

Effects on the mental health after COVID-19 lockdown period: results from a population survey study in Lima, Peru

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Abstract

1. The coronavirus disease 2019 (COVID-19) has created a rapid global health crisis, involving different social changes, which brought negative effects in different aspects in the mental health of the population, like the COVID-19 lockdown. The majority of COVID-19 cases concentrate in the region of the Americas, being Peru one of the most affected countries in the region. For this reason, to investigate possible effects related to COVID-19 lockdown, the main objective of this work is to establish a statistical model that could explain through different components the COVID-19 related stress in a population after COVID-19 lockdown of Lima, Peru. In this sense, online questionnaires were carried out in 400 participants, where the values of depressiveness, anxiousness and stress related to COVID-19 were evaluated. Other information related to the participant (e.g. gender, age, district, etc.) was collected through this electronic format. In order to explain the data, an ordinal logistic regression was carried out. From the information obtained, it was found that 35.50% of the participants showed mild stress and 9.30% showed severe stress due to COVID-19. The ordinal logistic regression model showed that the severity of stress due to COVID-19 is positive associated with the variables age, depressiveness and anxiousness, as well with the presence of a deceased relative due to COVID-19. On the other hand, the presence of a family member who was hospitalized for COVID-19 is negatively correlated to the stress produced by COVID-19. Therefore, the data shows that people with older age or who have lost relatives due to COVID-19 show higher levels of stress related to COVID-19. Additionally, participants with higher levels of anxiety and depression are more likely to produce higher levels of stress from COVID-19. These factors play an important role for the intervention of future studies that plan to intervene in the mental health of the population affected by the COVID-19 lockdown.

2. Introduction

The coronavirus disease 2019 (COVID-19) has created a rapidly widening health crisis with different negative consequences. Following the World Health Organization's (WHO) reports, the Americas contain actually the higher amount of cases with COVID-19 (1), being Peru one the most affected countries from this region. Initially, the Peruvian government declared in March 2020 an emergency health status, which included a prolonged lockdown with several social restrictions (2). These policies included: the restriction of free movement and the prohibition of any social or educational activity (3). Over time, the Peruvian authorities started to relax the proposed restrictive policies (e.g. with the use of mouth-nose-protection (4)), being these terminated after 4 months, i.e. in July 2020 (5).

Due to long periods of isolation and restriction, many authors have reported the negative effects of these lockdown periods on the mental health. For instance, Holmes et al reported that COVID-19 pandemic might cause an impact on the mental health with important consequences (6). Other reports indicate that pandemics, including COVID-19, are associated with higher depressiveness (7–9), anxiousness (10,11) and stress (12,13) in the general population. In addition, two studies pointed out that longer strictive restriction policies with social avoidance are related to higher anxiousness (14–16). Although the number of literatures regarding psychological effects of COVID-19 pandemic lockdown is growing, few studies

analyze the psychological effects after the COVID-19 pandemic lockdown period. There is agreement on the increase of psychological distress in the population during the pandemic (17), however the after-lockdown-phenomenon is not yet clearly described. The understanding of the effects of the restrictive policies and lockdown periods on the population's mental health suggests the need for further studies. Additionally, this topic gains more importance in the region of the Americas, since this involves the most affected regions and so far, there are no such studies regarding the mental health effects after COVID-19 lockdown policies.

To this end, the objective of the study is to analyze the effects after the COVID-19 lockdown period on the mental health in a general population sample in Lima (Peru), identifying the role and predictive character of sociodemographic variables, the presence of physical symptoms and other health-related variables. For this purpose, a statistical model statistical, that best describe the results obtained from this population survey study in Peru, will be established.

3. Materials And Methods

The information of this study comes from a population database of a Peruvian survey study that englobes health personnel (e.g. physicians, nurses, psychologists, etc.), medical students and general population, which is not related which the other two groups. The information from this database englobes the after-lockdown period due to COVID-19 in Peru

3.1 Study design and selection criteria

Information of recruited participants between the ages of 18 and 80 years old was used. The participants were recruited between 20th July and 18th August 2020. From this online survey database, the information of 400 participants was obtained. A complete description is shown in table 1.

