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Disability Adjusted Life Years (DALYs) for Leading Health Conditions in New Mexico

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Disability Adjusted Life Years (DALYs) are summary measures of health across geographies and time that can be used to assess disease burden and health system performance. The Institute for Health Metrics and Evaluation (IHME) at the University of Washington has recently compiled the 2016 Global Burden of Disease (GBD) study in conjunction with the World Health Association (WHO).[1] Unlike previous GBD studies that only had DALYs at the national level, the 2016 GBD now includes sub-national level DALYs, including those at the U.S. state-level. This enables direct examination of DALYs for New Mexico and comparison of New Mexico DALYs with those of other states and the U.S.

DALYs represent a new and innovative way of measuring health and disease burden at a state level. Traditionally, prioritizing conditions for state level health status improvement has been guided by mortality rates, where conditions with high mortality rates like heart disease and cancer are given higher priority than low-mortality conditions. However, there are many low-mortality health conditions that profoundly impact quality of life. One DALY represents 1 year of healthy life lost. It is a measure of the gap between current health status and an ideal situation where everyone lives into old age free from disease and disability. DALYs are typically reported as a rate per 100,000 population. A single DALY can also be reported as a percentage of the total DALYs for a given geographic region.

Methods

DALYs combine a mortality measure, the years of life lost due to premature mortality (YLL) with a measure of morbidity, the years lived with disability (YLD). The effect of fatal cases (of disease or injury) is captured by the YLL, while the YLD captures the future health consequences in terms of sequelae of non-fatal diseases or injuries. DALYs are calculated with this equation:

DALY = YLL + YLD

The YLL is based on remaining life expectancy when compared with a reference standard life table at age of death. The YLL component is calculated as follows:

YLL = Number of deaths (N) x Standard life expectancy at age of death (L)

Each death is attributed to a single underlying cause—the cause that initiated the series of events leading to death. Data sources used by IHME for YLLs include vital registration data, verbal autopsy studies, cancer registries, surveillance data, census data, and police records. Cause-specific mortality was estimated primarily using the standardized Cause of Death Ensemble model (CODEm).

The YLD is calculated by multiplying the prevalence (or incidence) of a disease or injury by its weighted level of severity. The YLD component can thus be calculated in two ways:

YLD = Number of Incident Cases (I) x Disease Weight (W) x Average Duration of the case (L)

Or:

YLD = Number of Prevalent Cases (P) x Disease Weight (W)

For locations with sparse or absent data, IHME estimates of YLDs were constructed by borrowing information from nearby locations and by using covariates. Primary data sources included literature searches (14,521 studies), survey data, surveillance data (18,792 sources), hospital inpatient data, and insurance claims. All sources of information for a disease were combined using the Bayesian metaregression tool DisMod-MR 2.1. DisMod synthesizes sparse and heterogeneous epidemiological data to model disease incidence and prevalence.

Results

From 1990-2010, total DALYs for New Mexico and the United States declined. This was from a high of 28,264 per 100,000 population for New Mexico in 1990 to a low of 25,841 in 2010 (Figure 1). This represents an 8.6% decrease. However, from 2010 to 2016 there was a slight increase in the total DALYs rate in New Mexico to the current level of 26,620 per 100,000 population (a 3% increase). New Mexico's total DALYs rates were very similar to the United States' rates in the 1990s. Since then, New Mexico has had higher rates compared to the U.S., with the current difference being approximately 2600 DALYs per 100,000 population.

