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Economic Costs Analysis of the Avoidable Mortality in Colombia 1998–2011

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ABSTRACT

Objective: To estimate the economic costs of avoidable mortality (AM) in Colombia during the period 1998 to 2011, with the human capital perspective valuing the productivity lost. **Methods:** The information of cases of avoidable death was identified from the Colombian official general mortality database, and we estimated the potential productivity years of life lost, assuming a productive life span between 18 years and 57 years and 18 years and 62 years in women and men, respectively. Two scenarios were built: lower loss with the minimum wage, and higher loss with the per capita gross domestic product. Total costs for the period were reported by sex and health event. Average cost per 1000 people was also estimated. All costs were adjusted and reported in 2012 US dollars. **Results:** Sixty-eight percent of the total AM in Colombia during the period 1998 to 2011 occurred during or before the productivity age. The total AM costs were estimated to range between US $80.5 million and US $150.4 million. Higher costs of AM were incurred in men. Events from the injuries group caused the higher productivity lost. **Conclusions:** All the avoidable deaths in Colombia have a huge economic impact from the productivity lost perspective, equivalent to between 1.6% and 3.0% of the annual gross domestic product. The cost analyses in public health are an additional input for decision making and prioritization of intervention.

Keywords: Colombia, cost and cost-analysis, cost of illness, human capital approach, mortality.

Introduction

Traditional indicators to measure population health changes include general and infant mortality and life expectancy. However, not all deaths occur according to the health expectancy [1]. Premature mortality analysis helps in establishing public health priorities [2] and in evaluating the economic consequences in addition to the burden of disease [3].

The concept of avoidable mortality (AM) was initially introduced by Rutstein et al. [4] in the mid-1970s, referring to events that should not occur in the presence of timely and effective health care. AM has been considered an indicator of the impact of public health interventions [5]. AM not only considers the life expectancy but also includes a judgment over events that potentially should not occur if there is health promotion and prevention and proper treatment, and public policies are implemented [6]. Several lists of preventable or amenable causes of death (CoD) have been published, each of them based on a different conceptualization of AM [4,7,8].

It is possible to economically value the impact of mortality in a population through the potential productivity years of life lost (PPYLL), which evaluate the loss to a society in terms of its individuals' productive capacity in relation to the working-age population, considering the wages unearned because of the premature death [9]. There are two methods to estimate productivity costs: the human capital approach and the friction costs method [10–13]. The human capital approach is a traditional approach for measuring and valuating production that is lost because of temporary work absences, reduced productivity at work, and permanent work absence from morbidity or premature mortality. It assumes no unemployment and captures all lost productivity due to disease mortality by assuming that individuals who died prematurely would have worked full time until the end of their working lives [12,14]. In contrast, the friction costs method captures the lost productivity only until a worker would likely be replaced by someone [14]. We chose the human capital approach, which is usually used to evaluate costs of illness [12,14–16].

Internationally, there are studies that estimate productivity losses due to premature mortality [14,16–18] but not the cost of AM. In Colombia, some mortality costs analysis had been carried out on a subnational scale [9,19,20]; however, there has been no national analysis estimating the costs of AM. The objective of the present analysis was to estimate using the human capital approach the economic costs of avoidable deaths that occurred in Colombia during the period 1998 to 2011.

Conflict of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

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Methods

A cost-analysis of AM in Colombia was carried out. For the classification of AM, the list of *International Classification of Disease, Tenth Revision* causes defined in the report of the Colombian National Health Observatory [6] was used. Concepts and lists of AM published between 1978 and 2010 were taken into account to construct the Colombian list [6], including international [7,8] and Latin American lists [21–23]. To account for the fact that the effectiveness of (primary and secondary) prevention and treatment of illnesses substantially decreases after a particular age, deaths only before a specified age (75 years) [24] were considered avoidable.

The mortality database for the period 1998 to 2011 was provided by the Colombian National Institute of Statistics (*Departamento Nacional de Estadísticas*). We selected the avoidable death cases according to the *International Classification of Disease, Tenth Revision* code for the basic CoD that occurred before the age of retirement (57 years in women and 62 years in men) [25,26]. For each avoidable death, the total PPYLLs were estimated. Deaths that occurred between ages 0 and 17 years were economically valued as equal to those that occurred in age 18 years.

$$PPYLL_i = \begin{pmatrix} a_r - 18, \text{ if } a_d \leq 18 \\ a_r - a_d, \text{ if } a_d > 18 \end{pmatrix}$$

where $PPYLL_i$ is potential productivity years of life lost for individual i, a_r is the age of retirement, and a_d is the age of death.

