DISASTERS: HEALTH CASE STUDIES

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INTRODUCTION

• Welcome
• Definitions
• Looking at disasters from different angles
• Types of disasters
• The disaster cycle
• Three case studies (if we have time)
SCHOOL OF PUBLIC HEALTH AND COMMUNITY MEDICINE

• People
  • ~ 90 academic, research and general staff
  • ~ 650 postgraduate students (500 coursework & 150 research)
  • ~200 conjoint and adjunct staff in clinical & research units

• Research
  • associated with many research centres including
    • Human Resources for Health Knowledge Hub (Asia/Pacific)
    • Australian Institute for Health Innovation
    • Centre for Clinical Governance
    • Centre for Primary Health Care and Equity
    • Kirby Institute of Infection and Immunity

• Teaching
  • Internationally recognised post-graduate programs in Health Management and Public Health
  • Taught by experts with research and practical experience
RESEARCH STRENGTHS

• Focus on
  • Health services management
  • Aged care
  • Primary health care
  • Clinical Governance
  • Global Health
  • Infectious diseases
  • Indigenous health

• Over 400 publications in peer-reviewed journals
• Highly successful in attracting research funding
WHAT ARE CRISIS, EMERGENCIES AND DISASTERS?
DEFINITIONS

Crisis
• An event that is *expected to lead to* a dangerous situation, whether it’s an emergency or a disaster. A time of intense difficulty, trouble, or danger.

Emergency
• An emergency is a situation that requires immediate attention, but is usually small in scale

Disaster: multifaceted.
• “A disaster is a sudden, calamitous event that causes serious disruption of the functioning of a community or a society causing widespread human, material, economic and/or environmental losses which exceed the ability of the affected community or society to cope using its own level of resources. (Source: UN/ISDR 2004) For a disaster to be included in the UN’s International Strategy for Disaster Reduction (ISDR), at least one of the following criteria must be met:
  • a report of 10 or more people killed
  • a report of 100 people affected
  • a declaration of a state of emergency by the relevant government
  • a request by the national government for international assistance
DEFINITION OF DISASTERS

The word *disaster* implies a sudden overwhelming and unforeseen event. At the household level, a disaster could result in a major illness, death, a substantial economic or social misfortune. At the community level, it could be a flood, a fire, a collapse of buildings in an earthquake, the destruction of livelihoods, an epidemic or displacement through conflict.

When occurring at district or provincial level, a large number of people can be affected. Most disasters result in the inability of those affected to cope with outside assistance. At the household level, this could mean dealing with the help from neighbours; at the national level, assistance from organizations such as the International Federation of Red Cross and Red Crescent Societies, the United Nations, various nongovernmental organizations (NGOs) and government agencies themselves.

As the limiting factor in disaster response is often the coping capacity of those affected, improving their resilience when responding to disasters is a key approach to lessening the consequence of a disaster.
Defining the scope of a disaster There is no single measure of a disaster that can capture the full scope of a disaster. A common measure is the number of people killed or affected. The individual will consider the impact on his or her family and livelihood.

Disaster managers will assess the speed and success of the disaster response. Economists will measure physical loss to houses and buildings and loss of production. Politicians will assess political damage from a poor response by state agencies.

Health workers will consider the resources required to contain an outbreak of meningitis or Ebola. Others may focus on the nature of the hazard, the social consequences and the impact to specific elements of the infrastructure.

To think seriously about a disaster means we must consider all affected and their losses both in the immediate and the longer term.

TYPES AND RATES OF DISASTERS
BASIC TYPES

1. “Natural” disasters
2. “Man” made disasters
3. Socio-cultural
NATURAL DISASTERS ARE DIVIDED INTO FIVE SUBGROUPS, 12 DISASTER TYPES AND MORE THAN 32 SUB-TYPES.

- **Biological disasters**: Insect infestations, epidemics and animal attacks
- **Geophysical disasters**: Earthquakes and tsunamis, volcanic eruptions, dry mass movements (avalanches, landslides, rockfalls and subsidence of geophysical origin)
- **Climatological disasters**: Droughts (with associated food insecurities), extreme temperatures and wildfires
- **Hydrological disasters**: Floods (including waves and surges), wet mass movements (avalanches, landslides, rockfalls and subsidence of hydrological origin)
- **Meteorological disasters**: Storms (divided into nine sub-categories)

