Helga Vera von Bargen*, María Espinosa Serrano, Daniel Martin Navarrete, Paz Ahumada Droguett, Carolina Méndez Benavente, Mónica Flores Castillo, Natalia Ramírez González, Gabriela Ulloa Contador and Marcia López Aceiton

Analysis of prevalence and sociodemographic conditions among women in labor with and without COVID-19 in public hospitals in Chile

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Abstract

Objectives: The SARS-CoV-2 virus continues wreaking worldwide havoc on health and between March and August 2020, the first outbreak of COVID-19 hit Chile. The pregnant population is especially vulnerable to infection. Studies have been published that associate socioeconomic status, overcrowding, and poverty with a higher prevalence of SARS-CoV-2 infection. There are few studies about the development of this pandemic in Latin American countries so far. This study seeks to show the prevalence and sociodemographic and perinatal characteristics in pregnant women at the time of delivery, comparing both groups with positive and negative COVID-19 PCR results.

Methods: A prospective, cross-sectional study of pregnant women who delivered at the San Juan de Dios Hospital in Santiago between April 15, 2020 and June 15, 2020. Analysis of epidemiological, sociodemographic, obstetric, perinatal and sociodemographic data of patients with positive and negative COVID-19 PCR results.

Results: There were 701 patients included in the study. The prevalence of those with a positive COVID-19 PCR was 9.7% and 67.7% being asymptomatic. Pre-term delivery was significantly higher in the group of positive patients (23.5%) vs. negative patients (8.7%), which was not the same rate as with cesarean sections (C-sections). A 13.2% of patients required management of the pathology in the Critical Care Unit (CCU) and there were no cases of maternal or fetal deaths. We found no significant difference between both groups when analyzing socioeconomic variables, though we noted a trend of greater overcrowding among the group of patients with infection.

Conclusions: The majority of pregnant patients with SARS-CoV-2 infection are asymptomatic. COVID-19 increases the rate of premature births, but this rate is not same with C-sections. Sociodemographic conditions and overcrowding do not show a higher infection rate in a homogeneous population in relation to the economic, social and demographic level.

Keywords: COVID-19; overcrowding; poverty; pregnancy.

***Corresponding author: Helga Vera von Bargen,** Francisco Otta 8066 Peñalolen, Chile; and Maternal Fetal-Medicine, San Juan de Dios Hospital, Santiago, Chile, Phone: +56(9) 98016005, E-mail: helgaisabelv@gmail.com. https://orcid.org/0000-0002-3199-9932

María Espinosa Serrano, Gynecolgy and Obstetrics Physician, San Juan de Dios Hospital, Santiago, Chile; and Obstetrics and Gynecology Program Scholarship, San Juan de Dios Hospital, Universidad de Chile, Santiago, Chile

Daniel Martin Navarrete, Maternal Fetal-Medicine, San Juan de Dios Hospital, Santiago, Chile

Paz Ahumada Droguett, Maternal-Fetal Medicine, Clinic de Barcelona, Barcelona, Spain

Carolina Méndez Benavente, Neonatology Service, San Juan de Dios Hospital, Santiago, Chile

Mónica Flores Castillo, Urban Planning, Observatory of Cities, Universidad Católica OCUC, Santiago, Chile

Natalia Ramírez González and Gabriela Ulloa Contador, Geography, Observatory of Cities, Universidad Católica OCUC, Santiago, Chile

Marcia López Aceiton, Gynecology and Obstetrics Service, San Juan de Dios Hospital, Santiago, Chile

Introduction

The COVID-19 disease is caused by the SARS-CoV-2 virus, belonging to the Coronaviridae family, being initially reported in Wuhan, China, in December 2019 [1]. It is capable of causing an infection with a wide clinical spectrum, ranging from asymptomatic presentation up to severe acute respiratory syndrome, which can even lead to death [2]. SARS-CoV-2 is highly contagious, which is why the World Health Organization (WHO) has declared a state of pandemic, leading to confinement actions worldwide to control its spread.

