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Perspective

Subnational Burden of Disease Studies: Mexico Leads the Way

Martin Tobias

Why Burden of Disease Studies?

The goal of any health system is to improve the level and distribution of health of its eligible population. This goal implies an ability to measure population health (including differences between subgroups and trends over time) and to assess the contribution of different diseases, injuries, and risk factors to health outcomes.

But to carry out such a needs assessment, diverse health outcomes have to be expressed in a common unit. While various "currencies" have been proposed, only time-based measures of health have literally withstood the test of time. Such measures may indicate time spent in different health states (health expectancy measures) or reflect "functional" time lost as a result of premature mortality and morbidity (health gap measures such as the disability-adjusted life year or DALY—see Box 1).

Burden of disease studies invariably employ DALYs (or HALYs—health-adjusted life years—as they are known in Canada), given their focus on quantifying the relative contribution of different causes to health loss. Such studies were first commissioned by the World Bank [1] and thereafter championed by the World Health Organization [2]. National burden of disease studies have now been completed by many high- and middle-income countries, including the United States, Canada (in progress), Mexico, France, The Netherlands, Mauritius, Australia, and New Zealand [3–8].

The Burden of Disease in Mexico

A study by Gretchen Stevens and colleagues in this month's *PLoS Medicine* reports on the burden of disease in Mexico [9]. Estimates of burden are reported for Mexico as a whole and for each of the country's 32 states (although for presentation in *PLoS Medicine* the results have largely been aggregated into six regions). Only Australia has previously reported subnational burden of disease estimates [4]. The "value added" by such studies reflects the reality that in many countries, state or provincial rather than national governments hold jurisdiction over health.

Stevens and colleagues show substantial heterogeneity in health, and the relative contributions of different causes to health, across Mexico. These authors interpret their results in terms of epidemiological transition theory, with different regions being at different stages of the transition. The transition is from a high mortality–high fertility demography dominated by childhood infectious diseases and nutritional deficiency disorders to a low mortality–low fertility demography dominated by chronic diseases affecting older adults in particular. They show that the Southern region (and in particular the state of Chiapas), with the least developed economy and the highest proportion of indigenous inhabitants, is at an earlier stage of epidemiological transition than other regions. Tellingly, the Southern region not only has the highest rates of pre-transitional conditions (such as infectious diseases and nutritional deficiency disorders), but also has the highest rates of injury and chronic diseases—although the *relative* proportion of health loss attributable to these latter cause groups is lower than in other regions.

The Southern region also shows markedly high health losses from alcohol use, mediated in particular through cirrhosis. Indeed, the burden from alcoholic cirrhosis is unusually high throughout Mexico. Neither volume of alcohol consumed nor drinking pattern seems to explain this unusually high burden. Instead, the authors speculate, the high burden may be related to *pulque*, a traditional fermented alcoholic beverage. The authors also find an unusually high burden from obesity and type 2 diabetes in Mexico as a whole, again highest in the Southern region. Unfortunately, detailed data on diet and physical activity levels are not available to explore this further.

Why Was Mexico Able to Undertake a Subnational Burden of Disease Study?

Mexico is fortunate in having invested for many years in high-quality health statistical systems. Most impressive is the National Health and Nutrition Survey, which collected subnationally representative measured data from some 95,000 participants in 2006. Even so, chronic disease incidence and survival data (needed to calculate the morbidity component of the DALY) are largely lacking—as in most countries,

Linked Research Article

This Perspective discusses the following new study published in *PLoS Medicine*:

Stevens G, Dias RH, Thomas KJA, Rivera JA, Carvalho N, et al. (2008) Characterizing the epidemiological transition in Mexico: National and subnational burden of diseases, injuries, and risk factors. PLoS Med 5(6): e125. doi:10.1371/journal.pmed.0050125

Gretchen Stevens and colleagues estimate deaths and loss of healthy life years (measured in disability-adjusted life years, DALYs) for Mexico as a whole and its 32 states.

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Abbreviations: DALY, disability-adjusted life year

Martin Tobias is at the New Zealand Ministry of Health, Wellington, New Zealand. E-mail: Martin_Tobias@moh.govt.nz

Box 1. The DALY

The DALY is a summary measure of population health that integrates health losses resulting from premature mortality with those resulting from functional limitation (disability). It is, in essence, a measure of unmet need.

The DALYs lost (by a specified population in a specified period) from each disease, injury, or risk factor are calculated as the sum of the years of life lost to premature mortality (YLL) and the equivalent number of "healthy" years lost to functional limitation (YLD) for incident cases of the condition, using the equation:

DALY = YLL + YLD

where YLL = number of deaths × standard life expectancy at age of death,
and YLD = incidence × duration × severity weight.

Thus one DALY represents the loss of one year of healthy life.

Estimating DALYs requires extensive—and internally consistent—epidemiological data. As well as estimates of incidence and mortality, data are needed on the severity distribution of the functional limitation associated with each condition, taking into account both stage of disease (or the presence of complications) and access to and effectiveness of current health care and disability support services.

Finally, disability (severity) weights must be assigned to each category of functional limitation, based on social preferences for time spent with such limitation relative to full health on the one hand and death on the other.

A number of value choices need to be made when estimating DALYs. These include whether to use the same "ideal" life expectancy standard for all populations; whether to use the same disability weight for everyone living a year in a specified health state (or to weight differently depending, for example, on the age at which the year is lived); and whether to discount the stream of future health losses to net present value (and, if so, what discount rate to use).

few chronic disease registries exist other than for cancer.

The authors have made good use of modelling to close such data gaps, including extrapolating from data obtained in other comparable countries, but better empirical data are sorely needed in all countries. Mexico also lacks local health state valuation studies (to construct DALYs, health states must not only be described, but also valued). For health state valuation, however, it may be adequate to use data from other countries—there is little cultural variation in the relative value people assign to different health states [10]. In fact, burden of disease technology has matured remarkably over the past decade. Better disease models are now available; adjustment for comorbidity can now be made; and structured workbooks have been developed to ease the data management task [11,12].

Why Should Other Countries Follow Suit?

From a health policy perspective, burden of disease studies are clearly not the whole story. Nevertheless, as every clinician knows, diagnosis must come before treatment. To give one example from Stevens and colleagues' study: the unacceptable burden of childhood malnutrition and infection (diarrhoea and pneumonia in particular) in Chiapas state calls for urgent and sustained action to improve water supplies, sanitation, housing, and access to high-quality primary health care—especially for disadvantaged, largely indigenous, and rural communities within that state.

Other countries can also use burden of disease studies to reveal previously hidden or neglected health problems within their own borders. Repeating the study at regular (five to ten-year) intervals can determine whether policies intended to improve levels of health and close gaps between regions and ethnic groups are in fact working.

Most importantly, both the Mexican and Australian burden of disease studies show that such analyses do not have to be restricted to the national level. Instead, studies should align with the level of jurisdiction at which important resource allocation decisions are made and priorities are set. Given this alignment, burden of disease studies will provide a policy-relevant, internally consistent set of epidemiological estimates (and, ideally, projections) as well as a standard metric with which the full range of health outcomes and risks can be described and valued. Mexico has taken the lead in demonstrating how subnational burden of disease studies can be done and how their output can be used to inform policy. Other countries would benefit from adopting a similar approach. ■

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