OUR PERCEPTIONS OF RISK HAVE CHANGED OVER TIME

RECENT “NATURAL” DISASTERS

• Ireland (1846-50) Irish potato famine - 1 million die, 2 million emigrate
• Martinique (1902) – pyroclastic flow from volcano - 29,000 deaths
• Bengal India (1943) - brown spot in rice - 2 million deaths
• Columbia (1985) - mud and ash flows (rain/melting snow) - 23,000 deaths
• Armenia (1988) – earthquake - 25,000 deaths
• Iran (1990) – earthquake - 40,000+ deaths
• Bangladesh (1991) - cyclone - 139,000 deaths from drowning due to storm surge flooding
• Turkey (1999) – earthquake - 17,000+ deaths
• Gujarat, India (2001) – earthquake - 20,000 deaths
• Bam, Iran (2003) – earthquake - 26,270 deaths
• Pakistan (2005) – earthquake - 80,000+ deaths
• Cyclone Nargis Myanmar (2008) - >140,000 deaths
• Indian Ocean tsunami: Indonesia, Thailand, Sri Lanka, India, etc. (2004) - 280,000 deaths
• Hurricane Katrina. New Orleans, USA (2005) - ~ 2,000 deaths
• Japan earthquake and Tsunami (2011) - 20,000 deaths (or missing) – 93% of deaths from drowning
• Christchurch, NZ (2011) - 185 deaths
• Haiti, 2010 - deaths: 90,000 (internet sources) to 300,000 (local sources)
PANDEMICS  Professor Richard Taylor

The plague

- Justinian plague 541-565 (to 700). From Egypt through Constantinople to Rome and France. More than 100 million died. Probably 50% decline in population 541-700
- Black death. 1346-1388. From Black Sea ports to Constantinople and Italian ports. 30-40% population mortality.
- Bubonic Plague 1894-. First noticed in South China, then spread to India, and many other countries by boat. Endemic in Americas.

Cholera

- 1st pandemic. 1817-20. Began in Bengal. Spread to Turkey, North China, Java
- 2nd pandemic. 1826-1835. Began in Ganges basin. Spread to Europe, North America and north Africa
- 3rd pandemic. 1852-1859. From India to East Africa
- 4th pandemic. 1863-1875. From India to Southern Europe and North Africa
- 5th pandemic. 1881-1896. India to Europe, North America (spread contained by water and sanitation), South America
- 6th pandemic. 1899-1923. India to Middle East and Russia
- 7th pandemic. 1961-1979. El Tor variety Sulawesi in Celebes
- Cholera spreads to Peru in 1991 after an absence of 100 years from South/Central America. 400,000 cases.
- Major concern after the Haiti earthquake

http://www2.estrellamountain.edu/faculty/farabe/e/8l08k/biobookpopecol.html
“MAN” MADE DISASTERS

- **Technological disasters** comprise three groups:
  - **Industrial accidents**: Chemical spills, collapse of industrial infrastructure, explosions, fires, gas leaks, poisoning and radiation
  - **Transport accidents**: Transportation by air, rail, road or water
  - **Miscellaneous accidents**: Collapse of domestic or non-industrial structures, explosions and fires.
TECHNOLOGICAL “DISASTERS”
SOCIO-CULTURAL DISASTERS

- Conventional war
  - International war: WWI, WWII,
  - Civil war with international interventions
  - Civil war
- Unconventional war: asymmetric and guerrilla war, insurgency, ‘terrorist’ episodes
  - Internal
  - External and trans-national
- Toxic exposures (also from War)
  - Chemical, including industrial disasters e.g. methyl isocyanate Bhopal, India (1984) 4,000+ deaths, ‘000s injured
  - Radiation e.g. Chernobyl (1986)
  - Biological e.g. bioterrorism with (inhaled) anthrax, smallpox, plague, etc
- Acts of terrorism
COMBINATION DISASTERS

• Drought leading to an interrupted distribution of food supplies leading to famine, or food blight leading to famine

• Japanese Tsunami and earthquake and Fukushima Daiichi Nuclear disaster (2011)

• Iceland volcano (2011)
WORLD DISASTER REPORT (2013)

- 364 natural disasters and 188 technological disasters were reported worldwide in 2012 (The Centre for Research on the Epidemiology of Disasters (CRED)). For a disaster to be entered into the database, at least one of the following criteria must be fulfilled:
  - Ten or more people reported killed
  - 100 people or more reported affected
  - Declaration of a state of emergency
  - Call for international assistance

- The number of natural disasters is the second lowest of the decade, while the number of technological disasters is the lowest of the decade, almost half the number for the peak year of 2005.

- The number of deaths caused by both natural and technological disasters was the lowest of the decade.

- The number of deaths caused by natural disasters (9,656) is 90 per cent below the average for the decade, much lower than the peaks of 2004 (242,010 deaths), 2008 (235,272 deaths) and 2010 (297,730 deaths).

