Climate change: an Australian intergenerational health equity analysis?

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Climate change and children’s health in Australia: Likely futures, new inequities?

Abstract

This century, Australians are likely to face higher temperatures, shifting rainfall systems, severe droughts and more fires and storms. Food and water costs are increasing, while weather-related disasters and droughts will generate financial insecurity, social dislocation and loss of livelihoods in affected farming, peri-urban and regional communities. These climate-induced changes are also likely to affect human health and well-being, especially children’s.

Because of their immature organ systems, neurobiology and dependence on caregivers, children are more likely to be affected by heat stress, gastroenteritis and natural disasters, as well as family stresses linked to droughts, loss of livelihood and familial dislocation. Furthermore, because of climate change, children living today will confront even greater health risks over their lifetime, with available estimates indicating a 30-100% increase across selected health risks by 2050. Future generations may face a 3 to 15-fold increase by 2100.

These greater health risks to children will unfold over their lifetime. We argue that they can be viewed as a form of health inequity. Indeed climate change suggests that two types of health inequities are likely. The first will be to lower the level of population health across current and future generations (including between adults and children living now). The second will be to increase the social gradient in health, with those at the top of the social hierarchy better able to protect themselves from impacts and to adapt. An intergenerational framework helps clarify the human health impacts of climate change, and may help research and policy efforts to address the time lag between cause and health consequence, thereby improving health, equity and sustainability.
"We are worried, but there is hope because we are a generation that knows more about these issues—we have more awareness and are more willing to make a change.....”

Australian schoolchild on climate change, Voices of the Future (1)

Despite climatic vulnerability, few Australian policies on climate change and its health impacts have a child or intergenerational focus. Most research, policy and interventions assume a single generational focus; however the time lag from cause to consequence makes climate change an intergenerational issue, especially in terms of health and well being. This paper explores the relationship between intergenerational health inequities linked to climate change, focusing on children in Australia.

*Climate change: Australia at the forefront.* Australia is the most arid populated continent, and is therefore vulnerable to changes in temperature and rainfall, on top of predicted southwards shifts in rainfall systems—many of them critical to regional farming practices. The key risks to the nation centre on extreme weather events, including cyclones, fires, higher temperatures, droughts and drying, with different regions likely to experience different impacts. In the north, a downward shift in rainfall systems increases risk of cyclones and storms in the populous areas of south-east Queensland and north-east New South Wales. Average temperatures in Australia have already increased by about 0.9°C since 1910,(2) but much larger increases in the interior and northern areas are expected this century.(3) South-eastern Australia expects an estimated 143% increase in catastrophic bushfires by 2050 (4) and the 2009 fires in south-east Victoria were unprecedented. Extended drought and high temperatures contributed to a series of fires that overwhelmed the state’s fire-fighting resources, leaving 173 people dead and at least 414 injured.(5)

The most important impacts on the southern Australian landscape are long-term drying and droughts, with likely reductions in rainfall of around 10%.(6) Up to 20% more droughts are predicted over most of Australia by 2030, and up to 80% more in south-
western Australia by 2070. Agricultural industries are also likely to be affected. The Murray Darling Basin river system supplies 70% of the water needed for the nation’s irrigated crops and pastures. Over 95% of the river system already shows evidence of environmental degradation. Climate change is forecast to further reduce annual stream flow by 10-25% in 2050 and 16-48% by 2100. (7) Financial hardship and dislocation is now reported in rural communities (8) and most urban residents are starting to pay higher prices for, and face restrictions on, water (Melbourne’s water storage is now about one half of the volume stored 10 years ago, (9)).

Thus, despite the nation’s affluence and political stability, the economic and social costs from climate change could be significant. Climate change, and its interplay with economic and social systems, is also likely to affect human health and well-being and exacerbate existing health inequities. (10)

*Health impact in Australia from climate change.* Climate change may not lead to new diseases and health disorders but instead alter the incidence, range and seasonality of existing ones. (11) These health risks may be direct (via changes in the environment or ecosystem) or indirect (via climate-induced changes in economic or social systems).

