Social costs tend to **persist over a person's lifetime** while most tangible costs are **one-off**

2. The social impact of natural disasters

Key points

- The total economic cost of natural disasters is a complex web of tangible and intangible costs
- Natural disasters have wide-ranging intangible impacts on health and wellbeing, education, community engagement and employment
- Intangible costs may be as high as, or higher than, tangible costs. Often intangible costs persist over a person's lifetime while most tangible costs are a one-off.

This report reviews evidence showing the range and significance of the social impacts of natural disasters in Australia and internationally. These impacts tend to be long term and incur considerable costs to individuals and their communities, governments and businesses. The research shows that the range and cost of social impacts are complex and difficult to measure, but there is clear evidence these costs form a substantial part of the total economic cost of natural disasters.

A review of the literature demonstrated the range and significance of the social impacts of natural disasters in Australia and internationally (see Appendix E).

The Productivity Commission *Inquiry Report on Natural Disaster Funding Arrangements* notes that economic costs are typically grouped into tangible costs (including direct and indirect) and intangible costs. These costs are defined as follows:

- **Direct tangible costs:** those incurred as a result of the hazard event and have a market value such as damage to private properties and infrastructure
- **Indirect tangible costs:** the flow-on effects that are not directly caused by the natural disaster itself, but arise from the consequences of the damage and destruction such as business and network disruptions
- **Intangible costs:** capture direct and indirect damages that cannot be easily priced such as death and injury, impacts on health and wellbeing, and community connectedness.

Figure 2.1 shows the complex web of tangible and intangible outcomes arising from natural disasters. The cost of intangible impacts may be as high as, or higher than, tangible costs. Importantly, in some cases, social impacts tend to persist over a person's lifetime while most tangible costs are a one-off. For example, a proportion of people will suffer from chronic disease or mental health problems post disaster, with negative impacts over their lifetime. These impacts may also be multiple and compounding (not necessarily linear).

Figure 2.1: Impacts of natural disasters

Source: Deloitte Access Economics, adapted from Productivity Commission (2015)

These outcomes can be quantified as human costs, general costs or economic efficiency losses (Table 2.1). This method of valuation adapts the World Health Organization's *WHO Guide to Identifying the Economic Consequences of Disease and Injury* (Box 2). The guide provides a framework for estimating the microeconomic and macroeconomic value of ill health based on market, non-market and economic welfare losses (WHO, 2009). For the purposes of this report, 'ill health' refers to the social impacts of natural disasters.

It is important to note that average costs have been used to estimate the cost of social impacts. In reality, anecdotal evidence shows that different people experience social impacts differently and their ability to recover depends on a range of other factors. For example, there were two women who both lost their husbands in the Black Saturday bushfires but only one also lost her house. As they reflected, the woman who lost her house found it more difficult to cope as she could not grieve in a familiar place where her husband had lived.

Figure 2.2 is an example of how each impact can be valued in monetary terms, and who bears the costs. For example, the rate of family violence has been shown to increase post-disaster. This leads to costs in the health system (including counselling services) and the justice system (if family violence is reported and/or proceeds to trial, or an intervention order is taken out). Businesses face costs due to absenteeism and the low productivity of physically and mentally affected employees. Costs are also associated with providing community support and services such as housing and relocation costs.

Box 2: Measuring the economic burden of disease and injury

There are a number of ways to measure disease burden. WHO provides a comprehensive guide to the methodology for measuring disease burden. Measurements of disease burden generally attempt to capture direct costs such as medical fees and travel time, and indirect cost such as reduced worker productivity.

A macroeconomic approach looks at the effects of disease on a societal level. 'Key channels through which disease or injury can impact on macroeconomic performance or output include increased health expenditures, labour and productivity losses, and reduced investment in human and physical capital formation' (WHO, 2009, p.4).

A microeconomic approach attempts to measure the burden at the level of an individual household, firm or government. Microeconomic models attempt to understand the trade-offs individuals make when affected by disease. Households, for instance, may shift consumption away from leisure and entertainment goods towards health expenditure. Education, which is important in human capital development, may be neglected, and savings may be run down to fund health costs.

However, these approaches can often fail to capture welfare loss from disease, focusing instead on market loss. To determine the welfare effects of disease on individuals' health, economists instead use models based on willingness to pay. Such models attempt to gauge how much individuals would be willing to forego to avoid or lessen the severity of a disease, taking into account a person's perception of medical care expenses, lost earnings, pain and suffering, and other subjective costs of illness. A greater willingness to pay to avoid a disease would indicate a greater welfare loss from the disease.

