

# Effects of mobility restrictions on mental health among young adults in the context of COVID-19 pandemic. A cross-sectional study

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# Effects of mobility restrictions on mental health among young adults in the context of COVID-19 pandemic. A cross-sectional study

## Mobility restriction and mental health

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CATV: Conceptualization. Methodology, formal analysis, investigation, data curation, writing, original draft, writing, review and editing.

PAJS: Formal analysis, data curation, writing original draft, review and editing.

NCTM: Conceptualization, data curation, writing original draft, review and editing

MADC: Drafting the English version of the manuscript, revision of language and formatting

PSMV: Conceptualization, writing original draft, review and editing.

TVEC: Design of the study, acquisition and interpretation of the data.

VVMF: Conceptualization. Methodology, formal analysis, investigation, data curation, writing, original draft, writing, review and editing.

All authors were involved in drafting of the work or revising it critically for important intellectual content. All authors approved the final version to be published and agree to be accountable for all aspects of the work.

**Consent to participate:** All participants accepted and filled an informed consent form included at the beginning of the survey. Participants responses where anonymous and confidential.

## **ABSTRACT**

**Purpose:** To explore the effects of mobility restriction on the mental health of Ecuadorian young adults. **Methods:** The current is a cross-sectional study that included 8426 young adults. Socio-demographic and mental health data were collected through an online survey during May-June 2020 in Ecuador. Data on mobility was extracted from Google Mobility Reports. Four aspects of the participants' mental health were evaluated: eating behavior (emotional eating), depression, sleep quality and sense of coherence using previously validated instruments. Data were analyzed using linear regression using R. **Results:** Mean age of the participants was 22.85 (SD = 4.43), most of whom were women (n = 5943, 70.53%). During mandatory confinement, mobility due to retail and recreation, to groceries and pharmacies, to parks, to transit stations, to workplaces were reduced by nearly 50%. In contrast, mobility to places of residence increased by nearly 20%. Less healthy eating behavior was associated with lower mobility to retail/recreation, residential or workplaces. Depression was associated with lower mobility to residential and workplaces. Worse quality of sleep was associated with lower mobility to retail/recreation, residential and workplaces. Higher sense of coherence was associated with higher mobility to residential and to workplaces. Women and youngsters more often showed depression, less healthy eating behavior, worse quality of sleep and lower sense of coherence. **Conclusion:** Mobility restrictions during COVID-19 pandemic has negative effects on people's mental health. Prevention and health promotion measures directed to ameliorate the effects of confinement on mental health should target risk populations including women and youngsters.

**Key words:** COVID-19, mental health, mobility, depression, eating behavior, quality of sleep, sense of coherence, young adults, Ecuador

## 1. INTRODUCTION

In March 2020 COVID-19 caused by the SARS-CoV-2 virus was declared global pandemic. Since then, COVID-19 has generated multiple public health concerns around the world, particularly due to the easiness of the virus transmission and disease morbidity and mortality <sup>1</sup>. Given the emergency situation, government authorities have imposed closure measures and restrictions in order to reduce mobility and therefore physical contact in order to reduce the rate of infection. Although lock-down measures have helped to ameliorate the spread of the virus and control the pandemic, they have also negatively impacted mental health of people <sup>2,3</sup>.

COVID-19 pandemic has been associated with considerable psychological distress in terms of anxiety, depression, posttraumatic stress disorder, among others, which on the other hand are known triggers of unhealthy eating behaviors and poor sleep quality <sup>4-6</sup>. It has been observed that the frequency of unhealthy eating behaviors and altered sleeping patterns have increased during COVID-19 pandemic <sup>5,7,8</sup>. On the other hand, resilience and adaptation can help to cope with the deleterious consequences of adverse events, such as the one we have been experiencing from March 2020 <sup>9</sup>. One factor which may play a role in the development of adversity-related resilience is sense of coherence (SOC), which refers to a way of viewing the world that facilitates successfully coping with stressors<sup>10</sup>.

Evidence suggests that some population groups are more vulnerable to suffer mental health issues than others<sup>6</sup>. For instance, it has been shown that in comparison to men or elders, women and young people more often show signs of depression and anxiety, and that the occurrence of both have substantially increased during COVID-19 pandemic <sup>11,12</sup>. Moreover, observing how mechanisms of resilience help to overcome difficult situations during the exceptional and unforeseen situation of confinement can help to understand how human beings deal with such situations <sup>13</sup>. From public health policy, identification of groups with lower capability of adaptation might help to prioritize attention on vulnerable groups and therefore to face the pandemic more efficiently.

