be up to 131 000 additional child deaths each year if climate change mitigation strategies are not enacted.² The world's children are the innocent victims of our – and prior generations' – damage to planetary health.³

Climate change challenges the fundamental rights espoused by the United Nations Convention of the Rights of the Child: to uphold the best interests of the child, and to promote their good health, survival, education and nutrition.⁴ It threatens recent gains in child survival and will amplify the vulnerabilities of children already living in perilous circumstances, despite their playing no role in the causative climate change pathway.⁵ Children already suffer 90% of the primary disease burden caused by climate change,^{6,7} and the top five global causes of child death – malnutrition, neonatal deaths, acute respiratory infections, diarrhoea and malaria – will all be exacerbated by deteriorating planetary health.⁸

There is a very real risk that our lack of action to mitigate and adapt to climate change will result in today's children, and future generations, being the first to have poorer physical and mental health than the generations prior, creating a major ethical

dilemma based on intergenerational health inequity.³ In this paper, we explore the ethical context in which climate change is affecting children, and the role child health professionals can play in addressing this.

A Tragedy of the Commons

Climate change and its impact on human health present a 'tragedy of the commons' – that is, the depletion of a common resource when multiple agents act with self-interest, instead of practising collective responsibility.⁹ This analogy is based on the infamous metaphor described by Garrett Hardin¹⁰ whereby a 'common' – or public grazing pasture – is available to many herdsmen who all choose to overgraze the land, causing significant cumulative harm.⁹ Climate change presents a 'tragedy of the commons' as multiple individuals and organisations act with self-interested priorities with no regard to a collective responsibility to protect our biosphere and future generations. In 1992, the United Nations Framework Convention on Climate Change stated: '*The Parties should protect the climate system for the benefit of the present and future generations of humankind, on the basis of equity and in accordance with their common but different responsibilities in respect to capacities*'.¹¹ Yet while greenhouse gas emissions ought to be calculated based on each person's equal right to the 'atmospheric commons', there exists a vast imbalance of causative responsibility for climate change between nations.¹²

The concepts *bioethics*, and later *global bioethics*, were conceptualised to represent the ethical values lying at the nexus of biology and ecology and their effect on future human survival. In '*Bioethics, A Bridge to the Future*'¹³ the father of bioethics – Van

Correspondence: Dr Phoebe CM Williams, Edward Ford Building, Faculty of Medicine, The University of Sydney, Camperdown, NSW 2006, Australia. Fax: +61 29382 1508; email: phoebe.williams@sydney.edu.au

Conflict of interest: None declared.

Accepted for publication 26 July 2021.

Rensselaer Potter – eschewed values of individual autonomy and rights, instead of promoting an ethos of personal and collective responsibility. This supports a communitarian view that includes universalised human values and extends to communities of other living things, presaging the significance of instilling these values into systems of medical knowledge and health care for future generations’ wellbeing.¹⁴ Sadly, Potter’s intellectual legacy and focus on the health of the biosphere has been somewhat neglected in subsequent decades, to the detriment of our collective moral concern for future generations.

Climate change forces us to re-visit these values, as it imposes involuntary exposure to significant global health inequity, which will be amplified for future generations. One of the striking features of this ‘tragedy’ is the regressive nature of its impact: the most vulnerable will be most at risk of the effects of climate change, but are least responsible for creating the problem. Vulnerable societies also possess minimal resources to adapt to the acute effects of global warming, such as major flooding (Fig. 1).¹² By contrast, wealthy nations – responsible for a vast burden of global warming – have adequate resources to protect themselves.⁹

This undermines tenets of substantive and distributive justice. Philosopher John Rawls’ *difference principle* holds that inequalities

related to the distribution of goods such as wealth, income, responsibility and power (which form the social bases for respect and social capital) are only ethically permissible if they benefit the least well-resourced in society.¹⁶ To this end, wealthy nations, responsible for the circumstances of our current planetary health, have an ethical responsibility to support the economic development of poorer nations, alongside providing assistance for the necessary adaptation strategies.

