AMA Position Statement on Climate Change and Human Health
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Human health is ultimately dependent on the health of the planet and its ecosystem. The AMA recognises the latest findings regarding the science of climate change, the role of humans, past observations and future projections. The consequences of climate change have serious direct and indirect, observed and projected health impacts both globally and in Australia. There is inequity in the distribution of these health impacts both within and between countries, with some groups being particularly vulnerable. In recognition of these issues surrounding climate change and health, the AMA believes that:

- because climate change involves potentially serious or irreversible harm to the environment and to human health, urgent international cooperation is essential to mitigate climate change. Reducing greenhouse gas emissions within a global carbon budget is necessary to prevent further climate harm as a result of human activity.

- Australia should adopt mitigation targets within an Australian carbon budget that represents Australia's fair share of global greenhouse gas emissions, under the principle of common but differential responsibilities.

- climate policies can have public health benefits beyond their intended impact on the climate. These health benefits should be promoted as a public health opportunity, with significant potential to offset some costs associated with addressing climate change.

- the health impacts of climate change and the health co-benefits of climate mitigation policies both bear economic costs and savings. Economic evaluations of the costs and benefits of climate policies must therefore incorporate the predicted public health impact accrued from such policies and the public health costs of unmitigated climate change.

- Regional and national collaboration across all sectors, including a comprehensive and broad reaching adaptation plan is necessary to reduce the health impacts of climate change. This requires a National Strategy for Health and Climate Change.

- there should be greater education and awareness of the health impacts of climate change and the public health benefits of mitigation and adaptation.

- renewable energy presents relative benefits compared to fossil fuels with regard to air pollution and health. Therefore, active transition from fossil fuels to renewable energy sources should be considered.

- decarbonisation of the economy can potentially result in unemployment and subsequent adverse health impacts. The transition of workers displaced from carbon intensive industries must be effectively managed.

Explanatory notes

1. Global Climate Change

The world's climate – our life-support system – is being altered in ways that are likely to pose significant direct and indirect challenges to health. While 'climate change' can be due to both natural forces and human activity, the evidence implicating human influence on the climate system has grown and is now clear.[1] Anthropogenic greenhouse gas (GHG) emissions in particular are extremely likely (95-100% probability) to have been the dominant cause of the observed warming since the mid-20th century.[1]

1.1. Observed global climate change

Observed scientific data indicate that warming of the climate system is unequivocal.[2] Between 1880 and 2012, the globally averaged combined land and ocean surface temperature data as calculated by a linear trend show a warming of 0.85°C (90% confidence interval [0.65, 1.06]).[2] 2014 nominally ranked as the warmest year since modern instrumental measurements began in the mid-1800s.[3] This adds to the observed warming trend, with 14 of the 15 hottest years on record occurring during the twenty-first century.[3] Since the 1950s, much of the observed warming is unprecedented over decades to millennia.[2] In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans.[1] The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, the sea level has risen, and the concentrations of greenhouse gases have increased.[2] The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.[2] Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions.[2] The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification.[2] Total anthropogenic GHG emissions have continued to increase over 1970 to 2010 with larger absolute increases between 2000 and 2010, despite a growing number of climate change mitigation policies.[1]

1.2. Projected global climate change

Anthropogenic GHG emissions are mainly driven by population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy.[1] Into the future, models based on these factors describe a range of emission scenarios. A 'stringent mitigation' scenario is consistent with a likely (66-100%) probability of limiting global average temperature rise to less than 2°C, with temperatures expected to rise by 0.3 to 1.7 degrees toward the end of this century.[1] A 'baseline scenario' models the impacts if no additional actions are taken to constrain emissions, with temperatures expected to rise by 2.6 to 4.8 degrees.[1] Scientists had previously agreed that a 2°C increase in global temperatures above pre-industrial levels is likely to give rise to "dangerous, irreversible and potentially catastrophic global impacts".[4] This 2°C target has been brought into question, with some arguing a 1.5°C target is needed to prevent dangerous anthropogenic interference in the climate system.[5] Consequently the United Nations Framework Convention on Climate Change (UNFCCC), subsequent to paragraphs 4 and 138 of the 2010 Cancun Agreements, will conduct a review during the 2013-2015 period to assess the adequacy of the 2°C target.[6]

