



BACKGROUND

- **Why is this study important?**
 - Examples of impacts on health infrastructure already occurring due to weather events and other disasters
 - Central Coast, NSW, heatwave, 1 Jan 2006
 - Hurricane Larry, Qld, Australia, 2006
 - Cyclone Katrina, US, 2005
 - Europe Heatwave, 2005
 - Asian tsunami, 2004
 - Bali Bombings, 2001
 - Cyclone Tracey, NT, Australia, 1974
- **Need to ensure that we have robust and resilient health infrastructure that can cope with these and similar events**

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BACKGROUND



Cyclone Larry, Qld, 2006



Hurricane Katrina, US, 2005



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BACKGROUND

Comments re the IPCC report issued on February 2, 2007 in Paris:

"Warming of the climate system is now unequivocal. That is evident in observations of air and ocean temperature as well as rising global mean sea level."

Susan Solomon, co-chair of the working group and an atmospheric scientist with the U.S. National Oceanic and Atmospheric Administration (NOAA).

"The 2nd of February in Paris will be remembered as the day that the question mark was removed from the idea that humans had anything to do with climate change."

Achim Steiner, executive director, United Nations Environmental Programme (UNEP)

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BACKGROUND

- Study sponsored by NSW Health Environmental Health Branch
- Part of *Human Health Impacts of Climate Change Adaptation Project* funded by NSW Greenhouse Office (and Australian Greenhouse Office)
- Intent = preliminary investigation of the adaptive capacity of NSW Health infrastructure to increasing incidences of extreme weather events associated with climate change.
- IPCC definition of 'adaptive capacity' adopted: 'the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences'. (McCarthy et al., 2001, 982)



BACKGROUND

- Mitigation vs Adaptation?
- 'Mitigation is essential and adaptation is inevitable' (UNFCCC, 2006)
- Concern that focus on adaptation might reduce urgency for mitigation – these are not alternatives!
- Risk management approach towards adaptation strategies recommended by UNFCCC (2006), Aust Greenhouse Office (2005), CSIRO (2006), UKCIP (Willow & Connell, 2003) and other authorities
- Risk management + precautionary principle + discursive strategies in design, construction and location of buildings should increase robustness and resilience of the built environment in responding to threats generated by climate change. (Liso, 2006)

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BACKGROUND

- Australian context – developed country, additional loads on systems already in place
- Global climate change context
- Climate change = increased occurrences of extreme weather events
 - [Heat waves and bushfires](#)
 - [Floods, storm surges, tsunamis](#)
- Inevitability of extreme weather events: number + severity + unpredictability
- Against a background of environmental and socio economic factors; technical, institutional and political capacity (Scott & Gupta, 2001)



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METHODOLOGY

- **Aims and Objectives**
- Parameters restricted to focus on facility-related impacts of climate-related extreme weather events such as heatwaves (and bushfires), floods, storm surges, and tsunamis.
- Overall Objective = to identify a range of potential adaptation strategies for NSW healthcare facilities in coping with extreme weather events.
- Develop an Action Plan to summarise key risk and opportunities, and a strategy for dealing with each of these.
- Determine the need for further research and investigation to further develop the NSW strategy.



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METHODOLOGY

Method

1. Identify key stakeholders
2. Conduct ROMS workshop
3. Prepare workshop report
4. Incorporate into project report including draft action plan





METHODOLOGY

Method

1. Identify key stakeholders

Ability to implement project objectives

Objectives affected by project outcomes

<p><i>Minor Stakeholders</i> Clinicians Green Building Council of Australia</p>	<p><i>Important Stakeholders</i> Experts/scientists Aust Building Codes Board Peak Industry Bodies (FMA, IHEA, etc) Private Hospital Associations</p>
<p><i>Major Stakeholders</i> Rural services sector Aged care sector Community services sector Nursing care Mental health sector Local Government Planning Authorities EMA</p>	<p>KEY STAKEHOLDERS NSW Health Asset and Contract Services Ambulance/emergency Services Private - designers and/or contractors/ Government – NSW Dept of Commerce (Govt architect) NSW Health Statewide Services Branch NSW Health Environmental Health Branch NSW Area Health Services (clinicians/public health officers)– NSCCAHS NSW Greenhouse Office Aged Care Services Assoc (ACSA)</p>