RISK FACTORS
DISASTER RISK FACTORS

• In **2000**, 47% of the world population was urban

• More than **half of the world’s population** is living in urban areas in **2012**

• By **2030**, it is expected that **60%** of the world population will live in urban areas.
EFFECTS OF DISASTERS

LOOKING AT CEDs FROM DIFFERENT ANGLES
REFLECTION ON UNDERSTANDING DISASTERS

• Human space and time scales and complexity of interaction affect definition and understanding of disasters (Sarewitz and Pielke, 2000)

   Notion of extremeness: norms vs. the unusual (extreme events, extreme phenomena eg diseases that were a chronic problem in 18th Century in Europe but were an epidemic in Australia and North America eg measles)

• Disasters as economics: understanding of persistence, severity and long-term effects and resilience, about property and economic loss

• Disasters as psycho-social: notion of widespread traumatic reactions, starting with the social and not the disaster cycle (eg impact not equally distributed, higher cost for vulnerable populations – as in New Orleans

   • There is an argument notion of society as sole dimension of disaster, if we trace through the impacts on populations from the causes, vulnerability, preparedness, and responses, through to the reconstruction efforts

Dr Sally Kane
SOCIO-POLITICAL ASPECTS OF RISK AND DISASTERS

Scale of disasters is growing (Michel-Kerjan, 2008) and there is a strong biases exist in behavior and risk reduction (H. Kunreuther and Michel-Kerjan, 2010) so that *decision-makers often misperceive future likelihood and possible consequences of disasters*

There are strong human biases in Perception and Decision-Making

- Improperly evaluate risk which is not the same as misperceiving the hazard
- Use short time horizons to value protective measures
- Disregard the interconnection of actions taken in both the private and public sectors
- Failure to learn from past disasters
- Follow others’ lead and not use innovativeness
- Individual perceptions, social communications (from scientists, government, and media), view of science is important
- Public trust is waning. We are in a post-trust society (Lofstedt, 2005)
  - E.G. Evacuation incomplete from hurricanes
  - E.G. Buy bottled water even with good public water systems

Dr Sally Kane
**INVITATION TO A DIFFERENT WAY OF THINKING ...**

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<tr>
<th>Foci</th>
<th>Perspectives</th>
<th>Victims</th>
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<tr>
<td>• Disaster cycle</td>
<td>• Social and political dynamics</td>
<td>• Number of victims</td>
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<tr>
<td>• Causes and consequences</td>
<td>• Particular vs generlisable</td>
<td>• Immediate (as a result of the disaster)</td>
</tr>
<tr>
<td>• Distribution and impact</td>
<td>• Local and global</td>
<td>• Immediate (early responders)</td>
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<tr>
<td>• Risk and vulnerability</td>
<td>• Systems theory</td>
<td>• Medium term</td>
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<tr>
<td>• Policy and Planning</td>
<td>• Multi-disciplinary</td>
<td>• Long term (attributable or not?)</td>
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<tr>
<td>• Human resources</td>
<td>• Ethics</td>
<td>• Vulnerable populations</td>
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<tr>
<td>• Responses</td>
<td>• Impact of “assistance”</td>
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<tr>
<td>• Resilience and recovery</td>
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EFFECTS ON HEALTH OF DISASTERS

**Short term**
- Immediate deaths
- Trauma direct: debris, collapses, gas emissions, electrocution, power shortages
- Trauma indirect: heart attacks
- Stress related mental illness
- Destruction of health, safety and transport facilities and infrastructure
- Translocation of large populations

**Medium term**
- Contamination of water by sewage and lack of potable water supply resulting in infections
- Respiratory infections fostered by crowding, and cold/wet conditions
- Illnesses associated with animal bites, particularly rodents
- Mosquito proliferation and increase in vector borne disease
- Destruction of animals, crops and stored food
- Destruction of health, safety and transport facilities and infrastructure

**Long term**
- Contamination of agricultural land and freshwater aquifers Resultant famine and/or reduction in cash crops (and income)
- Lack of fresh water supplies
- Destruction of health, safety and transport facilities and infrastructure
RESPONDING TO CEDS
Federal Emergency Management Agency (US)  Disaster cycle

1. Planning for hazards and vulnerabilities

2. Decrease damage from an event

3. Relief response – save lives and prevent injuries

4. Returning population to pre-event status (or better?)
ISSUES IN DISASTERS CREATION AND RESPONSE

• Risk and problem faming
  • Alternate decision options
  • Tendencies and biases in decision-making
  • Comparative risk
  • Equity
  • Targeting scarce funds and human resources for competing preparation and mitigation efforts

Dr Sally Kane
COORDINATION OF SERVICES

- Disaster responses are co-ordinated at multiple levels (UN, WHO, Country, States, localities, Government services, NGOs, voluntary organisations)
- But disasters occur across boundaries
- Each CED is unique
- For developing (and even not so developing) it can take 5-10 years to recoup

http://www.seismo.ethz.ch/static/GSHAP/
SO, WHAT IS THIS COURSE ABOUT?