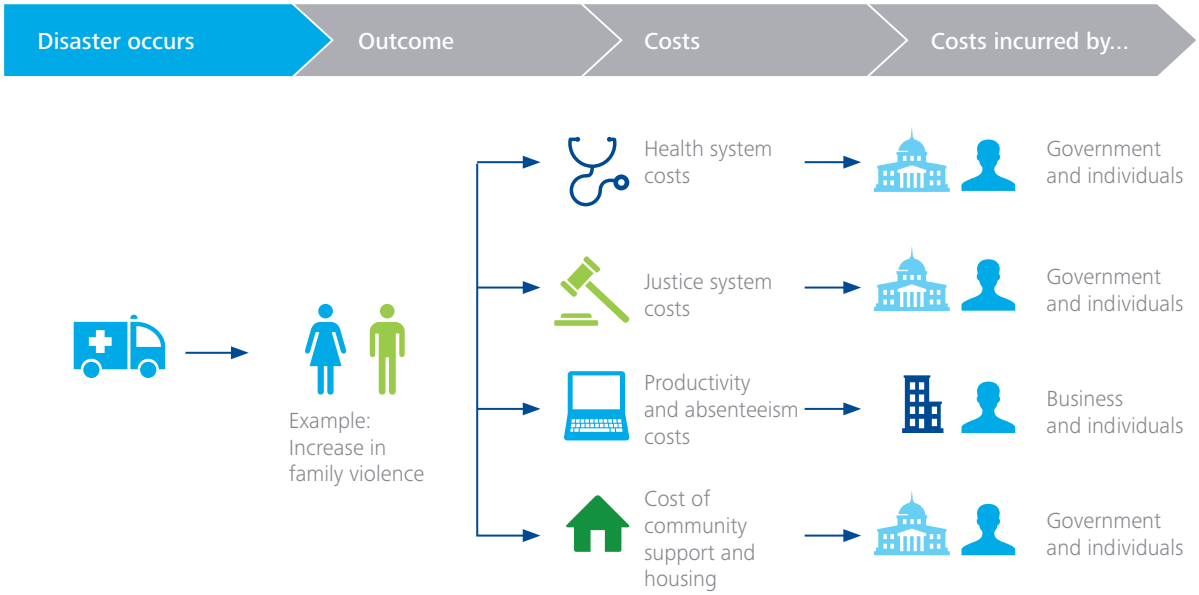
A common measure of overall disease burden is disability-adjusted life year (DALY). A loss of DALY can be conceptualised as the loss of a year from a 'healthy' life. The total DALY would capture the disease burden across the population. It is calculated using years of lives lost to a disease and years lost to disability. The weight of a disability is calculated from extensive survey data.

Table 2.1: Summary of the cost components of social outcomes

Level of government	Economic infrastructure
Direct health care system costs	Costs arising from services delivered within the health care system, including hospital, medical, paramedical and ambulance costs. Treatment may be provided by emergency services for those injured in a disaster, or someone with mental health problems or chronic disease may receive health care in hospital or by a general practitioner (GP).
Productivity loss	Poor health outcomes are likely to be associated with a reduced labour supply and lower productivity. This is valued as potential earnings lost as a result of disability, ill health or other outcomes. The human capital approach is used, which assumes that an employee cannot be easily replaced from the unemployment pool, and thus premature death or absence from work would result in a loss of productivity to the economy. Some productivity loss will be temporary and some over a person's lifetime.
Costs of informal care	Adverse health outcomes not only impose economic costs on individuals, but also on family and friends in caring for those who suffer from disability or ill health, or younger children who need care. These costs are estimated using the opportunity cost method, which measures the value in alternative use of time spent caring. This is typically valued by productivity losses (or value of leisure time) associated with caring.
Non-pecuniary costs	These put a value on the loss in quality of life as a result of premature death, disability or ill health, and on the pain and suffering of friends and families. This value is estimated using the value of statistical life year (VSLY) from the Office of Best Practice Regulation (OBPR, 2014).
Administrative and other costs	These include costs for legal services (associated with family violence, relationship breakdown and crime), temporary accommodation, paid care (as opposed to informal care), funerals and other publicly funded services.
Transfer payments	Transfer payments are not economic costs because they involve payments from one economic agent to another, but have been included to measure the allocative efficiency loss. These include social welfare payments from governments to individuals, victim compensation and accommodation subsidies.

Source: Deloitte Access Economics

Figure 2.2: Example of how outcomes maps to costs



Source: Deloitte Access Economics

Table 2.2 (page 31) shows how each impact maps to the costs as found in the literature review (Appendix E), and categorises them into one of three groups:

- Those quantified as part of *Building our Nation's Resilience to Natural Disasters*
- Those quantified as part of this report, with a breakdown of costs as a proportion of the total cost of that outcome
- Those examined qualitatively but not quantified as part of this report due to insufficient information.

The methodology for estimating costs is described more fully in Appendix D. In brief, it was based on three broad components.