The pregnant population is an especially vulnerable group to SARS-CoV-2 infection. Specific demographic factors have been identified that increase the risk of suffering a more severe evolution and requiring a CCU (Critical Care

Unit)/ICU (Intensive Care Unit). These factors include those between 35 and 44 years old and being hispanic [3, 4].

In the local reality, since the first case reported in Chile in March 2020, dissemination curves, similar to what occurs in other countries have been observed [5]. The incidence rate per 100,000 inhabitants increased exponentially from the beginning of May to June, with outstanding differences between the different neighborhoods of the Metropolitan Region. A New York study showed a higher level of transmission of SARS-VOC 2 in pregnant women who lived in sectors of lower socioeconomic income, in crowded conditions and with a greater number of people per household [3]. In Chile, 2020, a maximum of active cases was observed during the month of June, reaching 6,290 daily cases [5]. We are currently experiencing the most critical period of the pandemic, with more than 8,000 daily cases and approximately 100 daily deaths [6].

The Chilean health system is made up of a mixed care system made up of the public insurance called the National Health Fund (FONASA) and a private one, called Isapre. FONASA is divided into sections according to the contributor's gross income, and segments of free care in the public system (A and B) and others (C and D) differentiated according to income [7]. Santiago has 5,250,565 inhabitants and the highest population density in the country. According to the survey of data from the 2017 census, 80% of women belong to the public health system. The total population of women in the western area assigned to the hospital and registered in the FONASA system is 5,565,148 [8].

The San Juan de Dios Hospital (HSJD) is a public hospital of Santiago attending to 3,500 annual births. Since April 2020, due to the COVID-19 pandemic, Since April 2020, due to the COVID-19 pandemic, and by hospital rule, COVID-19 PCR tests were performed using nasopharyngeal or oropharyngeal swabs on all patients who were admitted for delivery – something unprecedented for the public system at that time.

The following study seeks to inform on the prevalence of SARS-CoV-2 infection in pregnant patients at the time of delivery and also makes a comparison between infected and seronegative patients admitted to the HSJD maternity, including demographic, epidemiological, socioeconomic, clinical, and maternal and perinatal outcomes.

Materials and methods

A prospective cross-sectional study carried out in a public hospital in the south-west area of Santiago, Chile.

The population of study consisted of women that gave birth (cesarean or vaginal), at the San Juan de Dios Hospital during the period of April 16 through July 15, 2020. This target group included patients who received a COVID-19 PCR test during delivery hospitalization. Pregnant women who had a delivery of less than 24 weeks gestation, fetuses who died *in utero* and patients who refused to sign the informed consent were excluded (Figure 1).

Epidemiological, demographic, social data, medical history, gynecology-obstetrics, habits and information about the delivery process were collected. The pregnant women who presented with COVID-19 were managed according to the current hospital protocol, including isolation and medical care according to clinical requirements in a critical patient ward or unit, depending on the severity of the clinical picture. In this group of patients, the symptoms, the types of treatments received, the weight and Apgar of the newborn, and the need for admission to the intensive care unit were tabulated.

The analysis of the socioeconomic conditions was carried out in conjunction with the team of the Observatory of Cities of the Catholic University of Chile, obtaining data at the level of the 2017 census zone according to the neighborhood of residence of the patients [9]. The Territorial Socio-Material Index (ISMT in Spanish) is a variable that integrates 2017 census data on educational levels, overcrowding, housing materiality, cohabitation of extended family members, generating a proxy for socioeconomic income [10]. Values range from 0 to 1, with 1 being the maximum score (household with the best socio-material conditions). The socioeconomic group classification (GSE) used is constructed from the ISMT, dividing the population into six sections (AB – C1 – C2 – C3 – D – E) based on percentiles of the distribution of households in Greater Santiago, according to the Association of Market and Public Opinion Researchers (AIM) for the year 2017 [11]. Group AB corresponds to households with a percentile from 0 to 3.1; C1 corresponds to 3.2–20.9 percentiles; C2 percentiles 21–35.6;

