

# Trends in infant mortality in Venezuela between 1985 and 2016: a systematic analysis of demographic data

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## Summary

**Background** Between the 1950s and 2000, Venezuela showed one of the most substantial improvements in infant mortality rates in Latin America. However, the recent economic crisis alongside an increase in infectious and parasitic diseases might be reversing previous patterns. Because no official updated mortality statistics have been published since 2013, the effect of these recent events has been difficult to assess accurately. We therefore aimed to estimate infant mortality rate trends and report the effect of the crisis.

**Methods** We estimated infant mortality rates using direct methods (ie, death counts from Venezuelan Ministry of Health via yearbooks and notifiable diseases bulletins, and birth records published by the UN Economic Commission for Latin America and the Caribbean and the Venezuelan National Institute of Statistics) and indirect methods (using census data and a Living Conditions Survey ENCOVI 2016). We shaped yearly estimations using a semiparametric regression model, specifically a P-Spline model with a cubic thin plate base. The primary objective was to estimate infant mortality rate trends from 1985 to 2016.

**Findings** Around 2009, the long-term decline in infant mortality rate stopped, and a new pattern of increase was observed. The infant mortality rate reached 21·1 deaths per 1000 livebirths (90% CI –17·8 to 24·3) in 2016, almost 1·4 times the rate of 2008 (15·0, –14·0 to 16·1). This increase represents a huge setback on previous achievements in reducing infant mortality.

**Interpretation** Our conservative estimation indicates that Venezuela is in the throes of a humanitarian crisis. The increase in infant mortality rate in 2016 compared with 2008 takes the country back to the level observed at the end of the 1990s, wiping out 18 years of expected progress, and leaves the Venezuelan Government far from achieving the target of nine deaths per 1000 livebirths stated in the UN Millennium Development Goals.

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## Introduction

Accelerated economic and social transformations led to improved living standards in Venezuela during the second half of the 20th century.<sup>1</sup> An increase in life expectancy mostly driven by a reduction of infant mortality—from 108·0 per 1000 livebirths in 1950 to 18·2 in 2000—was observed during this period.<sup>2</sup> As in most Latin American countries, this progress was linked to macroeconomic development, notably sanitary controls, mass vaccination campaigns, elimination of disease vectors, and antibiotic distribution.<sup>3</sup> Initial improvements were attributable to a reduction of infectious and parasitic diseases such as gastroenteritis, malaria, and tuberculosis.<sup>1</sup>

Recent socioeconomic and political events have led to a collapse in living standards, along with a breakdown of the health system.<sup>4</sup> Gross domestic product per capita decreased by almost 30% in 2016 and 14% in 2017.<sup>5</sup> Cumulative inflation reached 254·4% in 2016 and 1087·5% in 2017, and the national budget deficit was more than 13%.<sup>5</sup> At the individual level, the 2014 consumer survey report signalled declining consumption of foods providing essential micronutrients, such as

milk (–45%) and beef (–12%), compared with previous years.<sup>6</sup> In 2017, 61·2% of the population was in extreme poverty;<sup>7</sup> 89·4% of households reported not having enough money to buy food and 61·9% of the adult population had gone to bed hungry at least once during the past 3 months.<sup>8</sup>

In parallel, funding for the Venezuelan health system has been substantially reduced since 2007.<sup>9</sup> Patient-to-doctor ratios have decreased from 1·7 to 1·2 per 1000,<sup>10</sup> and hospital bed ratios (hospital bed per population) have fallen from 1·3 to 0·73 per 1000.<sup>11</sup> Vaccination campaigns have ceased in many parts of the country. Between 2007 and 2009, for example, the Venezuelan Ministry of Health did not provide vaccines against polio; diphtheria, tetanus, pertussis, hepatitis B, and *Haemophilus influenzae* type b; to children younger than 5 years, and did not vaccinate nearly 20% of children in 2010.<sup>12</sup> In addition, shortages of basic medicines, surgical supplies, and infant formula have increased health-care costs,<sup>13</sup> making it unaffordable for most of the population. Contrary to official governmental rhetoric, public health spending has never exceeded individual spending since 1990, and household

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