METHODOLOGY

Method

2. Conduct ROMS workshop(s)

Prior to workshop 1 - background briefing document

Workshop 1

Step 1 : Stakeholder analysis and common objectives

Step 2 : Identify risks and opportunities to those objectives

Step 3 : Assess their magnitude and prioritise them

Workshop 2

Step 4 : Develop an action plan to minimise risks and maximise opportunities



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METHODOLOGY

Conduct ROMS workshop(s):

Workshop 1 identified following common objectives for the study:

1. Quantifying impacts

Develop research program to identify, analyse & assess impacts of extreme weather events on health infrastructure

2. Evidence-based practice

Identify range of potential facility-related responses to healthcare challenges; ensure practitioner/researcher engagement, operationalise research, ensure relevance, practicality, dissemination in usable format

3. Asset management planning

Ensure effective procurement, design, FM, urban planning & asset management planning strategies responses & that do not exacerbate problems

4. Ensuring behavioural change

Raise awareness, change public expectations, behaviours, secure industry 'buy-in'

5. Integrated planning

Coordinated cross-jurisdictional responses – internal, local & society level

SUMMARY OF RESULTS

1. Risks to the Healthcare System due to Climate Change Extreme Weather events – Impacts on Human Health and Health Facilities
2. Possible Infrastructure Responses
3. Adaptive Capacity – existing and required
4. Integration with Current Disaster Management Strategies and other Community Responses
5. Research Required
6. Communication of Research Findings



SUMMARY OF RESULTS

1. Risks to the Healthcare System due to Climate Change Extreme Weather events – Impacts on Human Health and Health Facilities

- Patterns of disease will alter both within NSW & Australia generally
- Healthcare infrastructure will come under pressure due to people seeking refuge from extreme weather events – heat, storms, etc
- Will be subjected to increased demands by sufferers of injury or ill-health esp the elderly and other vulnerable 'at risk' populations
- Even developed countries such as Australia have pockets of 'at risk' populations requiring protection from extreme weather events.



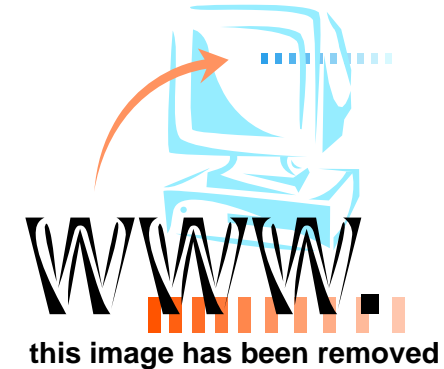
SUMMARY OF RESULTS

1. Risks to the Healthcare System (continued)

Effects of climate change on Australia:

- Increase in annual average temp of 0.4-2.0°C by 2030
- More heatwaves and fewer frosts
- Prolonged drought and heavy rains
- More severe wind speed – cyclones, storm surges
- More frequent storms and bushfires
- Changing ocean currents - affect coastal waters

(McCarthy, et al, 2006)



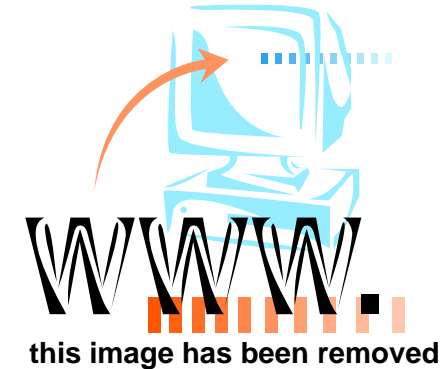
SUMMARY OF RESULTS

1. Risks to the Healthcare System (continued)

Effects of climate change on NSW:

- increase of 0.4-2.0°C warmer average annual temperature by 2070
- 50-100% more hot days >35°C and fewer cold nights
- More frequent heatwaves
- 70% increase in droughts
- 10-20% increase in the intensity of extreme daily rainfall
- More frequent rainstorms, strong winds (greater fire risks)

(Preston & Jones, 2005; CSIRO, 2006, AGO, 2003)



