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# Gender-related Differences in the Impact of COVID-19 Pandemic in Cardiometabolic Patients in Latin America: The CorCOVID LATAM Gender Sub-study

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**Abstract: COVID-19 pandemic and lockdown measures have disrupted lifestyle habits and self-care. Gender differences in health behavior during the pandemic have not yet been fully elucidated. The aim of this study was to evaluate gender related differences in the impact of COVID-19 pandemic on patients with cardiometabolic diseases. A cross-sectional survey was administered to cardiometabolic patients in 13 Latin American countries between June 15th and July 15th, 2020. The study included 4216 participants, of which 2147 (50.9%) were women. Women reported healthier eating habits as well as lower tobacco and alcohol consumption than men but exercised less and reported increased symptoms of depression. Low income and symptoms of depression were associated with sedentarism in women. The interplay between psychological factors and sedentarism could increase the risk of cardiovascular events in this population. (Curr Probl Cardiol 2022;47:101075.)**

## Introduction

**L**ockdown measures implemented by governments in Latin America have dramatically disrupted the lives and routines of the communities during the coronavirus disease 2019 (COVID-19) pandemic.<sup>1-3</sup> Lockdown measures were important for preventing COVID-19 spread but had a detrimental impact on health-related parameters such as eating habits, mental health status, and physical activity.<sup>1,4</sup> Cardiometabolic patients are particularly vulnerable to specific high-risk lifestyle habits, which can lead to an increase in visceral adiposity, blood pressure, insulin resistance and the activation of pro-inflammatory and pro-thrombotic mediators.<sup>5</sup> Guidelines and interventions have been developed to promote healthy lifestyle and mental health during COVID-

19 lockdown, yet it is still unknown to what extent they are adopted and the long-term impact on cardiometabolic patients.<sup>6</sup>

Gender-related differences in health behavior during the pandemic have not been fully elucidated. Adopting a gender-perspective in research has shown benefits in patient care for cardiovascular diseases (CVD) and other conditions that affect both women and men<sup>7</sup>; translating this perspective to the study of COVID-19 infection and its consequences may substantially optimize patients care.<sup>8</sup> In addition, a significant proportion of patients experienced an increased incidence of psychological symptoms during lockdown measures,<sup>9</sup> but little is known about how gender-related differences affected mental health status. As COVID-19 is a potent stressor, its consequences on mental health disorders need to be addressed with a gender-related approach, considering that women appear to be more susceptible to social isolation and specific stress-related psychiatric disorders.<sup>10</sup>

The present study evaluates gender-related differences in ambulatory patients with cardiometabolic diseases in order to elucidate whether women and men differed in lifestyle health habits and psychological symptoms during the lockdown period. This may help to improve primary care and public health interventions both during the pandemic and after it.

## Methods

### *Study Population*

The study population included ambulatory patients with cardiometabolic diseases during regular cardiology follow-up in Spanish-speaking Latin American countries who answered a survey questionnaire (CorCOVID LATAM Study) between June 15th and July 15th, 2020. The rationale and design of the CorCOVID LATAM Study was previously published.<sup>11</sup>

### *Ethics Approval*

Ethics approval was obtained from the Interamerican Society of Cardiology Research Ethics Board. The investigation conformed to the Declaration of Helsinki. All involved participants provided informed consent. Patients were informed about the objective of the survey questionnaire and the anonymity of their responses. No identifiable personal data was collected. The Health Insurance Portability and Accountability Act of

1996 was followed. In accordance with government measures to limit population mobilization in some countries, the survey was conducted either by face-to-face visits or by phone or video chat, in which case informed consent was verbally taken.

### *Inclusion Criteria*

Patients with prior CVD (hypertension, coronary artery disease, cardiomyopathy, valvular heart diseases, or pericardial diseases) or metabolic dysfunction (metabolic syndrome, obesity, dyslipidemia, diabetes mellitus) and no evidence of SARS-CoV2 infection were included during regular cardiology follow-up.

### *Exclusion Criteria*

Exclusion criteria are listed as follow: (I) Patients younger than 18 years old, (II) patients who tested positive for COVID-19 previously or patients under investigation for SARS-COV2 infection, and (III) patients who could not provide informed consent.

