Productivity loss associated with the consumption of sugar-sweetened beverages in Mexico

Carlos M. Guerrero-López, M. Arantxa Colchero*

Center for Health Systems Research, National Institute of Public Health, Mexico

ARTICLE INFO

ABSTRACT

The objective of the study was to estimate the productivity loss by premature death, absenteeism and presenteeism attributable to sugar sweetened beverage (SSB) consumption in Mexico in 2014. We used population attributable fractions due to SSBs for diabetes, cardiovascular diseases and cancers. We gathered information from a variety of publicly available sources: mortality data from the National Institute of Statistics and Geography; hospital discharges and outpatient visits from the Health Ministry; and productivity (measured in wages earned) from the National Occupation and Employment Survey. We estimated a total productivity loss of 1426.6 million USD attributable to SSB consumption. 56.9% of the attributable productivity loss was due to premature mortality and 41.1% was reduced productivity through presenteeism. Diabetes was the main cause of productivity loss (92.1% of premature death-related productivity loss and 99.8% from presenteeism). SSB consumption leads to a considerable loss of productivity in Mexico. Findings emphasize the need to strengthen fiscal policies to reduce or eliminate these indirect costs associated with SSB consumption.

1. Background

In Mexico, more than two thirds of the adult population and more than one third of children and adolescents are overweight or obese (Gutiérrez et al., 2012; Barquera et al., 2013). In 2012, the prevalence of hypertension among adults was 31.5% (Campos-Nonato et al., 2013) and of diagnosed diabetes 9.2% (Hernández-Ávila et al., 2013). Although these diseases are the result of multiple risk factors, evidence shows that consumption of sugar-sweetened beverages (SSB) is associated with weight gain, diabetes and other chronic diseases (Malik et al., 2010; Malik et al., 2006). According to prior literature, there are strong epidemiologic links between high SSB consumption and disease, through the biologic pathways of increased adiposity and adverse metabolic and glucose-insulin effects (Singh et al., 2015). Cardiovascular diseases, cancers and diabetes are the most common diseases associated with SSB intake (Singh et al., 2015). A systematic review found that higher consumption of SSBs was associated with a greater incidence of type 2 diabetes, with the risk increasing by 18% for each additional daily serving (Imamura et al., 2015). Diseases associated with high SSB consumption are related with a high burden of premature mortality and disability. The Global Burden of Disease study reports that high consumption of SSB caused 169,687 DALYs in 2016 among those aged 25 or older in Mexico (Institute for Health Metrics Evaluation, 2018).

In addition to this strong association with poor health outcomes, high SSB consumption may likely have negative economic consequences, such as loss of productivity. For instance, an active working individual with a disease may need to seek medical care, which may lead to missing work, a phenomenon known as absenteeism. Also, sick people may go to work but exhibit lowered productivity due to their ill health, known as presenteeism. In this case, the person with a disease is able to go to work full time but he/she is less productive as its capabilities are undermined. In the economics literature, wages (for employees in the formal sector) or income from labor (in the informal sector) have been used to estimate productivity (Zweifel et al., 2009). Several studies have used income data to estimate the productivity loss associated with various diseases. For instance, the U.S. Chamber of Commerce published a study on lost productivity caused by non-communicable diseases (NCDs) in several countries (Rasmussen et al., 2016). This study reports that in Mexico, NCDs were associated with a loss of 3.5% of the gross domestic product in 2015.

To our knowledge, there are no estimates of the indirect economic costs due to SSB consumption in Mexico. This analysis is particularly relevant since SSB consumption in Mexico is high, representing an average of 9.8% of total energy intake (Aburto et al., 2016). Moreover, since January 2014, Mexico implemented an excise tax of 1 peso per liter, representing about a 10% increase in price, to all non-alcoholic

---

sugar-sweetened beverages (Secretaría de Gobernación, 2013a).

This paper aims to estimate productivity loss attributable to diseases associated with SSB consumption in Mexico, such as diabetes, cardiovascular diseases and cancers. In particular, we estimated productivity loss in the forms of premature mortality, absenteeism (hospitalization and outpatient visits) and presenteeism.

2. Research design and methods

2.1. Data

To estimate expected productivity losses using wages or income from work, we relied on the 2014 National Occupation and Employment Survey (abbreviated as ENOE in Spanish) (Instituto Nacional de Estadística y Geografía, 2007–2015). The ENOE is a nationally representative survey collected quarterly since 2005 that provides information on occupation and its determinants, wages, and other labor statistics among the population aged 15 years and older.

To estimate productivity loss associated with premature mortality, we used mortality data for 2014 published by the National Institute of Statistics and Geography, the institution providing official mortality figures in Mexico (Instituto Nacional de Estadística y Geografía, 2017). The data provide the underlying cause of death using the International Classification of Diseases (10th revision), so we were able to calculate the number of cases with the underlying causes of death of our interest.