SUMMARY OF RESULTS

1. Risks to the Healthcare System (continued) Heatwaves (and Bushfires)



Events	Health impacts	Facility impacts
Heatwaves (and Bushfires)	<p>In Australia and other countries, heatwaves are responsible for more deaths than any other natural hazard but are mostly underrated because they are viewed as a 'passive' hazard in contrast to the more catastrophic hazards such as tropical cyclones or bushfires (Emergency Management Australia, 1998, Bureau of Meteorology, 2006).</p> <p>Heatwaves are likely to affect the elderly and other vulnerable populations (very young, dependent on alcohol or other drugs, chronically ill, etc) causing them to seek admission to health facilities due to increased incidence of CVD and other ailments.</p>	<p>Sydney heatwaves in 2005 "one hospital has been swamped by people not needing medical treatment - simply looking to take advantage of its spacious air conditioned reception area" (Mercer, 2001). The 7-day heatwave in Adelaide in February 1997 caused hospital computers to overheat and fail (Emergency Management Australia, 1998).</p> <p>Water shortages and water supply failures may also become a problem during prolonged heatwaves as demand for water may increase dramatically. Transport systems may also suffer from problems and interruption due to possible heat-related expansion of railway lines and steel bridges, and other associated damage to roadways (Emergency Management Australia, 1998).</p>

Table 1: Health and Facility Impacts associated with Extreme Weather Events (Carthey & Chandra, 2007)

SUMMARY OF RESULTS

1. Risks to the Healthcare System (continued) Floods

Events	Health impacts	Facility impacts
Floods	<p>The flooding of the river Elbe in 2002 in Saxony/ Germany required immediate public health action in order to ensure a proper public hygiene response (Meusel et al., 2004).</p> <p>Floods are significantly likely to result in degradation of human health and loss of life, high financial cost, trauma and associated human misery (Schreider et al., 2000, Meusel et al., 2004, Kundzewicz, 2002)</p>	<p>Where healthcare facilities are flooded, electrical power outages may be unavoidable. In the UK in June 2005, Warwick Hospital evacuated emergency patients by ambulance and helicopters to other facilities (BBC News, 2005).</p> <p>Flooding may also create an access problems for physicians and other staff travelling to and from the hospital (Cocanour et al., 2002)</p>



Table 1: Health and Facility Impacts associated with Extreme Weather Events (Carthey & Chandra, 2007)



SUMMARY OF RESULTS

1. Risks to the Healthcare System (continued)

Storm Surges



Events	Health impacts	Facility impacts
Storm Surges	<p>93 hospitals were adversely impacted Hurricane Katrina in the Southern USA in 2005, with 19 hospitals being evacuated and another 18 being closed (Planning 2.0, 2005).</p> <p>Numerous deaths were attributed to transportation shortages, although evacuation measures were aided by helicopters, buses, and ambulances.</p> <p>In March 2006, Tropical Cyclone Larry crossed the tropical north Queensland coast near Innisfail, giving pressure to medical services (Emergency Management Australia, 1998, Queensland Government, 2006), although at a much smaller scale than Hurricane Katrina.</p>	<p>Water pushing several kilometres inland where land is low lying may potentially knock down healthcare facilities and wash away roads (Commonwealth of Australia, 2006, Meusel et al., 2004, Joint Commission on Accreditation of Healthcare Organizations, 2006).</p> <p>In March 2006, Cyclone Larry in north Queensland, the Innisfail Hospital was forced to close, thus requiring medical support from Townsville and Cairns Base Hospitals.</p> <p>Herberton hospital was without power until a generator was provided and leaking roofs resulted in emergency evacuation (Emergency Management Australia, 1998, Queensland Government, 2006).</p>

Table 1: Health and Facility Impacts associated with Extreme Weather Events (Carthey & Chandra, 2007)

SUMMARY OF RESULTS

1. Risks to the Healthcare System (continued) Tsunamis



Events	Health impacts	Facility impacts
<p>Tsunamis</p>	<p>The South Asian tsunami in 2004 was one of the largest flooding disasters in recent history, causing about 280,000 fatalities in eight countries from Asia to Africa (Morgan et al., 2005).</p> <p>Post-traumatic stress disorders and problems of hygiene and infectious diseases were also noted, which caused many fatalities including a larger number of suicides (Morgan et al., 2005)</p>	<p>During the 2004 tsunami in Indonesia, 1 main referral hospital, 4 district hospitals, and 41 out of 240 clinics were destroyed (International Centre for Migration and Health, 2005).</p> <p>In the Maldives, where most healthcare facilities escaped major structural damage, some facilities such as Mulee hospital lost all their medical records and equipment. Access difficulties were also noted, hindering the provision of health services following the disaster.</p>

Table 1: Health and Facility Impacts associated with Extreme Weather Events (Carthey & Chandra, 2007)

SUMMARY OF RESULTS

2. Possible Infrastructure Responses (from the literature)

- The background brief identified potential adaptation responses by health and other authorities to assist health services and infrastructure to cope with extreme weather events.
- Workshop identified a key barrier to adaptation was a lack of understanding of the likely quantum and nature of the impacts of such events on health infrastructure.
- Adaptive strategies not currently included in health infrastructure processes ie design and tender processes do not incorporate this requirements
- Lack of evidence re need and effectiveness
- Commercial realities and 'efficiency' in expenditure of public monies.