The present study aimed to explore the effects of mobility restrictions implemented due to COVID-19 pandemic on several aspects of mental health among young adults. Four aspects of mental health were evaluated including, emotional eating, sleep quality, depression, and sense of coherence.

## **2. METHODS**

### **2.1. Study design and setting**

An observational cross-sectional study design was implemented. An on-line, self-administered survey was used to collect data on socio-demographics and mental health. Data on mobility was collected from Mobility Google Reports <sup>14</sup>. Data collection took place between May and June 2020, at that time confinement in Ecuador was mandatory <sup>15</sup>.

### **2.2 Population and sampling**

Our targeted population were young adults that is, individuals between 18 and 35 years old. Invitations to participate in the study were sent through different platforms and social networks from Ecuadorian universities (Facebook, Instagram, Twitter, WhatsApp). From the responses received in total 9522, we exclude those of people who were younger than 18, older than 35 years old or people for whom age was recorded (n = 1092). The final sample included 8426 people young adults.

### **2.3 Survey**

The on-line self-administered survey was reviewed by four experts and first applied to 30 adults as a pilot study. After corrections were implemented, the survey was then distributed through social networks using Google Forms. The survey had four sections: 1) included presentation, objectives and informed consent form; 2) was meant to collect socio-demographic data; 3) included questions regarding eating habits; 4), included questions to assess sleep quality, depression and sense of coherence.

### **2.4 Variables**

#### **2.4.1 Emotional eating (EE)**

EE was evaluated using a validated questionnaire <sup>16</sup>. The EE questionnaire included 10 questions with four possible answers: never, sometimes, frequently and always. Each one was graded with 0, 1, 2 or 3 respectively. Each participant could obtain a score between 0 and 30. The lower the score, the healthier the behavior. Depending on the score, subjects were classified in four groups: 0-5 non-emotional eater; 6-10 low emotional eater; 11-20 emotional eater; and 21-30 very emotional eater.

#### **2.4.2 Sleep quality (SQ)**

SQ was evaluated using the Spanish version of the Pittsburgh Sleep Quality Index (PSQI) <sup>17</sup>. This index consists of 19 self-evaluated items, which are grouped into seven components: Subjective

sleep quality, sleep latency, sleep duration, habitual sleep efficiency, presence of a sleep disorder, use of hypnotic medications, and daytime dysfunction. Each of these components receive a score of 0 to 3 points. The total score is the result of the sum of the 7 components, so the test can give a total score of 21 points. Higher scores indicate a more severe sleep disorder. SQ can be classified as “good” when PSQI scores <5 points, and “poor” when PSQI >5.

#### *2.4.3 Depression*

Depression was evaluated using the Patient Health Questionnaire 9 (PHQ9), which has been shown to have high sensitivity and specificity <sup>18</sup>. While the first 8 items ask about frequency of depression symptoms, such as anhedonia, feeling down or hopeless, item 9 asks over thoughts of dead or auto/mutilation. Response options for each item are as follows: “not at all” (0 points), “several days” (1 point), “more than half the days” (2 points) or “nearly every day” (3 points). PHQ9 total scores range from 0 to 27. Scores of 1–4 indicate minimal, 5–9 mild, 10–14 moderate, 15–19 moderately severe, and 20+ indicate severe symptoms of depression.

#### *2.4.4 Sense of coherence (SOC)*

SOC scale developed by Antonovsky was applied to measures general ability to cope with stressful life situations <sup>19</sup>. In this study, a reduced format with 15 items was used. The instrument was previously validated in Ecuadorian population <sup>9</sup>. Respondents were asked to mark their response to each item on a scale of five alternatives: never, almost never, sometimes, almost always, and always, which in turn received scores from 0 to 5, respectively. The final score ranges on a scale from 0 to 75 points <sup>9</sup>. The higher the score, the higher the SOC <sup>19</sup>.

#### *2.4.5 Mobility*

Six aspects of mobility were evaluated: mobility due to retail and recreation, mobility to grocery and pharmacy, to parks, to transit stations, to residential or workplaces <sup>20</sup>. For each of these aspects, mobility for each day were compared to a baseline value for day of the week and percentage of change was calculated. Baseline values correspond to median values for the corresponding day of the week during a 5 week period. Percentage of mobility change was calculated based on data from users who have opted-in to Location History for their Google Account <sup>20</sup>. We extracted data for mobility for day and matched to the date the respondent send the survey.

