

Management of heat related illness enhanced by climate change and global warming in the North West Kimberley region of Western Australia

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Introduction

Policy statement 13 of the Doctors Reform Society of Australia (1997) states that preservation of the whole environment is important in order to ensure survival of the planet and that environmental health is a prime public health issue facing the Australian community. In order to address environmental health issues, underlying causes of the problems and not just the symptoms of the problems must be addressed.

One significant environmental health issue is climate change and consequent heat related illness. The fears of many scientists in relation to climate change and global warming are well reported. Climatic conditions such as recurrent hot weather, and global warming, may potentially contribute to conditions such as heat related illness. This paper will explore climate change, global warming and, predominantly, possible impacts on increasing rates of heat related illness. The paper will focus on the effects on children in Aboriginal communities in the North West Kimberley region of Western Australia to determine whether heat related illness is an existing or possible future problem in this location if global warming becomes an issue to regional public health. A forward thinking strategy for detection and prevention of heat related illness is recommended. This strategy is based on concepts from existing unrelated programs but which have been demonstrated to be beneficial to improving health outcomes in other contexts. Economic factors contributing to health service delivery, risk assessment processes, and water usage in communities, will be addressed in regard to heat related illness.

Problems defined

Many climate scientists forecast that the continued accumulation of heat-trapping greenhouse gases will alter global patterns of temperature, precipitation and climatic variability in the coming decades (McMichael and Beaglehole 2000). The UN Intergovernmental Panel on Climate Change has assessed the potential health consequences of climate change and has determined that risks to human health will arise through increased exposure to temperature extremes and from regional unpredictable increases in weather disasters (WWF 1998). Extensive review of the literature shows that many scientists contend higher concentrations of greenhouse gases in the earth's atmosphere will lead to increased entrapment of infrared radiation. The lower atmosphere is likely to warm leading to weather and climate change. The daily temperature range is likely to decrease. Average rainfall across the globe is likely to increase, particularly during winter in high latitudes. Examples of human activities that are leading to increased greenhouse gases and consequent concerns about global climate change are rising concentrations of atmospheric carbon dioxide and deforestation (Costa and Foley 2000).

The CSIRO (1998) notes that at this stage it is unclear whether the distribution and frequency of severe storms such as tropical cyclones, will change. In regions where rainfall increases with the changing climate, more floods are anticipated. This information is significant since the Kimberley region experiences major climatic and geographic effects from storms, floods and cyclonic weather during the wet season. Increases in frequency or severity of storms will further impact on living conditions within the communities through possible infrastructure damage and ill health. If there is weather change as a consequence of excess water in the environment, higher humidity and temperature combinations pose a real threat to health with conditions such as heat related illness.

Many scientists contend that global warming will not increase significantly and that reports presented are merely possible scenarios and not predictions of potential impacts of climate change. For example, Koteen and Bloomfield (2000) note that numerous factors will affect the predicted impacts both related and unrelated to climate and that damaging and costly effects of global warming *could* occur, not *will* occur.

It is also possible that the small global temperature increases of the past 25 years and indeed over the last century, are natural changes that have also occurred in the past and are therefore not significant (Gray 2000). Weather surges such as heat waves occur, but Gray (2000) doubts that there will be changes to current rates of health problems which are weather related.

Amos (2000) reports that predictions of future climate change produced through computer models are deeply flawed because accurate simulations are beyond the capabilities of even the fastest computers. Further, that phenomena such as cloud formation and ocean heat transport are poorly understood and therefore there are no definitive answers to outcomes of weather variations, only assumptions.

Opposing viewpoints of scientists throw doubt over whether there is in fact any need for concern about climate change. The question remains as to whether we adopt a preventative as opposed to a reactive model of response.

Heat related illness

The three forms of heat related illness include heat stress, heat exhaustion and heat stroke. Heat stress is caused by exposure to heat leading to increase in body heat. Heat exhaustion is caused by dehydration and heat stroke is caused by sudden failure of the thermoregulatory system of the body (Pribut 2000). Heat related illness is the physical manifestation of overheating the body and in a hot environment, exercise adds greatly to the thermal load on the body (Raasch, 2001).

