

Covid-19 mortality in children and adolescents in Mexico

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Stern D, Arias-de la Garza E, García-Romero MT, Lajous M. Covid-19 mortality in children and adolescents in Mexico. *Salud Publica Mex.* 2022;64:328-332. <https://doi.org/10.21149/13211>

Stern D, Arias-de la Garza E, García-Romero MT, Lajous M. Mortalidad por Covid-19 en niños y adolescentes en México. *Salud Publica Mex.* 2022;64:328-332. <https://doi.org/10.21149/13211>

Abstract

Objective. To estimate Covid-19 and pre-pandemic low respiratory infection (LRI) mortality in children and adolescents in Mexico. **Materials and methods.** We estimated the percentage of total mortality attributable to Covid-19 (95% confidence intervals; 95%CI) and made the corresponding estimates for pre-pandemic LRI mortality. **Results.** In 2019, LRIs represented 8.6% (95%CI 8.3, 8.9) of deaths in children aged 0-9 years, and 2.0% (95%CI 1.8, 2.3) in those aged 10-19 years. In 2020, the corresponding estimates for Covid-19 were 4.4% (95%CI 4.1, 4.6) and 3.7% (95%CI 3.4, 4.1). **Conclusions.** Relative to LRI, Covid-19 may be exerting a considerable mortality burden, particularly in older children and adolescents.

Keywords: mortality; SARS-CoV-2; children; adolescents; Mexico

Resumen

Objetivo. Estimar la mortalidad por Covid-19 e infección respiratoria baja (IRB) pre-pandémica en niños y adolescentes en México. **Material y métodos.** Se estimó el porcentaje de mortalidad atribuible a Covid-19 (intervalos de confianza 95%; IC95%) y se realizaron las estimaciones correspondientes para IRB pre-pandémica. **Resultados.** En 2019, las IRB representaron 8.6% (IC95% 8.3, 8.9) de las muertes en niños de 0-9 años y 2.0% (IC95% 1.8, 2.3) en aquellos entre 10-19 años. Los valores correspondientes en 2020 para Covid-19 fueron 4.4% (IC95% 4.1, 4.6) y 3.7% (IC95% 3.4, 4.1). **Conclusiones.** En comparación con IRB, Covid-19 puede estar ejerciendo una carga de mortalidad considerable, particularmente en niños mayores y adolescentes.

Palabras clave: mortalidad; SARS-CoV-2; niños; adolescentes; México

In high-income countries (HIC), Covid-19 deaths are uncommon among children and adolescents.¹ However, in low- and middle-income countries, pediatric care may be less resilient to the challenges faced by the pandemic.² In Mexico, even while adolescents may have been important for SARS-CoV-2 transmission,³ the

observed number of deaths in persons aged ≤ 20 years remains lower than expected.⁴ Also, while Covid-19 may be within the first ten causes of death in this age group, in 2020 deaths due to perinatal and congenital conditions, malignancies, and injuries exerted a higher burden.⁵ As school activities resume and vaccination

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Received on: September 1, 2021 • Accepted on: December 17, 2021 • Published online: June 2, 2022

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efforts advance, understanding the patterns of mortality within this age group before and during the pandemic may provide an important context to parents, clinicians, and decision makers. We estimated Covid-19 mortality in children and adolescents in Mexico and prepandemic lower respiratory infection (LRI) for comparison.

Materials and methods

We obtained death certificate-based all-cause and Covid-19 mortality for people aged <1, 1-4, 5-9, 10-14, and 15-19 years in Mexico between January 1st, 2020 and July 10th, 2021.⁶ We used epidemiologic surveillance data for PCR- or antigen-confirmed SARS-CoV-2 deaths (March 1st, 2020-July 10th, 2021).⁷ We estimated age-specific cumulative all-cause, Covid-19, and lab-confirmed Covid-19 deaths per 100 000 for 2020 and for January 1st 2021-July 10th 2021, using mid-year population estimates.⁸ We calculated the percentage of the total mortality attributable to Covid-19 and 95% confidence intervals (95%CI; shown in Supplementary tables I and II).⁹ For comparison, Global Burden of Disease 2019 all-cause and LRI deaths were used to calculate the corresponding 2019 LRI estimates.¹⁰ We estimated the seven-day rolling average cumulative Covid-19 mortality by age group using the death certificate-based all-cause and Covid-19 mortality database. All analyses were conducted in Stata 14.