2. Climate change in Australia

2.1. Observed climate change in Australia

Observed scientific data show that Australia's climate has warmed since national records began in 1910, and especially since 1950, with mean surface air temperature warming by 0.9°C since 1910.[7] Sea-surface temperatures in the Australian region have warmed by 0.9°C since 1900.[7] 2013 was the warmest year on record in Australia, with seven of Australia's ten warmest years on record having occurred in the 13 years from 2002.[8] 2011 was the single year that was cooler-than-average in the past decade.[8] Record-breaking summer temperatures in Australia over 2012–2013, are very unlikely to have been caused by natural variability alone.[7]

National average rainfall has increased in northwest Australia since records began in 1900, but has decreased in the southeast and southwest in recent decades.[7] The duration, frequency and intensity of heatwaves have increased across many parts of Australia since at least 1950.[7] The severity and occurrence of extreme fire weather has increased in several sites since the 1970s.[7] Rates of sea-level rise vary around the Australian region, with higher sea-level rise observed in the north and rates similar to the global average of 225mm observed in the south and east.[7] Global sea level fell during the intense La Niña event of 2010–2011.[7] This was ascribed partly to the exceptionally high rainfall over land, which resulted in floods in Australia, northern South America, and Southeast Asia. [7] Some uncertainties still remain. Natural variability continues to play the dominant role in current extreme rainfall in Australia, and changes in the frequency and intensity of tropical cyclones remains equivocal.[7]

Recent events have highlighted the vulnerability of ecosystems and human systems to current climate variability. Since the late 1970s high sea surface temperatures have repeatedly bleached coral reefs in northeast Australia, and more recently in western Australia.[9] Between 1997 and 2009, widespread drought in southeast Australia resulted in substantial economic loss.[9] The 2009 Victorian heatwave was associated with approximately 374 excessive heat-related deaths,[10] with a further 173 deaths and 2133 houses destroyed in the subsequent bushfires.[11] While the consequences of a single extreme weather event cannot be solely attributed to climate change, projected changes in the climate system are expected to exacerbated present climate vulnerabilities.[9]

2.2. Projected climate change in Australia

According to the Australian Bureau of Meteorology (BOM) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), by 2030 temperatures are expected to rise by 0.6 to 1.5°C across Australia compared with the 1980-1999 average, noting that temperatures already rose by an average of 0.6°C by 1990 compared with 1910.[7] By 2070, temperatures are expected to rise by 1.0 to 2.5°C s and 2.2 to 5.0°C under scenarios similar to stringent mitigation and baseline scenarios respectively.[7] The projected effects of these temperature rises vary by region. Further decreases in average rainfall and more frequent and severe droughts and are expected over southern Australia, but average rainfall in northern Australia may increase or decrease.[7] An increase in the number and intensity of extreme rainfall events is projected for most regions.[7] The number of extreme fire-weather days is expected to increase across southern and eastern Australia.[7] Sea levels are expected to rise by 0.28 to 0.98m by 2100, depending the amount of GHG emissions released, and may continue to rise by beyond 2100.[7] Ocean acidity will continue to increase.[7] Without adaptation, further changes in climate, atmospheric CO_2, and ocean acidity are projected to have substantial impacts on water resources, coastal ecosystems, infrastructure, agriculture, biodiversity and health.[9, p1374]

3. Climate change and global health

3.1. Observed global health impacts of climate change

In recent decades, climate change has already contributed to levels of ill health, however, the present global burden of ill health attributable to climate change is relatively small compared with other stressors and is poorly quantified.[13] Rising temperatures are likely to have increased the risk of heat-related death and illness.[13] Local changes in temperature and rainfall have altered distribution of some water-borne illnesses and disease vectors, and reduced food production for some vulnerable populations.[13]