Climate Change Exacerbates Global Inequalities

One of the most significant generators of increasing atmospheric CO₂ emissions – the burning of fossil fuels – is simultaneously responsible for economic development which, in turn, improves health outcomes. Presently, we exist in a quagmire whereby calls to reduce atmospheric CO₂ emissions occur at a stage when half the world’s economies rely on economic development to establish the current survival benefits of resource-endowed nations. Simultaneously, the harms caused by the burning of fossil fuels have inequitably affected the world’s poorest nations.¹⁷

Climate change impacts are long term and cumulative in nature, requiring consideration of future exposure and of

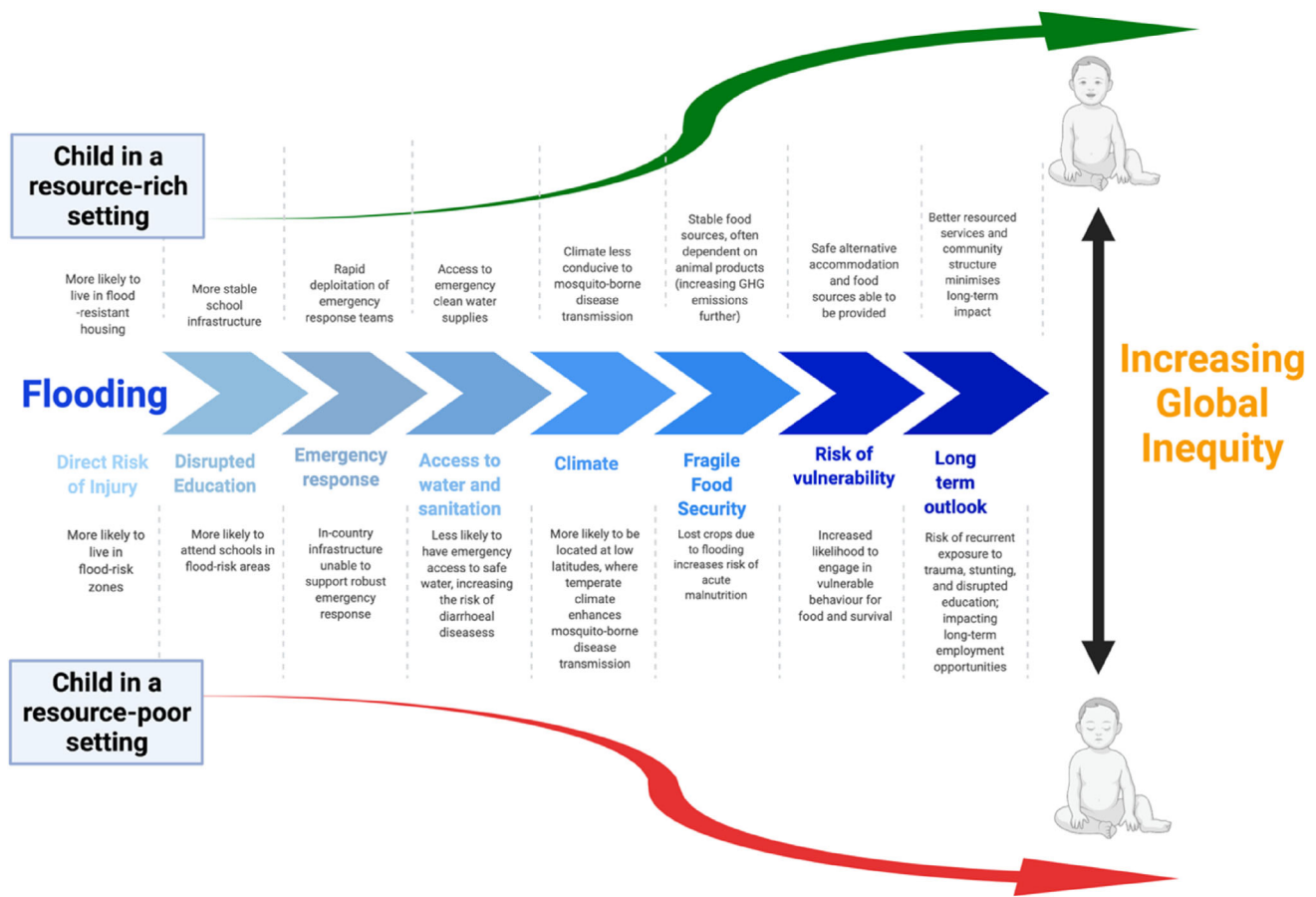


Fig. 1 Extreme weather events result in multiple immediate- and long-term impacts on children’s health that exacerbate current inequities, as exemplified by the consequences of flooding.¹⁵