Event(s)
What are CEDs and how can we better understand them and their impact?

Impact
How do they affect the individuals, groups and populations?

Response
What responses to CEDs are possible in the immediate, short, medium and long terms?

Act
What responses are effective and why?
KEY ACTORS

- Donors and well wishers
- UN
- Host communities
- Academic Institutions
- Governments
  - Central and local
- Media
- Displaced communities

WHO SEARO
UN LEAD RESPONSES FOCUS ON

**CLUSTER APPROACH**
Adequate capacity and predictable leadership in all sectors

**HUMANITARIAN COORDINATORS**
Effective leadership and coordination in humanitarian emergencies

**HUMANITARIAN FINANCING**
Adequate, timely and flexible financing

**PARTNERSHIP**
Strong partnerships between UN and non-UN actors
CLUSTER APPROACH

Cluster working groups
1. Agriculture
2. Camp Coordination & Camp Mgmt
3. Early Recovery
4. Education
5. Emergency Shelter
6. Emergency Telecoms
7. Health
8. Logistics
9. Nutrition
10. Protection
11. Water, Sanitation & Hygiene

Lead organisations
1. FAO
2. UNHCR & IOM
3. UNDP
4. UNICEF & Save the Children
5. UNHCR & IFRC (Convenor)
6. OCHA (UNICEF & WFP)
7. WHO
8. WFP
9. UNICEF
10. UNHCR
11. UNICEF
DISPLACEMENT

Temporary
• Partial or total damage
• Able to resettle back to their respected homes
• Can be relocated back to original place
• Within the country
• IDPs or Refugees

Permanent
• Total damage
• Situation does not permit resettlement
• Have to be relocated to another place for resettlement
• Within or outside the country
• IDPs or Refugees
POST DISASTER ISSUES WITH DISPLACED PERSONS

- Conflicts between host and displaced communities
- Land allocation
- Less attention to most vulnerable groups
- Lack of insurance
- Economic survival
- Shortage of trained professionals
- Development needs, funds end up in the hands of governments
- More focus and availability of funds in the emergency response phase
- Less focus in post disaster and pre-disaster phases
- Security concerns
- Ad-hoc interventions
- Parachuting of humanitarian workers
- Media stimulation and political competitions
- Donors’ preferences (forgotten crises)
- More disasters happening in other countries and regions, shift of interest

Dr Vijay Nath
YOU'RE CLEARLY UPSET... DO YOU HAVE A MOMENT TO DESCRIBE YOUR FEELINGS?
TWO EXAMPLES

Risk management for vulnerable populations is not possible using geographically broad or narrowly defined assessments of regions, states, or countries.
EXAMPLE 1

• Look deeply at the problem
• Continuous cycle of impoverishment and degradation in poor, vulnerable populations, and can be exacerbated by adaptive disaster strategies

(Bob Kates, 2000)
EXAMPLE 2

• Disaster losses are uneven, inequitable so target the disaster mitigation investments
• Risk concentration indices coupled with economic data can inform policy making and lower costs of disasters for vulnerable populations

(R. Bernknopf and P. Amos, 2012)
EXAMPLE 1

- **Continuous cycle of impoverishment and degradation affects disaster management**
- Social and economic welfare of poor, vulnerable populations are affected by adaptive strategies (Bob Kates, 2000).
- Primary importance: social causes of poverty and displacement.
EXAMPLE 1

• Continuous cycle of impoverishment and degradation affects disaster management

• Social and economic welfare of poor, vulnerable populations are affected by adaptive strategies (Bob Kates, 2000).

• Primary importance: social causes of poverty and displacement.
EXAMPLE 1

• Poor populations live in wealthy, industrialized, and least industrialized countries
• Large investments in disaster responses yield limited success because of a cycle of poverty
• Direct links between development and commercialization, population growth, poverty, and natural extreme events
• 5 analogues from developing counties in south Asia and Africa, including 30 village-level studies
• Look carefully at social costs of adaptation: direct costs of adaptation, the cost of adapting to the adaptations, and the costs of not adapting
EXAMPLE 2

- Risk concentration curves for vulnerable populations can inform policy making, lowering losses and costs of response

R. Bernknopf and P. Amos (2012)
CASE STUDY

• Earthquake Scenarios for California
• Results Match Experience with Katrina

• Analysis: Risk concentration indices use spatial patterns of geophysical risk and damage.

• Indices correlate with populations of lower income who follow basic behaviors that differ from wealthier citizens.