### *Study Design*

A prespecified gender-related analysis of the CorCOVID LATAM study results was performed. The survey consisted of 38 queries and included questions examining demographic variables, CVD history, health behavior during the pandemic (including physical activity, eating habits, alcohol intake, tobacco consumption), access to medications, level of medication compliance, and self-reported depressive symptoms. The main objective of this sub-study was to describe the gender-related differences in lifestyle habits and psychological symptoms in this population. The secondary goals were to assess predictors of negative health behaviors and mental health symptoms in women.

### *Statistical Analysis*

Data was initially collected in Google Forms and exported into IBM SPSS (version 24.0 for Windows, Armonk, NY) for statistical analysis. Data was described using mean and standard deviation or median and interquartile range according to distribution. Frequencies and percentages were reported for categorical variables. Independent sample t-tests were used to compare the normally distributed continuous variables, the Mann-Whitney U test was used for non-normally distributed continuous

variables, and the Pearson chi-squared test (or the Fisher's Exact test as appropriate) was used for categorical variables.

To establish the differences between women and men, univariate analysis was performed initially and followed by a multivariate regression analysis adjusted by occupation, income level, history of established CVD, hospitalizations, medication use, physical activity, consumption of alcohol, tobacco use, as well as fruit and vegetable consumption. Additionally, unadjusted logistic regression was performed in the study population of women to elucidate factors related to negative health lifestyle. Results are expressed as odds ratio (OR) and 95% confidence interval (95%CI). A *P*-value of less than 0.05 was considered statistically significant.

## Results

A total of 4216 patients with a mean age of  $60.4 \pm 15.4$  years were included; 2147 (50.9%) were women. Baseline socio-demographic characteristics and cardiometabolic profile of men and women are listed in [Table 1](#). Within the study population, women had lower education and income levels and had a better cardiometabolic profile with lower proportion of established atherosclerotic CVD than men ([Table 1](#)).

### *Physical Activity*

Men were more likely to perform physical activity than women, both in the univariate analysis (OR 1.46 95%CI 1.29-1.66, *P* < 0.001) and multivariate analysis (OR 1.47, 95%CI 1.28-1.70, *P* < 0.001). Gender-related differences in physical activity levels are listed in [Table 2](#) and [Figure 1](#). The factors associated with sedentarism in women included psychological and nonpsychological factors and are depicted in [Figure 2](#). Overall, the study population reported a low use of fitness Apps, but men (12.1%) were significantly less likely to utilize them than women (16.9%) (OR 0.67 95%CI 0.56-0.80; *P* < 0.0001).

### *Eating Habits and Tobacco Use*

Men reported higher rates of tobacco use (OR 2.27 95%CI 1.90-2.72, *P* < 0.001), and women who reported tobacco use smoked less cigarettes than men ([Table 2](#), [Fig 3](#)). Alcohol consumption appeared to be higher in men compared to women (OR 3.03 95%CI 2.67-3.44, *P* < 0.001); 10.9% of women and 11.9% of men who consumed alcohol reported higher

**TABLE 1.** Gender-related differences in socio-demographic characteristic and cardiometabolic profile of the population