3.2. Projected global health impacts of climate change

Into the future, climate change is likely to affect proximal and distal risk factors for a wide range of health outcomes, resulting in both direct and indirect impacts on health.[13-18] The direct effects of climate change include injuries and deaths from increased heat stress, floods, fires, drought, and increased frequency of intense storms.[13-18] The indirect effects include adverse changes in air pollution, the spread of disease vectors, lost work capacity and reduced labour productivity, food insecurity and under-nutrition, displacement, and mental ill health.[13-18] Irrespective of climate change, ocean acidification from rising atmospheric CO_2 presents a threat to marine ecosystems, specifically coral reefs and calcifying organisms, which in turns threatens the nutrition of millions of people who rely on fish and aquatic invertebrates for their food security.[19] In 2030, climate change is expected to result in substantial additional deaths, including: 38,000 due to heat exposure in elderly people; 48,000 due to diarrhoea; 60,000 due to malaria; and 95,000 due to childhood under-nutrition.[15] Between 2030 and 2050, the WHO conservatively estimates 250,000 additional deaths per year due to climate change.[15] This figure likely underestimates the impacts of climate change on health, as not all major causal pathways are readily quantifiable.[15]

By contrast, climate change may have some benefits for health. In temperate climates, mortality is higher in winter than in summer.[20-22] Fewer cold extremes may lead to a reduction in cold-related morbidity and mortality. However, the association between cold-temperatures and winter mortality remains unclear, and may be mediated through seasonal factors other than temperature.[20, 21] There is therefore low confidence that climate change will substantially reduce winter mortality.[13] In addition, climate change may produce some beneficial geographical shifts in food production, and reduce the capacity of some disease-carrying vectors due to exceedance of thermal thresholds.[13] All in all there is high confidence that the positive effects of climate change on health will be increasingly outweighed, worldwide, by the magnitude and severity of the negative effects.[13]

3.3. Vulnerable groups

All populations will be affected by a changing climate, but the initial health risks vary greatly, depending on a number of factors.[13-18] People living in small-island developing states and other coastal regions, large cities, and rural areas are all particularly vulnerable in different ways.[13-18] Health effects are expected to be more severe for children; the poor, especially women; elderly people; people who work outdoors; and people with pre-existing medical conditions.[13-18] Major diseases that are sensitive to climate change - diarrhoea, vector-borne diseases like malaria, and infections associated with under-nutrition - are most serious for children living in poverty.[14]

Climate change will therefore have its greatest effect on those who have contributed the least to its cause and who have the least resources to cope with it.[17] Without mitigation and adaptation, it will worsen global health inequity through negative effects on the social determinants of health, and may undermine the last half-century of gains in development and global health.[17, 18] This led to the principle of common but differentiated responsibilities in the 1992 *Rio Declaration*,[23] which reflects the principle of justice in medical ethics.[24] This principle emphasises the need for a strategy of contraction and convergence, whereby wealthier countries rapidly reduce emissions and poorer countries can increase emissions to achieve health and development goals, until at a point of convergence at sustainable emissions per person.[17]

3.4. Mitigation as preventative public health

Mitigation of climate change can be considered a public health measure, which seeks to prevent its adverse health impacts. Limiting global average temperature rise to less than 2°C above pre-industrial levels with a probability of greater than 66% requires cumulative CO_2 emissions from all anthropogenic sources since 1870 to remain below about 2900 $GtCO_2$.[1] Approximately 1900 $GtCO_2$ had already been emitted by 2011.[1] This leaves a global carbon budget of approximately 1000 $GtCO_2$, which must be adhered to in order to prevent the most adverse health impacts of climate change.

Irrespective of climate change, policies to reduce GHG emissions have potentially large public health benefits.[13, 18, 25, 26] Air pollution is considered the world's single largest environmental health risk and caused approximately 7 million premature deaths in 2012 from ischaemic heart disease, stroke, chronic obstructive pulmonary disease, acute respiratory infection and lung cancer.[27] Air pollution is estimated to cost US$3.5 trillion per year in lives lost and ill health to the world's most advanced economies plus India and China.[28] Emissions from motor vehicles, industrial processes, power generation, and the household combustion of solid fuel are common sources of air pollution. [29] Particulate matter (PM) is an especially dangerous pollutant and is considered a carcinogen by the International Agency for Research on Cancer.[29] Ground-level ozone is another important air pollutant, as it damages both human health and crops.[30] It is estimated that global losses to soybean, maize and wheat crops due to ground-level ozone pollution could be US$17-35 billion per year by 2030.[31]