Productivity loss caused by absenteeism was assessed using hospital discharge and outpatient visits from health care facilities in the public health sector in 2014, provided by the General Directorate of Health Information of the Ministry of Health (Secretaría de Salud, 2017a). The data include the diagnosis for each hospitalization under the ICD-10 and the number of days hospitalized

The productivity loss caused by presenteeism was estimated using outpatient visits figures provided by the Services Provision System (SIS in Spanish), which is part of the General Directorate of Health Information (Secretaría de Salud, 2017b).

We used the population attributable fractions (PAFs) related to SSB consumption estimated by Singh et al. for specific ICD-10 causes in Mexico (Singh et al., 2015). For diabetes associated with SSB consumption, Singh et al. estimated a PAF of 0.197 for mortality and 0.158 for morbidity for insulin-dependent and noninsulin-dependent diabetes mellitus. The estimated PAFs for cardiovascular diseases (CVD) (ischaemic heart diseases, cerebral infarction, occlusion and stenosis of precerebral arteries, other cerebrovascular diseases, sequelae of cerebrovascular disease, and hypertensive heart disease) are 0.024 and 0.023 for mortality and morbidity, respectively. PAFs for cancers (malignant neoplasm of breast, uterus, malignant neoplasm of esophagus, pancreas, colon, rectosigmoid conjuction, rectum, anus,

gallbladder, and kidney) are 0.014 for mortality and 0.003 for morbidity. Table 1 shows the relevant parameters for our analyses and ICD-10 codes included.

We used diabetes prevalence from the National Health and Nutrition Survey (Instituto Nacional de Salud Pública, 2012), reports published by the Direction of Epidemiology in the Health Ministry for cardiovascular incidence (Dirección General de Epidemiología, 2017) and prevalence of cancers in Mexico provided by the International Agency for Research on Cancer (International Agency for Research on Cancer, 2012).

2.2. Methods for estimation

2.2.1. Estimation of expected productivity

Using data from the ENOE, we applied a linear regression to estimate expected productivity, measured as hourly wage or income from work, as a function of the following predictors: sex, age, squared age, quarter of the year, region of the country, and medical insurance for individuals with positive wages (*i.e.* those in the labor force). These analyses were conducted for the complete sample of individuals between 20 and 76 years, as we assumed that the entire population was productive, regardless of their labor status (formal or informal). We then calculated the expected daily productivity by multiplying the expected hourly wage by 8 h per day. Expected annual productivity was calculated by multiplying expected daily productivity by 240 working days in a year.

2.2.2. Productivity loss due to premature death

For every death in the mortality data, we estimated the productivity loss as the sum of future expected productivities obtained from ENOE from age at death until life expectancy. We performed this method for all registered deaths and summed the lost productivities for deaths caused by diabetes, cardiovascular diseases, and cancers. To estimate the present value of future monetary figures, we discounted these expected productivities at a 3% annual rate. To estimate the productivity loss attributable to SSB consumption by premature death (P_d), we calculated the sum of lost productivity for each cause of death multiplied by the corresponding PAF of SSB for that disease, using the PAFs estimated by Singh et al. (Eq. 1).

Productivity loss attributable to SSB consumption by premature death:

$$P_d = PAF_j \left(\sum_{i=1}^{n} \sum_{t}^{LE} \frac{Y_{age}}{(1-r)^{LE-t}} \right) \tag{1}$$

where: j = diabetes, CVD, cancers; $n = 1, …,$ death cases, LE = life expectancy = 76 years, Y_{age} = annual expected productivity at a

Table 1
Parameters used for the estimation of productivity loss in Mexico in 2014.

	Disease		
	Diabetes	Cardiovascular diseases	Cancers
ICD codes	E10-E11	I20-I25, I63, I65-I67, I69.3, I11.	C50, C54-C55, C15, C25, C18-C21, C64, C23
Number of deaths (Instituto Nacional de Estadística y Geografía, 2017)	66,387	47,156	16,075
Outpatients visits (Secretaría de Salud, 2017b)	8,760,241	Not available	Not available
Hospitalization days (Secretaría de Salud, 2017a)	737,506	487,957	235,911
Total annual income for work (millions of USD), population aged 20–76 years (Instituto Nacional de Estadística y Geografía, 2017b)	329,015		
Prevalence or incidence	*	53.85/100000 (Dirección General de Epidemiología, 2017)	430.2/100000 (Dirección General de Epidemiología, 2017)
Mortality PAF related to SSB (Singh et al., 2015)	0.197	0.024	0.014
Morbidity PAF related to SSB (Singh et al., 2015)	0.158	0.023	0.003
Presenteeism adjusting factor (Goetzel et al., 2004)	0.114	0.068	0.085

* Estimated and modelled by age using the National Health and Nutrition Survey 2012 (Secretaría de Salud, 2017b).