	Women (n = 2147)	Men (n = 2069)	P-value
<b>Age</b>	60.49 (SD 15.40)	60.21 (SD 15.39)	0.563
<b>Education level</b>			
None	2.4% (52)	2.1% (44)	<0.001
Primary	22.1% (474)	16.1% (333)	
Secondary	31.8% (683)	32.5% (672)	
Tertiary	16.1% (346)	14.5% (300)	
Post-graduate	27.6% (592)	34.8% (720)	
<b>Occupation</b>			
Unemployed	3.0% (64)	6.3% (130)	<0.001
Housekeeper	35.1% (753)	0.6% <sup>13</sup>	
Independent contractor	11.3% (242)	27.9% (577)	
Graduate student	5.7% (123)	7.8% (161)	
Private employee	9.9% (212)	14.5% (300)	
Public employee	11.8% (254)	13.2% (274)	
Pensioner	23.2% (499)	29.7% (614)	
<b>Income level</b>			
Very low (requires support)	12.4% (266)	7.5% (156)	<0.001
Low (basic needs covered)	38.4% (825)	32.5% (673)	
Medium (some savings)	45.7% (981)	51.5% (1066)	
High	3.5% (75)	8.5% (174)	
<b>Cardiometabolic profile</b>			
Stroke	3.7% (81)	4.2% (87)	0.473
Peripheral vascular disease	4.2% (92)	4.3% (89)	0.979
Coronary disease	10.9% (236)	25.7% (533)	0.001
Diabetes	21.0% (452)	21.6% (447)	0.662
Arterial hypertension	73.7% (1584)	71.8% (1487)	0.164
Dyslipidemia	36.3% (780)	37.4% (775)	0.448
Heart failure	9.4% (202)	11.3% (234)	0.043
Cardiomyopathy	3.1% (67)	5.0% (105)	0.001
Valvular heart disease	7.8% (168)	8.6% (178)	0.357
Arrhythmias	17.9% (386)	15.8% (328)	0.066
Cardiac devices	2.8% (61)	4.9% (103)	<0.001
Established vascular disease	19.5% (419)	34.9% (722)	<0.001
Last hospitalization due to a cardiovascular event			
None	56.1% (1204)	46.4% (961)	<0.001
Before 2018	18.3% (393)	20.3% (421)	
2018	5.9% (127)	8.3% (171)	
2019	10.5% (225)	11.8% (244)	
2020	9.2% (198)	13.2% (272)	

Categorical variables are shown as percentages with counts in parentheses

consumption during lockdown, with no statistical differences between genders regarding that increase in alcohol intake (Table 3). The higher amount of food intake during lockdown measures was associated with increased alcohol consumption in women (OR 5.87 95%CI 2.11-16.31,

**TABLE 2.** Gender-related differences in lifestyle habits and barriers to access to healthcare services during lockdown measures

	Women (n = 2147)	Men (n = 2069)	P-value
<b>Minutes per wk of physical activity</b>			
<100 min	68.6% (1473)	60.7% (1255)	<0.001
100-150 min	18.5% (397)	21.4% (442)	
>150-200 min	8.1% (174)	10.0% (208)	
>200 min	4.8% (103)	7.9% (164)	
Use of App for physical activity	16.9% (362)	12.1% (250)	0.001
<b>Smoking</b>			
No history of smoking	90.5% (1942)	80.6% (1668)	<0.001
1-9 cigarettes per d	6.1% (131)	12.1% (250)	
10-20 cigarettes per d	2.4% (52)	5.5% (113)	
> 20 cigarettes per d	1.0% (22)	1.8% (38)	
<b>Alcohol consumption</b>			
Occasionally	81.4% (610)	65.8% (827)	<0.001
Every wk	10.4% (78)	19.0% (239)	
Almost every d	4.3% (32)	8.7% (109)	
Every d	3.9% (29)	6.5% (82)	
<b>Fruit/vegetable consumption</b>			
Hardly ever	5.2% (112)	10.3% (214)	<0.001
1-3 times a wk	34.4% (738)	35.3% (731)	
4-6 times a wk	21.2% (454)	24.4% (504)	
Everyday	39.2% (843)	30.0% (620)	
Barriers to obtain some medication	31.8% (638)	31.3% (647)	0.706
Had to quite some medication because of lockdown	17.6% (379)	16.5% (341)	0.312

Categorical variables are shown as percentages with counts in parentheses.