Apart from addressing climate change, mitigation strategies have potentially large public health benefits and health economic cost savings, which may substantially offset the cost of mitigation.[13, 18, 25] Strategies that focus on improvements in energy and combustion efficiency, and transition to non-combustion energy sources, such as solar, wind and wave, would mutually reduce emissions of health-harming pollutants and climate-altering GHGs.[13, 18, 25] In the United States, direct economic benefits of reducing $PM_{2.5}$ and ground-level ozone pollution under the 1990 Clean Air Act Amendments are estimated to be up to 90 times the cost of implementing them.[32] About 85% of this economic benefit would be due to fewer premature deaths linked to reducing $PM_{2.5}$ in the outdoor environment, with the premature deaths of 230,000 people avoided in the year 2020 alone.[32] For example, designing transport systems that promote active transport and reduce use of personal motorised vehicles, leads to lower GHG emissions and better health through improved air quality and greater physical activity.[13, 25, 26]

3.5. Adaptation as preventative public health

Adaption strategies have a substantial capacity to reduce the burden of climate change on health.[13] Adaptation strategies can be categorised as incremental, transitional, and transformational actions.[36] Incremental adaptation includes improving public health and health care services for climate-related health outcomes.[36] Transitional adaptation refers to shifts in attitudes and perceptions, leading to initiatives such as vulnerability mapping and improved surveillance systems that specifically integrate environmental factors.[36] Transformational adaptation requires fundamental changes in health systems.[36] There are, however, limits to adaptive capacity. With temperature rises above 2°C, health impacts are expected to accumulate non-linearly.[13] This is due to physiological limits to human heat tolerance; biological limits to crop production and subsequent human nutrition; thermal tolerance of disease vectors; geographic limits to migration; and limits to infrastructure operating capacity.[13, p735] As such, while adaptation strategies are vital for health protection, they work best together with, rather than in lieu of, mitigation strategies.

4. Climate change and Australian health

4.1. Observed health impacts of climate change in Australia

There is robust evidence to show hot weather increases mortality in Australia, with air pollution exacerbating this relationship.[37] The ratio of summer to winter deaths in Australia has increased from 0.71 to 0.86 between 1968 and 2006, in association with rising annual average temperatures.[38] This trend was consistent between States, sexes, and age group categories above 55 years.[38] Moreover, extreme heat conditions are associated with substantial increases in hospital admissions and deaths.[39-41] For example, in addition to the 374 excess deaths during the 2009 Victorian heatwave, which represented a 62% increase in all cause mortality, there was a 46% increase in ambulance emergency cases over the three hottest days; and a 34-fold increase of cases with direct heat related conditions.[10] Heatwaves also affect mental health. In South Australia, heatwaves were associated with a 7.3% increase in mental health admissions, and an increase in mortality attributed to mental and behavioral disorders.[42]

4.2. Projected health impacts of climate change in Australia

4.2.1. Heat-related impacts

Projected increases in heatwaves will result in increased heat-related deaths and hospital admissions, particularly among the elderly and compounded by ageing and population growth.[43-45] In southern Australia, this may be partly offset by reductions in cold-related deaths.[43] With strong mitigation, climate change is projected to result in 11% fewer temperature-related deaths in both 2050 and 2100 in Australia.[43] However, without strong mitigation, temperature-related deaths are expected to rise by 14% and 100% in 2050 and 2100, respectively,[43] particularly in northern Australia.[45] Heat stress in the workplace is also an occupational health hazard, with rising temperatures expected to lead to occasional deaths, increased hospital admissions, and economic costs from lost productivity.[46-48] The impact of heat on work performance in 2013/2014 alone was estimated to cost the Australian economy US $6.2 billion, representing 0.33 to 0.46% of Australia's GDP.[46]