1. **Estimating the intangible costs of two natural disasters** (specifically the Queensland floods and the Black Saturday bushfires) using a bottom-up approach. Due to insufficient information on the intangible costs of the Newcastle earthquake, a top-down approach was used to calculate the earthquake's total average cost. A bottom-up approach estimates total cost by applying an incidence rate and average cost to the population affected by the natural disaster
2. **Estimating the tangible cost of two natural disasters** (specifically the Queensland floods and the Black Saturday bushfires) using the methodology from *Building our Nation's Resilience to Natural Disasters* (2013). This includes using updated data from the Insurance Council of Australia (ICA) as well as ratios of insured losses to uninsured losses from *Economic Costs of Natural Disasters in Australia* (2001) by the Bureau of Transport Economics (BTE) – now known as the Bureau of Infrastructure, Transport and Regional Economics. This method produced the intangible-cost-to-tangible-cost factor for each case study
3. **Applying the intangible-cost-to-tangible-cost** factor to the estimated average annual tangible cost to obtain the total cost of natural disasters in an average year of natural disaster events.

2. The social impact of natural disasters

January 15, 2011: Rosalie, QLD. Beth Waters is overcome with emotion as she helps residents and other volunteers with the clean-up operation in Fairfield in Brisbane, Queensland, after floodwaters receded leaving behind widespread property damage. *(Robert MacColl / Newspix)*

Table 2.2: Outcomes of natural disasters and their associated costs as a proportion of total costs

Costs	Direct health care system	Productivity loss	Informal care	Non-pecuniary	Administrative and other costs	Transfer payments	Total costs
Tangible costs	Quantified in Building our Nation's Resilience to Natural Disasters						
Health and wellbeing*							
Fatality^	✔	✔		✔	✔		
Physical injury and disability^	2.9%	7.7%	0.3%	86.3%	2.4%	0.4%	**100%**
Mental health	13.4%	70.5%	0.6%			15.5%	**100%**
Alcohol misuse	18.8%	34.0%	33.6%	13.5%			**100%**
Ill health including chronic disease	✔	✔	✔	✔		✔	
Family violence	4.9%	6.2%		44.8%	6.1%	38.0%	**100%**
Relationship breakdown	Caruana (2010) notes there is 'a dearth of data on the rate of family breakdown following natural disasters' but 'anecdotal evidence, supported by a small number of studies, suggests that intimate partner violence, child abuse and sexual violence are more prevalent after disasters'. Hence, this has not been quantitatively measured in addition to family and domestic violence.						
Employment							
Short-term and long-term unemployment	Unemployment and loss of income has been measured as part of the cost of social outcomes (as above either through ill health, physical injury or disability or other social outcomes). To avoid double counting, unemployment has not been quantified separately.						
Impact on hiring and retaining qualified employees	Not quantified due to insufficient information on both the rate and value of this impact. However, it was found that Hurricane Katrina sparked difficulties for some local government human resources managers who, two years after the hurricane, were still struggling to retain workers and attract qualified people to fill positions (French, 2008).						
Education							
School enrolment and completion, and academic outcomes	Educational outcomes are difficult to value and attribute to natural disasters. They are largely a second order impact, influenced by trauma and mental health problems, relocation, physical injury and family violence post-disaster. Direct impacts are generally more immediate in nature, such as the inability for children to attend school due to disaster damage.						
Community							
Community dislocation	Not quantified due to insufficient information on the prevalence and long-term impact of community dislocation. Although it's acknowledged that natural disasters can dislocate communities, and examples have been documented (for example, in Arendt, 2014), the extent to which communities are affected is critically dependent on a number of factors that vary significantly in each setting.						
Crime	Only the cost of property crime post-disaster, such as looting and theft, has been quantified as part of this paper. Physical assault has been partly captured in the cost of family violence.						
Loss of animals	Costs associated with loss of livestock were estimated as part of *Building our Nation's Resilience to Natural Disasters.* Evidence shows that separation of pets and their owners in natural disasters may cause psychological distress. However, due to insufficient information on the rate and value of this impact, it has not been quantified.						
Environmental damage	Quantified as a one-off cost associated with damage to the environment as a result of natural disasters. This is based on the ecosystem service framework (Simpson, 2011), which values the environment in terms of ecosystem services it provides to humans, such as water supply, nutrient cycling, climate regulation and recreation.						
Social networks	Not quantified due to insufficient information on both the rate and value of the impact. The evidence is mixed on the impact of natural disasters on social networks. In some cases, natural disasters have had negative effects on social capital such as trust and social connection. In others, evidence shows positive impacts as volunteers work collectively in disaster recovery (Aldrich, 2012).						
Loss of heritage or culture	Not quantified due to insufficient information on both the rate and value of the impact. However, anecdotal evidence suggests these are important. An example is the loss of heritage-listed buildings and significant cultural objects in the Christchurch earthquakes.						

Source: Deloitte Access Economics
Note: A detailed literature review of each impact can be found in Appendix E
* Breakdown of cost components is based on existing studies that have quantified the economic cost of these outcomes. Refer to Table D.6 for more detailed information
^ Quantified in *Building our Nation's Resilience to Natural Disasters* (Deloitte Access Economics, 2013) and refined in this paper.