### **2.5 Statistical analyses**

In order to study the association between the four aspects of mental health and mobility restrictions due the pandemic, we implemented four regression models. Each of the mental health aspect including, EE, SQ, depression and SOC were included in the models as dependent variables. Adjusted predicted means with 95% confidence intervals (95% CI) were calculated for each of the scores. Percentage of mobility change as well as sex and age were included in the model as predictor variables. Living with a partner, taking sleeping pills, area of residence (urban vs. rural), and occupation (student, working or unemployed) were included in the models as confounding variables. Huber-White method was used to correct correlated responses from cluster samples. A cluster in this case was the date in which participants sent the on-line survey.. All analyses were conducted using R<sup>21</sup> and related packages, including rms<sup>22</sup>.

## **2.6 Ethics approval and related considerations**

Was carried out following the Declaration of Helsinki to work with human beings and in accordance with the "Singapore Declaration on Integrity in Research". It was approved by the Scientific Committee of the School of Medicine and Instituto de Investigación (IDI) of the Escuela Superior Politécnica de Chimborazo. All participants accepted and filled an informed consent form included at the beginning of the survey. Participants responses where anonymous and confidential.



### 3. RESULTS

#### 3.1 General characteristics

Sample included 8426 individuals. Mean and median age of participants were 22.85 (SD = 4.43) and 21 (IQR = 6), respectively. The majority of respondents were women (n = 5943, 70.53%). The majority reported living without a partner, residing in urban areas, and not needing medication to sleep. More than 80% of respondents among women and men were university students (Table 1). During the time the survey took place (May and June 2020), mobility due to retail and recreation was reduced by 47.22%, mobility to grocery and pharmacy was reduced by 29.75%, to parks by 46.44%, to transit stations by 52.93%, and to workplaces to 39.83%. In contrast, mobility to residential places increased by 23.71%. Mean and median percentages for different aspects of mobility by sex are showed in Table 1.

In comparison to men, women showed worst scores for EE, PHQ-9 and PSQI (Supplementary table 1). On the other hand, SOC was higher for men in comparison to women (Supplementary table 1). Percentage of emotional eaters or very emotional eaters were higher among women in comparison to men (29.09% vs. 17.08%) (Supplementary table1). Additionally, women more often showed signs of depression (Supplementary table 1). Finally, in comparison to men, women more often reported having poor SQ (Supplementary table 1).

### **3.2 Mobility and EE behavior**

From the six aspects evaluated regarding mobility, five were significantly associated to EE behavior: retail and recreation ( $df = 1$ ,  $F = 8.99$ ,  $p = 0.003$ ), mobility to grocery and pharmacy ( $df = 1$ ,  $F = 6.35$ ,  $p = 0.012$ ), mobility to residential places ( $df = 1$ ,  $F = 14.77$ ,  $p < 0.001$ ), mobility to workplaces ( $df = 1$ ,  $F = 24.84$ ,  $p < 0.001$ ) and mobility to transit stations ( $df = 1$ ,  $F = 5.61$ ,  $p = 0.018$ ). Mobility to parks ( $df = 1$ ,  $F = 0.95$ ,  $p = 0.329$ ) was not associated with EE behavior. An inverse association was found between EE behavior and mobility due to retail and recreation, and mobility to residential and workplaces (Figure 1, panel a, b, c), suggesting that the more restricted the mobility related to those activities, the worse the eating behavior. In contrast, a direct association was found between EE behavior and mobility to groceries, pharmacies and transit stations (Figure 1, panel d, e), suggesting that the less restricted the mobility related to those activities, the worse the eating behavior of young adults.

### **3.3 Mobility and depression**

From the six aspects evaluated regarding mobility, three were significantly associated to depression: mobility to grocery and pharmacy ( $df = 1$ ,  $F = 12.19$ ,  $p = 0.001$ ), mobility to residential places ( $df = 1$ ,  $F = 27.43$ ,  $p < 0.001$ ), and mobility to workplaces ( $df = 1$ ,  $F = 28.94$ ,  $p < 0.001$ ). In contrast, mobility to parks ( $df = 1$ ,  $F = 0.67$ ,  $p = 0.414$ ), to transit stations ( $df = 1$ ,  $F = 0.01$ ,  $p = 0.937$ ) and due to retail and recreation ( $df = 1$ ,  $F = 3.01$ ,  $p = 0.083$ ) were not associated with depression. An inverse association was found between depression and mobility to residential and workplaces (Figure 2, panel a, b), suggesting that depression was associated with more restricted mobility related to those activities. In contrast, a direct association was found between depression and mobility to groceries and pharmacies (Figure 2, panel c), suggesting that less restricted mobility related to this activity was associated to depression among young adults.