Pribut (2000) noted that 75% of energy used during activity is directed solely to the production of body heat. This is important in cold weather but is not useful in hot weather. Radiant heat energy of the sun further contributes to a high body heat burden on clear and cloudless days. Dissipation of heat from the body is needed and this occurs in the form of convection, conduction and electro-magnetic radiation (Raasch 2001). Rise in blood temperature occurs in hot weather conditions and leads to a rise in core body temperature. This becomes a problem if the body is stressed by too great a change in a brief period of time.

As a further compounding factor in heat related illness, McMichael and Beaglehole (2000) assert that a population's health reflects more than a simple collection of just the risk-factor profile and health status of its individual members. For example, the effect on morbidity and mortality of heatwaves differs between populations at low and high altitudes. This population variance also encompasses differences in culture, housing design, and environmental conditioning or acclimatisation. Cedaro (1992) reaffirms that the human body is adaptable provided additional stresses are applied slowly. A body's reaction to heat and humidity is the same as for any stress, but when exercise is conducted in a hot environment without a chance to acclimatise the body will demonstrate a reaction such as a heat related illness.

Humidity

Humidity is a major component of heat stress. When humidity levels are high, perspiration does not evaporate as quickly and the core body temperature can rise to dangerous levels (American Academy of Paediatrics 2000). Humidity will decrease the evaporation of perspiration and thereby inhibit one of the primary means by which the body can cool itself. Heat balance in the body depends upon the amount of heat produced by muscle activity and metabolism and the amount of heat that is gained or lost either by the effect of the environment or evaporation of perspiration (Pribut 2000).

The higher the humidity, especially if the ambient temperature is also high, the more problems with body heat balance. Wind velocity in conjunction with humidity and ambient temperature is also a significant factor in potential problems with heat related illness in an individual. Wind velocity variances may be more problematic in the tropics than in colder temperate areas especially in combination with higher humidity and air temperature (Pribut 2000).

In relation to Aboriginal children in the North West Kimberley, several points must be considered:

- The instinctive lifestyle of aborigines which would generally ensure that shade protection and low activity are adhered to in the heat of the day.
- Adaptability of the population to the environment - a natural acclimatisation has occurred due to protracted periods of time living in the hot environment.
- Non-reporting of heat related problems if they do occur because of non-recognition of problematic symptoms and distrust of health professionals leading to lack of desire to present for assistance.

The author acknowledges that the discussion within this paper pertaining to heat related illness in children from aboriginal communities may be hypothetical. No literature was found to support the proposition. Discussion with both parents and health professionals yielded conflicting viewpoints as to whether problems of exposure actually occur. Given the information known about heat related illness, it is reasonable to assume that problems arise but are unreported or under reported.

Exercising children do not adapt as effectively as adults when they are exposed to high climatic heat. This may affect their performance and wellbeing as well as increase the risk for heat related illness (American Academy of Paediatrics 2000). Children are more at risk for several reasons:

1. Children have a larger surface area to body mass ratio than adults and can gain heat faster from the environment.
2. Children produce more metabolic heat than adults at a given running speed probably because of their inefficient style.
3. Sweating capacity is not as great in children thus reducing their ability to dissipate body heat by evaporation.
4. The capacity to convey heat by blood from the body core to the skin is less than that of adults (ASMF, 1991).
5. Children also may be more prone to dehydration because of inadequate fluid intake. Children are subject to a greater increase in core body temperature than adults when hydration levels are lowered.

The likelihood of heat intolerance in children increases with conditions that are associated with excessive fluid loss such as abnormal hypothalamic thermoregulatory function. Such abnormal function occurs in advanced malnutrition and where there has been a prior episode of heat related illness (Bar-Or et al. 1980).

Initial and significant possible outcomes of heat related illness in children include a state of dehydration. A major consequence of dehydration is an excessive increase in core body temperature. A dehydrated child is more prone to heat related illness than a fully hydrated child. A child may experience cramps initially, then headache, nausea, dizziness, and progression to lack of motor control and possible loss of consciousness. A further increase in core body temperature may occur as a result of cessation of sweating. Heat stroke may result as evidenced by delirium, convulsions, hot dry skin, hypovolemic shock and loss of consciousness (Cedaro 1992).