Participants younger than 18 years old, with insufficient knowledge of Spanish language and with medical difficulties to participate in the online survey were not included in this study. Additionally, the information of health personnel and medical students were also excluded from the analysis.

Each participant was fully informed of this study and gave their consent to participate. This study was approved by the ethics committee from the Faculty of Medicine of the Peruvian University Cayetano Heredia and carried out in accordance with the Helsinki Declaration and the ethical standards of the APA.

3.2 Data collection

3.2.1 Online Survey

For the data recollection, an online survey was carried out. Due to the restrictive policies for avoiding COVID-19 infection, all instruments and questions were digitalized and programmed in a survey internet free program (Google Forms). The recollected questions included: (1) the informed consent and the declaration of not being under 18 years old, (2) questions regarding age, gender, district, confession/faith

and occupation, (3) previous medical diagnosis and medication intake, (4) assessment of the COVID-19 peri-traumatic distress index (CPDI) for COVID-19 pandemic, (5) GAD-7 and PHQ-9 instruments.

Finally, it was also asked to the participant through these online electronic questionnaires different questions related to COVID-19 infection. These questions were the following: "*in the last 14 days, did you have cough, difficulty to breath, sore throat and fever?*" (COVID_1), "*do you have positive results for any sort of COVID-19 test?*" (COVID_2), "*have you been hospitalized (or are you hospitalized at the moment) due to COVID-19?*" (COVID_3), "*do you have relatives with positive results for any sort of COVID-19 test?*" (COVID_4), "*do you have relatives who have been hospitalized due to COVID-19?*" (COVID_5) and "*do you have relatives who have passed away due to COVID-19?*" (COVID_6).

After the participant filled the information of the online survey, the data was saved in a Microsoft Excel 2019 file for further analysis.

3.2.2 COVID-19 Peritraumatic distress index (CPDI)

The COVID-19 peritraumatic distress index (CPDI) was first applied in China (18) and lately validated in other countries (i.e. Brazil, Iran and Peru) (19,20). This instrument was designed for a population to evaluate changes related to mood, behavior, cognitive skills, circadian rhythm and other somatic symptoms due to the COVID-19 pandemic.

This instrument consists in 24 items, with a four-factor design: negative mood, cognition, behavioral change, somatization and hyper-arousal/exhaustion. Each item was evaluated by using Likert elements (from 0 to 4: *never, occasionally, sometimes, often* and *most of the time*). The sum of each value per question results in the raw score. The display score is obtained by adding 4 to the raw score and used to calculate the CPDI severity degrees. For this reason, this instrument defines different categories for peritraumatic stress due to COVID-19 pandemic: *normal* (0 to 28 display points), *mild* (29 to 52 display points) and *severe* (53 to 100 display points).

3.2.3 Depressive and anxiety symptoms

The Peruvian version of the PHQ-9 (21) was used to assess the severity of depressive symptoms. The PHQ-9 delivers values in the range between 0 and 27. The highest value indicates a higher depressiveness. This instrument was validated in Peru with a representative sample ($n = 30446$), showed good internal consistency (Cronbach's $\alpha = 0.87$). This inventory defines different categories for depressiveness: *minimal* (1 to 4 points), *mild* (5 to 9 points), *moderate* (10 to 14 points) and *severe* (15 to 27 points).

For the anxiety symptoms, the Peruvian version of the GAD-7 (22) was used to assess the severity of anxiety symptoms. The GAD-7 delivers values in range between 0 and 21 points. The highest value indicates a higher anxiousness. This instrument was also validated in Peru with a representative sample ($n = 2978$), showing a good internal consistency (Cronbach's $\alpha = 0.89$). This inventory defines also

different categories for anxiousness: *minimal* (0 to 4 points), *mild* (5 to 10 points), *moderate* (11 to 15 points) and *severe* (16 to 21 points).

