**Title: Homicides increase variation on lifespans in Mexico and its States, 2005-2015 [intended for Demography] [Second PDR] [or a health journal]**

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**Abstract:**

**Introduction**

The first decade of the twenty-first century was marked by the stagnation of Mexican life expectancy caused by the unprecedented rise of homicide mortality after 2005 and the burden of diabetes mortality. The effect of violence was such that improvements made in other causes of death, such as birth conditions and respiratory diseases, were whipped out by the rise of homicides, particularly in males. Homicide rate more than doubled between 2007 and 2012 (gamlin), as a result every state in Mexico experienced losses in life expectancy and some states, like Chihuahua in the northern part of the country, lost almost 3 years in male life expectancy between 2005 and 2010. Importantly, homicide mortality is mostly concentrated in the young adult population between ages 15 and 50. In 2011, the number of homicides reached a pick, with over 20 homicides for every 100,000 people, with a parallel rise in extortion and kidnapping rates. These acts of violence have left an imprint in the Mexican population. For instance in 2014, women were expected to live more than 70% of their remaining life expectancy being afraid of becoming a victim in their home state. Although homicides rates have slowly gone down after 2011, by 2015 they have not fully recovered to their 2005 level. Results at the state level are mixed, a recently wave of violence have led homicide rates to rise in some states in the South such as Guerrero and …/, while some states have experienced a steady recovery from the level observed in 2011. As a result, life expectancy for males has not improved since 2005, .

Although these results underscore important consequences of the rise in homicide mortality, they mask variation in lifespans, a fundamental inequality between individuals. Lifespan variation is dimension of public health that has arisen as an important topic since it addresses the growing interest in health inequalities and its linkage with health behavior. Studying both, life expectancy and lifespan variation, is important since individuals make take decision based not only in their expected lifetime, but also in the uncertainty surrounding it.

**Study data and Methods**

Data on deaths from vital statistics files publicly available through the Mexican National Institute of Statistics and Geography were used. These data include information on cause of death by age at the time of death, sex, and place of occurrence from 1995 to 2015. Additionally, we used population estimates corrected for completeness, age misstatement, and international migration available from the Mexican Population Council construct age-specific death rates by sex and state.

***Cause-of-death classification***

We classify deaths in ten categories according to previous studies targeting the main causes of death in Mexico. The first category refers to conditions amenable to medical service. We analyze separately diabetes, ischemic heart diseases (IHD), HIV/AIDS, lung cancer, cirrhosis, road traffic accidents, suicide, homicides, and the rest of causes of death labeled “Other causes”.

Originally, data on deaths were classified according to the International Classification of Diseases (ICD), revision 9 for years 1995-1997 and revision 10 for 1998-2015. Previous studies have checked validity of the cause-of-death codes used in this paper and did not find cause-specific ruptures in the transition from ICD 9 to ICD 10.

***Dispersion measure***

Several dispersion measures have been proposed to analyze lifespan variability. In this study, is used as a dispersion indicator and we refer to it as “life disparity”. It is defined as the average remaining life expectancy when death occurs, or life years lost due to death. For example, if a cohort of newborns die at the same age then the value of is zero; while when death is very variable, people will die before their expected lifetime, contributing lost years to life disparity. In lifetable notation it is defined as:

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Where and are the survival function, the force of mortality, life expectancy at age , and the open-aged interval (100+ in our case), respectively.

This indicator was chosen because it has an easy to understand interpretation and it is decomposable. These properties allow quantifying the impact of age and cause-specific mortality on changes in life disparity over time. The high correlation with other variation indices, such as Keyfitz entropy, coefficient of variation, or the Gini coefficient, suggests that the main results would not differ by a large extent regardless of the measure used.

Demographic and statistical methods

To mitigate random variations, these rates are adjusted in two steps. First, cause-specific death rates over age and time for each state and sex separately using a 2-d p-spline were smoothed. Second, smoothed cause-specific deaths were rescaled to raw all-cause death rates for each sex and state. Period life tables for males and females from 1995 to 2015 were calculated following standard demographic methods. Life expectancies and life disparities were calculated and cause-specific contributions to the difference between 1995-2005 and 2005-2015 were estimated using standard decomposition techniques.

**Results**

**Discussion**

**Funding**

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**References**