• Disaster mitigation policies can target areas with greatest vulnerability (measured by deaths, property damage, ability to rebuild and survive in place.)
The Great Healthcare Challenge
Achieving Patient-Centred Outcomes

SPATIAL SCIENCE AND SOCIAL VULNERABILITY IN HEALTH CARE

AUTHORS
HAMISH ROBERTSON
JOANNE TRAVAGLIA, PHD
NICK NICHOLAS
BACKGROUND

• Well-established history of natural hazards, man-made disasters and vulnerability studies (30+ years)
• Historical disasters for research and deeper understanding e.g. history, geography, social impacts etc
• Predicted and emergent problems – what do concepts and techniques offer?
• Sociologically nuanced – less so in health sciences => social variables often presented as concrete and theory-free
• Wisner on theory and applied vulnerability analyses – age, gender, disability, ethnicity (‘race’), class (SES)
• Knowledge production on social factors underpinned by implicit theory (epistemic vs ontological) regardless of models used i.e. no theory-free scenarios
• Vulnerability work in patient safety under-emphasised and under-theorised (Travaglia, 2009)
BACKGROUND

• All health phenomena are unevenly distributed in space including risk factors, populations, workforce, services and expenditures
• Standard statistical methods do not address spatial issues (x,y data not x,y,z)
• Quantitative domain lacks a spatial dimension, post codes are simply not enough
• Social variables have spatial (and temporal) characteristics
• Spatial technologies are working to include temporal capacity (but limitations still exist)
SPACE AND PLACE IN HEALTH QUALITY

- Vulnerability is linked to location – vulnerability factors and hazard events are spatially patterned
- Location can include broader context and circumstances (spatial extension and scalar factors)
- Scale is made explicit in knowledge production about vulnerabilities in spatial science
- Spatial science can accommodate quantitative and qualitative perspectives and data eg. cognitive mapping
- Implications for PS movement are substantial and fit within an expanded and expanding scientific paradigm ie. an emergent disciplinary field
<table>
<thead>
<tr>
<th>Forms of vulnerability</th>
<th>Types</th>
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<tbody>
<tr>
<td>Bio-genetic vulnerability</td>
<td>Demographic profiles and factors including age, individual health status, genetic predisposition</td>
</tr>
<tr>
<td>Psycho-social vulnerability</td>
<td><strong>Location</strong>, social and psychological factors, including presence of carers and/or family and friends, sexuality, disability, symbolic capital</td>
</tr>
<tr>
<td>Epidemiological vulnerability</td>
<td>Groups and populations, both genetic and environmental illnesses and conditions</td>
</tr>
<tr>
<td>Socio-economic vulnerability</td>
<td>Social, economic, cultural/religious, social and economic capital</td>
</tr>
<tr>
<td>Spatio-temporal vulnerability</td>
<td>Time, space, physical transitions, environmental</td>
</tr>
<tr>
<td>Inter-personal vulnerability</td>
<td>Relationship between patient and practitioner, &quot;difficult/problem clients&quot;, &quot;non-compliant&quot; clients</td>
</tr>
<tr>
<td>Cultural vulnerability</td>
<td>Language, literacy, cultural and linguistic capital</td>
</tr>
<tr>
<td>Practice vulnerability</td>
<td>Knowledge, skills, attitudes, stance of clinicians</td>
</tr>
<tr>
<td>Team vulnerability</td>
<td>Communication, collaboration, peer relationships and pressures</td>
</tr>
<tr>
<td>Structural vulnerability</td>
<td>Systemic, organisational, resources, media and public opinion</td>
</tr>
<tr>
<td>Organisational vulnerability</td>
<td>Organisational, team, professional and locational culture and relationships</td>
</tr>
<tr>
<td>Environmental vulnerability</td>
<td>&quot;Natural&quot; disasters coupled with locational disadvantage, availability and timeliness of rescue and clean up services</td>
</tr>
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CASE STUDY 1: SPATIAL STUDIES OF HAZARDS AND SOCIAL ENVIRONMENTS

MR HAMISH ROBERTSON
POTENTIAL MAN-MADE HAZARDS IN METRO SYDNEY
CLUSTERING OF MAN-MADE HAZARDS IN METRO SYDNEY
LAND USE CLASSIFICATION
LAND USE PLUS HAZARDS
SOURCE: ENVIRONMENT AND HERITAGE
RESIDENTIAL CARE FACILITIES WITHIN 5KMS OF IDENTIFIED HAZARDS
PEOPLE NEEDING ASSISTANCE
AGE 65+ AND CONTAMINATION EVENTS
NEED FOR CORE ACTIVITY ASSISTANCE – PROXY FOR DISABILITY
SEIFA SCORE AND CONTAMINATION EVENTS
SPATIAL SMOOTHING TO PRODUCE ZONES OF IMPACT
ADDITIONAL CONNECTIONS BETWEEN MAN-MADE HAZARDS, LOCATION, SOCIAL POSITION AND HEALTH
INCREASING INCIDENCE OF MALIGNANT MESOTHELIOMA AFTER EXPOSURE TO ASBESTOS DURING HOME MAINTENANCE AND RENOVATION