### **3.4 Mobility and sleep quality**

From the six aspects evaluated regarding mobility, four were significantly associated to sleep quality: mobility to grocery and pharmacy ( $df = 1$ ,  $F = 17.77$ ,  $p < 0.001$ ), mobility to residential places ( $df = 1$ ,  $F = 23.76$ ,  $p < 0.001$ ), mobility to workplaces ( $df = 1$ ,  $F = 24.02$ ,  $p < 0.001$ ) and mobility due to retail and recreation ( $df = 1$ ,  $F = 7.46$ ,  $p = 0.006$ ). In contrast, mobility to parks ( $df = 1$ ,  $F = 0.00$ ,  $p = 0.985$ ) and to transit stations ( $df = 1$ ,  $F = 0.33$ ,  $p = 0.565$ ) were not associated with sleep quality. An inverse association was found between sleep quality and mobility to residential and workplaces and mobility due to retail and recreation (Figure 3, panel a, b, c), suggesting that a worse sleep quality was associated with more restricted mobility related to those activities. In contrast, a direct association

was found between sleep quality and mobility to groceries and pharmacies (Figure 3, panel d), suggesting that less restricted mobility related to this activity was associated to worse sleep quality among young adults.

### **3.5 Mobility and SOC**

From the six aspects evaluated regarding mobility, three were significantly associated to SOC: mobility to grocery and pharmacy ( $df = 1$ ,  $F = 13.04$ ,  $p < 0.001$ ), mobility to residential places ( $df = 1$ ,  $F = 17.66$ ,  $p < 0.001$ ), and mobility to workplaces ( $df = 1$ ,  $F = 9.93$ ,  $p = 0.002$ ). In contrast, mobility to parks ( $df = 1$ ,  $F = 0.04$ ,  $p = 0.852$ ), to transit stations ( $df = 1$ ,  $F = 2.99$ ,  $p = 0.084$ ) and mobility due to retail and recreation ( $df = 1$ ,  $F = 2.91$ ,  $p = 0.088$ ) were not associated with SOC. A direct association was found between SOC and mobility to residential and workplaces (Figure 4, panel a, b), suggesting that the more restricted the mobility related to those activities, the lower the sense of coherence. In contrast, an inverse association was found between SOC and mobility to groceries and pharmacies (Figure 4, panel c), suggesting that the less restricted the mobility related to this activity, the higher the sense of coherence of young adults.

## **DISCUSSION**

This is the first study to evaluate mental health in Ecuadorian population during the COVID-19 pandemic, addressing four aspects of mental health: EE, SQ, depression and SOC. We found that EE, poor SQ, depression and a low SOC are more common among women in comparison to men. These four aspects of mental health were also significantly related to the level of compliance with lock-down measures. Interestingly, we found that the level of confinement affected mental health of women and men differently, especially in regard to depression and SQ.

### **Mental health and compliance with confinement**

We found that depression, poor SQ and EE were associated with never leaving home or leaving home more often during the period of mandatory confinement. These findings suggest that never leaving home or leaving home more often than recommend during confinement somehow were associated with higher psychological distress. The fact that lock-down measures negatively influenced mental health is supported by previous evidence <sup>23</sup> not so the fact that poor compliance causes detrimental effects on mental health <sup>24</sup>. It is likely that people who left home more often, did so because of need, in terms of food insecurity or economic crisis, which on the other hand are also associated with poorer mental health <sup>25,26</sup>. In this way, it is likely that in informal-predominant economies, confinement measures might limit labor supply of informal workers, especially self-employed, and subsequently imply less comply with stay-at-home orders <sup>27</sup>.