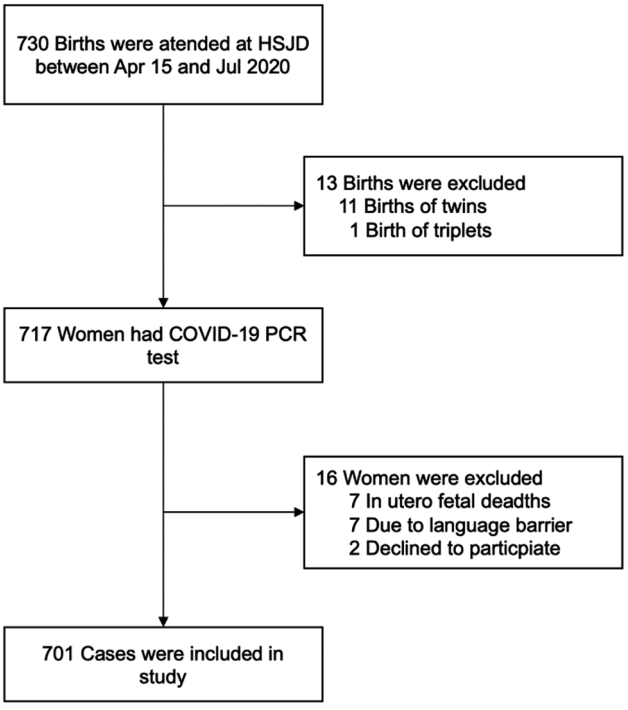

Figure 1: Study population.

C3 percentiles 35.7–63.1; D percentiles 63.2–92.8 and E with percentiles 98.3–100. The segregation index (entropy) indicates the heterogeneity of the socioeconomic groups in a neighborhood, grouped in three: High (AB + C1), Medium (C2 + C3) and Low (D + E) [11]. Values range from 0 to 1, with 0 being the minimum of diversity or entropy (maximum segregation) and 1 being the maximum of entropy (or minimum neighborhood segregation with a perfect mix of households from the different GSEs) [12, 13].

Statistical analysis

Descriptive data were presented as the mean (±SD) for continuous variables with normal distribution and as the median with interquartile range for data with non-normal distribution. The categorical variables were presented as quantities (percentages).

Two independent samples were analyzed via a Student's t-test. The χ^2 test was performed to compare the count data (The Yates correction for continuity test of proportions) and a two-tailed value of p=0.05 was considered statistically significant. All statistical analyses were performed with RStudio Team (2016). RStudio: Integrated development for R. RStudio, Inc., Boston, MA URL http://www.rstudio.com/.

Ethical considerations

This is an anonymous study in which the confidentiality of the data was ensured through encryption through a personalized alphanumeric password key. All patients participating in the study signed an informed consent, ensuring their approval of the use of their data. Underage patients, and the legal guardian of the hospitalization, were asked to sign the informed consent. The patients received standard clinical management according to their health status and relevant clinical condition at the time of care. All patients were informed of the results of their examinations. The study was approved by the ethics committee of the hospital and adheres to the Declaration of Helsinki [14].

Results

The study consisted of 701 patients, all of whom received a COVID-19 PCR test upon admission to the hospital. Of the total included patients, 90.3% (633) had a negative COVID-19 PCR result and 9.7% (68) a positive result. Of the seropositive patients, 67.6% (46) were asymptomatic and 32.4% (22) symptomatic (Figure 2).

Of the total patient population, the average age was 28, with no differences between the two groups. Regarding nationality, 78.3% (54) of the patients were Chilean. Haitians made up the main foreign nationality for both positive and negative COVID-19 PCR patients, 7% (44) and 10.3% (7) respectively. The study found 8.5–8.8% of the women were overweight (BMI>25) and 61.1–66.2% were obese (BMI>30), with no significant differences between patients with negative and positive COVID-19 PCR. There were 1.1% (8) patients, who were active smokers and 36.8% (255) quit smoking at the beginning of their pregnancy in the non Covid group; 10.2% had chronic pathologies and 27.1% obstetric pathologies (Table 1).