Future estimates indicate that Australians will face significant additional health burdens (see Table 1). Heat stress and associated deaths are expected to increase. (12) The range and seasonality of vector-borne diseases such as malaria and dengue fever may widen. (12) As the frequency and severity of fires, cyclones and floods increases, so too will related deaths, injuries and mental disorders linked to loss and trauma (as yet, there are no Australian estimates of future impacts). The health impacts from the slow-moving disasters of desertification, rising sea levels and drought are most likely to be indirect but equally severe. Losses, hardship and chronic financial stresses are predictive of depression and anxiety, as is the experience of dislocation and community disruption. (13)

The health impacts of climate change impinge unequally between populations, countries and regions. Globally, the estimated 150,000 annual deaths in 2000 (from major selected
causes of death), attributable to climate change that had occurred (relative to the 1961-1990 average climate), were almost entirely confined to the world’s low-income nations with poorer and more vulnerable populations. Within Australia, climate change could also exacerbate existing health inequities.(10)

Adaptive responses to climate change may not reduce the social patterning of health risk from climate change. Successful adaptation to climate change will require resources to counteract rising food, water and energy costs in Australia. The unequal distribution of money and resources and differences in the quality of living and working conditions put socially disadvantaged groups at greater risk of climate change-related health outcomes.(10) People who adapt relatively successfully are therefore most likely to have the resources to do so; a growing pool of socially disadvantaged could face a much greater health risk because they do not have the resources to cope. In Australia, socio-economic disadvantage, living conditions and access to health services are stratified by location (remote, rural or urban). Loss of livelihood and the internal migration of rural families to cities may add further to this widening health differential, and within cities may exacerbate residential segregation by income. Australian cities are characterized by high housing costs, urban sprawl and spatial polarization, with low income households concentrated in the mid to outer suburbs. These suburbs often lack services essential to good health, amplifying the health risks flowing from low socio-economic status. Furthermore, exposures to climate-related risks vary by occupation and social status with, for example, low paid outdoor labourers and workers at heightened risk of heat stress.(14)

*Children’s health vulnerability.* There are very few estimates of the climate change-related health impacts for Australian children. However, it is well documented that children show greater exposures and sensitivity to extreme weather and heat events, vector-, food- and water-borne diseases and those associated with air pollution and aeroallergens.(15) Because climate change is likely to increase these sorts of health risks, children are a population subgroup that will be particularly affected—another form of inequity.
Immature physiological systems increase sensitivity to air-borne pollutants, bushfire smoke and allergens. These are predicted to increase because of changing seasonal patterns, pollen production and vegetation. Recent Australian research shows that young children are prone to overheating, and that hot days can also increase likelihood of fever or gastroenteritis. Indeed, for every 1°C increase in temperature there is a 3-8% increase in incidence of diarrhoeal disease which will disproportionately affect children, especially those who are disadvantaged. A similar, close relationship between temperature and the incidence of vector-borne diseases has been observed in children, although to date they have not posed major health threats in Australia.

Children’s immature neurobiology, along with their dependence on caregivers, adds another dimension to their vulnerability, and this is especially relevant for understanding the health impact of the expected increases in natural disasters in Australia, such as fires and flooding. Compared with adults, trauma exposure in childhood can lead to marked alterations in brain function and longer term cognitive and mental health impacts. Children surveyed six months after the 2003 bushfires in Canberra, which destroyed 500 homes, showed much higher rates of emotional and behavioural problems compared to Australian norms, with nearly half showing elevated Post Traumatic Stress Disorder symptoms. Furthermore financial hardship, trauma and loss associated with climate change-related disasters may affect parents’ mental health, which may increase family conflict and erode the close and supportive relationships that are determinants of children’s mental health. For example, in the US, rates of inflicted head injury to children under 2 years old increased five-fold after a hurricane. Even less is known about possible child age-specific impacts of climate change, including differences in vulnerability from exposures in infancy or in utero, relative to exposures in older children. Children’s exposure to health risk and hardship is partly determined by their parents’ socio-economic status; thus a widening gap between households in their access to income and other resources will be profoundly consequential to children.
Children in the developing world face the double jeopardy of climate change compounding extreme poverty, but even in an affluent nation like Australia children will show a greater vulnerability to health impacts. Some children currently confront compounding impacts linked to geography and socio-economic status, such as disadvantaged Indigenous children and those living in remote areas. Such compounding impacts will have ramifications for their future adult health quite different to the health trajectory of current adults. It is also likely that climate change will impact on the health of those as yet unborn, foregrounding the issue of intergenerational health inequities.