NOLA J OLSEN, PETER J FRANKLIN, ALISON REID, NICHOLAS H DE KLERK, TIMOTHY J THRELFALL, KEITH SHILKIN AND BILL MUSK

MJA 2011; 195 (5): 271-274
DOI: 10.5694/MJA11.10125
A NATIONAL PLAN TO CLEAN UP AIR QUALITY WILL BE DEVELOPED AFTER A GOVERNMENT REVIEW FOUND THE CURRENT STANDARDS WERE NOT PROPERLY PROTECTING HEALTH.

FEDERAL, STATE AND TERRITORY ENVIRONMENT MINISTERS YESTERDAY PROMISED TO TAKE A "FRESH LOOK AT AUSTRALIA'S AIR QUALITY", VOWING TO USE THE PLAN TO PRIORITIZE AND RESPOND TO THE REVIEW'S 23 RECOMMENDATIONS.

THE REVIEW INTO AUSTRALIA'S AIR QUALITY STANDARDS, LAST UPDATED IN 2003, FOUND THAT FOR THE POLLUTANTS MONITORED, THERE WAS NO SAFE LEVEL OF EXPOSURE. "THE RESULTS . . . SHOW THAT THERE ARE SIGNIFICANT HEALTH EFFECTS AT CURRENT LEVELS OF AIR POLLUTION IN AUSTRALIAN CITIES," IT SAID. "CURRENT STANDARDS ARE NOT MEETING THE REQUIREMENT FOR ADEQUATE PROTECTION OF HUMAN HEALTH."

THE REVIEW SAID SOME STATES AND TERRITORIES REPORTED THEY COULD NOT FULLY IMPLEMENT THEIR MONITORING PLANS BECAUSE OF "RESOURCE CONSTRAINTS AND COMPETING PRIORITIES".
PROJECTIONS IN SPACE AND OVER TIME

Alzheimer's Disease Prevalence in 2026
CONCLUSION

• Mapping and spatial analysis support evidence-based policy and practice, including quality and safety initiatives
• It readily links natural phenomena to human hazards and at risk groups => vulnerability analysis
• It permits visualisation of complex scenarios for a broad audience
• It encourages secondary analysis and planning (speed, data etc)
• Spatial technology (satellite imagery, GPS data, health data with location attributes) is ubiquitous but poorly utilised in most health research
• Spatial science can contribute to risk and vulnerability planning and analysis from local to international levels
CASE STUDY 2: MULTIPLE PERSPECTIVES ON DISASTERS
TŌHOKU EARTHQUAKE AND TSUNAMI “GREAT EAST JAPAN EARTHQUAKE” OF 11TH MARCH 2011
IMPACT - GEOGRAPHY AND GEOLOGY

IMMEDIATE - IMPACT HUMAN AND ENVIRONMENTAL

Human
- 15,870 deaths
- 6,114 injured
- 2,814 missing
- 20 km radius of the Fukushima Daiichi Nuclear Power Plant evacuated
- 10 km radius of the Fukushima Daini Nuclear Power Plant evacuated

Environmental
- 129,225 buildings destroyed
- 254,204 buildings collapsed
- 691,766 buildings damaged
- 4.4 million households without electricity
- 1.5 million without water
• Earthquake hits (8.9 on the Richter Scale, reactors designed to withstand 8.2) at 2.46pm
• With a total loss of power, the auxiliary cooling systems in the Nuclear Power plant stopped and cooling water was lost to the reactor cores
• The reactor core heated up due to decay heat (as in Chernobyl)
• Meltdowns (level 7 INES) at three reactors in the Fukushima Daiichi Nuclear Power Plant
• Explosions in three reactors due to hydrogen gas after cooling system failure
• Tsunami hit about an hour later – loss of emergency power, loss of control
IMPACT: HUMAN AND ENVIRONMENTAL

FOCUS: POLITICS, GOVERNANCE

• The TEPCO Fukushima Nuclear Power Plant accident was the result of collusion between the government, the regulators and TEPCO, and the lack of governance by said parties. They effectively betrayed the nation’s right to be safe from nuclear accidents. Therefore, we conclude that the accident was clearly “manmade.”

• We believe that the root causes were the organizational and regulatory systems that supported faulty rationales for decisions and actions, rather than issues relating to the competency of any specific individual.