3.2.4 Statistical Analysis

Statistical analyses were performed using SPSS version 26.0 (Statistical Package for the Social Sciences, International Business Machines Corporation, New York, United States of America) and jamovi 1.2.5.0 (23). For the choropleth map of metropolitan Lima (figure 1), the software CARTODB (CARTODB Inc., Denver, United States of America) was used.

Descriptive data was managed with count data and percentages. To improve readability, the information was presented in tables. Quantitative variables approximately fitting a normal distribution are specified in the text as mean \pm standard deviation ($M \pm SD$), those with a non-normal distribution were expressed as median (Me) with percentile 75 (Q3) and percentile 25 (Q1) and the interquartile range (Q3 – Q1; IQR). Categorical variables were specified with count data and percentages. Data was rounded to the next decimal, in order to obtain results with two decimals. Values smaller than 0.001 were shown as < 0.001 and values greater than one million were expressed in scientific notation.

For the statistical model that explains the CPDI values of this sample size, an ordinal logistic regression was computed, considering the CPDI severity degrees as dependent variable. The best model, that explained the CPDI values, was chosen by using the Akaike information criterion (AIC). The following were picked up as predictor variables: *age*, *GAD-7 scores*, *PHQ-9 scores*, *COVID_1*, *COVID_2*, *COVID_3*, *COVID_4*, *COVID_5*, *COVID_6*, *domicile*, *medication intake* and *previous medical disease*. The results of this statistical modelling are presented in table 4. The odds ratio was flagged as “significant” if the two-tailed-p-value was smaller as 0.05. 95-percent confidence intervals were calculated for this model.

4. Results

4.1 General sample description

The first issue was to describe the data regarding the emotional impact after COVID-19 lockdown period in a Peruvian sample of a survey study. General sample description, including medication intake and previous clinical diagnoses of the 400 participants included in the study are listed in table 1. Previous information regarding COVID-19 infection, including COVID-19 infection on relatives are represented in table 2. Descriptive data regarding anxiousness, depressiveness and CPDI scores are presented in table 3. CPDI descriptive data sorted by Lima districts, which include percentages of participants with high CPDI values are represented in figure 1.

4.2 Statistical Modelling for emotional impact after COVID-19 lockdown

The second issue was to establish a plausible statistical model that could explain the obtained differences of emotional impact after the COVID-19 lockdown period in a Peruvian sample of a survey study. For this reason, an ordinal logistic regression was carried out, considering as the dependent

variable CPDI severity (*normal, mild, severe*). The variables *age, GAD-7 scores, PHQ-9 scores, COVID_1, COVID_2, COVID_3, COVID_4, COVID_5, COVID_6, domicile, medication intake and previous medical disease* were included as predictors in this model ($\chi^2_{(df = 13)} = 324, p < 0.001, AIC = 439$). Due to the AIC criterion, the variables *gender, domicile, medication intake, previous medical disease, COVID_1, COVID_2, COVID_3 and COVID_4* were removed from the model, achieving a statistical model with the best AIC value ($\chi^2_{(df = 5)} = 318, p < 0.001, AIC = 429$). Therefore, the variables that remain in the model as predictors were *age, GAD-7 scores, PHQ-9 scores, COVID_6 (Do you have relatives who have passed away due to COVID-19?) and COVID_5 (Do you have relatives who have been hospitalized, or they are hospitalized at the moment, due to COVID-19?)*. The results of this ordinal logistic regression are shown in table 4.

5. Discussion

Obtained descriptive data: The following study was carried out in metropolitan Lima, which is actually concentrates the majority of COVID-19 cases in Peru. Most of the COVID-19 infections are localized in the eastern, central and southern districts of Lima. During the COVID-19 lockdown in Peru, the government declared a sanitary emergency status, generating many restrictions for avoiding the spread of the infections. However, the government did not emphasize on the possible complications related to mental health problems, such as depression, anxiety or stress related to events.