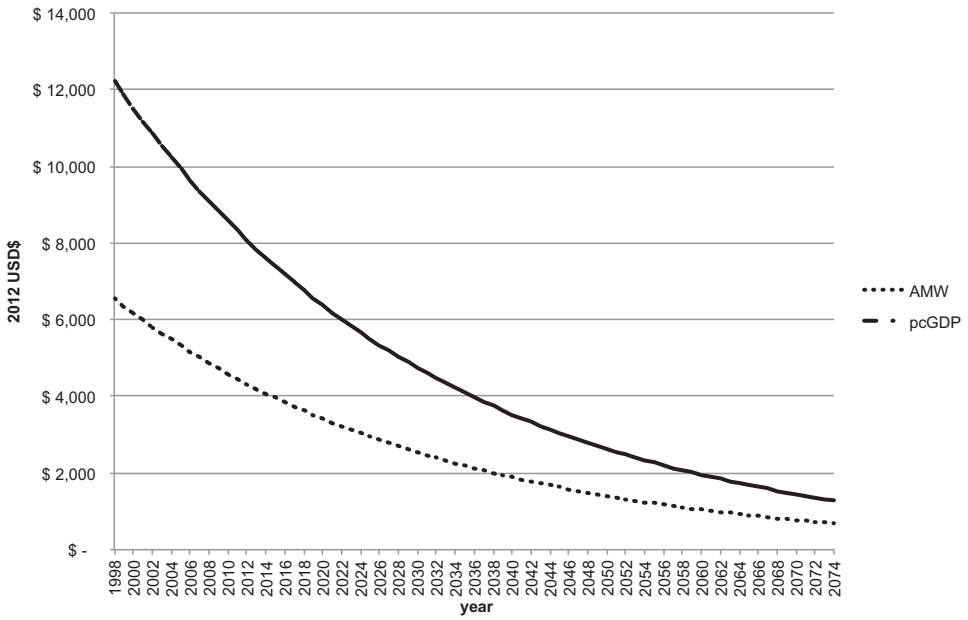
The PPYLLs were multiplied by their cost in 2012 US dollars. Two scenarios were considered: the best-case scenario (lower loss) with a cost per PPYLL equivalent to the 2012 annual minimum wage (US $4326.6) [27] and the worst-case scenario (higher loss) with a cost per PPYLL equivalent to the 2012 per capita gross domestic product (GDP) (US $8080.3) [28], an indicator of the average productivity in Colombia.

$$C_{PPYLLi} = \sum_{a_d}^{a_r} C_{YPLLij}$$

where C_{PPYLLi} is the cost of the total PPYLL for individual i, a_d is the age of death, a_r is the age of retirement, and $C_{PPYLLij}$ is the cost of the PPYLL for individual i in year j.

All costs were reported in 2012 US dollars (US $1 = 1768.23 Colombia pesos [COP]) [29]. The choice of the appropriate discount rate in analyses of productivity costs is controversial and can be varied [14]. An annual discount rate of 3% was used to adjust the costs of all periods. This choice was made considering the fact that in the particular case of economic evaluations of health technologies in Colombia, most studies use a discount rate of 3% [30], similar to the rate in the international literature [31]. We conducted a sensitivity analysis using discount rates of 0% and 5% to include the uncertainty in our estimations. Fig. 1 reports annual salaries applied according to the year of loss. A half-cycle adjustment was implemented to avoid overestimation of the economic loss, assuming that all deaths occur on June 30 each year.

Classification of events in three main groups—communicable, maternal, neonatal, and nutritional disorders; noncommunicable diseases; and injuries—was performed according to the 2010 Global Burden of Disease analysis from the Institute for Health Metrics and Measurement at the University of Washington [32]. The classification also includes 21 groups and 236 individual events. For the present analysis, injuries of undetermined intention were included as an additional subgroup in the injuries group. The results were presented by year, sex, disease, and department (equivalent to states) of residence. Annual cost trends were assessed with a linear regression analysis, reporting the P value of the slope coefficient. All data were managed in Microsoft Excel 2013 (Microsoft) and Stata 12 (Stata Corporation, College Station, TX).



AMW: annual minimum wage
pcGDP: *per capita* Gross Domestic Product

Fig. 1 – Low and upper limits for annual salaries according to the year of loss in 2012 US dollars. AMW, annual minimum wage; pcGDP, per capita gross domestic product.