Background

Information on the health impacts and distribution of different diseases and injuries is important for monitoring population health and in providing an evidence base to inform health policy and service planning. Many different data sources and measures are reported in HealthStats NSW to describe the determinants and outcomes of disease and injury and their distribution among population sub-groups. Burden of disease analysis moves beyond just estimating disease and risk factor prevalence, such as the number of people who smoke or have cancer, heart disease or diabetes in a population.1,2

What extra information does burden of disease analysis provide for monitoring population health?

Burden of disease analysis combines health data from many sources and evidence from epidemiological studies to create summary measures that incorporate both the prevalence of a given disease or risk factor and the relative harm it causes. The measures allow decision-makers to compare the relative effects of different diseases or outcomes associated with risk factors, such as smoking-related diseases versus cancer or heart disease, and then use that information for health policy development, planning and evaluation.1

What are the burden of disease measures?

The Australian Burden of Disease Study (ABDS) 2011 has adapted the methods developed for the ‘Global Burden of Disease’ studies to produce estimates that are more relevant to the Australian health policy context. The indicators presented in HealthStats NSW relate to the NSW population for 2011.2,2

Burden of disease analysis measures the combined impact on the population as a whole of living with illness and injury (non-fatal burden) and dying prematurely (fatal burden). More than merely counting deaths and disease prevalence, it takes into account age at death and severity of disease. The summary measure ‘disability-adjusted life years’ (or DALY) is used to count the total years of healthy life lost from premature death (fatal burden measured as ‘years of life lost’ – YLL) and illness (non-fatal burden or ‘years lived with disability’ – YLD) in the whole population. The severity weighted measures of illness and injury (YLD) are used as inputs for computing health-adjusted life expectancy (HALE).

Life expectancy and health-adjusted life expectancy

Life expectancy is the average number of years that a newborn is expected to live if current mortality rates in the population continue to apply.3 It can be calculated for people at any age but is usually reported as life expectancy at birth. HALE is life expectancy adjusted for disease and disability. This is the average number of years that a person can expect to live in ‘full health’ by taking into account years lived in less than full health due to disease and/or injury. It captures both fatal and non-fatal health outcomes in a summary measure of average levels of population health.1,4

Measuring disability or non-fatal disease burden

In order to measure HALE we need to measure both how many people a disease affects and the overall degree and impact of the severity of that disease on the people who have it. We combine these to create a measure of disease prevalence (i.e. people living with a disease) weighted by the severity of disease. This measure is available from the ABDS 2011 in the form of years lived with disability (YLD)2 or non-fatal disease burden.
A standard life table

A standard life table displays the life expectancy for a population at each age or age group. A life table presents a set of tabulations that describe the probability of dying, the death rate, and the number of survivors for each age or age group. Accordingly, life expectancy at birth is an output of a life table. Once we have data from a standard life table and for the severity weighted disease prevalence (YLD), HALE may be computed.

Sullivan’s method for computing HALE

Using Sullivan’s method, HALE is derived by computing the total years lived without disability using a measure of the years lived at each age group (obtained from ABS life tables for 2010–2012) and a measure of the years lived with disability (YLD) (obtained from the ABDS 2011).

Example of calculating and using HALE as a health indicator

Table 1 shows that HALE for males at birth in NSW between 2010 and 2012 was found to be 71.1 compared to a standard life expectancy of 79.9 years. This indicates that, at birth, the average NSW male can expect to lose the equivalent of 8.8 years of life lived at ‘full health’ through reduced quality of life due to disability.

Example of how to calculate HALE using data from the ABS life tables and the ABDS 2011

Table 1. Example of calculating HALE for all diseases using an abridged life table for males in NSW, 2010–2012
How the columns of the life table are computed and any underlying assumptions

1_x: number of survivors at age x (x represents the lower end of the age interval for the age groups). This column is taken directly from the ABS life table data.

L_x: number of years lived at age x. This is the sum of the L_x column from the ABS life tables for the age interval being considered.

Σ L_x: total years lived from age x. This is the sum of L_x (derived as explained above) from age x to the last age category being considered (100+ for our example).

LEx: life expectancy at age x. This is the total years lived from age x, Σ L_x, divided by the number of survivors at age x, l_x.

YLD_x: years lived with disability at age x per person year. This is the proportion of years lived with disability by the population at age x per person year. A rate of 1 would indicate that every person at age x experienced the most severe disability possible (this represents very low quality of life).

YWD_x: years lived without disability at age x. This is derived by adjusting the total years of life expected to be lived by the total years expected to be lived without disability (by calculating the proportion of years lived without disability at age x per person year as (1-YLD_x) multiplied by the number of years lived at age x, L_x).

Σ YWD_x: total years lived without disability from age x. This is the sum of YWD_x from age x to the last age category being considered (100+ for our example).

HALE_x: health-adjusted life expectancy at age x. This is the total years lived without disability from age x, Σ YWD_x, divided by the number of survivors at age x, l_x.

Deriving HALE for different disease groups

The ABDS 2011 provided YLD rates in 2011 per 1,000 persons for specific diseases within the disease groups being considered in the study. To obtain the YLD rates for each disease group we simply sum the rates for each sex and age group for all diseases within each disease group. We then compute disease group-specific YLD_x, YWD_x, Σ YWD_x, and HALE_x, as described above.

The number of years of HALE or years of healthy life lost to disability is the difference between average life expectancy and health-adjusted life expectancy (Figure 1). Note that when comparing different diseases, some diseases with higher case-fatality rates may appear to have a lower burden in terms of HALE compared to other chronic diseases. For example, cancer appears to have a lower burden than cardiovascular diseases (Figure 1). People in the population as a whole may expect to live longer with disability associated with cardiovascular disease compared with disability associated with cancer, as cancer is more likely to be fatal in the short term (Figure 2). Burden due to death is summarised by years of life lost (YLL) and is higher for cancer than for cardiovascular disease, whereas HALE adjusts life expectancy for lower quality of life due to disease and disability (YLD), which is higher for cardiovascular disease than for cancer.

The burden in terms of HALE in the population is quite small for a number of diseases. A rare disease that is significantly disabling (i.e. having a high YLD) will have a low impact in terms of the total (reduced) HALE across the whole population.
References