

# Prevalence of Covid-19 sequelae in the National Health and Nutrition Survey 2020

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Vidaña-Pérez D, López-Olmedo N, González-Morales R, Shamah-Levy T, Barrientos-Gutiérrez T. Prevalence of Covid-19 sequelae in the National Health and Nutrition Survey 2020. *Salud Publica Mex.* 2021;63:799-802. <https://doi.org/10.21149/13269>

## Abstract

**Objective.** To estimate the prevalence of Covid-19 sequelae and its association with sociodemographic and medical care characteristics. **Materials and methods.** Mexican adults that experienced Covid-19 symptoms and were seropositive to the N-protein of Sars-CoV-2 in the Ensanut 2020 responded to a question regarding sequelae. Associations were estimated using Poisson regression. **Results.** The prevalence of sequelae was 15.7%, being higher for people with higher education and who were hospitalized or treated at an emergency room during the acute Covid-19 phase. **Conclusions.** Self-reported sequelae associated to Covid-19 was frequent. Covid-19 sequelae could represent an important challenge for the health system and the Mexican society.

Keywords: sequelae; Covid-19; national prevalence

Vidaña-Pérez D, López-Olmedo N, González-Morales R, Shamah-Levy T, Barrientos-Gutiérrez T. Secuelas de Covid-19: Encuesta Nacional de Salud y Nutrición 2020. *Salud Publica Mex.* 2021;63:799-802. <https://doi.org/10.21149/13269>

## Resumen

**Objetivo.** Estimar la prevalencia de secuelas para Covid-19 y su asociación con características sociodemográficas y de atención médica. **Material y métodos.** Adultos mexicanos que experimentaron síntomas de Covid-19 y fueron seropositivos a la proteína N del SARS-CoV-2 respondieron una pregunta sobre secuelas. Se estimaron las asociaciones mediante regresión Poisson. **Resultados.** La prevalencia de secuelas fue de 15.7%, siendo mayor en personas con alto nivel educativo y que recibieron atención hospitalaria o de urgencia durante la fase aguda de Covid-19. **Conclusiones.** El autorreporte de secuelas asociadas con Covid-19 fue frecuente. Las secuelas por Covid-19 podrían representar un reto importante para el sistema de salud y la sociedad mexicana.

Palabras clave: secuelas; Covid-19; prevalencia nacional

The pathogenesis and complications of Covid-19 have been extensively described.<sup>1,2</sup> Covid-19 long-term consequences or sequelae appear to be more frequent than for other respiratory infections;<sup>3</sup> however, there is scarce information regarding the population prevalence of sequelae.<sup>4</sup> Estimating the prevalence of Covid-19

sequelae could inform efforts to prepare the health system to treat affected people.<sup>5</sup> We aimed to estimate the prevalence of self-reported sequelae and to analyse its association with sociodemographic and hospitalization factors in Mexican adults that experienced Covid-19 symptoms and were seropositive to the N-protein of

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**Received on:** September 20, 2021 • **Accepted on:** September 23, 2021 • **Published online:** October 25, 2021  
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SARS-CoV-2 in the National Health and Nutrition Survey Covid-19 2020 (*Encuesta Nacional de Salud y Nutrición Covid-19 2020*, Ensanut Covid-19 2020).

## Materials and methods

### Study design

We retrieved information from the Ensanut Covid-19 2020 conducted from August to November 2020. Ensanut Covid-19 2020 is a representative survey at the national level, urban and rural areas, and nine regions of the country. A total of 10 216 households were included. As a first step, the head of the household responded to a family questionnaire, with sociodemographic and health-related information for all household members, including information regarding Covid-19 symptoms.<sup>6</sup> A total of 21 707 individuals were randomly selected to provide a blood sample, collecting 9 640 blood samples to assess seroprevalence, for a 51% response rate. Details of the design and procedures for Ensanut Covid-19 2020 are available elsewhere.<sup>7</sup>

For this analysis we selected all household members aged 20 years and older, who experienced at least one major and one minor Covid-19-related symptom (symptom list in supplementary appendix 1),<sup>6</sup> to comply with the case definition provided by the Ministry of Health,<sup>8</sup> and who were seropositive to immunoglobulin G against nucleocapsid protein (N protein) using the Roche Elecsys Anti-SARS-CoV-2 pan-immunoglobulin immunoassay test. The analytical sample included 677 participants, which expand to 1 372 203 people in the Mexican population.

### Sequelae

The presence of sequelae was reported by the head of the household through the question: "What is the current health status of [name]?" which was asked for all members of the households. The answer "recovered but has sequelae" accounted for the presence of sequelae. Other answer options included: completely recovered, still recovering at home, died, other and unknown/did not answer.

### Sociodemographic and medical attention factors

The sociodemographic factors included in this study were: sex (men/women), age (20-39,40-59, or 60 or older), urbanization (size of the area of residence, 2 500, 2 500-100 000, or  $\geq$ 100 000 inhabitants), education (primary or less, secondary, high school or university or higher), and

medical services received during the acute symptomatic phase (outpatient, inpatient or emergency room).

### Analysis

We examined the distribution of sociodemographic and medical services received by the presence of sequelae. Then, we estimated a Poisson regression model for the association of these characteristics and the report of sequelae. All analyses were performed in Stata 14,<sup>\*</sup> considering the survey design and sampling weights.