14401754, 2021, 11, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jpc.15704 by Universitätsbibliothek - Wiley Online Library on [28/07/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

interpreting many indirect rather than direct risks distributed unequally within and between populations.² Global inequalities between and within countries dictate how climate change will impact children; clearly, disadvantaged children will suffer from a disproportionately high and unreasonable health burden. Some of the most densely child populated areas of the world are those most prone to climate change – including coastal South Asia, the Mekong Delta, the Nile River basin, the Pacific Islands, Equatorial Africa and the Pacific Coast of Latin America.¹⁵ The impact of climate change will most likely be concentrated on poorer populations living in low latitudes, where many climate-sensitive disease states (malnutrition, diarrhoeal disease and vector-borne diseases) are ubiquitous.¹⁸

The Direct and Indirect Impacts of Climate Change on Child Health

The broad effects of climate change on child health include the direct physical effects of heat stress, weather disasters, reduced air quality, and food and water insecurity, alongside the psychological burden of global instability, mass migrations and increasing conflict over scarce resources (Fig. 2). The current COVID-19 pandemic reminds us that practices that drive climate change – such as deforestation, overwhelming urbanisation, and perpetual demand for animal product consumption – promote the emergence and

subsequent rapid spread of zoonotic infectious diseases. Children will bear the brunt of the increasing burden of infectious diseases driven by climate change, compounded by the synergistic compromising condition of malnutrition (Fig. 3).^{2,19} Further direct physical effects on children are evident in the increasing frequency, severity and duration of heat waves, particularly dangerous for young infants who suffer up to 50% excess mortality during extremely hot weather.^{20,21} Meanwhile, for older children, increasing pollen counts (which extend the duration of allergy season) result in a rise in atopic symptoms and cause significant morbidity, while direct pollutants and wildfire smoke are responsible for worsening children’s respiratory status.^{1,22}

Climate change will increase the frequency and severity of severe weather events, which can disrupt infrastructure critical to children’s wellbeing, including access to schools and health facilities.¹⁵ These weather events threaten children with injury, loss or separation from their care givers, exposure to infectious illnesses and the psychological trauma of having survived these events.^{1,18,23} Over half a billion children live in areas of extreme flood risk, while more than 160 million children live in extreme drought zones (Fig. 4).^{15,25} Natural disasters sideline routine child health care, reducing access to antenatal care, limiting access to birthing in a health-care facility, and disrupting routine immunisation services.¹⁸

For a child to thrive, a stable socio-economic environment is key. Climate change threatens this stability through extreme