Results

Relative to 2019, 2020 all-cause deaths of children and adolescents were lower (37 279 vs. 44 439) and the distribution across age groups changed (e.g., % all deaths in <1 year: 56.8% in 2019 and 47.0% in 2020; table I). In 2019, LRI represented 8.6% (95%CI 8.3, 8.9) of deaths in children aged 0-9 years and 2.0% (95%CI 1.8, 2.3) in those aged 10-19 years. In 2020, 4.4% (95%CI 4.1, 4.6) of deaths in children 0-9 years were attributable to Covid-19. In the 10-19-year group, the corresponding estimate was 3.7% (95%CI 3.4, 4.1). Adolescents aged 15-19 years appear to be driving the mortality rate in this group; however, the proportion of deaths attributable to Covid-19 in different age groups is similar (10-14 years 4.0%, 15-17 years 3.6%, 15-19 years 3.7%, 18-19 years 3.7%, and 12-17 years 3.7%). Compared to 2020, between January 1st and July 10th 2021, we observed a lower proportion of deaths attributable to Covid-19 (2.1; 95%CI 1.7, 2.4) in children <1 year. For those aged 10-19 years, the corresponding estimate remained at 3.6% (95%CI 3.4, 4.1).

Lab-confirmed Covid-19 deaths were lower for all age groups. In children 0-9 years, 302 Covid-19 deaths (1.2% of all deaths; 95%CI 1.1, 1.4) were lab-confirmed,

and in the 10-19 year age-group 226 deaths were recorded (1.8% of all deaths; 95%CI 1.6, 2.0). There was an overall increase between 2020 and 2021 in lab-confirmed relative to Covid-19-certificate attributed deaths (34.0 to 39.0%). While in the <1-year age group, this proportion increased (17.4% in 2020 vs 30.5% in 2021), in those aged 15-19 years this proportion decreased from 47.2 to 12.6%.

Between January 1st 2020 and July 10th 2021, the largest increase in cumulative Covid-19 mortality was observed in children <1 year and in those aged 15-19 years (figure 1). At the first pandemic peak (July 2020), adult cumulative mortality was 57 versus 23 per 100 000 in children <1 year and 1.1 per 100 000 in those aged 15-19 years. By the second peak (January 2021), the corresponding estimates were 194 per 100 000 for adults, 41 per 100 000 for children <1 year, and 3.3 per 100 000 for adolescents aged 15-19 years.

Discussion

The mortality burden of Covid-19 among those aged 10-19 years was higher than that of LRI before the pandemic. Yet, for younger children, Covid-19 mortality was lower than for pre-pandemic LRI.

Relative to HIC, Mexico's Covid-19 mortality burden in people aged <20 years appears to be higher. In the United Kingdom by early 2021, Covid-19 mortality was 0.1 and 0.3 per 100 000 in children and adolescents aged 0-9 years and 10-19 years, respectively.¹ Based on death certificates, the corresponding estimates for Mexico were 5.0 and 2.1 per 100 000. Lab-confirmed Covid-19 mortality rates provided a lower bound of the mortality rate (1.4 and 1.0 per 100 000 for ages 0-9 and 10-19, respectively). Also, the proportion of deaths attributable to Covid-19 in 2020 was higher than in HIC¹ and was almost two times of what was observed for LRI prior to the pandemic in those aged 10-19 years (3.7 vs. 2.0% of all-cause deaths). Among children 0-9 years, 4.4% of all-cause deaths were attributable to Covid-19 (vs. 8.7% for LRIs).