(Nuclear Accident Independent Investigation Commission)
IMPACT: AFTERMATH

• Environmental: food, water, sea and ocean contamination, debris
• Economic: cost US$235 billion – the most expensive ‘natural’ disaster ever known
• Political: the Fukushima plant was “nationalised”
• Psychological: significant psychological impact due to losses and fear of both nuclear impact and possibility of another earthquake and tsunami (eg Christchurch “quake brain”)
• Infrastructures: loss of workplaces and schools, closure of
• Social: social dislocation, displacement - 590,000 (UN) immediate then in 2012 still 330,000
• Social: Use of ill-informed, unskilled labor for clean-up (facilitated by Yakuza)
• Ethical: over and above immediate and related deaths, death of 300 workers
• Reconstruction: slow (as per L’Aquila, Haiti)
Hundreds of such markers dot the Japanese coastline, some more than 600 years old, warning future generations of the risk of tsunamis.

This one, erected in 1933 after another massive tsunami killed thousands of people along the Pacific coastline reads:

*A house on high ground will lead to peace and happiness for posterity. Remember the calamity of the great tsunami. Never build houses from this point down .... No matter how many years pass, keep vigilance high*
CASE STUDY 2: HEATWAVES
DEFINITION

• A heatwave is now defined by three or more days of unusually high maximum and minimum temperatures in any area (Tuesday, 14 January 2014).

The Bureau of Meteorology says heatwaves have taken more Australian lives than any other natural hazard in the past 200 years, but until now it had not given a national definition of just what constitutes a heatwave.
THE IMPACT OF HEAT ON HEALTH

http://journals.co-action.net/index.php/gha/article/view/2057/2538
<table>
<thead>
<tr>
<th>Heat wave event</th>
<th>Attributable mortality (% increase)</th>
<th>Baseline measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976—London, UK</td>
<td>9.7% increase England and Wales and 15.4% Greater London</td>
<td>31-day moving average of daily mortality in same year</td>
</tr>
<tr>
<td>1981—Portugal</td>
<td>1906 excess deaths (all cause, all ages) in Portugal, 406 in Lisbon (month of July)</td>
<td>Predicted values</td>
</tr>
<tr>
<td>1985—Rome, Italy</td>
<td>35% increase in deaths in July 83 in 65+ age group</td>
<td>Compared with deaths in same month in previous year</td>
</tr>
<tr>
<td>1987—Athens, Greece</td>
<td>estimated excess mortality &gt;= 2000</td>
<td>Time trend regression adjusted</td>
</tr>
<tr>
<td>July 21—31, 1991—Portugal</td>
<td>997 excess deaths</td>
<td>Predicted values</td>
</tr>
<tr>
<td>July 12—21, 1995—London, UK</td>
<td>11.2% (768) in England and Wales, 23% (184) Greater London</td>
<td>31-day moving average of daily mortality in previous two years</td>
</tr>
<tr>
<td>July 30—August 3, 1994—Netherlands</td>
<td>24.4% increase, 1057 (95% CI 913, 1201)</td>
<td>31-day moving average of previous 2 years</td>
</tr>
<tr>
<td>July 19—31, 2003—Italy,</td>
<td>3134 (15%) in all Italian capitals</td>
<td>Deaths in same period in 2002</td>
</tr>
<tr>
<td>June 1—August 15, 2003—France</td>
<td>14802 (60%)</td>
<td>Average of deaths for same period in years 2000 to 2002</td>
</tr>
<tr>
<td>August 1—20, 2003—Portugal</td>
<td>1854 (40%)</td>
<td>Deaths in same period in 1997–2001</td>
</tr>
<tr>
<td>August 1—31, 2003—Spain</td>
<td>3166 (8%)</td>
<td>Deaths in same period 1990–2002</td>
</tr>
<tr>
<td>August 1—31, 2003—Switzerland,</td>
<td>975 deaths (6.9%)</td>
<td>Predicted values from Poisson regression model</td>
</tr>
<tr>
<td>June 1—August 31 (3 months), 2003—Netherlands</td>
<td>1400 deaths</td>
<td>Number of degrees above 72°F multiplied by the estimated number of excess deaths per degree (25–35 excess deaths)</td>
</tr>
<tr>
<td>June 1—August 23, 2003—Baden-Wuerttemberg, Germany</td>
<td>1410 deaths</td>
<td>Calculations based on mortality of past five years</td>
</tr>
<tr>
<td>August 1—24, 2003—Belgium</td>
<td>1297 deaths for age group older than 65</td>
<td>Average of deaths for same period in years 1985–2002</td>
</tr>
<tr>
<td>August 4—13, 2003—England and Wales</td>
<td>2091 (17%). Mortality in London region: 616 deaths (42% excess)</td>
<td>Average of deaths for same period in years 1998 to 2002</td>
</tr>
</tbody>
</table>
GLOBAL TOLLS

