Perceived stress in different countries at the beginning of the coronavirus pandemic

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Abstract

Objective: The coronavirus has spread around the world, causing an ongoing pandemic. After the lockdown and quarantine protocols, an evaluation of the population's current emotional state was made through a web-based survey available in both English and Spanish. The objective was to observe how respondents perceived stress and worry as a result of COVID-19.

Methods: The survey gathered data across three sections: socio-demographic data, the Perceived Stress Scale (PSS-10) by Cohen, and additional queries on current worries and behaviors due to this pandemic.

Results: The survey received 1523 respondents from 48 countries. The mean of the PSS-10 score was 17.4 (SD 6.5). Significantly higher scores were observed among women, young adults, students, and those who expressed concern about getting infected and considered themselves high-risk. No significant differences were observed between health professionals and other professions.

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Conclusions: We describe an increase in stress levels due to the COVID-19 and point out groups at high risk. These findings could help to address the mental health care that is needed.

Keywords
coronavirus, COVID-19, pandemic, PSS-10, stress, worry

Introduction

Towards the end of 2019, the WHO China Country Office was informed of pneumonia cases with an unknown etiology detected in Wuhan City, Hubei Province of China. Further on, after trying to trace the outbreak's cause, Chinese authorities identified a new type of coronavirus on January 7, called SARS-CoV-2. On 12 January 2020, China shared the genetic sequence of the novel virus. Since the beginning of the outbreak, what is now known as the Novel Coronavirus (COVID-19) has spread subsequently to the rest of the world, causing this respiratory disease to be a pandemic. COVID-19 can cause anything from mild respiratory problems to pneumonia or death, with men and the elderly the most vulnerable to suffer the severity of this infectious disease. As the ongoing pandemic continues to develop, the World Health Organization (WHO) declared COVID-19 a public health emergency of international concern. Currently, approximately 98% of the global COVID-19 cases are outside China. When our survey ended, there were over 3 million confirmed cases and more than 200,000 deaths (mainly in the US and Europe). There was a remarkably high rate of reported cases in Health Care Workers (HCW) among all cases.

We anticipated that the outbreak of COVID-19 would cause stress, producing an increase of anxiety and psychological distress, just like it is suggested by the first studies of this pandemic in China.[1,2] Taylor et al. describe high levels of reliance to explain others' support to get through tough times.[3] For example, the vulnerability that this potential global health threat may feel requires the use of physical control measures. Measures like social distancing, home quarantine, school, and work closures; resulting in disruption to social support networks when this was most in need. Brooks et al. inform that quarantine's psychological impact is wide-ranging, substantial, and maybe long-lasting.[4] This change of circumstances and rise of stressors have promoted psychiatrists to be attentive to possible relapses in patients with prevailing mental health problems. Considering the lockdown and quarantine situation, we decided to evaluate the general population's current state with a web-based survey to efficiently distribute worldwide and receive immediate results, which was already used in

this pandemic.[5,6] Feizi et al. point out that psychological stresses are also associated with a considerable increase in mortality in the general population.[7] Brooks et al. studies the psychological impact of quarantine, suggesting that health officials should provide measures to ensure the quarantine experience as something tolerable, if not, the negative experience during quarantine can have long-term consequences that not only affect the people quarantined but also the healthcare system that conducted it.[4]

This survey is an attempt to measure the perceived stress at the beginning of this pandemic. First, it aims to find out how this pandemic influences the affective state of diverse populations. Next, it seeks to identify groups at risk for higher stress levels. Therefore, this study represents an attempt to understand how current mental health care practice may need to shift due to this pandemic. Early identification of the behavioral effects of a pandemic helps to set the community measures and responses to deal with it.[8]

Methods

From 17 March 2020 to 1 May 2020, a web-based survey was sent through social media, with a version in both English and Spanish. The frame time chosen was the first three months of the pandemic COVID-19 in order to study the first emotional impact in different countries. The survey was sent to the academic colleges the investigators had in different countries; following a virtual snowball sampling, they were encouraged to spread it around, so different countries participated. The Research Ethics Committee of the Hospital of University of Salamanca Health Care Complex was informed of the project, and after evaluation, the members approved the study.