**Intergenerational health inequities.**

Intergenerational health inequity refers to the unequal and unfair distribution of health across generations. The term encompasses poorer health outcomes for children relative to adults, and the avoidable—through reasonable social action—differences in health between the unborn and people living now. Akin to the notion of sustainability, achieving intergenerational health equity would require that economic, social and health policies and actions must conserve the health and quality of life of children now and into the future, and of future generations (to paraphrase Edith Brown Weiss’s 1989 definition of intergenerational equity).(23)

We argue that an intergenerational framework helps clarify the human health impacts of climate change because it encompasses three things: children’s vulnerability to these risks (an age- and development-related element); increased health risk over ensuing decades, which children will confront as they age; and increased health risks over the longer term, experienced by future generations as yet unborn. We have already discussed children’s age- and development-related vulnerability. The next section considers the expected future health differences that constitute a rarely considered form of health inequity: potentially avoidable disparities in health across generations (see Figure 1).

To illustrate this aspect of intergenerational health inequities, we summarise estimates of the future health impacts in Australia in Table 1, which contains available estimates for heatwave-related deaths and hospitalisations, bacterial gastroenteritis, dengue fever, and
flood-related deaths and injuries. These estimates are based on either no or relatively little emission reduction; that is, they are for high emission scenarios and assume little or no mitigation. Relative to the current generation, Australians living in 2050 will confront a 30-100% increase in selected health risks; those living in 2100 face a 3 to 15-fold increase. Although these future estimates underline a likely, significant health inequity by generation, they are both incomplete and conservative. Many future health outcomes have not yet been estimated, especially the mental health problems related to social and economic stress, drought, natural disasters and loss. Nor are there quantified estimates of the interactions between the health risks posed by climate change and age or developmental status.

Figure 1 further illustrates the notion of an intergenerational health gap, using a hypothetical population distribution of mental health problems. Currently, 20% of Australian adults experience some type of significant mental health problem in a 12-month period. (24) If climate change increases the prevalence of mental health problems, including prevalence of traumatic stress-related problems, it shifts the population curve. This will mean significantly higher numbers of people in future generations will experience clinically-significant disorder (the area marked by the line, under the future curve), creating a marked disparity in population mental health across generations. This figure is illustrative only, as the size of the intergenerational gap is not known and will depend on actions to reduce emissions, adaptation capacity and the resources available to prevent or treat mental health problems.

Policy and research issues. Compared with adults living today, future Australians may not only experience worse health on average, but they may be living in a society characterised by greater health inequity. Furthermore, Australian children will face over their lifetime an increase in climate change-related health risks. Even if CO₂ emissions were immediately confined to current levels, the amount in the atmosphere will keep increasing for at least the next 100 years. (25) The extent of health risk they confront,
however, is not fixed, and some of the health impacts could be reduced by policy and intervention.

So far, Australian policy discussions of climate change do not directly focus on the consequences for children’s health or on equity. Reducing avoidable health differences is a foundational principle in public health policy and health promotion, as well as a policy goal in an increasing number of countries worldwide. A report from WHO’s Commission on the Social Determinants of Health(26) represents a global effort to compile evidence that will galvanize action to improve health equity. We argue that the health risk posed by climate change must also be viewed through the lens of health inequity and represents the additional policy challenge of closing the health gap across generations. Indeed, climate change suggests that two types of health inequities are likely. The first will lower population health overall across generations, including between adults and children living now. The second will widen the health gap and increase the social gradient in health, with those at the top of the hierarchy better able to adapt.

Lack of robust evidence contributes to the present paucity of attention to child health impacts and intergenerational equity issues. Although we know enough to act now, an important step in building an intergenerational health framework is developing age-specific and child-focussed health risk estimates. In Australia, we lack estimates in three critical areas: first, impacts of climate change on children’s mental health; second, the extent the health effects of climate change will vary by location (urban, rural, remote, regional) and by family structure and resources (including socio-economic); and third, the way Indigenous children may be affected (climate change could threaten, for example, traditional food and cultural resources as well as exacerbate social and economic disadvantage). Additionally, age-sensitive periods for some exposures may exist, for example heat stress in infancy.