Table 1: Epidemiological variables of patients with negative and positive PCR results.

	Negative COVID-19 PCR n=633	Positive COVID-19 PCR n=68	p-Value
Age, years	28 (14–45)	28 (17–43)	NS
Chilean nationality	496 (78.3%)	50 (73.5%)	NS
BMI	32.3 (19–54.3)	32.7 (23.8–44.1)	
25–29.9	54 (8.5%)	6 (8.8%)	NS
30–34.9	195 (30.8%)	26 (38.2%)	NS
≥35	192 (30.3%)	19 (27.9%)	NS
Tobacco smokers			
Active	7 (1.1%)	1 (1.5%)	NS
Quit at start of pregnancy	233 (36.8%)	22 (32.4%)	NS
Chronic pathology	65 (10.2%)	6 (8.8%)	NS
Obstetric pathology	172 (27.1%)	14 (20.6%)	NS
Maternal death	0	0	–

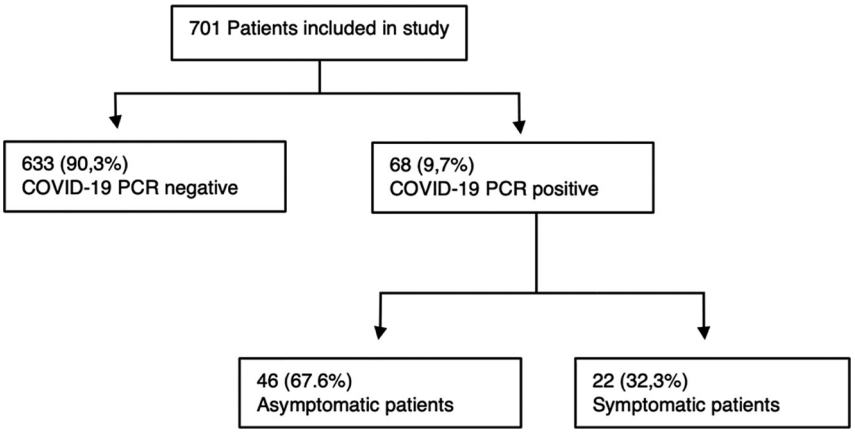

Figure 2: Patients according to PCR results and symptoms.

When analyzing the obstetric variables, a significant difference is observed in relation to preterm births. We found that 8.7% (55) of the patients with a negative COVID-19 PCR had a preterm delivery, vs. 23.5% (16) of the positive patients.

When subdividing between preterm labor greater and less than 34 weeks, the significant difference between both groups is maintained. Of the total patients, 33.3% (239) had a cesarean delivery, with no significant difference between women with negative and positive COVID-19 PCRs. Three (3) C-sections were for maternal decompensation due to COVID-19. Vaginal delivery occurred in 66.7% of negative patients and in 58.8% of positive patients. The weight of the newborn was also not significant between the groups (Table 2).

When analyzing the same obstetric variables of the patients with a positive COVID-19 PCR, comparing the group of asymptomatic patients with the symptomatic ones, no significant differences were observed in the different variables (Table 3).

Table 2: Obstetric variables of patients with negative and positive COVID-19 PCR.

	Negative COVID-19 PCR n=633	Positive COVID-19 PCR n=68	p-Value
Premature births	55 (8.68%)	16 (23.52%)	0.0002
34–<37 weeks	39 (6.16%)	10 (14.70%)	0.0175
<34 weeks	16 (2.52%)	6 (8.82%)	0.0137
Cesarean	211 (33.33%)	28 (41.17%)	0.2453
Elective	97 (15.33%)	16 (23.52%)	0.2054
Urgency	114 (18.00%)	9 (13.23%)	0.4146
Due to COVID-19	–	3 (4.41%)	–
Weights of newborns, g	3,350 (3,015–3,650)	3,163 (960–4,780)	0.0910
Fetal death	0	0	–

Table 3: Obstetric variables of patients with positive PCR results according to the presence or absence of symptoms.