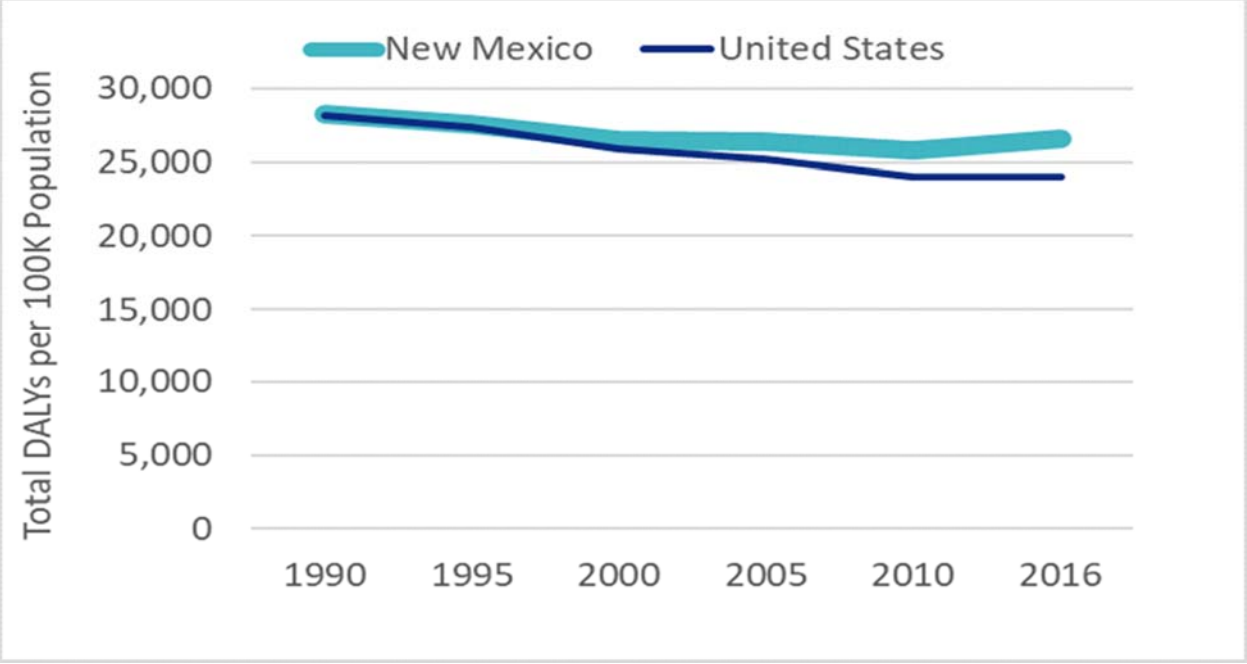
The highest DALYs rates for New Mexico in 2016 were found for the following conditions (starting with the highest): drug use disorders, ischemic heart disease, low back and neck pain, road injuries, skin and subcutaneous diseases, depressive disorders, diabetes mellitus, self-harm, chronic obstructive pulmonary disease, and cerebrovascular disease (Figure 2). The highest ranked condition, drug use disorders, is an aggregate rate comprised of opioid, cocaine, amphetamine, cannabis, and other drug use disorders. Figure 2 also shows the YLL and YLD components of each DALYs rate. For low mortality conditions such as low back and neck pain the DALYs rate is primarily comprised of the YLD, i.e., the morbidity component. For high mortality conditions such as ischemic heart disease, the DALYs rate is primarily comprised of the YLL, i.e., the mortality component. These top 10 DALYs rates can be compared directly to the DALYs rates for the same conditions in the United States for 2016 (Figure 3). For most of these conditions the DALYs rates for New Mexico are similar to those of the United States. However, for drug use disorders, road injuries, and self-harm the DALYs rates in New Mexico are significantly higher than those found in the U.S.

The conditions with the highest DALYs rates overlap with several conditions with the highest mortality rates such as heart disease (ranked #1), unintentional injuries (#3), chronic lower respiratory diseases (#4), and intentional self-harm (#9). Drug use disorders are not present in the top ten highest mortality rate conditions. This is an excellent example of the value of including DALYs in assessing population health status over using mortality rates alone. Low-mortality conditions that greatly impact quality of life, such as low back/neck pain, skin diseases, and depressive disorders, may be neglected entirely in allocating health resources if focusing on mortality rates alone.

Discussion

DALYs can be used in conjunction with other information, such as mortality and morbidity rates and

Figure 1. Total Disability-adjusted Life Years (DALYs), Age-Standardized, New Mexico and United States, 1990-2016



Source: Institute for Health Metrics and Evaluation

health surveys, to arrive at a more complete picture of the burden of disease in New Mexico. Examination of levels and trends of DALYs facilitates quick comparison between different diseases and injuries across different geographies and time periods. The total DALYs rate for New Mexico has generally been trending downward since 1990 and tracking closely with the total U.S. rate. Three conditions with high DALYs in New Mexico, drug use disorders, road injuries, and self-harm, are significantly different from the U.S. rates for 2016. The inclusion of DALYs in state health assessment will help to emphasize low-mortality conditions that have great impact on citizens' quality of life.