The following study reports the mental health effects after the COVID-19 lockdown period from a sample of Lima, Peru. To evaluate the stress levels due COVID-19 pandemic lockdown, this study used the CDPI, which was used in different countries and its Spanish translation was validated through experts in Peru. The results of this study showed 35.50% of the cases with mild COVID-19 related stress and 9.30% with severe COVID-19 related stress. Similar results were found in Chinese and Iranian population (18,19), but the frequencies were smaller when compared to those obtained in Brazilian population (20). Regarding the obtained values for PHQ-9 and GAD-7, the results of this study showed similar and comparable results with those obtained in Chinese population.

Proposed statistical model – results of the ordinal logistic regression: The results of the ordinal logistic regression model showed that having a deceased relative due to COVID-19 is associated positively with CDPI severity scores. On the other hand, having a relative which were hospitalized due to COVID-19 is associated negatively with CPDI severity scores. These associations could be explained with the fact, that the death of a relative due to COVID-19 generates a stronger negative emotional impact on individuals, whereas having a relative which was hospitalized due to COVID-19 could generate a relief and positive emotions. Other variables, such as age, anxiousness and depressiveness scores, showed also positive associations with CPDI severity scores. The positive associations with age could be explained with the fact that an older age represents more likely a fragility state, being vulnerable for acquiring COVID-19.

Other studies reported similar results to the proposed statistical model in Peruvian population from Lima. One study in Brazil done by *Zhang et al* found different variables with positive association to COVID-19 related stress, such as gender, education, sedentary life, age, etc. (20). This study, in comparison with the

work done in Brazil, found that gender and education did not correlate with COVID-19 related stress. Instead, this study found a strong positive correlation between age and COVID-19 related stress severity.

Similar results were found in the study of *Mazza et al* in Italian population. In this population, female gender, negative affect and detachment were associated with higher levels of depression, anxiety, and stress. *Mazza et al* found also positive correlations with having relatives infected with COVID-19 and higher levels with stress. Similar results were found in this study, since positive associations between CPDI severity values and deceased relatives due COVID-19 were seen. Positive associations with gender were seen in the work of *Mazza et al*. However, in this study no significant associations were seen between COVID-19 stress and gender (24).

Another example is the study of *Losada-Baltar et al*. In this study, different variables (gender, age, having negative self-perceptions about aging, being more time exposed to news about COVID-19, fewer positive emotions, lower quality of sleep, higher loneliness, etc.) correlated positively with psychological distress due to COVID-19 lockdown crisis. The assessments of the study of *Losada-Baltar et al* were done during the lockdown period at home, with similar conditions as this study. Similarity between both studies are seen in the positive associations with age. Although the study of *Losada-Baltar et al* found positive associations between gender and psychological distress, the results of this study were not reported significant positive associations between COVID-19 related distress and gender. Measurements of anxiousness and depressiveness were not carried out by the study of *Losada-Baltar et al*, as well as questions regarding contagiousness and relatives with COVID-19 were evaluated in this study but not in the work *Losada-Baltar et al* (25).

The findings of this study contribute mostly to identify important variables that are positive or negative correlated with COVID-19 related stress severity. Future studies should take this in consideration, mostly the different correlations to possible mental health problems related to pandemics, in order to establish possible public health interventions.