Compounding factors

A broad-based review of some possible factors compounding both the causation of global warming and the consequent potential for heat related illness in children is required in order to understand both impacts on, and management of, the problem. For instance, economics plays a major role in the creation of climate changes such as global warming and in the management of the problems raised by climate changes.

McMichael and Beaglehole (2000) contend that the combination of rapid progressions of socio-economic change, demographic change, and global environmental change in the modern world requires a broad understanding of what determines population health. Further, there is currently a tendency to a widened rich-poor gap, and weakened public health systems as a result of the rapid progressions (Koopman 1996). This state of inequity means that the strongest voices are heard and those who are disempowered in society will either be not listened to or not heard. Therefore the people who perhaps have the greatest health and social needs are the least likely to express that need or be heard.

Aboriginal children of The Kimberley are in the compounded situation of not only being possibly from an impoverished and disempowered base due to living circumstances, but also from the perspective of a non-contributing voice by the fact of their childhood status. Management strategies relating to heat related illness prevention might therefore be even more difficult to negotiate with health departments, and to instigate.

Current public health risk assessors, epidemiologists and policy makers are facing unfamiliar challenges in population health. For example, Koopman (1996) notes that 'epidemiology is in transition from a science that identifies risk factors for disease to one that analyses the systems that generate patterns of disease'. McMichael and Beaglehole (2000) state that 'the sustained good health of populations requires enlightened management of our social resources, economic relations, and of the

natural world'. Diminishment of both global warming and its potential consequences to children, especially in the Kimberley region, is essential to ensure health risks from heat related illness are curbed or avoided.

Globalisation

Globalisation may be a significant factor to consider in relation to economic considerations in developing preventative and management strategies for global warming and subsequent possible increases in heat related illness. For instance, Bryan and Rafferty (1998) contend that the driving forces of globalisation put profit before environmental protection, preservation and sustainability.

An example of a specific environmental health problem relating to economic globalisation is the growth of economic inequality which compounds social inequality. This leads to exacerbation of the rich-poor gap with creation and maintenance of poverty-associated conditions for poor health (Bryan and Rafferty 1998). The author contends that economic inequality in turn impacts on the development of strategies to improve aboriginal health status. Prevention strategies such as shade provision through appropriate shelter and housing construction, through tree planting programs, and through adequate water outlets in communities may be adversely affected.

McMichael and Beaglehole (2000) state that from a public health perspective, globalisation has accelerated economic growth and technological advances have enhanced health and life expectancy in many populations. On the other hand though, features of globalisation jeopardise population health via the erosion of social and environmental conditions and exacerbation of the rich-poor gap between and within countries. This leads to possible lack of research, contemporary needs assessments and follow through of recommendations to improve conditions in areas such as remote aboriginal communities. Heat related illness may thus remain unexamined as a significant health consideration in this location because of lack of funding provision both for prevention and management strategies.

However the other side is worthy of consideration since the consequences of globalisation are not all negative. Kunitz (2000) states that for the aboriginal peoples of poor countries, globalisation has potentially important benefits. These are the result not of participation in the global economy but of participation in global networks of other indigenous peoples, environmental activists and non-governmental organisations. Kunitz (2000) further contends that it is the aboriginal peoples' growing visibility and ability to mobilise international support against the policies of their own national governments that has contributed in some instances to their improved chances of survival.

Prevention of heat related illness

Prevention strategies may initially seem simple. For example, erection of shade and weather protective shelter facilities throughout aboriginal communities would have numerous benefits for people. Consideration would need to be given to ground surface (a grass or concrete surface would be required), environmentally appropriate materials, construction and maintenance of facilities. Tree planting would have the dual purpose of shading and providing a source of carbon dioxide dispersal. Installation and maintenance of adequate water outlets to provide appropriate access to drinking water requires review. The author contends that these strategies may well be both complex and difficult in the contextual situation of the Kimberley. This is because of the variety of previously discussed factors which impact on aboriginal health. Since the consequences of heat related illness are serious, every effort to prevent or at least recognise signs and symptoms at an early stage is essential. Community education on heat related illness is essential. ASMF (1991) and the American Academy of Paediatrics (2000) recommend avoidance of heat related illness by ensuring hydration levels are maintained, acclimatisation is allowed to develop, personal fitness and non-overestimation of the state of fitness, maintaining a healthy body, and cool dressing. A further strategy recommended by these organisations is to look for ways to increase voluntary drinking in children such as by the availability of water, and preferably flavoured drinks such as sport drinks. Recommendations by The American Academy of Paediatrics (2000) include the provision of sports drinks due to the fact that fluid intake increased by 90% when flavoured drinks were available. Availability and cost are prohibitive factors in aboriginal communities. Therefore adequate water sources should be available to ensure fluid intake. Water outlets in communities may however, be both inadequate and non-functioning.