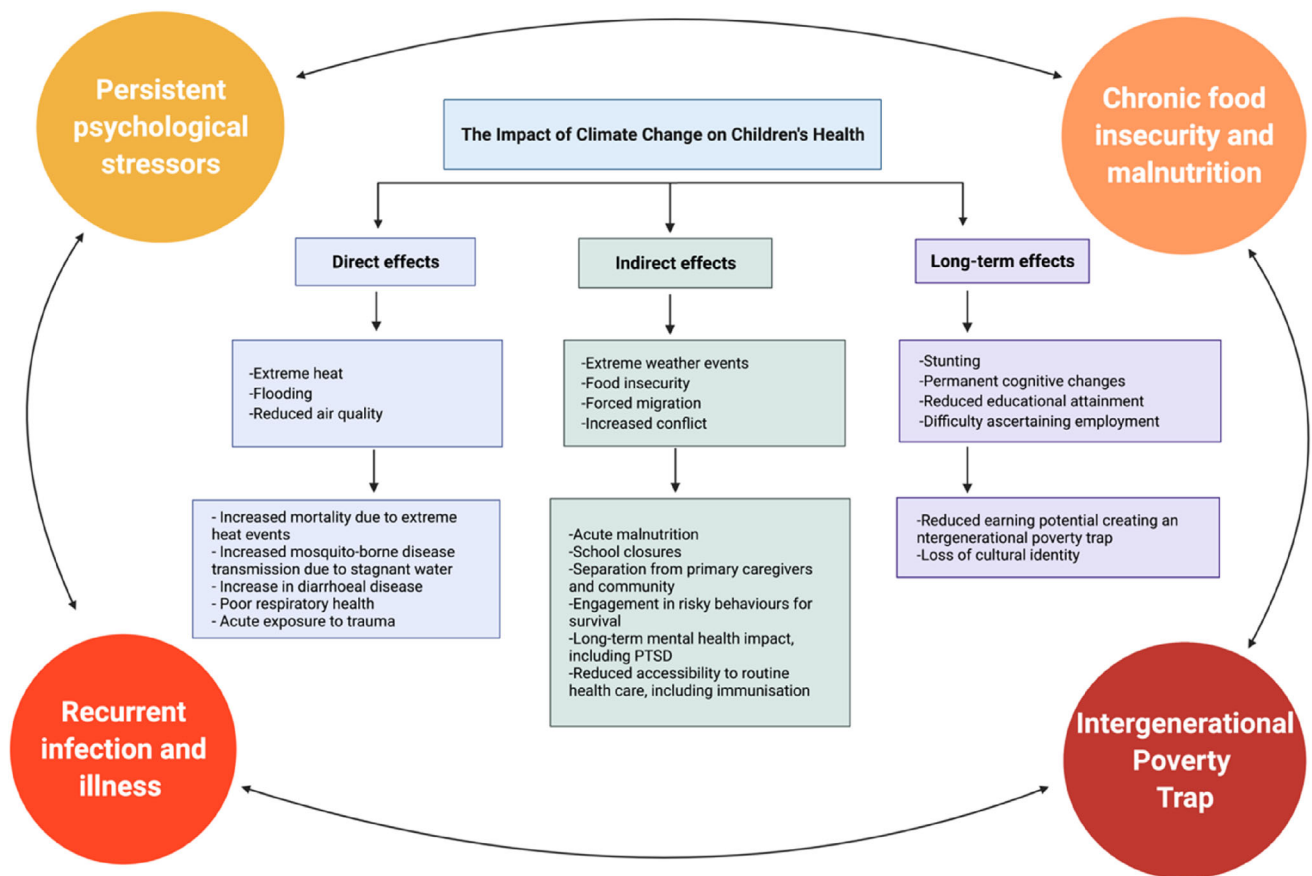


Fig. 2 Climate change results in direct, indirect and long-term effects on children’s health that are exacerbated by socio-economic circumstances.

weather events, which may impact the security of their home, their school, and impact their community structure affecting their mental health and cognitive outcomes. Prior droughts across East Africa have resulted in food crises which threatened children's lives and forced them to leave school to beg for food, or engage in hazardous employment activities to support their families – exposing them to violence, exploitation and abuse.¹⁵



Fig. 3 In the midst of a period of food scarcity, a malnourished child with malaria is carried to the Emergency Department of a rural hospital in sub-Saharan Africa. Temperate climates exacerbated by global warming with prolonged monsoonal seasons that enable efficient mosquito breeding to occur in poor areas with minimal infrastructure result in high rates of mosquito-borne illnesses in children, which are exacerbated by underlying vulnerabilities precipitated by malnutrition.

By predisposing to drought and environmental degradation which drives resource scarcity, climate change drives internal and international displacement, resulting in mass migrations and the risk of conflict.¹ By 2050, there will be an estimated 200 million climate refugees – many of them women and children, who are most vulnerable to adverse health effects resulting from dislocation.^{1,18,26}

Climate Change, Undernutrition and the Impact of Food Insecurity

Climate change and climate policies have the potential to increase food scarcity and food prices.¹⁷ For every 1°C increase in temperature, global wheat production is estimated to reduce by 6%.²⁷ Loss of food security causes both acute and chronic malnutrition, the latter of which may be estimated via stunting rates. Currently, more than 150 million children are stunted due to the effects of chronic malnutrition, a number anticipated to increase due to the impact of climate change on food security.^{28,29} Meanwhile, undernutrition (encompassing both macro- and micro-nutrient malnutrition) is responsible for at least one-third of deaths in children under 5 years of age globally, and by the year 2030, climate change may cause an additional 95 000 deaths each year due to undernutrition.^{2,18}

