**Title:** Gender disparities in access to care for time-sensitive conditions during COVID-19 pandemic in Chile

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**Abstract**

**Background**: During the COVID-19 pandemic reduction on the utilization of healthcare services are reported in different contexts. Nevertheless, studies have not explored specifically gender disparities on access to healthcare in the context of covid-19. **Methods**: To evaluate gender disparities in access to medical in Chile we conducted an interrupted time series design using a segmented regression. The outcome variable was the number of weekly confirmed cases of a set of oncologic and cardiovascular time-sensitive conditions at a national level. The series contained data from week 1 to 39 for 2017 to 2020. Intervention period started at week 12. We selected this period because preventive interventions, such as school closures or teleworking, were implemented at this point. We estimated level effect using a dummy variable indicating the intervention period and slope effect using a continuous variable from week 12 to 39. To test heterogeneity by sex and age-group, we conducted stratified analysis. **Results**: We observed a sizable reduction in access to care with a slowly recovery for oncologic (level effect 0,323; 95% CI 0,291-0,359; slope effect 1,022; 95% CI 1,016-1,028) and cardiovascular diseases (level effect 0,586; 95% CI 0,564-0,609; slope effect 1,009; 95% CI 1,007-1,011). Greater reduction occurred in women compared to men, particularly marked on myocardial infarction (level effect 0,595; 95% CI 0,566-0,627 versus 0,532; 95% CI 0,502-0,564) and colorectal cancer (level effect 0,295; 95% CI 0,248-0,35 versus 0,19; 95% CI 0,159-0,228). Compared to men, a greater absolute reduction was observed in women for oncologic diseases, excluding sex-specific cancer, (1.352; 95% CI 743-1.961) and cardiovascular diseases (1.268; 95% CI 946-1.590). **Conclusion**: We confirmed a large drop in new diagnosis for time-sensitive conditions during the COVID-19 pandemic in Chile. This reduction was greater for women. Our findings should alert policy-makers about the urgent need to integrate a gender perspective into the pandemic response.

**Keywords:** Gender, Pandemics, Health Services Accessibility

**Background**

The COVID-19 pandemic reduced the utilization of health care services, similarly to the phenomena reported in previous epidemic outbreaks, like SARS1, MERS2, and Ebola3. In the current pandemic, studies have shown a decrease in the frequency of different interventions like surgeries (electives or not) and hospital admissions, including specific time-sensitive conditions, such as acute coronary syndrome4,5, myocardial infarctions6,7, stroke8-11 and cancer12-17

Although it has been largely studied that gender impacts access to healthcare18,19,20, gender and sex differences in access to healthcare have been scarcely examined during the COVID-19 pandemic. While most studies have not explored heterogeneity by gender4,9-15, some studies that examine differences by sex on acute coronary syndrome5,6 and stroke8 have not found relevant disparities. Only one study was done in Latin America and did not explore gender differences11. To the best of our knowledge, a single research explored access differences in cancer care by sex during a pandemic. The authors did not identify any relevant differences, although the more considerable decrease was for breast cancer17.

Gender has been proposed as a structural determinant of health, as gender norms shape social stratification, health-related exposures and behaviors, healthcare access, health systems, and health research21. Nevertheless, the response to outbreaks has been usually devoid of a gender perspective, limiting the effectiveness of the public health response22,23. Sex refers to the biological differences between men, women and intersex. These biological differences between sexes can produce differential vulnerability to infectious diseases. For example, for COVID-19, some sex-specific mechanisms have been suggested as a relevant factor for worse disease outcomes in males, such as hormone-regulated expression of genes or immune response24.

Gender norms and stratification could influence social and economic outcomes, which in turn could impact access to health care25. First, evidence has demonstrated that school closure and mandatory confinement has increased caregiving responsibilities in families, which traditionally fall on women, producing significant disruption in their daily lives compared with men26. Second, as there is a general reduction in the availability of health services, gender bias that usually affects access for women, especially to cardiovascular diseases, may increase27. Finally, during the pandemic, employment was impacted, and many people suffered income reduction. As women are overrepresented in informal jobs, they experienced higher unemployment rates and a more significant reduction in working hours and salaries compared with men during the pandemic in different contexts28,29. Also, COVID-19 has increased levels of gender violence, and reproductive health is usually not prioritized during emergencies25, potentially reducing access to relevant diagnostic services such as smear test for cervical cancer. Furthermore, it is important to consider in this framework the intersections that each of these areas has with other conditions such as age, socioeconomic level, ethnic background, migration status, and others, which may modify their implications30.