Viewing climate change as an intergenerational health inequality issue may also help channel public health resources towards adaptation and mitigation strategies, which can be viewed as health interventions as well as environmental ones. However there is no
agreed methodology for policy analyses that considers future health. Economists handle the uncertainty involved in quantifying future states by making assumptions about expected returns, utility and value, and in some instances by discounting future utility and costs.(27) Criticisms of this approach in relation to climate change are widespread and longstanding.(28) It is equally doubtful that assumptions of diminishing value can be applied to health policies across generations, including the health of children.

Global bodies are beginning to recognise the importance of children’s interests and health. Both the UNDP and UNICEF are developing environmental education resource packs for schools. The WHO has formed two initiatives: Healthy Environments for Children Alliance (HECA) and Children’s Environmental Health Indicators (CEHI) to support action on children, health and environment issues and to improve the evidence base and monitoring of children’s environmental health indicators. However, an intergenerational health framework is largely lacking in policy efforts and debate regarding climate change, including in Australia. Meanwhile, in an age of digital media and widespread internet access, children themselves are aware of the emerging problem posed by climate change, as illustrated by the quote opening this paper.
### Table 1
Summary of estimated direct health impacts from climate change, Australia 2050 and 2100

<table>
<thead>
<tr>
<th>Expected climate change</th>
<th>Vulnerable areas</th>
<th>Health impacts</th>
<th>Estimated health impacts 2050</th>
<th>Estimated health impacts 2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>More heat waves</td>
<td>Widespread, urban (heat island)</td>
<td>Deaths, hospitalisations</td>
<td>+36% deaths, +186% hospitalisations&lt;sup&gt;(29)*&lt;/sup&gt;</td>
<td>+195% deaths, +223% hospitalisations&lt;sup&gt;(29)*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increased average temperatures</td>
<td>Widespread (airborne allergens), urban (pollution)</td>
<td>Asthma, food poisoning (bacterial gastroenteritis including Salmonella)</td>
<td>Bacterial gastroenteritis + 334, 598 notifications annually&lt;sup&gt;2&lt;/sup&gt; +11% indigenous child hospitalizations&lt;sup&gt;(12) ‡ ‡&lt;/sup&gt;</td>
<td>Bacterial gastroenteritis + 870,198 notifications&lt;sup&gt;(29)**&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vector habitat change</td>
<td>Wider vector habitats 200km south and west</td>
<td>Dengue Fever, Ross River Virus</td>
<td>+114% people exposed dengue&lt;sup&gt;(29)***&lt;/sup&gt;</td>
<td>+1500% people exposed dengue&lt;sup&gt;(29)***&lt;/sup&gt;</td>
</tr>
<tr>
<td>More extreme weather disasters, fires, cyclones, flooding</td>
<td>Peri-urban, rural, coastal fringe (including cities)</td>
<td>Deaths, injury, stress disorders, asthma (fire smoke)</td>
<td>Flooding injuries and deaths +29-48% (does not include mental health)&lt;sup&gt;(12, 29)‡&lt;/sup&gt;, fire deaths, injuries to increase (no estimates)</td>
<td>Flooding and fires to increase, health estimates not available</td>
</tr>
<tr>
<td>Drought and drying</td>
<td>Rural, remote, indigenous communities</td>
<td>Depression, suicide, asthma (dust storms)</td>
<td>Likely increase&lt;sup&gt;(30)§&lt;/sup&gt;</td>
<td>Likely increase&lt;sup&gt;(30)§&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

* Assuming no further climate change, accounting for likely population growth and change in age profiles.
** New notifications per annum relative to baseline notifications assuming no further climate change, accounting for likely population growth and change in age profiles.
*** Percentage change from current notifications (assuming no further climate change, accounting for likely population growth and change in age profiles).
‡ High emission scenario, no change in population or age profile assumed.
‡ ‡ Based on central Indigenous population baseline, no population or age profile changes assumed.
Based on current mortality and morbidity studies, no estimates of future impacts provided.
Figure 1
Hypothetical population distribution of mental health, current and future (2050)
References


22. Bartlett S. Climate Change and Urban Children Impacts and Implications for Adaptation in Low and Middle Income Countries; Human Settlements Discussion Paper – Climate Change 2, prepared as a background paper for the work on Adapting Urban Centres to Climate Change in Low and Middle-income Nations with a strong pro-poor focus that IIED’s Human Settlements Group is undertaking for the World Bank. 2008.