### **Emotional eating among women and men**

Emotional eating is defined as the propensity to eat in response to positive or negative emotions <sup>5,7</sup>. Stressful situations such lock-downs trigger stress and/or discomfort, which could prompt people to develop emotional attitudes when eating <sup>28</sup>. Our finding is in line with others in that, all suggest an increased frequency of alterations of eating patterns during COVID-19 pandemic <sup>27,29</sup>. We also found that in the context of the COVID-19 pandemic, women are more likely to show EE behaviors in comparison to men. In line with our results, recent evidence showed that EE occurs quite often among women <sup>7</sup>. Vulnerability of women to experience EE is not well understood, but it is probably related to hormonal changes due to the menstrual cycle.

## **Sleep quality among women and men**

Our findings regarding sleep quality are in line with those of others carried out in the context of the pandemic, indicating that confinement is associated with worse sleep quality <sup>30,31</sup>. It is likely that forced confinement results in increased levels of stress/anxiety, as well inability to maintain a physically active lifestyle, which in turn are associated with poorer sleep quality <sup>31-33</sup>. The fact that women more often experienced poorer sleep quality is probably explained by the fact that women are more susceptible to suffer greater psychological burden than men under stressful or demanding situations <sup>34</sup>. Such susceptibility of women can also be explained by an earlier circadian variation of sleep and awaking superimposed on advanced circadian rhythms <sup>35</sup>.

## **Depression among women and men**

Our findings regarding the frequency of signs of depression in the general population in the context of the COVID-19 pandemic agree with those of previous studies <sup>36,37</sup>. Our results indicating that women more often experience signs of depression are also in line with previous research <sup>38</sup>. These differences between women and men regarding depression likely originate in preexisting gender inequalities that may be exacerbated by the COVID-19-related restrictions <sup>38</sup>. In this way, women are probably much more likely than men to do unpaid work for caring for children and dependent relatives, which in turn significantly contributed to a higher risk of symptoms of depression and anxiety <sup>38</sup>.

## **¿Why women?**

As early as April of 2020, a United Nations policy brief (2020) <sup>39</sup> stated that COVID-19 pandemic will place a disproportionate burden on women, as it will negatively impact women's economy and productivity<sup>39</sup>. Worldwide, women are more likely to be working informally and thus, hold less secure jobs usually earning and saving less and, more importantly, women constitute the majority of single-parent households. In Latin America, for instance, it is estimated that 54% of women involved in non-agricultural work are participating in informal jobs. All these considered, the capacity of women to absorb economic shocks is less than men's<sup>40</sup> and therefore could affect their resilience and overall mental health. A similar impact was already observed after the Ebola epidemic, where quarantining measures heavily reduced the economic and livelihood activities of women<sup>39</sup>. Interestingly, countries in the European Union in which gender inequality is less marked than in Latin America, women were also reported to have higher levels of anxiety and depression than males, possibly indicating that the distribution of symptoms following sex patterns were maintained during the pandemic worldwide <sup>40</sup>.

## **Implications, strengths and limitations**

Our findings comply with others in that, they suggest a profound burden of COVID-19 pandemic on mental health. On the other hand, our study emphasizes the need for a strong public health policy in order to carry out differentiated actions to respond to the needs of most vulnerable populations and for measures that promotes resilience. In this way, our findings highlight the importance of applying measures differentiated by sex, given that women more often show mental health issues and lower resilience than men. Our study is important because is the first one conducted in Ecuador including near 10 000 participants. Moreover, it provides for the first time an insight of mental health of young adults in Ecuador and for differences among women and men. However, our study has several limitations: First, we fail to extract information on the reasons that could explain the lack of compliance to lock-down measures. Moreover, sample was not selected by probabilistic sampling therefore our study is probably misrepresenting the general population.

## **CONCLUSION**

Our study confirms the importance of discussing and addressing the consequences of preventive measures such as confinement on mental health as well as the urgency of the implementation of gender-specific strategies to monitor and control the negative effects of the COVID-19 pandemic.