4.2.2. Food- and water-borne diseases

Food- and water-borne diseases are expected to increase, however the magnitude of specific increases is difficult to predict due to a range of climate- and non-climate-related factors.[9] By 2050 there it estimated to be between 205,000 and 335,000 additional cases of bacterial gastroenteritis in Australia each year, and between 239,000 and 870,000 new cases by 2100.[43] An additional 335,000 cases could result in $92.3 million in health and surveillance costs and 1.6 million lost workdays.[43]
Increased frequency of storms and floods may cause sewage or farm run-off to contaminate human water supplies with pathogens such as *Cryptospiridium* and *Giardia*.[49, 50] Conversely, some viral causes of gastroenteritis, especially rotavirus, are more commonly reported in winter and may therefore become less frequent in the future.[49, 51]

Droughts may increase the concentration of pathogens in water supplies, causing particular danger to rural Australians and livestock through blooms of toxic blue-green algae, or cyanobacteria.[52]
Legionella pneumonia incidence may increase following humid, warmer weather and heavy precipitation events.[49] Also, in a warming climate, reliance on air-conditioning may lead to increased human exposure to *Legionella* contaminated cooling towers [49]

4.2.3. Vector-borne diseases

Without effective action to reduce emissions, the geographic distribution of mosquitoes capable of bearing dengue fever may spread southwards from their current northern Queensland confines.[43, 49] This could increase the population at risk from 430,000 to 5-8 million Australians by the end of the century.[43] By contrast, with substantial emission reductions, fewer than 1 million people will be at risk by 2100.[43] The impacts of climate change on Barmah Forest Virus in Queensland will vary substantially among different coastal regions, depending on a range of factors.[53] Frequent travel within and outside Australia, together with a changing climate and recent incursions of exotic mosquito species, has the potential to expand the geographic distribution of other arboviruses, including Ross River Virus and arboviral encephalidites (Murray Valley and Kunjin),[49] The installation of large water tanks as an adaptive measure against climate change may serve as breeding reservoirs for mosquitos, exacerbating this trend.[52] Conversely, endemic malaria is not expected to return to Australia before 2050, depending on socioeconomic, development, and emissions scenarios, and sporadic cases could be readily treated.[54]

4.2.4. Respiratory illnesses

In addition to sharing common sources with GHGs, ground-level ozone and PM levels may worsen with GHG-induced climate change.[55-57] In some circumstances, such as in urban areas, hotter temperatures may enhance ozone production in the lower atmosphere.[55-57] Exposure to ozone in the lower atmosphere can reduce lung function and increase respiratory problems, including asthma exacerbations.[55-57] It may also be associated with premature death, as it was in the 2004 Brisbane heat wave,[40] particularly in people with heart and lung disease.[55] Increased frequency and intensity of bushfires, drought and dust storms with corresponding acute increases in PM levels, is also likely to lead to increased asthma exacerbations, respiratory medication use and hospital admissions for asthma and other respiratory conditions.[56, 58] Warmer conditions may also promote the production and release of airborne allergens, such as fungal spores and plant pollen, consequently affecting atopic conditions including asthma, allergic rhinitis, conjunctivitis and dermatitis.[58, 59]

4.2.5. Other indirect impacts

In addition to the relationship between heat and mental health, climate-related disasters, including persistent and severe drought, floods, and storms, are associated with significant mental health risks.[60, 61] These impacts may be especially acute in rural communities where climate change places additional stresses on livelihoods.[61, 62] A changing climate in Australia is likely to reduce local food yields and quality and increase food prices.[61, 63] This is a particular problem for lower-income families and remote communities where food choices are often limited, and may lead to dietary insufficiencies, nutritional imbalances and health impairments, especially in young children.[61, 63] In addition, our health system and infrastructure stand to suffer under climate change, with a 1.1m sea level rise is expected to place $266 billion of coastal infrastructure at risk by the end of the century, including 258 police, fire and ambulance stations as well as 75 hospitals and health services.[64] Finally, the impacts of climate change in the Pacific may contribute to an increase in the number of people seeking to move to nearby countries, including Australia, and affect political stability and geopolitical rivalry within the Asia-Pacific region.[9, 65] Together this presents a potential national security and health threat to Australia.[9, 65]