Alongside its mortality risks, undernutrition results in structural brain changes impairing cognitive development and behaviour impacting on learning outcomes, educational attainment and subsequent employment opportunities.³⁰ Combining the estimated costs of undernutrition in Asia and Africa (4–11% of GDP) with the direct cost of unmitigated climate change (7–10% of GDP), as well as the ongoing burden due to diminished educational outcomes, the detrimental impact on economic development is clear.^{28,31}

How to Solve a Wicked Problem

A 'wicked problem' is one with many causes, requiring several different strategies to ensure resolution.³² They require collaboration across multiple stakeholders to solve, and have major societal effects if they remain unsolved (Fig. 5).³ Wicked problems affecting children include obesity, behavioural challenges, poor mental health and juvenile crime alongside more broad societal problems – such as health and education inequalities – and the impact of climate change.³ These problems require concurrent

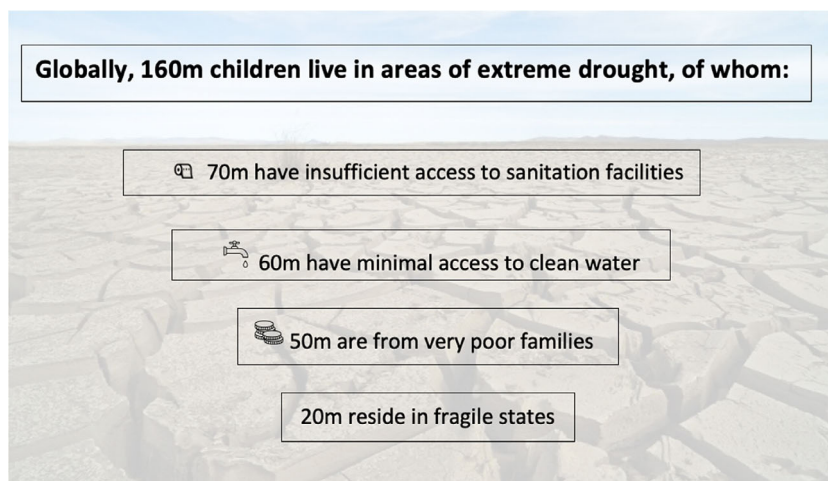


Fig. 4 Of the millions of children surviving in areas of extreme drought, many are exposed to further risks¹⁵ that compound their risks for poor health outcomes. Very poor families are those defined by the World Bank as living on less than US\$3.20 per day.²⁴

coordinated public health interventions that appreciate the complex causal circumstances. Often, solving one aspect of the problem may reveal (or create) other problems.^{3,33}

While the health impacts of climate change on children present an unmistakably wicked problem, with major action required outside of health, interlinked policies and programmes could effectively improve both climate and child health through global consensus and collaboration. Adequate climate change policies may have important co-benefits for child health, bearing in mind the challenges they may concurrently create. For example, advocating for a low carbon transport system (to encourage walking, cycling and public transport) will improve atmospheric CO₂ levels and reduce air pollution while simultaneously resulting in benefits to childhood obesity and respiratory health.³⁴ However, these policies may further deepen inequities – as for a child to safely walk or ride to school, parental or carer supervision is necessary, which may be impossible for a single-parent household. Policies implemented to address climate change and child health should therefore be established and implemented with multi-department input that considers the health, planetary and ethical considerations of each decision prior to legislation and implementation.

What Can Paediatric Health-care Professionals Do?

Advocating encompasses speaking up for another person with less agency, to give them a voice.³⁵ Physicians, and particularly

paediatricians, have a moral imperative to advocate for children and their health.⁹ Our expertise in clinical conditions is as important as our duty to advocate for our patients individually, socially, and also for future generations of children for whom planetary resources are held in trust. Paediatricians have advocated effectively for children held in detention and to reduce gun violence, and now need to stand-up as vocal advocates for the world’s most vulnerable children experiencing the health impacts of climate change.³³

Paediatricians and other health-care professionals can play a key role in stimulating a global movement to address the health determinants and minimise the inequities resulting from climate change. It is incumbent on those working in child health to understand the issues at hand, appreciate these in the context of the Convention on the Rights of the Child (and the political system in which they are embedded), and to engage policy makers and the wider public using their position of influence as ‘the voice’ for today’s children and future generations.