Limitations: Although these findings reveal important correlations and describe the actual panorama in a country with high COVID-19 rates, many limitations may be taken into consideration. As always, the sample size could be larger to generalize the results beyond the context of the study. However, the power obtained from this study with 400 participants was $1-\beta = 0.98$, value that overcome the $1-\beta = 0.80$ threshold. The sample size for the study design used should therefore be sufficient to examine the expected effects. Then, the higher number of women compared to men could have influenced the results. However, studies related with COVID-19 lockdown distress have also reported a higher female participants proportion, which is also reflected in this study. In addition, the proposed model did not show an association between gender and COVID-19 distress severity. As expected, there were many very low CPDI, PHQ-9 and GAD-7 scores in the evaluated participants, which led to skewed distributions. To overcome this limitation, an ordinal logistic regression was computed, due to the fact, that there is no consideration regarding skewed statistical distributions. Finally, Medication intake, previous medical condition and district could affect COVID-19 distress scores. All these variables were included in the

model, in order to observe possible influences on the CPDI severity values. However, these variables did not appear to affect the results of the current study.

Conclusions: In conclusion, there are higher prevalence of COVID-19 related distress, mostly in the northern and southern part of metropolitan Lima, which are mostly affected by COVID-19 infections and represent the poorest districts of this metropolis. In addition, the variables age, depressiveness, anxiousness and the presence of a deceased relative explain higher COVID-19 related distress values. On the other hand, relatives that were hospitalized due to COVID-19 represent a protective factor in this model. Although most of the higher values of the CPDI are concentrated on the poorest districts of metropolitan Lima, no associations were seen between district or domicile and COVID-19 distress severity values.

6. Declarations

The authors declare to have no conflict of interests.

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8. Tables

Table 1: General sample descriptions

	<i>n</i> = 400
Age	
Gender	
<i>Female</i>	262 (65.50%)
<i>Male</i>	138 (34.50%)
Sexual orientation	
<i>Heterosexual</i>	372 (93.00%)
<i>Homosexual</i>	12 (3.00%)
<i>Bisexual</i>	6 (1.50%)
<i>Asexual</i>	3 (0.80%)
<i>Preferred not to answer</i>	7 (1.80%)
Marital status	
<i>Single</i>	174 (43.50%)
<i>Married</i>	144 (36.00%)
<i>Cohabitation</i>	41 (10.30%)
<i>Separated</i>	11 (2.80%)
<i>Divorced</i>	25 (6.30%)
<i>Widowed</i>	5 (1.30%)
Domicile	
<i>Central Lima</i>	284 (71.00%)
<i>Peripheral Lima</i>	116 (29.00%)
Faith	
<i>None</i>	98 (24.50%)
<i>Catholicism</i>	269 (89.40%)
<i>Protestantism</i>	25 (8.30%)
<i>Judaism</i>	2 (0.7%)
<i>Others</i>	5 (1.62%)
Occupation	
<i>Independent worker</i>	41 (10.30%)

<i>Housewife/Househusband</i>	34 (8.54%)
<i>Student</i>	33 (8.29%)
<i>Private concern & enterprises</i>	28 (7.04%)
<i>Unemployed</i>	24 (6.03%)
<i>Teaching</i>	24 (6.03%)
<i>Engineering</i>	21 (5.28%)
<i>Employee</i>	19 (4.77%)
<i>Business administration</i>	18 (4.52%)
<i>Law/Attorney</i>	17 (4.27%)
<i>Others</i>	118 (29.65%)
<i>Work not specified</i>	23 (5.78%)
Medical diagnosis	
<i>Healthy participant</i>	262 (65.50%)
<i>Participant with only 1 medical diagnosis</i>	89 (22.30%)
<i>Participant with more than 1 medical diagnosis</i>	49 (12.30%)
Medication intake	
<i>No medication intake</i>	172 (43.00%)
<i>Medication intake</i>	228 (57.00%)