SUMMARY OF RESULTS

2. Possible Infrastructure Responses (from the literature)

POSSIBLE INFRASTRUCTURAL RESPONSES TO EXTREME WEATHER EVENTS	
Immediate	<ul style="list-style-type: none"> •Increased public awareness •Warning procedures for the community especially those at highest risk •Thermal control – airconditioning, close blinds, windows, etc (heatwaves/bushfires) •Environmental control (to filter out smoke and dust, etc) •Emergency fire fighting response •Evacuation of those in immediate danger to safer facilities, surge hospitals, etc.
Long-term	<p><u>Urban planning</u></p> <ul style="list-style-type: none"> •Regulations – such as the Australian Standards, Building Codes, Health Facility Guidelines, Engineering Services guidelines – to ensure appropriate ventilation, air quality, thermal condition •Urban Design (e.g. land use, green spaces, water bodies) •Environmental management of high risk areas adjacent to urban areas or health facilities •Improved communication networks among urban planners •Redundancy built into road and transport networks to avoid isolation of facilities and emergency services •Availability of safe and environmentally controlled gathering spaces for the community to seek relief e.g. shopping centres, public libraries, etc, and to avoid unnecessary burdens being placed on health care facilities by those not in need of healthcare interventions. <p><u>Health System Responses</u></p> <ul style="list-style-type: none"> •Coordinated disaster responses – emergency services – ambulance, fire, police, etc that work with facilities to ensure healthcare delivery is uninterrupted •Relief plan: surge hospitals, counselling, etc <p><u>Facility Management</u></p> <ul style="list-style-type: none"> •Site selection and utilisation •Facility design, detailing, and construction •Maintenance of equipment, e.g. airconditioning and facility fabric such as roofs and downpipes, so that structural failure is avoided in a disaster situation •Backup and spare capacity for building services e.g. electricity, water, ensuring uninterrupted supply

Table Two: Summary of possible infrastructure responses for managing the risks associated with extreme weather events impacting on healthcare facilities (Carthey & Chandra, 2007)



SUMMARY OF RESULTS

3. Adaptive Capacity – existing and required

- Little research to date that would assist in development of effective response strategies for healthcare infrastructure
- Comprehensive identification of impacts on the social, financial, technology and political climate is still at a relatively early stage
- Sense of urgency becoming apparent but not yet translated into policy or adaptation strategies
- Changing attitudes and ensuring behavioural change are important factors in enhancing adaptive capacity to cope with extreme weather events
- Attitude of funders is one impediment identified; lack of understanding and certainty re impacts; inappropriate triggers/impractical targets may be set which could mitigate against longer term behavioural changes.



SUMMARY OF RESULTS

3. Adaptive Capacity – existing and required (continued)

- Practical examples, case studies could improve understanding
- Political influence is needed for promotion of climate change adaptation agenda
- ‘Bottom up’ approach could also be effective – local, facility-level efforts to seek endorsement from higher organisational levels.
- Currently asset planning strategies would be a suitable mechanism for assessing the adaptive capacity of NSW health care infrastructure
- Need for ‘spare’ or ‘surge’ capacity to cope with increasing demands associated with greater number of extreme weather events
- To be considered in conjunction with disaster management strategies.



SUMMARY OF RESULTS

4. Integration with Current Disaster Management Strategies and other Community Responses

- Currently adaptation strategies considered under banner of disaster management and emergency planning in countries such as the US, UK, Australia
- Do not embrace clear adaptation strategies nor the practical implications for infrastructure in terms of safeguarding critical service functions such as health service delivery.
- Studies show that Aust emergency depts already have little additional capacity to cope with crisis events (Traub, et al., 2007) other than those generated by climate change.
- Need to develop appropriate responses and capacity
- Further understanding of the nature and impacts of climate change on health and health facilities should guide development of these responses.