LRI mortality in people <20 years is uncommon in HIC (2% of total deaths).¹⁰ Mexico still lags behind other middle-income countries like Argentina (5%) and Chile (3%). Mexico's LRI mortality in people <20 years (7%) may reflect poor healthcare access and substandard quality of care. Thus, Covid-19 mortality in adolescents may echo health system challenges to provide adequate care for LRI in this age group. However, relative to adults and other causes, Covid-19 mortality in children and adolescents in Mexico has remained low.

Our findings may be limited by our reliance on error-prone death certificates. For Covid-19 the magnitude of the error is possibly higher than for LRI, could

Table 1
AGE-SPECIFIC DATA FOR MEXICO SHOWING ALL-CAUSE AND LRI MORTALITY FOR 2019 AND ALL-CAUSE AND COVID-19 MORTALITY FOR 2020 AND THE FIRST HALF OF 2021. MEXICO CITY, AUGUST 2021

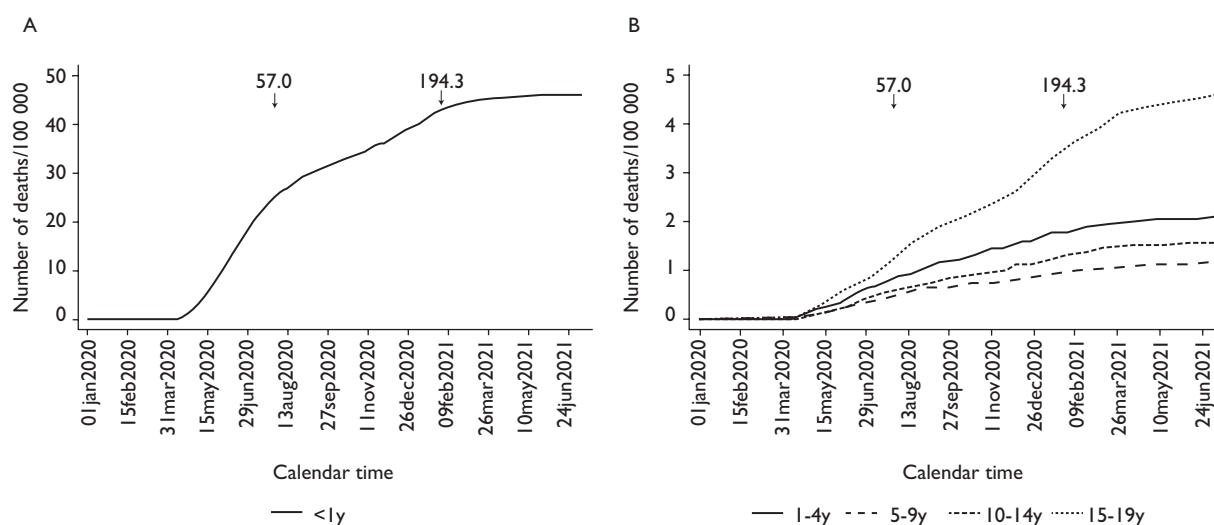
		All-cause deaths*			LRI deaths*			LRI % all deaths		
		n	per 100 000	%	n	per 100 000				
2019										
	<1 y	25 221	1 171.6	56.8	2 193	101.9			8.7	
	1-4 y	5 112	58.5	11.5	523	6.0			10.2	
0-9 y	5-9 y	2 542	23.0	5.7	114	1.0			4.5	
		32 876	149.7	74.0	2 831	12.9			8.6	
	10-14 y	3 260	29.2	7.3	98	0.9			3.0	
10-19 y	15-19 y	8 304	75.1	18.7	139	1.3			1.7	
		11 563	52.1	26.0	237	1.1			2.0	
		All-cause deaths‡			Covid-19 deaths‡		Covid-19 % deaths	Lab-confirmed deaths§		Lab-confirmed %
		n	per 100 000	%	n	per 100 000		n	per 100 000	
2020										
	<1 y	17 531	820.8	47.0	846	39.6	4.8	147	6.9	0.8
	1-4 y	4 524	52.1	12.1	146	1.7	3.2	109	1.3	2.4
0-9 y	5-9 y	2 708	24.5	7.3	95	0.9	3.5	46	0.4	1.7
		24 763	113.3	66.4	1 087	5.0	4.4	302	1.4	1.2
	10-14 y	3 244	29.2	8.7	129	1.2	4.0	66	0.6	2.0
10-19 y	15-19 y	9 272	83.7	24.9	339	3.1	3.7	160	1.4	1.7
		12 516	56.4	33.6	468	2.1	3.7	226	1.0	1.8
Jan 1st - July 10th 2021										
	<1 y	6 882	324.8	43.1	141	6.7	2.0	43	2.0	0.6
	1-4 y	1 885	21.9	11.8	35	0.4	1.9	55	0.6	2.9
0-9 y	5-9 y	1 144	10.4	7.2	34	0.3	3.0	26	0.2	2.3
		9 911	45.6	62.1	210	1.0	2.1	124	0.6	1.3
	10-14 y	1 547	14.0	9.7	44	0.4	2.8	21	0.2	1.4
10-19 y	15-19 y	4 493	40.6	28.2	174	1.6	3.9	22	0.2	0.5
		6 040	27.3	37.9	218	1.0	3.6	43	0.2	0.7