Table 2 – General previous information regarding COVID-19

	<i>n</i> = 400
(COVID_1) In the last 14 days, did you have cough, difficulty to breath, sore throat and fever?	
<i>No</i>	362 (90.50%)
<i>Yes</i>	38 (9.50%)
(COVID_2) Do you have positive results for any sort of COVID-19 test?	
<i>No</i>	384 (96.00%)
<i>Yes</i>	16 (4.00%)
(COVID_3) Have you been hospitalized (or are you hospitalized at the moment) due to COVID-19?	
<i>No</i>	399 (99.80%)
<i>Yes</i>	1 (0.30%)
(COVID_4) Do you have relatives with positive results for any sort of COVID-19 test?	
<i>No</i>	269 (67.30%)
<i>Yes</i>	131 (32.80%)
(COVID_5) Do you have relatives who have been hospitalized due to COVID-19?	
<i>No</i>	334 (83.50%)
<i>Yes</i>	66 (16.50%)
(COVID_6) Do you have relatives who have passed away due to COVID-19?	
<i>No</i>	346 (86.50%)
<i>Yes</i>	54 (13.50%)

Table 3 – Anxiousness, depressiveness and CPDI score

	PHQ-9	GAD-7	CPDI	CPDI categories	
N	400	400	400	<i>Normal</i>	221 (55.30%)
Missing	0	0	0	<i>Mild</i>	142 (35.50%)
Mean	6.21	5.06	29.50	<i>Severe</i>	37 (9.30%)
Standard deviation	6.07	4.39	14.30		
25th percentile	1.00	1.75	19.00		
Median	5.00	5.00	27.00		
75th percentile	9.00	7.00	38.00		
Minimum	0	0	6		
Maximum	27	21	76		
Skewness	1.29	1.15	0.71		

Table 4 – Ordinal Logistic Regression Model

Model Specific Results - Omnibus Likelihood Ratio Tests					
Predictor		χ^2	df	p	
<i>GAD-7 scores</i>		71.96	1	< 0.001	
<i>PHQ-9 scores</i>		34.15	1	< 0.001	
<i>age</i>		5.63	1	0.02	
<i>COVID_5</i>		5.59	1	0.02	
<i>COVID_6</i>		7.97	1	0.01	
<i>COVID_1</i>		2.01	1	0.16	
<i>COVID_2</i>		0.58	1	0.45	
<i>COVID_3</i>		0.02	1	0.90	
<i>COVID_4</i>		2.95	1	0.09	
<i>gender</i>		0.14	1	0.71	
<i>Domicile</i>		0.56	1	0.45	
<i>Previous medical disease</i>		0.18	1	0.67	
<i>Medication intake</i>		1.50e-5	1	1.00	
Best Model Coefficients (dependent variable: CPDI severity degrees)					
Predictor	Estimate	SE	Z	p	OR, CI95
<i>GAD-7 scores</i>	0.40	0.05	7.80	< 0.001	1.49 [1.35;1.66]
<i>PHQ-9 scores</i>	0.20	0.04	5.62	< 0.001	1.29 [1.14;1.31]
<i>age</i>	0.02	0.01	2.40	0.02	1.02 [1.01;1.04]
<i>COVID_5</i>	-1.19	0.42	-2.83	0.01	0.30 [0.13;0.69]

COVID_6	1.26	0.46	2.73	0.01	
					3.53 [1.43;8.82]

The dependent variable (CPDI severity degrees) had the following order: normal, mild, severe peritraumatic distress due to COVID-19. Abbreviations: PHQ-9 = Patient health questionnaire – 9 items, GAD-7 = Generalized anxiety disorder – 7 items, CPDI = COVID-19 peritraumatic distress index; COVID_1 = “in the last 14 days, did you have cough, difficulty to breath, sore throat and fever?”, COVID_2 = “do you have positive results for any sort of COVID-19 test?”, COVID_3 = “Have you been hospitalized (or are you hospitalized at the moment) due to COVID-19?”, COVID_4 = “Do you have relatives with positive results for any sort of COVID-19 test?”, COVID_5 = “Do you have relatives who have been hospitalized (or they are hospitalized at the moment) due to COVID-19?”, COVID_6: “Do you have relatives who have passed away due to COVID-19?”