Sex and gender are highly entangled, and therefore is difficult to separate them for analysis31. In this study, we state that the measured differences in access to healthcare by sex are explained mainly by gender norms. First, because the role of gender in access to healthcare has been previously studied as a relevant factor18-20. Second, because it seems less plausible that the variations between female and male in the utilization before and after the pandemic are due to biological characteristics. Therefore, and following other authors who choose the term gender to account for social and structural factors31, on hereafter the paper refers to “gender” for the studied categories of women and men.

During a pandemic, people have massively delayed their consultation due to fear of contagion and reduced availability of medical services. Additionally, we pose that women were differentially affected in the outbreak response due to gender-roles. This study aims to evaluate disparities in access to medical care in Chile during the COVID-19 pandemic from a gender-based perspective. We focus on severe and time-sensitive group conditions (cardiovascular diseases and cancer) with guaranteed access in the context of the Chilean health system. As observed in other countries, we hypothesized a large drop in both group conditions diagnosis, but with a more significant decrease in women.

**Methods**

*Study setting*

In 2005 Chile implemented a Health Reform which included the National Explicit Health Guarantees Regime (“AUGE”, nowadays “GES” - explicit guarantees in health-), a set of guarantees aimed to ensure access to timely (opportunity guarantee), affordable, and quality services for people of both insurance systems predominant in Chile (public, National Health Fund - FONASA-, and private, ISAPRES), for 56 health conditions, which have been amplified to 85 nowadays32. During the current pandemic, the obligation for FONASA and ISAPRES to comply with the Explicit Guarantee of opportunity established for the health problems was suspended for up to one month since the 8th of April, except for severe conditions included in this study such as acute myocardial infarction, stroke, and cancers.

*Data sources*

We obtained data from the National Health Fund (Fondo Nacional de Salud - FONASA) which finances all public hospitals in Chile and provides health coverage to nearly 15 million inhabitants (75% of the Chilean population). We selected a set of nine time-sensitive conditions included in the National Explicit Health Guarantees Regime (“AUGE”): two acute cardiovascular diseases (stroke and myocardial infarction) and seven cancers (gastric cancer, colorectal cancer, lymphoma, leukemia, cervical cancer, breast cancer, and testis cancer).

The attending physician registers every public insured patient with a medical diagnosis of these conditions as a confirmed case. National clinical guidelines standardize the diagnostic process for each disease, reducing practice variation and improving reporting quality. A confirmed case report is mandatory by law for healthcare providers. A description of case definitions included in National Clinical Guidelines is available in the Supplemental material (Table S1, Supplemental material).

*Analysis*

We conducted an interrupted time series design using a segmented regression33. Due to the count nature of the data (number of cases diagnosed per week), we fitted generalized linear models with a Negative Binomial distribution. The outcome variable was the number of confirmed cases for the following diseases: stroke (includes transient ischemic attack), myocardial infarction, all cardiovascular diseases (stroke plus myocardial infarction), gastric cancer, colorectal cancer, lymphoma, leukemia, cervical cancer (includes dysplasia), breast cancer, testicular cancer, and all cancers.

The series contained data from epidemiological week 1 to 39 for the years 2017 to 2020 (156 weeks). The intervention period started at week 12. We selected this period because most of the public health interventions implemented during the pandemic, including school closures and remote working recommendations, started at this point (March 15th). Also, in that period started a process of cessation of electives surgeries and centralization of acute beds by the Ministry of Health. Interventions and dates details are available in the Supplemental material (Table S2, Supplemental material).

The model was defined as:

With the number of confirmed cases of disease *d* in week *t*, the population (number) of public health beneficiaries by age-group, is the time elapsed since the start of the study (in weeks), is a dummy variable indicating the intervention period (coded 1), is the time elapsed since the beginning of the intervention (in weeks), adjust for the effect of age (20 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, 80 years, and more), a vector of adjustment co-variable for weekly and yearly seasonal trends and is an error term.

To test heterogeneity, we did stratified analysis by gender and gender-age. As a sensitivity analysis, we fitted unadjusted and adjusted models for all cancers, after excluding sex-specific cancers (breast cancer, cervical cancer, and testicular).