References

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2. A. D. Lopez, C. D. Mathers, M. Ezzati, D. T. Jamison and C. J. L. Murray, Eds., Global Burden of Disease and Risk Factors, New York: Oxford University Press, 2006, pp. 73-74.
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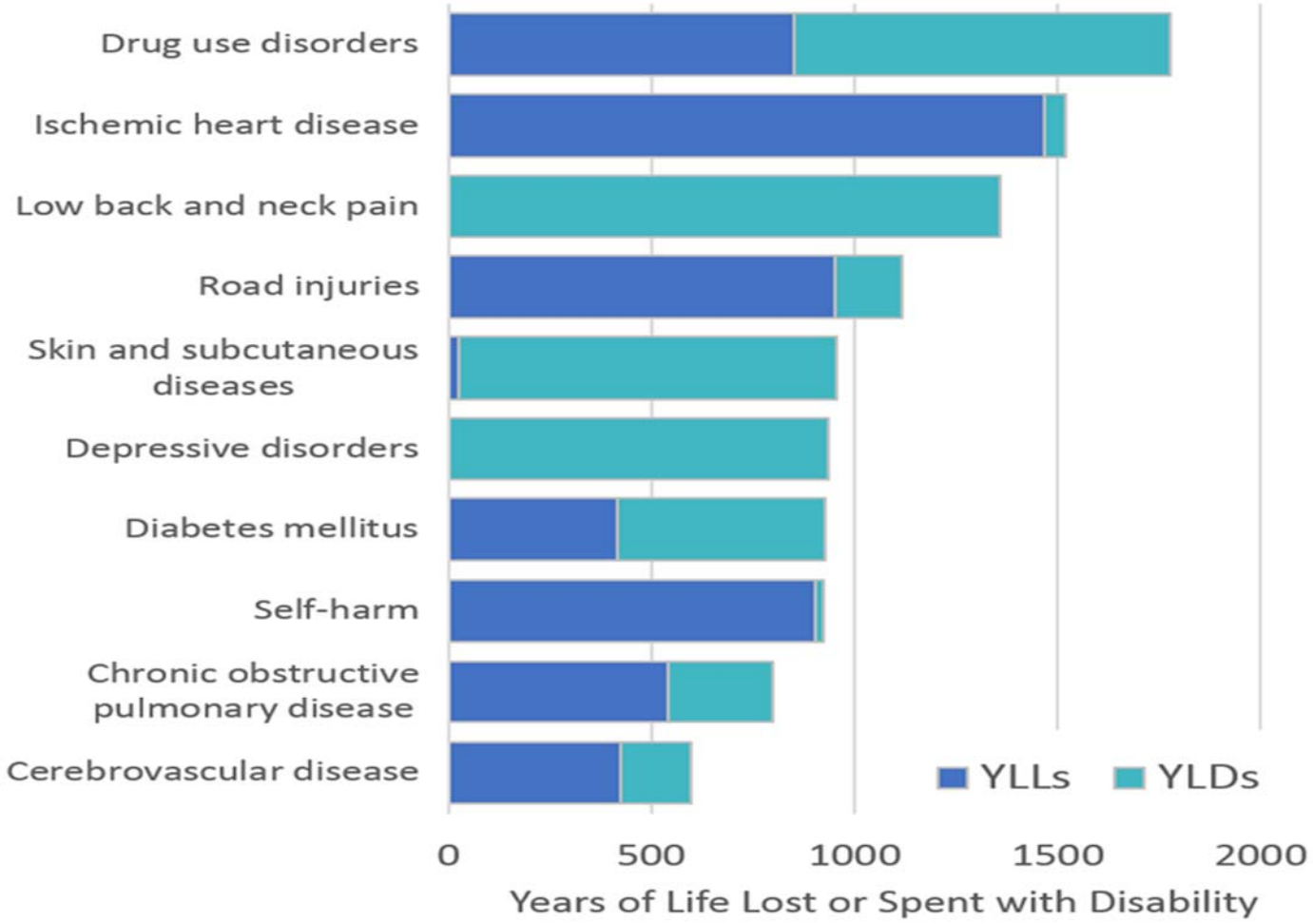
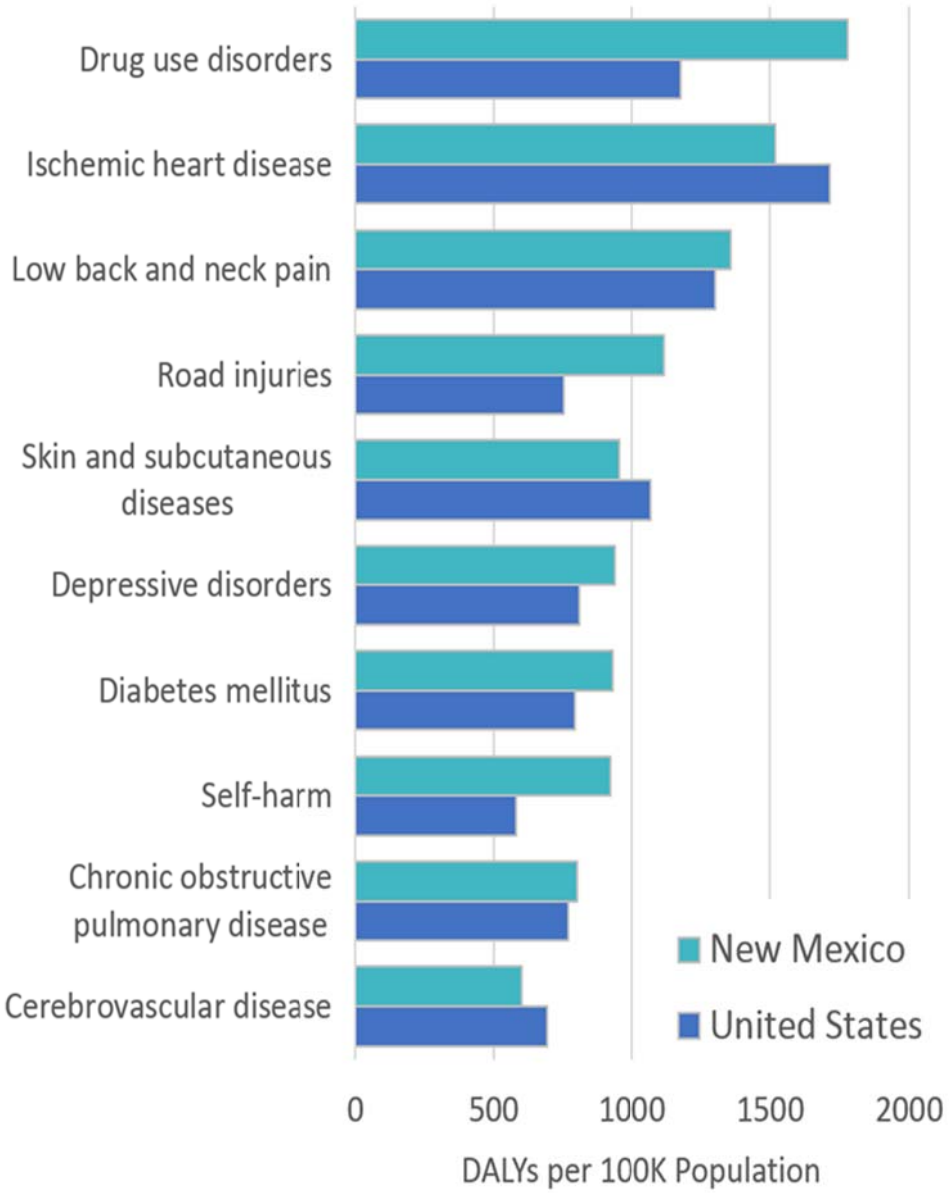
Figure 2. Top 10 Disability-adjusted Life Years Conditions, YLLs versus YLDs, Age-Standardized, New Mexico, 2016



YLL=Years of Life Lost due to disease/condition. YLD=Years lived with Disability.
Source: Institute for Health Metrics and Evaluation

Figure 3. Top 10 Disability-Adjusted Life Years, New Mexico and United States, 2016



Source: Institute for Health Metrics and Evaluation

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