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LETTER TO THE EDITOR

Epidemiological transition in Venezuela: Relationships between infectious diarrheas, ischemic heart diseases and motor vehicles accidents mortalities and the Human Development Index (HDI) in Venezuela, 2005—2007

Socioeconomical approaches assessing quantitatively relationships between nations' development and diseases epidemiology are still limited [1,2] particularly in Latin America. In the case of the United Nations Development Programme's (UNDP) Human Development Index (HDI), few studies have explored its relationship and/or impact on the epidemiology of communicable and non-communicable diseases [3—6]. The HDI is the normalized measure of life expectancy (LEI), literacy, education (EI), standard of living, and gross domestic product per capita (GDP index) for countries worldwide. This index is included in the Human Development Report (HDR), which is annually published by the UNDP using data of the 2 years before the date of the report (e.g. HDR of 2009 used data of year 2007). It is a standard means of measuring well-being. It is used to determine and indicate whether a country is a developed, developing, or underdeveloped and also to measure the impact of economical, social and policies on quality of life [7,8].

This study describes relationships between the HDI and its components and the mortality due to infectious diarrheas (ID), ischemic heart diseases (IHD) and motor vehicles accidents (MVA) in all the Bolivarian Republic of Venezuela federal entities, which includes 23 states and a Capital District, during 2005—2007 as a reflect of the country's epidemiological transition. Socioeconomical data was obtained from the National Institute of Statistics, including the HDI and its components for each year studied; and the epidemiological data (mean rates) from the Ministry of Health, both from Venezuela. The general formula of the HDI is: Index = (LEI + EI + GDP index)/3 [8]. For the analysis, regression models were done using GraphPad Prism®, at 95% confidence level.

The HDI varied in the states from 0.711 to 0.866 (an HDI $\geq$ 0.800 is high development, HDI 0.500—0.799 is medium development and HDI < 0.500 is low development) [8]. ID mortality ranged from 1.55 to 49.62 deaths/100,000pop; IHD mortality from 14.77 to 97.78 deaths/100,000pop; and MVA mortality from 12.63 to 47.05 deaths/100,000pop. Linear regression models evidenced that the relationship between different causes of mortality and HDI was negative for ID, positive for IHD and neutral for MVA. Those states with higher HDI and its components had lower ID mortality rates (r^2 = 0.2341; p < 0.0001; Fig. 1A) and higher IHD mortality rates (r^2 = 0.1853; p = 0.0001; Fig. 1B). In the case of MVA there was no significant variation regarding the HDI and its components (r^2 = 0.01624; p = 0.2758; Fig. 1C).

These preliminary results reflect significant influences of a socioeconomical indicator of development, such as the HDI, on the ID and IHD mortality rates in Venezuela, with different patterns, compatible with the epidemiological transition in the country. Better socioeconomical conditions, reflected in the HDI and its components, result in lower mortality rates from ID but higher rates from IHD. However, in further studies, extended in time, components of the HDI should be also included and presented in order to have a better understanding of these relationships between socioeconomical conditions and diseases epidemiology in the country. A developing country such as Venezuela (HDI of 0.844, HDR 2009) [8] shows mixed patterns of disease with a significant prevalence of chronic-non-transmissible conditions predominantly in north coastal urban regions, and
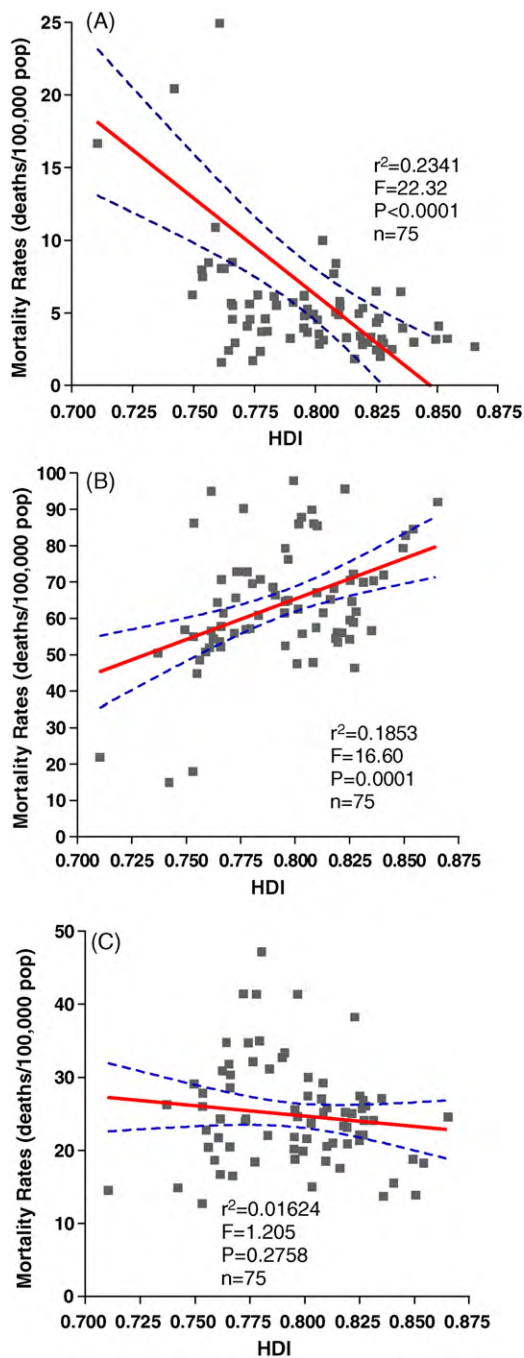
Fig. 1 Relations between the Human Development Index (HDI) and the mortality rates in Venezuela, 2005—2007. (A) Linear regression between infectious diarrhea mortality rates and HDI. (B) Linear regression between ischemic heart diseases mortality rates and HDI. (C) Linear regression between motor vehicles accidents mortality rates and HDI, 2005—2007. Central red line represents the regression slope and the dotted blue lines the 95% confidence interval. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)

conversely, a significant prevalence of infectious-transmissible diseases predominantly in southern rural areas [9,10].

Conflicts of interest

The authors have no conflict of interest to disclose.

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