Adaptation strategies are recommended by scientists such as Koteen and Bloomfield (2000). These strategies include:

- Increasing public health education and warnings for risks such as heat waves and high ozone concentrations.

- Improvement of health care for low-income groups and aboriginal communities.
- Cooling the environment by planting more trees.
- Establishing parks and increasing reflective surfaces.
- Review of water resource planning to ensure adequate, efficient and accessible water supply and dispersal.

Glick (1999) suggests that, in addition to reducing use of fossil fuels that are contributing to rising greenhouse gases, an effective global warming mitigation strategy should include efforts to eradicate the underlying causes of deforestation. For example, the strategy suggested is for efforts to be made to stem population growth and reduce poverty to reduce pressure to clear forested land for agricultural use and development and to burn wood for fuel.

It would be useful if a risk assessment of heat related illness in the Kimberley region was undertaken by state health authorities to determine the extent and potential of the problem. There is a need to increase both community member and nurse awareness of issues pertaining to heat related illness in children and then to record reports and presentations of children suspected of experiencing heat related problems. There is a necessity to find out whether there is actually a problem. Note should be taken of climatic temperature and humidity changes at the same time. The assessment should include analysis of possible exposure problems in community areas, such as sun-exposed basketball courts. Risk characterisation and initiation of correction or minimisation strategies such as shade structures should follow.

Recommendation

A forward thinking strategy involves utilisation of aboriginal community women as environmental health workers, who, as a component of the role of environmental improvement, will ensure that children are given adequate water, that adequate water sources are maintained, and that shade facilities are constructed and maintained in order to prevent heat stress. Emeharole (1991) states that the inclusion of women in what is hitherto a man's job domain as environmental health workers, will yield large socio-economic development bonus'.

The aboriginal environmental health worker program could be assisted by women in the communities along the lines of the successful Northern Territory 'Strong women, strong babies, strong culture' program in which female health workers conduct, assist and monitor pregnancy health check attendance and infant growth and development following the birth.

A Nigerian project involving training of women as community sanitarians (environmental health workers) vindicated the impact made on environmental health by women (Emeharole 1991). Several components of primary health care fall within the realm of environmental health workers. These include education concerning prevailing health problems and methods of identifying, preventing and controlling these problems. Promotion of proper nutrition, adequate supply of safe water, and maternal and child health concerns are significant components of primary health care and would be well addressed by women environmental health workers given appropriate training and support in the communities (Emeharole 1991).

Public health policies are based on primary health care principles, which require that service provision is acceptable, affordable, appropriate, accessible and available. Stephenson (2001) contends that co-opting community-based practitioners, such as aboriginal environmental health workers, into specific roles without supporting them with appropriate levels and forms of professional development, may in fact impede a project. This would then be counterproductive to bringing about environmental health improvement in community settings. Obstacles to training, such as appropriately skilled trainers, paucity of numbers of women who may be interested or able to afford the time and money in the communities are considerations.

A multidisciplinary approach by medical health professionals, public health officers, community council members, governmental and non-governmental bodies, role models (such as sporting personalities) and interested local persons would need to provide assistance to interested community women. This assistance could be by way of time, and money for suitable infrastructure development for such issues as education about heat related illness, and construction of appropriate shade facilities in communities.

Project funding sources would need to be considered from an economic perspective and include agencies such as ATSIC, and the Aboriginal Affairs Department. Local and state government funding from project resources would require that an approach from communities detailing currently occurring and possible future preventative problems pertaining to heat related illness are well reviewed and presented.

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