LRI: Low respiratory infections. Additional estimates and 95% confidence intervals can be found in supplementary tables 1 and 2.

* Data obtained from the Global Burden of Disease 2019

‡ Data for all-cause deaths obtained from the excess mortality dataset in Mexico. In these data, Covid-19 deaths were identified when Covid-19 or terms associated with this diagnosis were mentioned on the death certificate.

§ Data obtained from Sistema de Vigilancia Epidemiológica de Enfermedades Respiratorias with laboratory-confirmed Covid-19 (RT-PCR or antigen test)



A) <1 year; B) 1-4 years, 5-9 years, 10-14 years, and 15-19 years. Arrows denote the date of peak all-age reported mortality per day from Covid-19. The numbers above the arrows correspond to the cumulative mortality/100 000 people on the date of peak for all-age groups in Mexico.

FIGURE 1. TRENDS OF CHILD AND YOUNG PERSON MORTALITY FROM COVID-19 IN MEXICO BETWEEN JANUARY 1ST, 2020 AND JULY 10TH 2021. MEXICO CITY, AUGUST 2021

be age-dependent, and may have changed over time. In addition, our use of 2019 for comparison may seem arbitrary given yearly influenza epidemics. However, variation in LRI deaths was minimal in 2015-2019 in Mexico and the fraction of LRI mortality attributable to influenza in children is below 2%.¹¹ We could not rely on lab-confirmed Covid-19 because SARS-CoV-2 testing has been limited in Mexico, particularly for children and adolescents. However, we presented results on lab-confirmed Covid-19 as a lower bound for Covid-19 mortality estimates. Covid-19 deaths may include high-risk populations with co-morbidities (i.e., cancer), which could not be identified. The mortality rates for the first half of 2021 are not comparable with those for 2020. Also, estimates for the first half of 2021 may be less reliable because of the increasing importance of SARS-CoV-2 variants of concern, the seasonality of respiratory infections, and reported lag. Thus, future studies should monitor whether the proportion of Covid-19 mortality among children and adolescent changes as schools return to in-person learning.

Relative to pre-pandemic LRI deaths, Covid-19 may exert considerable mortality burden, particularly in older children and adolescents. Our conclusion differs from a previous assessment that limited the comparison to Covid-19 mortality in adults and focused on Mexico City only.¹² While most SARS-CoV-2 infections in children and adolescents will likely result in mild disease,¹³ community transmission will increase demand for spe-

cialized pediatric care. As vaccination efforts in adults advance in Mexico and information on the potential harms of vaccinating younger age groups emerge, policy makers should weigh the benefit of vaccinating older children and adolescents in a setting where pediatric care for LRI has been suboptimal and when Covid-19 has become a vaccine-preventable disease.

Declaration of conflict of interests. The authors declare that they have no conflict of interests.

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