	Asymptomatic patients n=46 (67%)	Symptomatic patients n=22 (33%)	p-Value
Premature births	8 (17.4%)	8 (36.4%)	NS
34–<37 weeks	5 (10.9%)	5 (22.7%)	NS
<34 weeks	3 (6.5%)	3 (13.6%)	NS
Cesarean	16 (34.8%)	12 (54.5%)	NS
Elective	9 (19.6%)	6 (27.3%)	NS
Urgency	6 (13.0%)	3 (13.6%)	NS
Due to COVID-19	1 (2.2%)	3 (13.6%)	NS
Weights of newborns, g	3,241 (960–4,870)	2,997 (1,075–3,860)	NS

We found 13.2% of patients with a positive COVID-19 PCR result required admission to the ICU (Table 4). Two (2) of these patients had twins and 77.8% (7) were obese. The percentage of preterm deliveries increased significantly in patients who required the ICU (from 13.6% to 88.9%). The cesarean section rate also had a significant increase, mainly due to emergency C-sections (33.9% in patients without an ICU requirement vs. 88.9% in those who did need it).

Evaluating the socioeconomic variables, 20 patients were excluded due to lack of data regarding their home residence. There were 613 patients included who had a negative COVID-19 PCR and 69 with a positive result (Table 5). There was no significant difference when analyzing the socioeconomic variables of patients with a positive or negative COVID-19 PCR result, highlighting that more than half of the population belongs to the socioeconomic group D and to FONASA A and B. Regarding overcrowding, there is no significant difference between the two groups either, but there is evidence of increased medium and critical overcrowding in patients with a positive COVID-19 PCR result.

Discussion

Pregnant women are especially susceptible to respiratory pathogens and severe pneumonia, due to physiological changes in the immune and cardiorespiratory systems.

Table 4: Epidemiological an obstetric variables of patients with positive COVID-19 PCR as required by the Critical Care Unit (CCU).

	Patients without CCU requirement n=59	Patient with CCU requirement n=9	p-Value
Age, years	28 (18–43)	30 (17–40)	NS
Chilean nationality	41 (69.5%)	7 (77.8%)	NS
BMI≥30	40 (67.8%)	7 (77.8%)	NS
Chronic pathology	8 (13.6%)	0 (0.0%)	NS
Obstetric pathology	15 (25.4%)	4 (44.4%)	NS
Premature births	8 (13.6%)	8 (88.9%)	<0.001
34–<37 weeks	4 (6.8%)	3 (33.3%)	NS
<34 weeks	4 (6.8%)	5 (55.6%)	<0.001
Cesarean	20 (33.9%)	8 (88.9%)	<0.001
Elective	12 (20.3%)	0 (0.0%)	–
Urgency	8 (13.6%)	4 (44.4%)	NS
Due to COVID-19	0 (0.0%)	4 (44.4%)	–

Table 5: Socioeconomic and overcrowding variables of patients with negative and positive COVID-19 PCR

	Negative COVID-19 PCR n=613	Positive COVID-19 PCR n=68	p-Value
FONASA A and B segment	443 (72.3%)	56 (82.4%)	NS
Predominant socioeconomic group	Group D 363 (59.2%)	Group D 38 (55.9%)	NS
Territorial Socio-Material Index	0.5 (0.4–0.8)	0.5 (0.4–0.7)	NS
Segregation Index	0.7 (0.6–0.9)	0.73 (0.6–0.9)	NS
Overcrowding Index	1.7 (0.3–6)	1.8 (0.5–5)	NS
Without overcrowding (<2.5)	542 (88.4%)	55 (80.9%)	NS
Medium overcrowding (2.5 a 4.9)	69 (11.3%)	12 (17.6%)	NS
Critical overcrowding (≥5)	2 (0.3%)	1 (1.5%)	NS
Number of persons per dwelling	4.4 (1–17)	4.4 (1–14)	NS
≥6 persons per dwelling	133 (21.7%)	18 (26.5%)	NS

FONASA, National Health Fund.