Figures

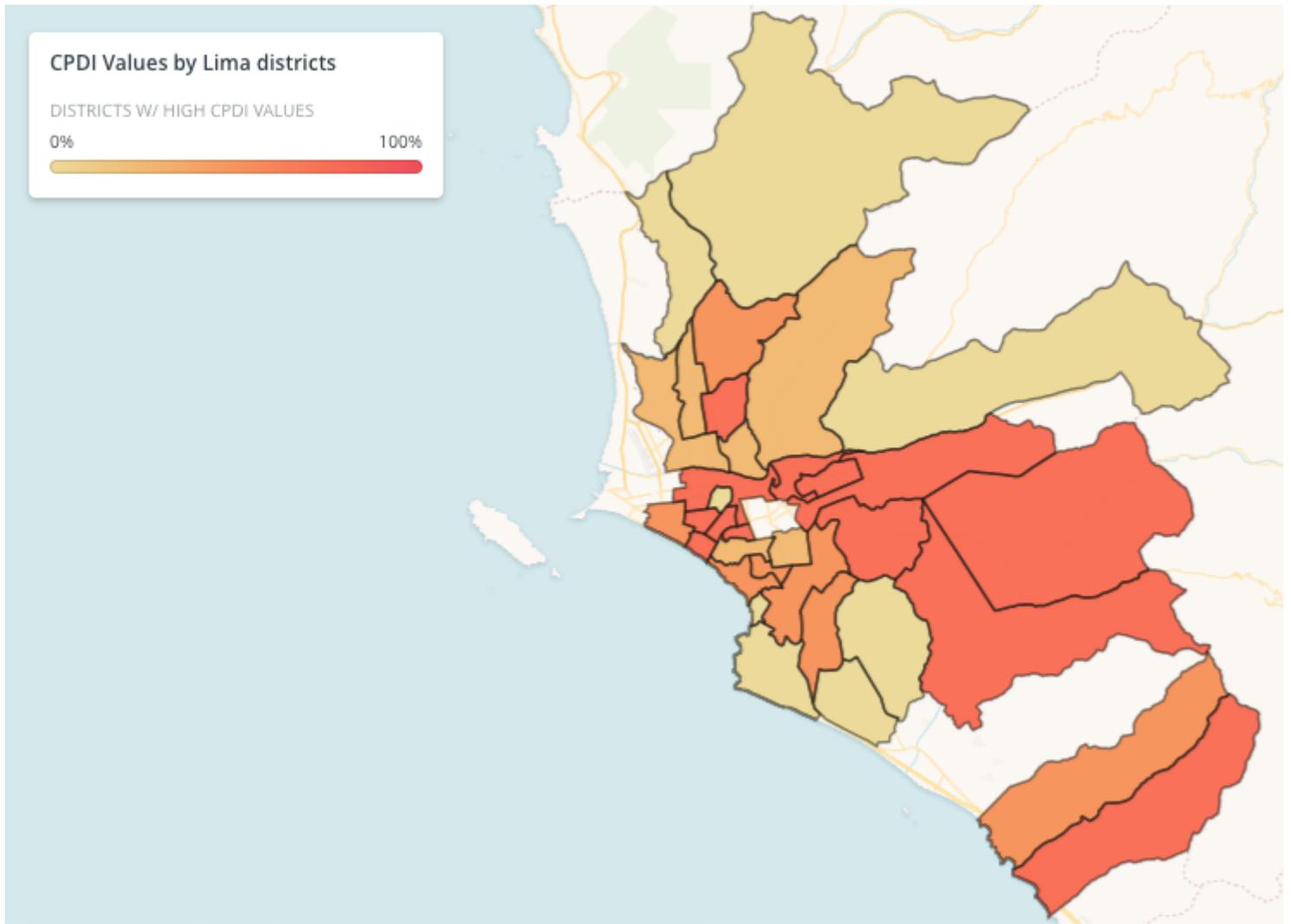


Figure 1

Percentages of cases with high CPDI values for each district of metropolitan Lima