**Table I**  
**PREVALENCE OF SEQUELAE IN SEROPOSITIVE MEXICAN ADULTS (20 YEARS AND OLDER) THAT WERE SYMPTOMATIC DURING THE ACUTE PHASE OF COVID-19. ENSANUT COVID-19 2020**

	N	%	CI95%
Sequelae	3.74	15.8	12.7,19.4
Sex			
Male	1.33	13.4	8.9,17.9
Female	2.41	17.5	13.2,21.8
Age (years)			
20-39	1.73	16.9	12.4,21.6
40-59	1.37	13.6	9.2,18.0
60 +	0.64	18.5	9.9,26.9
Urbanization (population)			
<2 500 inhabitants	0.53	11.9	6.6,17.3
2 500-100 000 inhabitants	0.89	11.5	7.4,15.5
>100 000 inhabitants	2.32	20.1	14.5,25.7
Education			
Primary or less	0.62	11.3	6.6,16.1
Secondary	1.03	16.0	9.7,22.3
High school	0.71	13.1	7.9,18.3
University or higher	1.38	21.5	13.7,29.3
Treatment during acute Covid-19 period			
Did not seek medical attention	0.80	10.1	5.3,14.8
Outpatient treatment	2.29	16.4	12.0,20.6
Hospitalization/ER	0.65	36.3	21.6,50.9

N: expanded population in thousands.  
Study conducted in Mexico, August 2021.  
Ensanut: *Encuesta Nacional de Salud y Nutrición*.

\* StataCorp, Stata Statistical Software, Release 14, 2015

## Results

Table I presents the prevalence of sequelae by sociodemographic characteristics. From a total of 677 symptomatic and seropositive cases 15.8% experienced sequelae. A higher prevalence of sequelae was observed among women (17.5%) compared to men (13.4%), in people living in densely populated areas (20.1%), with a university degree (21.5%), and among those who required hospitalization (16.4%) or were treated at an emergency department (36.3%) during the acute phase of Covid-19.

Table II shows the results of the multivariable analysis for the association of sequelae and sociodemographic characteristics. The prevalence of sequelae was two times higher (PR 2.05; 95%CI: 1.09,3.80) among people with university education compared to people with elementary school, and 3.4 (PR 3.45; 95%CI: 1.84,6.47) times higher for people who were hospitalized or treated

**Table II**  
**SOCIODEMOGRAPHIC CHARACTERISTICS ASSOCIATED TO SEQUELAE IN SEROPOSITIVE MEXICAN ADULTS DURING THE ACUTE COVID-19 PHASE. ENSANUT COVID-19 2020**

	PR	CI95%	P-value
Sex			
Male		REF	
Female	1.48	0.99,2.22	0.057
Age (years)			
20-39		REF	
40-59	0.79	0.51,1.18	0.234
60 +	1.27	0.77,2.11	0.350
Urbanization (population)			
<2 500 inhabitants		REF	
2 500-100 000 inhabitants	0.91	0.51,1.62	0.750
>100 000 inhabitants	1.46	0.85,2.48	0.166
Education			
Primary or less		REF	
Secondary	1.53	0.84,2.79	0.179
High school	1.21	0.66,2.23	0.456
University or higher	2.05	1.09,3.80	0.024
Treatment during acute Covid-19 period			
Did not seek medical attention		REF	
Outpatient treatment	1.45	0.86,2.45	0.160
Hospitalization/Emergency room	3.45	1.84,6.47	<0.001

Study conducted in Mexico, August 2021.  
Ensanut: Encuesta Nacional de Salud y Nutrición.

at emergency rooms compared to positive cases that did not seek medical attention. No differences by age or urbanization were observed.

## Discussion

We found that 15.8% of the symptomatic and seropositive population in Mexico reported sequelae. This estimate is similar to the nationally representative UK COVID Symptom Study (13.7%),<sup>9</sup> and to a study conducted in three States of the US (14%).<sup>10</sup> A meta-analysis estimated that 80% of the Covid-19 patients developed sequelae, however studies were mostly conducted in clinical settings where severity is overrepresented.<sup>4</sup> We also found a higher report of sequelae in people with university education or higher compared to those with lower education levels. Prior studies have shown that people with higher income and education tend to be more aware of the disease,<sup>11</sup> which could lead to more frequent reporting of sequelae. We found a higher report of sequelae in people that were hospitalized or treated at the emergency room compared to those who did not seek medical attention. This has been previously reported, as the most severe cases have higher risk of sequelae and complications.<sup>12,13</sup>

Our study has some limitations. First, we cannot rule out information bias since the head of the household reported sequelae and symptoms for all family members; this was unavoidable as it was needed to reduce contact time with household members. We were not able to explore an association of sequelae and comorbidities, given large differences between the household-head report and directly assessed measurements, such as obesity (7% household-head, 36% anthropometry). Third, Ensanut Covid-19 2020 was planned early during the first Covid-19 wave in Mexico, when potential sequelae were still unclear. Consequently, the question used to define sequelae was general, preventing us from understanding the type and duration of sequelae; this limits our ability to compare results to other studies and provide better guidance on the types of health services needed to attend sequelae. Despite limitations, the results provide a first although limited assessment of characteristics associated with Covid-19 sequelae in Mexico.

Our study suggests that the population will face a large burden of Covid-19 sequelae. This first approach provides insights that can be used to plan actions to prevent, treat and mitigate Covid-19 sequelae in the Mexican population. Comprehensive research of the type of sequelae will be necessary to understand the impact of this infection on the Mexican population.

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

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