• 1923/1924: Marble Bar, WA - 160 days from 31 October 1923 to 7 April 1924, set the world record for the most consecutive days above 100 °F (38 °C)
• 1936, 1950s: North American Heat Waves (and Cold Waves)
• 1972: USA death toll - 891 people died, heat conditions lasted almost 16 days with high humidity
• 1980: USA – 1,700 – 5,000 people died
• 1988: USA - 5,000 to 10,000 people known to have died, some estimates up to 17,000 deaths
• 1995: Chicago Heat Wave – 739 deaths across the US
• 2003: Europe – more than 46,000 people deaths, with estimates in excess of 70,000. Most died in France, where nearly 15,000 people died, India same year – 1,500 deaths
• 2010: Russia – 56,000 deaths
• 2010: Japan – 1,718 deaths ...
CITY-SPECIFIC ESTIMATES OF THE EFFECT OF HEAT-WAVES ON DAILY MORTALITY (% INCREASE AND 90% CI) DURING SUMMER 2003 AND IN OTHER YEARS.
Heat islands can be deadly. This graph shows how the number of deaths spiked in Paris during a sweltering heat wave in 2003. **Credit:** University of Hawaii at Manoa/Benedicte Dousset

http://www.nasa.gov/topics/earth/features/heat-island-sprawl.html
• Explored and compared causes of deaths in two major Chicago heatwaves
• Undertook a “social autopsy” and found that higher risk of death was associated with a combination of:
• Economic factors: elderly poor; living in the centre of the city; with no working air conditioning; or could not afford to turn it on
• Social factors including:
  • fear of crime: older persons hesitant to open windows and doors at night (compared to the 1930 heatwaves where many residents slept outside in the parks)
  • Gender: elderly women, who may have been more socially engaged, were less vulnerable than elderly men
• Ethnicity: African Americans more likely to die than Anglo Americans, but Hispanics had unusually low death rate
  • African Americans lived in sub-standard housing and less cohesive neighborhoods
  • Hispanics lived in places with higher population density, social cohesion
KLINENBERG 2003: THE GREAT CHICAGO HEATWAVE AND OTHER UNNATURAL DISASTERS

• **Lack of preparation:** there were inadequate warnings, power failures, inadequate ambulance service and hospital facilities, with the medical system severely taxed as thousands taken to hospitals (including children who got heat stroke in school buses)

  Government officials refused to call in extra staff or ambulances and waiting until bodies piled up to declare an emergency.

• **Lack of warning:** City officials did not release heat emergency warning until last day of heat wave

• **Lack of coordination:** Emergency cooling centers under-utilized and un-advertised

• **Town-planning:** the impact in Chicago’s urban center were exacerbated by urban heat island: raised nocturnal temperatures by more than 2 °C, urban heat islands caused by concentration of buildings and pavement in urban areas,

• **Environmental:** Lack of wind increased pollution and humidity
Official response: Human Services Commissioner to Press

“We’re talking about people who die because they neglect themselves. We did everything possible. But some people didn’t want us to open their doors to us.”

The disaster was a “unique meteorological event” that proved that the “government alone cannot do it all.”

• Klinenberg: services were outsourced, the political layer had lost contact with the needs of the constituents
2009 SOUTHEASTERN AUSTRALIA HEAT WAVE

- In Adelaide: average daily maximum 27 January – 7 February was 40.5 °C (104.9 °F) – (11.1°C (20.0°F) above average): 13 Consecutive days over 33 °C (91 °F), six consecutive days over 40 °C (104 °F), four consecutive days over 43 °C (109 °F)
- Set off the Black Saturday bushfires
- Estimated to have cost 374 lives
http://www.geog.ucs.edu/events/department-news/1150/australian-heat-wave-prompts-addition-of-new-colors-to-heat-map-scale/
Average number of very hot days

Australian Bureau of Meteorology

Number of very hot days

Year

10-year running average shown by black curve
2006 EUROPEAN HEAT WAVE
RUSSIAN HEAT WAVE 2010

- Warmest July since at least 1880
- 14,000 extra deaths in Moscow in July
- Combination disaster: thousands of fires occurred and hundreds of villages burnt down and 47 peat bogs under ground kept the fires burning
- Air quality was at an all time low, some radioactive as the fires were burning in the Chernobyl affected areas
- The power grid lines disrupted
- Infrastructure broke down, as airports, roads, trains were unable to operate
- Concerns about nuclear power plants
IN CLOSING THE PRACTICAL IMPORTANCE OF EDUCATION
DON’T UNDERESTIMATE THE PRACTICAL IMPORTANCE OF EDUCATION ...