Elevation of the diaphragm, increased oxygen consumption, and edema of the respiratory mucosa increase the risk of hypoxia [2]. The 1918 influenza pandemic resulted in a mortality rate of 2.6% in the general population, as opposed to the rate in pregnant women, which was 37% [15]. Likewise, in 2009, during the H1N1 influenza pandemic, a higher hospital admission rate was registered in pregnant women than in the general population [16].

The prevalence of 9.71% of positive COVID-19 CRP in women at the time of delivery is similar to international publications [17, 18] and depends on the time of the pandemic in which the study is carried out. Publications have reported up to 87.9% of asymptomatic COVID-19 CRP patients [3]. The rate in our study was lower, at 67%. This figure is quite accurate since swabs were performed in all patients, reaffirming the importance of incorporating universal maternal screening as a strategy to reduce the risk of in-hospital infection.

Obesity is among the risk factors for suffering from COVID-19 and having severe disease [19, 20]. In our population there is no significant difference in relation to the *body mass index* between patients with negative and positive COVID-19 PCR, but it does stand out that 61.6% of the total population is obese, unlike the population described in the Dávila Clinic, in whose work only 13% of the patients have a BMI greater than or equal to 30(20). Other risk factors described are ethnicity and age. Knight et al., published that African-American and/or Hispanic patients and young patients suffered a higher prevalence of the disease [19]. We found no significant difference in relation to age, nationality or concomitant pathologies.

Multiple publications have shown that suffering from COVID-19 significantly increases preterm birth and the rate of C-sections [19, 21–23]. In our study population, preterm delivery was significantly higher in patients with positive COVID-19 PCR, but the rate for C-sections was not. At the beginning of the pandemic, Chen et al., published a 100% cesarean section rate in COVID-19 [24, 25] patients. The experience of managing COVID-19 in Europe and Asia showed that vaginal deliveries were possible in this group of patients [4, 26]. In our population, patients who had a more severe presentation of the pathology had a higher rate of C-sections and premature delivery than patients with asymptomatic presentation, in the context of maternal decompensation due to COVID-19. In addition, the admission rate to the ICU was 13.2%, higher than in the multicenter study of 7.1% (21), and at the San José hospital [27], similar to that of the Dávila clinic [20], which found only 14%. This may in part be due to different criteria and/or availability for ICU admission and to different prevalence of risk factors in the population, such as obesity.

There have been few published studies that relate poverty to the prevalence of SARS-CoV-2 [3, 28, 29]. In Chile, Telias et al., according to the analysis of the SARS-CoV-2 infection rate by sector and municipality of Santiago, published a positive and significant correlation between multidimensional poverty and overcrowding with the rate of infection and deaths from this cause [30]. The data analysis of our population did not show a significant association between the prevalence of a positive COVID-19 PCR and socioeconomic status or overcrowding. The analysis of the socioeconomic variables was carried out according to the neighborhood to which the pregnant patient belongs and does not necessarily correspond to her particular reality. Additionally, the population treated at the San Juan de Dios Hospital is homogeneous, so the socioeconomic indices are similar between neighborhoods. The overcrowding analysis obtained from the personal survey conducted at the time of admission shows us that the majority of patients live without overcrowding, but a trend towards greater overcrowding can be seen in patients with a positive COVID-19 PCR. In addition, it is important to highlight the high number of people who live per dwelling considering the socioeconomic group and the socio-material territorial index of these dwellings. It is noteworthy that 79.1% of the patients in our study have a monthly income of less than $326,500 (400 dollars per month), and therefore belong to the FONASA A or B segment.