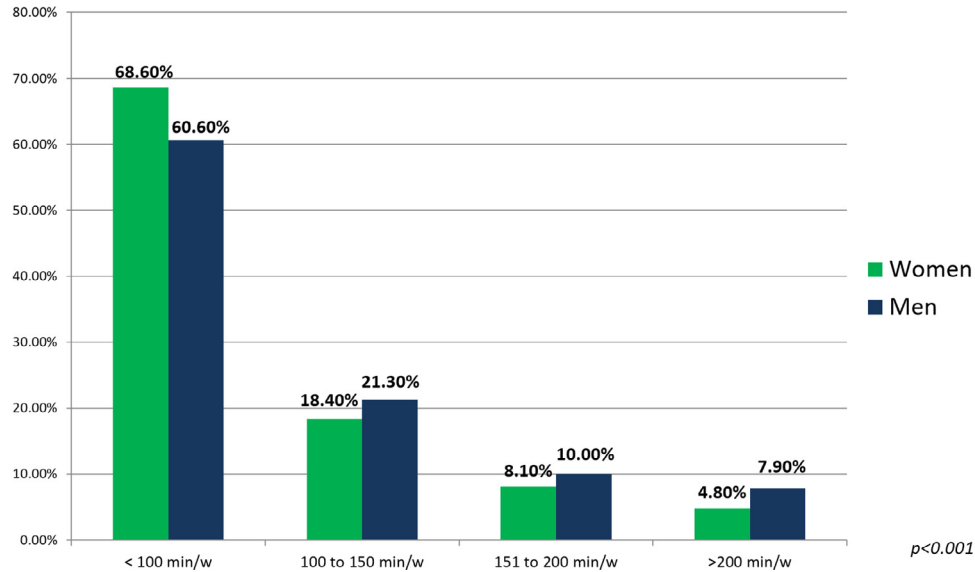
$P = 0.001$ ). Regarding eating habits, a higher proportion of women reported daily consumption of fruits and vegetables (Table 2, Fig 3).

The lower proportion of smoking, lower alcohol consumption, and healthier eating habits in women were confirmed in the multivariate analysis (Table 4).

## Access to Healthcare

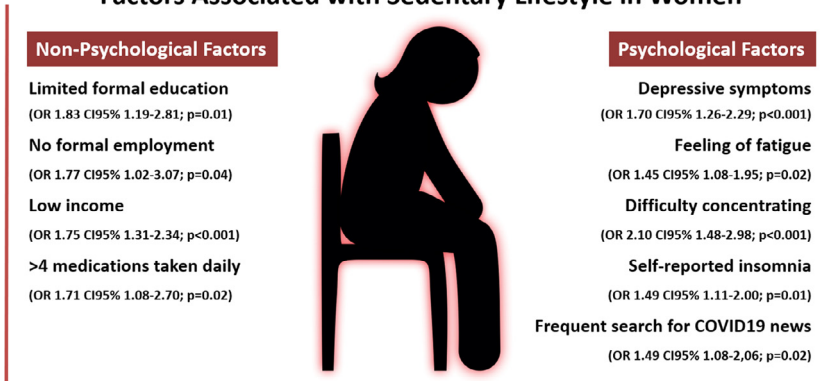
One third of the study population had barriers to obtain their medications, but no gender differences were detected (OR 0.97 95%CI 0.85-1.11,  $P = 0.706$ ). Among women, 17.65% had interrupted some medications during lockdown, with no significant differences with men (Table 2). The most significant factors related to non-compliance in women were low income (OR 3.54 95%CI 2.36-5.30;  $P < 0.001$ ), and symptoms of depression (OR 2.70 95%CI 1.82-4.03,  $P < 0.001$ ), among others (Supplementary Table 1).





**FIG 1.** Exercise reported as minutes per week in women and men who performed physical activity during COVID-19 lockdown measures. Color version of figure is available online.