4.3. Vulnerable groups in Australia

With a high proportion of the population living in coastal regions, and a high reliance on broad acre agriculture, Australia is particularly vulnerable to climate change.[52] The most marginalised groups will disproportionately feel the overwhelmingly negative health impacts of climate change, including: rural Australians; low-income individuals and families; people with chronic diseases; children and elderly people; physical and outdoor workers; tourists; and indigenous Australians.[52] Indigenous peoples have higher than average exposure to climate change because of a heavy reliance on climate-sensitive primary industries, strong social connections to the natural environment, and constraints to adaptation.[9] As with the global assessment, inequity in the distribution climate change health impacts in Australia necessitates that mitigation and adaptation policies should attempt to equitably distribute burdens and benefits both domestically and internationally.

4.4. Mitigation as preventative public health in Australia

Mitigation of climate change will be necessary in Australia in order to prevent the adverse health impacts of climate change. Australia contributed about 1.1% of GHG emissions in 2010.[66] While this seems small in absolute terms, there are only 16 countries, which emitted more than Australia, and 178 that emitted less.[66] If these latter countries chose not to reduce emissions based on low absolute emissions per country, this would leave approximately 25% of global emissions unaccounted for.[66] This underscores a necessity for a global framework of action, in which all countries participate. Additionally, Australia ranks 52nd in the world for population size, making it one of the highest emitting countries per capita.[67] In line with the principle of common but differentiated responsibilities, the Climate Change Authority combines information from climate science and the actions taken by other countries in a modified contraction and convergence model to calculate recommended emission reduction targets for Australia.[68]

Australia stands to reap potential public health benefits from actions taken to reduce greenhouse gas emissions. It is estimated that in 2010 cancer, cardiovascular disease, nervous system and sense disorders, mental disorders, chronic respiratory disease, and diabetes contributed greatest to the disease burden in Australia.[69] Many of these are chronic diseases, which already consume large amounts of the health budget, with costs expected to rise into the future.[70] Mitigation and adaptation actions have the potential to reduce some of this disease burden, thus presenting a public health opportunity for Australia.

Long-term exposure to urban air pollution accounts for 1.5% of all deaths in Australia and short-term exposure accounts for a further 0.8%.[55] The health cost of air pollution in Sydney alone is estimated to be between $1 billion and $8.4 billion each year.[71] Air pollution from motor vehicles and coal-fired power generation are estimated to carry annual health costs of AU$2.7 [72] and $2.6 [73] billion respectively. Thus strategies that focus on improving energy and combustion efficiency, transitioning to non-combustion energy sources, and promoting active transport have the mutual benefit of reducing GHG emissions and the disease burden from air pollution in Australia. Associated health savings may substantially offset the cost of policy implementation.[18]

Mitigating climate change can also have some negative health impacts. A low-carbon transition entails a shift away from carbon intensive sectors and technologies toward low-carbon ones.[78] In the short to medium term, that transition means reallocating capital, labor, and rents, and cannot be done without some negative impacts for some workers.[78] Consequent unemployment has potential health impacts, particularly mental illness.[79] On the other hand, mitigation strategies can also create job opportunities in renewable energy generation, climate-smart agriculture, land restoration, selective logging, and forest protection.[78] Government and industry can proactively employ a range of strategies to alleviate adverse impacts for workers during the transition to a decarbonised economy.[78, 79]

4.5. Adaptation as preventative public health in Australia

In Australia, adaptation to protect health will involve improving health care services and social support for those most at risk; improving community awareness to reduce adverse exposures; developing early warning and emergency response plans[80]; and understanding perceptions of climatic risks to health as they affect adaptive behaviours.[81] Adaptation planning and implementation will require coordination and collaboration both within the health and emergency services sector and between sectors, as well as between regional governments.[13, 82, 83]

As with mitigation, adaptation plans may also confer public health benefits.[18] For example, expanding green spaces in cities can not only work to reduce the heat island effect, thereby lowering heat-related mortality by 40-99%,[84] but can also reduces both morbidity and mortality from many cardiovascular and respiratory diseases and stress-related illnesses.[13]

Endnotes

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