Conclusions

The information obtained through this study is relevant because there are few studies that integrate this pathology with data about the socioeconomic conditions in patients. In this way, objective information is available on a particularly vulnerable population given its socioeconomic characteristics and the prevalence of risk factors, especially obesity and overcrowding. It is necessary to integrate different knowledge from different specialists to better identify the factors that influence the spread of this pathology. Also it is important to extend this research in neighborhoods with a higher socioeconomic stratum to compare the impact of the risk factors that are important. Only that way it will be possible to develop policies that better address and prevent the spread of SARS-CoV-2.

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References

1. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020;382:727–33.
2. Wastnedge EAN, Reynolds RM, van Boeckel SR, Stock SJ, Denison FC, Maybin JA, et al. Pregnancy and COVID-19. Physiol Rev 2021; 101:303–18.
3. Sutton D, Fuchs K, D'Alton M, Goffman D. Universal screening for SARS-CoV-2 in women admitted for delivery. N Engl J Med 2020; 28:2163–4.
4. Rasmussen SA, Smulian JC, Lednicky JA, Wen TS, Jamieson DJ. Coronavirus Disease 2019 (COVID-19) and pregnancy: what obstetricians need to know. Am J Obstet Gynecol 2020;222: 415–26.
5. Minsal; 2020. Available from: https://www.gob.cl/coronavirus/cifrasoficiales/.
6. Ministerio de Salud de Chile. Reporte coronavirus. Minsal [Internet] 2020:1–6. Available from: https://cdn.digital.gob.cl/public_files/Campañas/Corona-Virus/Reportes/12.04.2020_Reporte_Covid19.pdf.
7. Superintendencia de Salud Gobierno de Chile. ¿Cómo se clasifican los beneficiarios de Fonasa según su tramo? Avalaible from: https://www.supersalud.gob.cl/consultas/667/w3-article-6304.html.
8. Ministerio de Desarrollo Social. SALUD Síntesis de resultados CASEN 2017. Observatorio Social [Internet] 2018. Available from: http://observatorio.ministeriodesarrollosocial.gob.cl/casen-multidimensional/casen/casen_2017.php.
9. Instituo Nacional de Estadísticas Chile. Censos de Población y Vivienda; 2017. Available from: https://www.ine.cl/estadisticas/sociales/censos-de-poblacion-y-vivienda.
10. Chile Ideo de OCUC Ponitificia Universidad Católica de Chile. Facultad de Arquitectura y Urbanismo; 2020. Available from: https://ideocuc-ocuc.hub.arcgis.com/.
11. Asociación de Investigadores de Mercado y Opinión Pública de Chile. Clasificación grupos socioeconómicos y manual de aplicación. Actualización 2019; 2019. Available from: https://www.aimchile.cl/wp-content/uploads/2020/07/Actualización-y-Manual-GSE-AIM-2019-1.pdf.
12. Iceland J. The multigroup entropy index. In: Beyond black and white: residential segregation in multiethnic America, june science research; 2004, vol. 33:248–71 pp.
13. Mejia-Arbelaez C, Sarmiento OL, Mora Vega R, Flores Castillo M, Truffello R, Martínez L, et al. Social inclusion and physical activity in Ciclovía Recreativa programs in Latin America. Int J Environ Res Publ Health [Internet] 2021;18:655 [cited 2021 Nov 7].
14. Association WM. World medical association declaration of Helsinki ethical principles for medical research involving human subjects. J Am Med Assoc 2013;310:2191–4.
15. Gottfredsson M. The Spanish flu in Iceland 1918. Lessons in medicine and history. Laeknabladid 2008;94:737–45.
16. Schwartz DA, Graham AL. Potential maternal and infant outcomes from coronavirus 2019-NCOV (SARS-CoV-2) infecting pregnant women: lessons from SARS, MERS, and other human coronavirus infections. Viruses 2020;12:1–16.
17. Allotey J, Stallings E, Bonet M, Yap M, Chatterjee S, Kew T, et al. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. BMJ 2020;370. https://doi.org/10.1136/bmj.m3320. 32873575
18. di Toro F, Gjoka M, di Lorenzo G, de Santo D, de Seta F, Maso G, et al. Impact of COVID-19 on maternal and neonatal outcomes: a systematic review and meta-analysis. Clin Microbiol Infect 2021; 27:36–46.
19. Characteristics and outcomes of pregnant women admitted to hospital with confirmed SARS-CoV-2 infection in UK: national population based cohort study. BMJ 2020;369:m2107–9.
20. Díaz-Corvillón P, Mönckeberg M, Barros A, Illanes SE, Soldati A, Nien JK, et al. Routine screening for SARS CoV-2 in unselected pregnant women at delivery. PLoS One 2020;15. https://doi.org/10.1371/journal.pone.0239887. 32991621.
21. Hernández BO, Honorato SM, Silva GMC, Sepúlveda-Martínez Á, Fuenzalida CJ, Abarzúa CF, et al. COVID 19 y embarazo en Chile: informe preliminar del estudio multicéntrico GESTACOVID. Revista chilena de obstetricia y ginecología [Internet] 2020;85: S75–89 [cited 2021 Nov 7].