We reported the mean and standard deviation for descriptive analysis and incidence rate ratios (IRR) and absolute effects (counts) with 95% confidence intervals for regressions models. We used STATA 16.0 for analyses.

**Results**

We analyzed a total of 156 weeks with 327.477 cardiovascular events (83.034 strokes and 244.443 myocardial infarction) and 137.700 cancer diagnosis (23.135 gastric cancers, 24.579 colorectal cancers, 5.290 lymphomas, 2.535 leukemia, 42.143 cervical cancers, 37.443 breast cancers, and 2.575 testicular cancers) during the study period (Table S3, Supplemental material).

Compared to previous years (2017-2019), after week 12 (March 15, 2020) an immediate downward trend in the number of events was confirmed for all diseases (figure 1). In the oncologic diseases group, a smaller decrease occurred for lymphoma and leukemia (figure 1). In the cardiovascular diseases group, we observe more substantial reductions for myocardial infarction compared to stroke. Previous to the observed downward, trends were parallel for all studied diseases. The drop observed at week 38 is related to national holiday. When analyzed by sex, women showed a greater impact on their access compared with men for both diseases groups during the study period (figure 2).

**Figure 1**

*Figure 1: Points represent the average number of events (new cases diagnosed) per week for each disease during the first 39 weeks of the year. Solid lines are the point estimate for the fitted model. Colored areas around the lines are the 95% confidence intervals for the fitted model. In blue, the cases observed in years 2017-2019 (used as a control group). In green, the number of patients diagnosed in 2020 (affected by the COVID-19 pandemic). The vertical line represents the starting week of the first population-level interventions for COVID-19 in Chile (week 12).*

**Figure 2**

*Figure 2: Points represent the average number of events (new cases diagnosed) per week for all-cancers and cardiovascular events during the first 39 weeks of the year. Cancers exclude sex-specific conditions such as breast, cervical or testicular cancer to facilitate comparisons between sexes. Cardiovascular events include stroke and myocardial infarction. Solid lines are the point estimate for the fitted model. Colored areas around the lines are the 95% confidence intervals for the fitted model. In blue, the cases observed in years 2017-2019 (used as a control group). In red, the number of patients diagnosed in 2020 (affected by the COVID-19 pandemic). The vertical line represents the starting week of the first population-level interventions for COVID-19 in Chile (week 12).*

In our model, we confirmed a larger immediate reduction (level effect) for cancer conditions (0,323; 95% CI 0,291-0,359) compared to the cardiovascular events (0,586; 95% CI 0,564-0,609). In contrast, the post intervention slope was larger for cancer conditions (1,022; 95% CI 1,016-1,028) than cardiovascular events (1,009; 95% CI 1,007-1,011) (Table 1). Among cancer conditions, a greater immediate reduction was observed in colorectal cancer (0,229; 95% CI 0,199-0,265), gastric cancer (0,306; 95% CI 0,253-0,371), cervical cancer (0,335; 95% CI 0,287-0,392) and breast cancer (0,336; 95% CI 0,293-0,385). A greater post intervention slope was observed in colorectal cancer (1,036 95% CI 1,028-1,043), breast cancer (1,028 95% CI 1,021-1,036) and gastric cancer (1,022 95% 1,011-1,032). In the cardiovascular group, the most affected condition was myocardial infarction (0,564 95% CI 0,539-0,589) with similar post intervention trends. (Table 1)

A differential impact, with larger effects on women than men, was observed across cardiovascular and oncological diseases. For the former, a 6,8% (0,621 95% CI 0,593-0,65 in men and 0,553 95% CI 0,527-0,579 in women) additional immediate reduction in access for cardiovascular events in women compared with men was evident. For the latter, a further non-significant 5,2% immediate reduction (0,364; 95% CI 0,315-0,408 in men and 0,312 95% CI 0,279-0,35) in access to newly diagnosed cancers among females compared with males was observed in the pandemic period. In the sensitivity analysis, differences between sexes in the cancer group increased after excluding sex-specific cancers such as breast, cervical, and testicular cancers. In this analysis, a bigger impact on access was confirmed among women (0,351; IC 95% 0,302-0,408 in men and 0,254; IC95% 0,218-0,296 in men). Differences in post intervention trends were similar in both groups. (Table 1)