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## Legends

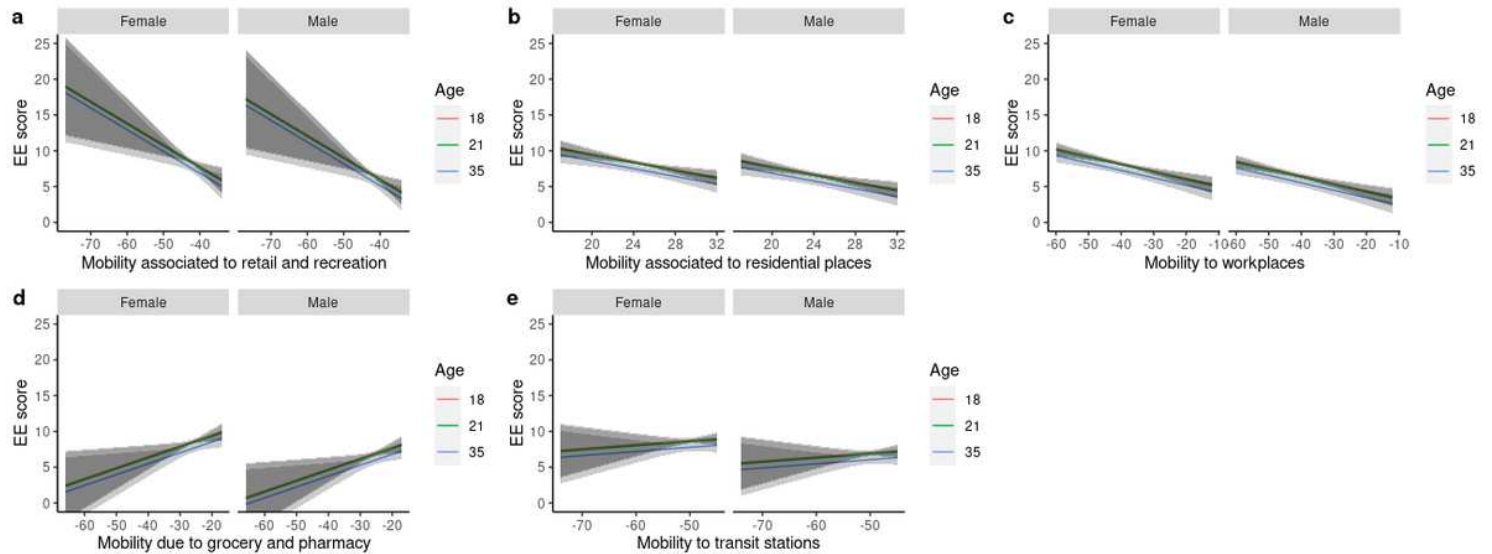
**Figure 1. Emotional eating behavior by sex, age and level of confinement.** Emotional eating behavior was measured by EEQ score (see Methodology). Figure shows adjusted means and 95% CI for EEQ score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.

**Figure 2. Depression by sex, age and level of confinement.** Depression was measured by PHQ-9 score (see Methodology). Figure shows adjusted means and 95% CI for PHQ-9 score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.

**Figure 3. Sleep quality by sex, age and level of confinement.** Sleep quality was measured by PSQI score (see Methodology). Figure shows adjusted means and 95% CI PSQI score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.

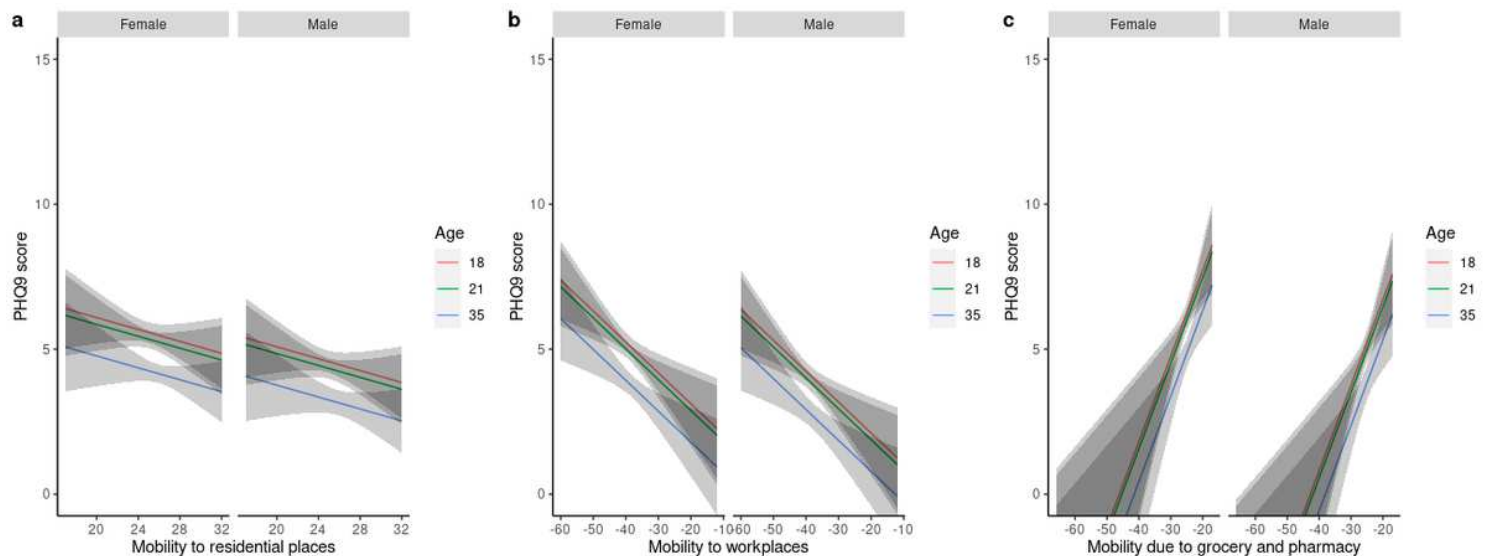
**Figure 4. Sense of coherence by sex, age and level of confinement. Sense of coherence was measured by SOC-15 score (see Methodology).** Figure shows adjusted means and 95% CI SOC-15 score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.