22. Gajbhiye RK, Modi DN, Mahale SD, Mahajan NN, Waghmare RB, Zala S, et al. PregCovid Registry Network. Clinical characteristics, outcomes, & mortality in pregnant women with COVID-19 in Maharashtra, India: results from PregCovid registry. Indian J Med Res 2021;153:629–36.
23. Ellington S, Strid P, Tong VT, Woodworth K, Galang RR, Zambrano LD, et al. Characteristics of women of Reproductive age with laboratory-confirmed SARS-CoV-2 infection by pregnancy status —United States, January 22–June 7, 2020. MMWR Morb Mortal Wkly Rep 2020;69:769–75.
24. Chen L, Li Q, Zheng D, Jiang H, Wei Y, Zou L, et al. Clinical characteristics of pregnant women with COVID-19 in Wuhan, China. N Engl J Med 2020;382. https://doi.org/10.1056/nejmc2009226. 32302077.
25. Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. Lancet [Internet] 2020;395:809–15.
26. Cai J, Tang M, Gao Y, Zhang H, Yang Y, Zhang D, et al. Cesarean section or vaginal delivery to prevent possible vertical transmission from a pregnant mother confirmed with COVID-19 to a neonate: a systematic review. Front Med 2021;8. https://doi.org/10.3389/fmed.2021.634949. 33681259.
27. Haye MT, Cartes G, Gutiérrez J, Ahumada P, Krause B, Merialdi M, et al. Maternal and perinatal outcomes in pregnant women with confirmed severe and mild COVID-19 at one large maternity hospital in Chile. J Matern Fetal Neonatal Med 2021;1–6. https://doi.org/10.1080/14767058.2021.1902498. 33792466.
28. Ramírez IJ, Lee J. COVID-19 emergence and social and health determinants in Colorado: a rapid spatial analysis. Available from: www.mdpi.com/journal/ijerph.
29. Martinez-Portilla RJ, Sotiriadis A, Chatzakis C, Torres-Torres J, Espino y Sosa S, Sandoval-Mandujano K, et al. Pregnant women with SARS-CoV-2 infection are at higher risk of death and pneumonia: propensity score matched analysis of a nationwide prospective cohort (COV19Mx). Ultrasound Obstet Gynecol 2021;57:224–31.
30. Telias Simunovic A, Figueroa Urquiza N. Hacinamiento: la variable clave en la propagación del COVID-19 en el Gran Santiago [Internet]. 17/10/2020; 2020. Available from: https://www.ciperchile.cl/2020/10/17/hacinamiento-la-variable-clave-en-la-propagacion-del-covid-19-en-el-gran-santiago/.