## Factors Associated with Sedentary Lifestyle in Women



**FIG 2.** Associated factors with sedentarism in women. Color version of figure is available online.

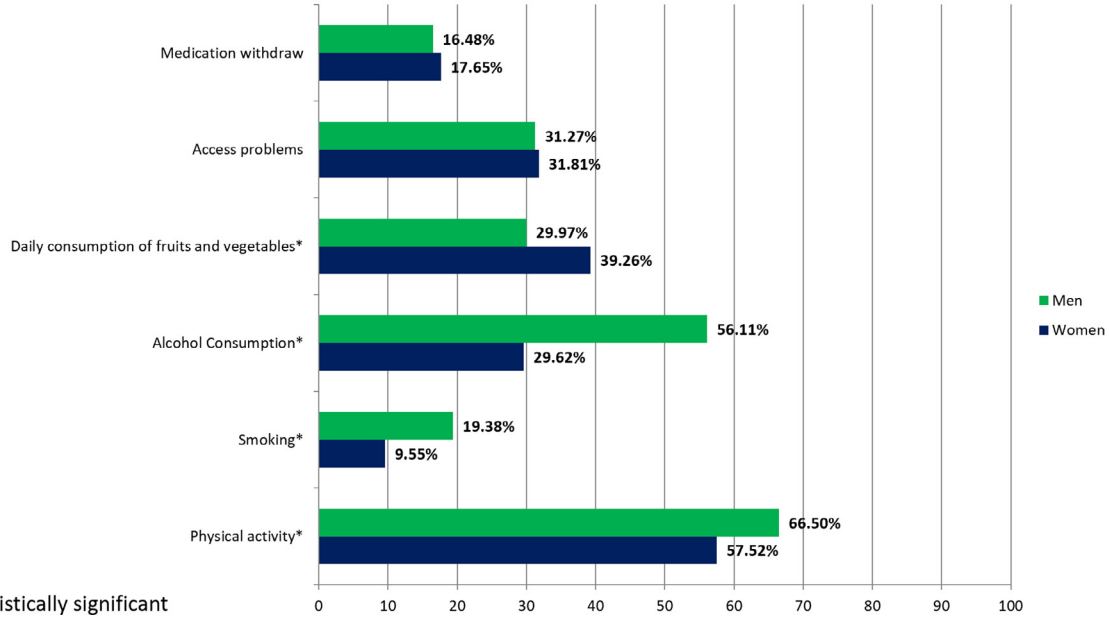
### *Psychological Symptoms*

Multivariate analysis showed that self-reported symptoms of major depression were more frequent in women (OR 1.72 CI 95% 1.40-2.11,  $P < 0.001$ ) after adjusting for age, level of education, income, type of job, established CVD, previous hospitalization, medication use, alcohol consumption, fruit and vegetable intake, treatment compliance, and immunization status.

### **Discussion**

Gender-based analysis of the CorCOVID LATAM study demonstrated that women reported higher rates of sedentarism, reduced physical activity, and more psychological symptoms than men. On the other hand, women were more likely to have healthy eating habits, as well as lower tobacco and alcohol consumption.

Data from the prepandemic era demonstrated that women are particularly vulnerable to the adverse impact of CVD following menopause and that this fact can be counteracted by physical exercise. In this group, physical activity can balance the ratio between cortisol and dehydroepiandrosterone sulfate, controlling weight gain and improving the cholesterol and glucose profile in post-menopausal period.<sup>12</sup> Nonetheless, consistent with the present study, previous work has also found that women are less likely to follow exercise recommendations, which may be influenced by social role, income level, and education.<sup>13</sup> In a similar study, Wang et al. also observed lower levels of daily step counts since

**Gender differences in habits, medical follow-up, and treatments during pandemic lockdown measures****FIG 3.** Gender differences in lifestyle habits and access to healthcare during COVID-19 lockdown measures. Color version of figure is available online.

**TABLE 3.** Gender-related differences in changes in lifestyle habits during lockdown measures

	Women (n = 2147)	Men (n = 2069)	P-value
<b>Cigarette smoking frequency</b>			
has been less	49.1% (106)	55.0% (216)	0.332
has been the same	32.8% (71)	27.7% (109)	
has been more	18.1% (39)	17.3% (68)	
Plan to quit smoking during lockdown	47.4% (103)	55% (214)	0.075
<b>Alcohol use</b>			
has been less	53.8% (363)	52.0% (590)	0.701
has been the same	35.2% (238)	36% (409)	
has been more	11.0% (74)	12.0% (136)	
<b>Food behavior (amount of food)</b>			
has been less	28.3% (607)	27.5% (570)	0.332
has been the same	48.8% (1048)	51.0% (1055)	
has been more	22.9% (492)	21.5% (444)	

Behavior is expressed as percentage of affirmative answers and within brackets the number of patients involved.