When analyzed by specific cardiovascular diseases, a greater immediate decrease in women than men took place for myocardial infarction (0,697; 95% CI 0,649-0,75 in men and 0,532 95% CI 0,502-0,564 in women). When analyzed by specific oncologic diseases, a greater immediate decrease in women than men occurred for colorectal cancer (0,295; 95% CI 0,248-0,35 in men and 0,19; 95% CI 0,159-0,228 in women). Also, a greater immediate reduction on cervical cancer (0,335 95% CI 0,287-0,392) and breast cancer (0,336 95% CI 0,293-0,385) compared to testicular cancer (0,469; 95% CI 0,339-0,649) was observed (Table 1). Post intervention trends were similar for all specific cardiovascular and oncologic diseases.

**Table 1**

*Interrupted time series analysis crude and stratified by sex. Both analyses were adjusted by age, population size, and seasonality (week and year). The model includes level and slope effect terms. Complete models are available in Supplemental material (Table S5-S32)*

To make sense of these findings, we also present absolute effects sizes. Greater absolute effects in access for women compared to men occurred in almost all conditions (Table 2). An excess impact in women compared to men was observed for oncologic (9.140; 95% CI 4.619-13.661) and cardiovascular diseases (1.268; 95% CI 946-1.590) during the 28 weeks of the pandemic included in the study period. In the sensitivity analysis, differences between sexes persisted but were smaller (1.352; 95% CI 743-1.916). When analyzed by specific diseases, we found sizable differences in access for women compared to men for myocardial infarction (729 95% CI 631-930), colorectal cancer (844 95% CI 288-1.401), gastric cancer (562; 95% CI 362-762) and stroke (538 95% CI 250-624).

**Table 2**

In our final analysis, we estimated relative and absolute effects across sex and age-groups for cardiovascular diseases and oncologic diseases, excluding sex-specific cancer (Table S4, Figure S1-S2). For cardiovascular diseases, we observed a larger, but non-significant, immediate decrease for women in almost all age-groups, with exception of the 20 to 29 years’ group. Larger absolute difference for women compared to men was observed in the older groups (527 95% CI 485-569 in the 70 to 79 years’ group and 668 95% CI 472-614 in the 80 years and older group). For oncologic diseases, a larger immediate decrease was evident for women in all ages groups and the greater absolute difference was observed among middle age and older women (426 95% CI 175-676 in 50 to 59 years’ group and 395 95% CI 364-427 in 60 to 69 years group).

**Discussion**

In our study, we confirmed a large drop in the medical diagnosis for time-sensitive conditions during the COVID-19 pandemic in Chile. This decrease was more significant for oncologic than cardiovascular diseases. Also, we confirmed our hypothesis of gender disparities in medical diagnosis. A large group of time-sensitive conditions were affected by this differential effect, even though healthcare access for these conditions is guaranteed by law to everyone. This finding is worrisome because delaying care for these severe conditions can lead to long-term disability and - eventually - premature death.

Gender is a structural determinant of health18 and, usually, is not prioritized during an outbreak response22,23. Through different mechanisms, gender could affect healthcare access in a pandemic. Nevertheless, differential access by gender has not been adequately studied during this current outbreak. Only a few studies explored heterogeneity by sex in cardiovascular5,6,8 and cancer care17 without finding any significant effect. None of these studies were done in Latin America.

Because these diseases have different etiological mechanisms, it is highly implausible to explain this finding through biological causes. While a stroke and myocardial infarction could increase after COVID-19 infection34,35, a reduction in the number of cardiovascular events is probably due to decreased access. If men are more prone to COVID-1924, this could explain, at least partially, that the decline in stroke and myocardial infarction in males could be smaller compared with women. Although, this explanation cannot be given in cancer because these diseases do not share the same causes and acute changes in cancer incidence are unlikely to be attributable to COVID-19 infection. In this setting, a reduced number of newly diagnosed cancers, particularly among women, is a clear marker of reduced access and unmet needs.

Gender norms and hierarchies could explain better this wide effect. Differences in help-seeking behavior between genders have been commonly described36. On average, Chilean women use more healthcare services than men37. During COVID-19, school closure to control disease transmission has a differential effect on women because they provide most of the informal care in families26. A greater differential effect was observed on diseases (colorectal, cervical, gastric, and breast cancer) that require scheduled appointments for testing. Added to income reduction due to work hours decrease28 and unemployment29 an increase in domestic workload can decrease women’s time availability and reduce healthcare demand during a pandemic.