Conclusion

While the expansion of market-based economies has generated wealth and enhanced quality of life for millions, the tenacious pursuit of economic development has come at a significant price to planetary, human, and particularly child health. Half a century ago, Robert F Kennedy noted: *‘the gross national product (GNP) counts air pollution...and the destruction of the redwood, and the loss of*



Fig. 5 The impact of climate change on children’s health is a ‘wicked problem’, with multiple inter-dependent causes and requires solutions that may result in unintended consequences to vulnerable children.

natural wonder in chaotic sprawl... yet the GNP does not allow for the health for our children, the quality of their education, or the joy in their play... it measures everything except that which makes life worthwhile.³⁶

The prescience of bioethicists¹³ imperative to incorporate biology and human values into a nascent communitarian model of health-care systems upholding global solidarity is even more relevant today. Climate change disproportionately affects society's most defenceless, and we have reached a crisis point that requires global solidarity. As we face skies filled with bushfire smoke, intense heat waves and out-of-season monsoonal rains in a world bought to a standstill by a pandemic, we must act now to protect our children, who will bear the greatest burden in our pursuit of economic development.

More research is necessary to assess the impact of climate change policies on child health, while seeking to address these policies in multidimensional manners – recognising that solutions may further result in new challenges as this 'wicked problem' is confronted. The UN Convention of the Rights of a Child provides a sound framework for our advocacy.¹⁸ The circumstances in which we find our planetary health questions these Rights, as eloquently summarised by Greta Thunberg, who states:

*You say you love your children above all else, and yet you are stealing their future in front of their very eyes... Humanity is now standing at a crossroads. We must now decide which path we want to take.*³⁷

Our planet is not indestructible, and without timely action the damage of the Anthropocene may be irreversible. We have an ethical duty to hold our ecosystems in trust for future generations, and to protect vulnerable children who cannot defend their right to a healthy future.