# Figures



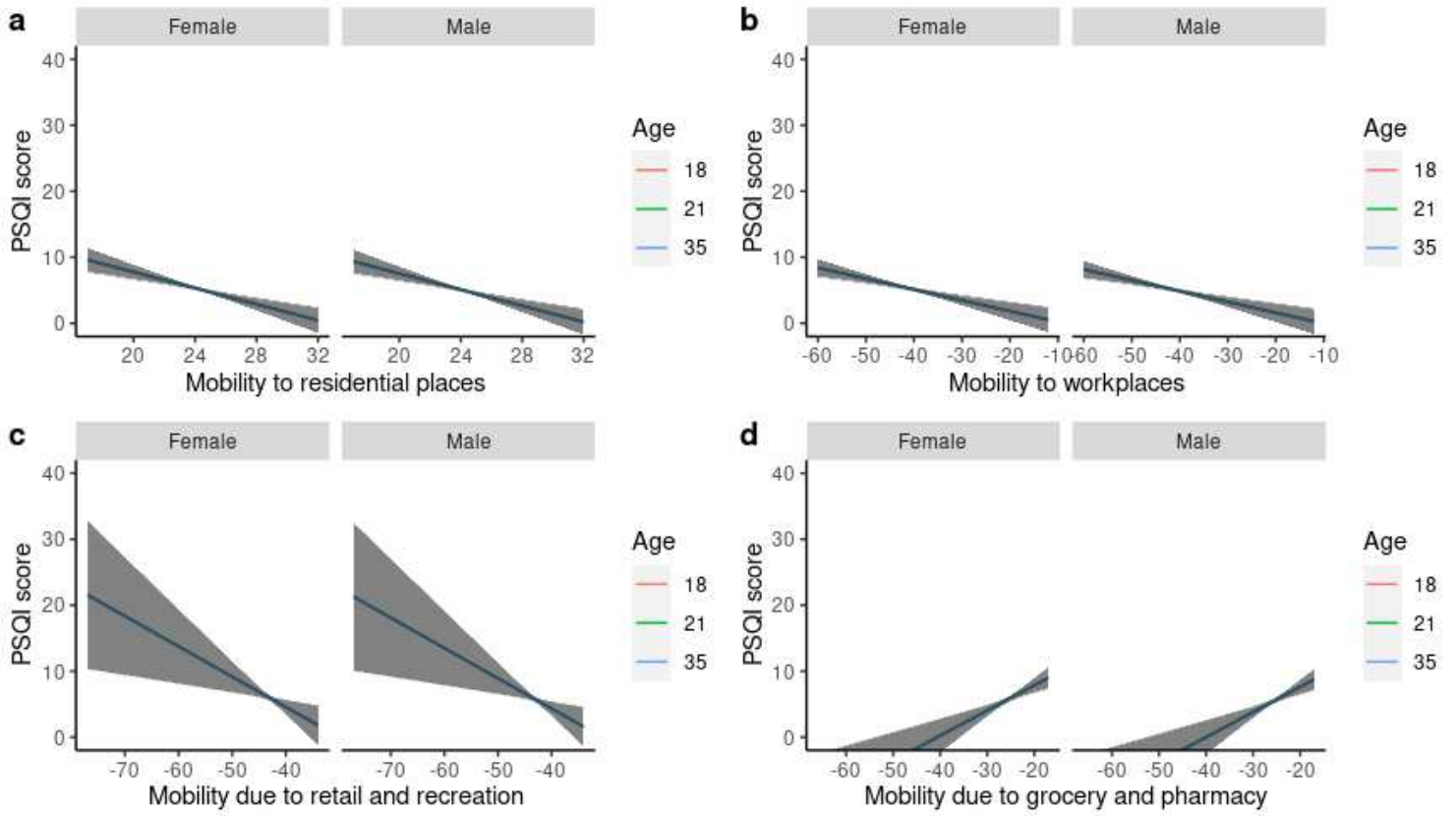
**Figure 1**

Emotional eating behavior by sex, age and level of confinement. Emotional eating behavior was measured by EEQ score (see Methodology). Figure shows adjusted means and 95% CI for EEQ score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.



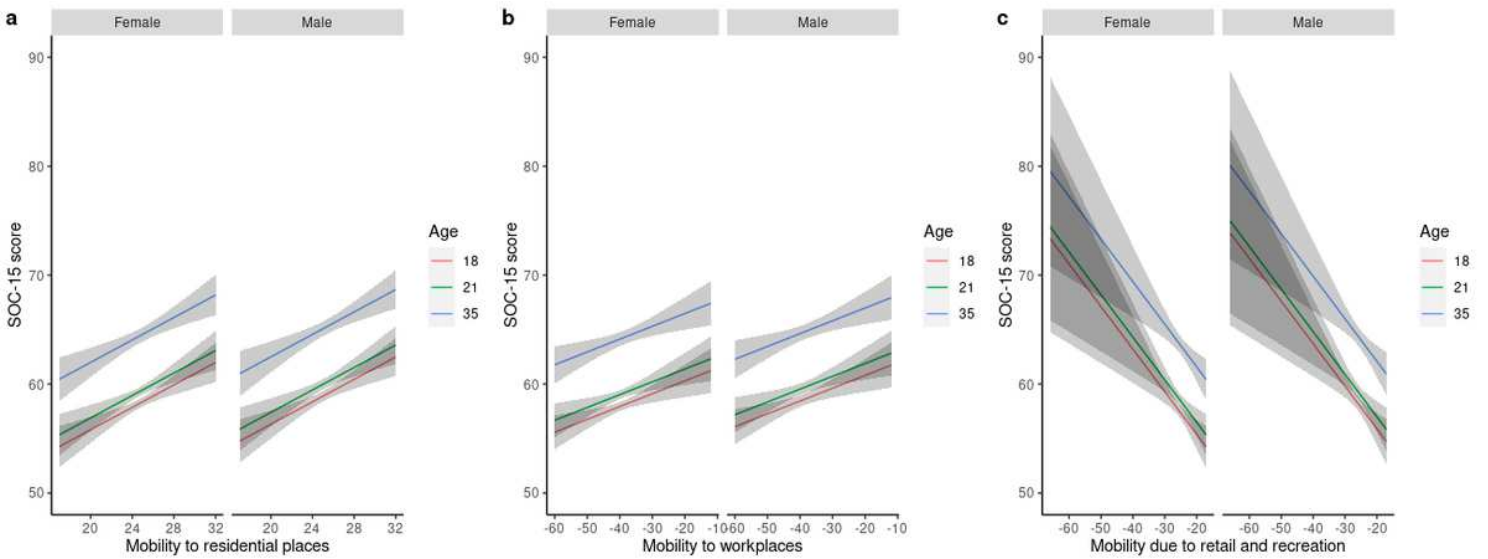
**Figure 2**

Depression by sex, age and level of confinement. Depression was measured by PHQ-9 score (see Methodology). Figure shows adjusted means and 95% CI for PHQ-9 score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.



**Figure 3**

Sleep quality by sex, age and level of confinement. Sleep quality was measured by PSQI score (see Methodology). Figure shows adjusted means and 95% CI PSQI score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.



**Figure 4**

Sense of coherence by sex, age and level of confinement. Sense of coherence was measured by SOC-15 score (see Methodology). Figure shows adjusted means and 95% CI SOC- 15 score. Models were adjusted by age, living with a partner, area of residence, use of sleeping pills, perceiving income, number of people living at home.

## Supplementary Files

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- [table118022021.odt](#)
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