From the supply side, gender biases21 have been associated with delayed access to cardiovascular treatment in women27. Potentially, these biases could aggravate during the pandemic. Service offering reduction could promote severe disease prioritization by medical teams, which could unintentionally reduce healthcare access for women. For instance, in the context of scarcity, since men are categorized as higher risk for cardiovascular disease, the treatment for this group could be prioritized over women.

This study has several limitations. First, we use administrative data, which might be subject to underreporting during the pandemic. Nevertheless, confirmed case reports have been mandatory for healthcare providers since 2004. Moreover, they are used for health claim payments in the Chilean health system, therefore making it less likely that reduced reporting could explain the observed effect. Second, due to the data codification, this study only considers two categories for sex and gender (female and male). This dichotomy excludes a spectrum of gender identities and the intersex population21. Future studies must explore differential effects on health care accessibility during pandemics for a broader gender classification. Third, we cannot rule out residual confounding in the context of observational data. Nevertheless, due to the characteristic of the exposure of interest (the pandemic) is unlikely that better data could be obtained using alternative sources or study designs. We controlled confirmed cases by population and age in our models and included seasonal adjustments by week and year to control for unobserved time-specific confounding factors. The use of previous year trends as a control for the same observational units allows adjustment for confounding, but since no parallel control group was available adjustment for other time-variant effects concomitants to the pandemic was not feasible.

As strengths, this is the first study from Latin America that explores access by sex to medical diagnosis during the COVID-19 pandemic. To test our hypothesis, we used a rich, comprehensive, and reliable national database where cases were defined based on standardized diagnostic processes. We select a variety of severe time-sensitive conditions to avoid generalization based on anecdotal evidence. Moreover, we tested different models, maintaining our conclusions unchanged.

As previous researchers have posed22,23, our findings should alert policy-makers about the urgent need to integrate a gender perspective into an outbreak response. If school closure has a role in the observed differential effect, increasing healthcare services availability will not shorten disparities between genders. Services provision should enhance access, especially for women who are raising children or have other caregiver responsibilities and reduce economic barriers. Also, health professionals should be aware of this situation and encouraged through clinical guidelines to reduce current gender bias in their clinical practice.

Future research must evaluate the consequences of access reductions on disability and premature death. The observed effect occurred in a set of severe time-sensitive conditions where care delays could worsen prognosis. Additionally, we need to know the causes, which could be informed through surveys and innovative ways to provide care for these diseases during the actual pandemic.

**Conclusion**

As previous studies have shown4-15, we confirmed a large drop in medical diagnosis for cardiovascular and oncologic conditions in Chile during COVID-19 pandemic. Additionally, we demonstrate that women were far more affected compared to men. This differential effect by gender was observed for a broad group of time-sensitive conditions. Because these conditions have different etiological mechanisms, biological causes are unlikely to explain our findings. Gender norms and hierarchies define better this differential effect. Emergent healthcare barriers, such as an increase in care work due to school closure, aggravation of gender bias, and income reduction could decrease healthcare access in women during pandemics and potentially cause long-term disability and premature death in them. Our study should alert policymakers and put women’s access to healthcare as a top global health priority during this pandemic.

**List of abbreviations:**

* AUGE: Acceso Universal a Garantías Explícitas (National Explicit Health Guarantees Regime)
* COVID-19: Coronavirus disease 2019
* FONASA: Fondo Nacional de Salud (Public insurer)
* IRR: Incidence Rate Ratio
* ISAPRES: Instituciones de Salud Previsional (Private insurers)
* MERS: Middle East respiratory syndrome
* SARS: Severe acute respiratory syndrome

**Declarations**

**Ethics approval and consent to participate**

Since this study used secondary data from publicly available sources collected by the Ministry of Health, which are registered anonymously, we did not require institutional review board approval.

**Consent for publication**

Not applicable

**Availability of data and materials**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Competing interests**

The author(s) declare(s) that they have no competing interests.

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**Authors' contributions**

JP did literature research, collected data, developed the study design, analyzed data and drafted the manuscript. FC did literature research, design figures, interpreted data and drafted the manuscript. TA did literature research, analyzed data, interpreted data and drafted the manuscript. MSM interpreted data and critically revised the manuscript. CC developed the study design, interpreted data, design graphs, and drafted the manuscript.

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