the implementation of lockdown measures in women.<sup>14</sup> Among 3544 participants (34% women) the number of steps per day fell from 8097 to 5440 and the proportion of people considered to have low step counts increased by 3%-18.5% during the pandemic period.<sup>14</sup> Being a woman or an elderly patient were factors related to a higher prevalence of walking fewer steps per day during the pandemic.<sup>14</sup> Similarly, a cross-sectional study in Croatia evaluated changes in lifestyle parameters in 3027 participants (70% women) during lockdown measures.<sup>15</sup> During the pre-confinement period, a higher proportion of men exercised when compared to women and the frequency and duration of exercise significantly decrease during lockdown in women but not in men.<sup>15</sup> The greater physical inactivity in women was one of the main findings of our study. In addition, we found that low income and self-reported depressive symptoms were factors related to a sedentary lifestyle. Taken together, our data demonstrates how aspects of mental health as well as the adverse social environment can play an important role in physical inactivity in women.

**TABLE 4.** Multivariate analysis of gender-related differences in lifestyle habits during lockdown measures (Men = 1 and Women = 0, for the analysis)

	Adjusted OR	95%CI	P-value
Physical activity	1.47	1.28-1.70	<0.001
Smoking	2.19	1.56-2.32	<0.001
Alcohol consumption	2.92	2.54-3.36	<0.001
Daily consumption of fruit and vegetables	0.32	0.24-0.43	<0.001

OR = Odds ratio; 95%CI = 95% Confidence Interval.

It is imperative that lifestyle interventions are implemented in populations at increased risk for associated adverse events, such as those with cardiometabolic disorders. Existing literature reports that the use of exercise programs improve volume as well as exercise intensity.<sup>16–18</sup> A study conducted by Yang et al. demonstrated in 431 individuals during pandemic lockdown, that those who used physical activity electronic applications significantly increased exercise levels.<sup>19</sup> Our study population reported a low use of fitness applications, but women were significantly more likely to utilize them than men. Contrary to what might be expected with more frequent use of fitness applications, we found no increase in the amount of physical activity in women.

In the present analysis, almost 60% of the women presented with symptoms of major depression. This is noteworthy given the interplay between decreased mental health and detrimental changes to lifestyles habits. The COVID-19 pandemic has generated an increase in symptoms of anxiety and stress;<sup>9,20</sup> ambiguity regarding COVID-19, increased exposure to news sources, and the increased perception of possible physical, social, and financial harm are related to deleterious impact on mental wellbeing.<sup>20</sup> Wang et al. also reported that being a female was an independent risk factor associated with higher prevalence of anxiety and depression during the initial stage of COVID-19 pandemic.<sup>21</sup> A previous publication of the psychological impact of CorCOVID LATAM study also showed a higher incidence of self-reported depressive symptoms in women.<sup>9</sup>

As the pandemic continues, follow-up studies monitoring long-term impact on physical and mental health are essential.<sup>22</sup> Additionally, a better understanding of gender disparities could contribute in the development of better public health policies.<sup>23</sup>

## *Limitations*

The survey questionnaire was conducted in a population with cardiometabolic diseases and the perception of belonging to a high-risk group for contracting severe COVID-19 infection may have influenced lifestyle. These results may not accurately represent the impact of lockdown on lifestyle factors in the general population. Memory bias cannot be excluded, as patients' clinical records were not reviewed. No gender-related differences were seen in the changes in alcohol consumption and smoking before and after the pandemic. The differences observed between genders could be related to baseline habits. Finally, the self-

reported variables may lead to bias, related to the type of survey and psychological status of patients during the interview.

## Conclusions

Women with cardiometabolic diseases presented with healthier lifestyle habits than men during the COVID-19 pandemic, except for physical activity levels. Women also had a higher incidence of self-reported depression symptoms. These findings raise concerns about the long-term impact of the pandemic on this population, as the interplay between psychological factors and unhealthy habits such as sedentarism could increase the risk of cardiovascular events, deepening gender differences in cardiovascular health. Further intervention studies should focus on how to increase mental and physical wellbeing during the lockdown period and the years following.

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## Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.cpcardiol.2021.101075](https://doi.org/10.1016/j.cpcardiol.2021.101075).

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