SUMMARY OF RESULTS

4. Integration with Current Disaster Management Strategies and other Community Responses (continued)

Barriers may include:

- the lack of integration between capital and operational expenditure budgets on healthcare projects, which leads to short term responses based on capital cost efficiencies only
- Lack of integration between government authorities responsible for planning leads to inadequacy of governance structures and poor coordination of efforts.
- Problems of coordination exacerbated by inconsistencies in processes, lack of continuity of personnel, shifting areas of responsibility, changing realms of influence, etc



SUMMARY OF RESULTS

5. Research required

- *Impacts of climate change extreme weather events on health and facilities*
 - Clarify commitment to adaptation as well as mitigation strategies
 - Climate change related impacts on human health – Oceania and Australasian context
 - Impact on real locations – GIS, LIDAR, etc
 - Modelling of impacts on real locations on regional basis (is starting to occur in Australian context- CSIRO)
- *Infrastructure responses and adaptive capacity*
 - Innovative strategies developed through multi-disciplinary research
 - Align proposed strategies with current processes and procedures, require minimal additional resources for implementation



SUMMARY OF RESULTS

5. Research required (continued)

- *Integration with current disaster management strategies and other community responses*
 - Work with existing disaster planning agencies to ensure that additional challenges due to climate change can be met
 - Adaptive capacity targeted to ensure continuity of health care delivery in disaster situations – business continuity framework
 - Applied research to be more prescriptive in outcomes specifications
 - Prioritisation of strategies within agreed adaptation frameworks
 - Costs and operational benefits to be identified and tested against performance measures specifically developed for health services and infrastructure
 - Requires engagement with building industry experts (contractors and facility managers) in an arena apart from prevailing contract arrangements.



SUMMARY OF RESULTS

6. Communication of Research Findings

- Range of strategies required
- Clear and effective communication with stakeholders
- Use influential or credible bodies of researchers to point out likely impacts of extreme weather events on human health and health infrastructure
- Communicate clearly and effectively early assessment of gains from pursuing the adaptation route.
- Other strategies include:
 - Release information via AMA, insurance bodies, hospitals, local govt, etc
 - Maintain relationship with wider national research agenda
 - Clarify extent of problems and costs associated with neglecting the efforts
 - Identify a range of possible adaptation strategies for health facilities in terms of suggested future projects, costs, programs, actions and demonstrable outcomes



SUMMARY OF RESULTS

6. Communication of Research Findings (continued)

- Influence clinical and asset management practices by means of demonstration projects, including ongoing evaluation of these.
- Development and implement of govt policy
- Other future efforts should include:
 - Translate research into a practical, applied format
 - Disseminate information through appropriate sources, eg demonstration projects
 - Provide evidence of cost, safety, social benefits, reduced operational costs
 - Develop strategies that require incremental adjustments to existing processes and processes, rather than adding new burdens
 - Influence health care project procurement processes to reward the incorporation of adaptation strategies.



SUMMARY OF RESULTS

6. Communication of Research Findings (continued)

- Collaborate with key stakeholders
- Align with existing disaster management strategies
- Keep the dialogue simple
- Establish mechanisms to facilitate cross sectional communications
- Encourage health services to be proactive in accelerating change and being brokers in determination of action agendas.



DISCUSSION AND RECOMMENDATIONS

- Current lack of understanding of the problems – uncertainty re need for adaptive strategies for health services and infrastructure
- Further research needed – to understand impacts and how to ensure uninterrupted delivery of services
- Education and communication strategy needed to inform key stakeholders regarding:
 - Likely impacts of climate change on demand for health services in NSW facilities
 - Adequacy of current infrastructure to cope with additional demands
 - Implementation strategies for reconfiguring or augmenting capacity to cope with the additional demands
 - Costs associated with reconfiguration/augmentation plus assurances given that these will be met
 - Confidence that an integrated disaster planning and management strategy is in place to ensure continued operation of health facilities in the event of increased incidences of extreme weather events associated with climate change and other causes.



CONCLUSION

- Findings generalisable to other geographic regions and health systems
- Need for a systems approach to developing adaptive capacity in healthcare infrastructure to cope with climate change and other disasters
- Need to determine not only the impact on the health of the community but also how to prevent healthcare infrastructure failing due to imposition of increased demands
- Working with existing systems offers greatest chance of achieving these aims
- Tapping into existing disaster management frameworks will ensure more effective responses and greater pressure for development of adaptive capacity.
- More responsive to political, social, technological and institutional capacity, wherever the system is located.



CENTRE FOR HEALTH ASSETS AUSTRALASIA

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Major research programs include:

- Australasian Health Facility Guidelines
- Australasian Post Occupancy Evaluation and Benchmarking projects
- Industry capacity building programs including annual conference, regular seminars and other activities.

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Leonardo da Vinci

*I have been impressed with the urgency of doing.
Knowing is not enough; we must apply. Being
willing is not enough; we must do.*