References

- Ahdoot S, Pacheco SE. Global climate change and children's health. *Pediatrics* 2015; **136**: 992–7.
- The World Health Organization. *Quantitative Risk Assessment of the Effects of Climate Change on Selected Causes of Death, 2030s and 2050s*. Geneva: The World Health Organization; 2014.
- Stanley F, Farrant B. Climate change and Children's health: A commentary. *Children* 2015; **2**: 412–23.
- The United Nations. Convention on the Rights of the Child. Geneva; 1989.
- Helldén D, Andersson C, Nilsson M, Ebi KL, Friberg P, Alfvén T. Climate change and child health: A scoping review and an expanded conceptual framework. *Lancet Planet Health* 2021; **5**: e164–75.
- Sheffield PE, Landrigan PJ. Global climate change and children's health: Threats and strategies for prevention. *Environ. Health Perspect.* 2011; **119**: 291–8.
- Philipsborn RP, Chan K. Climate change and global child health. *Pediatrics* 2018; **141**: e20173774.
- Kiang K, Graham S, Farrant B. Climate change, child health and the role of the paediatric profession in under-resourced settings. *Trop. Med. Int. Health* 2013; **18**: 1053–6.
- Isaacs D. Climate change: The moral role of paediatricians. *J. Paediatr. Child Health* 2015; **51**: 843–4.
- The tragedy of the commons. *Science* 1968; **162**: 1243–8.
- The United Nations The United Nations Framework Convention on Climate Change. Geneva; 1992.
- Patz JA, Gibbs HK, Foley JA, Rogers JV, Smith KR. Climate change and global health: Quantifying a growing ethical crisis. *Ecohealth* 2007; **4**: 397–405.
- Potter V. *Bioethics Bridge to the Future*. New Jersey: Prentice-Hall; 1971.
- Whitehouse P. The rebirth of bioethics: Extending the original formulations of Van Rensselaer Potter. *Am. J. Bioeth.* 2003; **3**: W25–31.
- UNICEF Unless We Act Now: The Impact of Climate Change on Children. Geneva; 2015.
- Rawls J. *A Theory of Justice*. Cambridge, MA: Harvard University Press; 2009.
- Hosking J, Jones R, Percival T, Turner N, Ameratunga S. Climate change: The implications for child health in Australasia. *J. Paediatr. Child Health* 2011; **47**: 493–6.
- Akachi Y, Goodman D. Global climate change and child health: A review of pathways, impacts and measures to improve the evidence base. UNICEF Innocenti Discussion Paper. 2009; 03.
- Williams PCM, Bartlett AW, Howard-Jones A *et al.* The impact of climate change and biodiversity collapse on the global emergence and spread of infectious diseases. *J. Paediatr. Child Health* 2021; **57**: 1775–80.
- Xu Z, Etzel RA, Su H, Huang C, Guo Y, Tong S. Impact of ambient temperature on children's health: A systematic review. *Environ. Res.* 2012; **117**: 120–31.
- Basagaña X, Sartini C, Barrera-Gómez J *et al.* Heat waves and cause-specific mortality at all ages. *Epidemiology* 2011; **22**: 765–72.
- P S, D. V. Climate impacts on air quality and child health and wellbeing. *J. Paediatr. Child Health* 2021: 57.
- Meherali S, Punjani N, Louie-Poon S *et al.* Mental health of children and adolescents amidst COVID-19 and past pandemics: A rapid systematic review. *Int. J. Environ. Res. Public Health* 2021; **18**: 3432.
- Joliffe D, Prydz E. Estimating International Poverty Lines from Comparable National Thresholds. Washington: World Bank Group; 2016. Available from: <https://documents1.worldbank.org/curated/en/837051468184454513/pdf/Estimating-international-poverty-lines-from-comparable-national-thresholds.pdf> [accessed 1 June 2021].
- Bhutta ZA, Aimone A, Akhtar S. Climate change and global child health: What can paediatricians do? *Arch. Dis. Child.* 2019; **104**: 417–8.
- Myers N. Environmental refugees: A growing phenomenon of the 21st century. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 2002; **357**: 609–13.
- Zhao C, Liu B, Piao S *et al.* Temperature increase reduces global yields of major crops in four independent estimates. *Proc. Natl. Acad. Sci. U. S. A.* 2017; **114**: 9326–31.
- Swinburn BA, Kraak VI, Allender S *et al.* The global Syndemic of obesity, Undernutrition, and climate change: The Lancet Commission report. *Lancet* 2019; **393**: 791–846.
- Lloyd SJ, Kovats RS, Chalabi Z. Climate change, crop yields, and undernutrition: Development of a model to quantify the impact of climate scenarios on child undernutrition. *Environ. Health Perspect.* 2011; **119**: 1817–23.
- Victoria CG, Adair L, Fall C *et al.* Maternal and child undernutrition: Consequences for adult health and human capital. *Lancet* 2008; **371**: 340–57.
- Dietz WH. Climate change and malnutrition: We need to act now. *J. Clin. Invest.* 2020; **130**: 556–8.
- Rittel HW, Webber MM. Dilemmas in a general theory of planning. *Policy Sci.* 1973; **4**: 155–69.
- Waterston T. Advocacy and the paediatrician. *Paediatr. Child Health* 2016; **26**: 179–84.
- Haines A, McMichael AJ, Smith KR *et al.* Public health benefits of strategies to reduce greenhouse-gas emissions: Overview and implications for policy makers. *Lancet* 2009; **374**: 2104–14.
- Isaacs D. Advocacy. *J. Paediatr. Child Health* 2015; **51**: 747–8.
- Kennedy RF. Remarks at The University of Kansas. Washington: JFK Library. 1968. Available from: <https://www.jfklibrary.org/learn/about-jfk/the-kennedy-family/robert-f-kennedy/robert-f-kennedy-speeches/remarks-at-the-university-of-kansas-march-18-1968> [accessed 1 June 2021].
- Greta Thunberg *Addressed the UN COP24 Climate Talks*. 2019.