Those who received the survey and were interested in participating answered the questionnaire freely; all survey answers were collected anonymously, handled confidentially without identifying information. Participants were not compensated for collaborating. Completion of the survey was considered to imply consent. The questionnaire had 22 items that gathered information in 3 sections:

1. Sociodemographic data including age, gender, nationality, employment status, and the current city of residence when answering the questionnaire. A dichotomous question was added to specify if they were health professionals or not.
2. Supplementing this, they answered the Perceived Stress Scale (PSS-10), which is designed with ten questions, each graded on a 5-Likert scale from never to very often.[9] The total score ranged from 0 to 40, considering low from 0 to 13, moderate from 14 to 26, and severe from 27 to 40. The scale was chosen as a widely used psychological instrument to measure the degree to which circumstances are identified as stressful and validated in English and Spanish.[10,11] The Cronbach's α in this study was 0.86.

3. Also, based on the study of the influenza A/H1N1 pandemic of Liao et al., respondents answered one additional question to estimate (all related to COVID-19): the anticipated worry (a prospective measure), experienced worry (a retrospective measure), current worry (a current measure), perceived absolute susceptibility (a prospective measure), perceived relative susceptibility (a prospective measure) on a 5-Likert.[12] Two additional questions were included in determining the altered/or not behavior due to the COVID-19 related to the CDC recommendations: avoiding crowded places and hand cleaning.
4. Moreover, the following epidemiological data was gathered based on the responses: Human Development Index of the Country (HDI) as provided by the United Nations Development Programme; the number of inhabitants per town; culture of the country (as described in Baxter et al.).[13] To explore the impact of restrictive measures, Oxford COVID-19 Government Response Stringency Index (OxGRSI) and mobility trends from the Google and Apple mobility reports were used.[14–16] OxGRSI, through 20 indicators, assesses how strict the government measures are against COVID in each country; meanwhile, mobility is assessed in different ways. For example, the Apple mobility report is based on how many addresses have been searched compared to baseline volume (January 13, 2020). Finally, the relative search volume (RSV) in Google Trends of the terms "coronavirus" and "COVID" 1, 7, and 14 days before each response was collected. RSV ranges from 0 to 100 and is the "query share of a particular term for a given location and time period, normalized by the highest query share of that term over the time-series".[17]

Dichotomic variables were analyzed using the chi-square test, and the t-student test (or U Mann-Whitney, when proceed) was used to assess the differences between continuous variables. Spearman's rho was used to measure the correlation between variables. Finally, multiple linear regression with backward elimination was conducted to identify independent factors that determine the PSS-10. Statistical analysis was performed using SPSS package v 20.0.

Results

The survey received 1523 respondents from 48 countries between March 17 to May 1, 2020; higher PSS-10 is represented in darker colors (Figure 1 and Supplementary Table). Most participants were from Spain (43.8%), the Philippines (31.6%), and Colombia (9.4%). The respondents' mean age was 42.3 (13.5) years old, and more than two-thirds were women. 74.9% of respondents were part-time or full-time workers, and 23.9% were health personnel. Most of the respondents came from countries with high or very high HDI

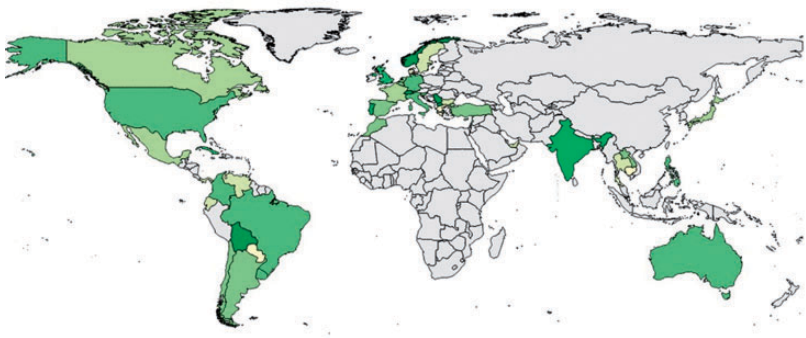

Figure 1. Countries that responded to the survey. Darker colours show higher PSS-10 scores.

and urban environments. The primary cultures were Ibero/Latin, Indo/Asia, and Euro/Anglo (Table 1).

The majority of respondents were from countries where COVID-19 cases had already been declared before answering the survey (median 6411 cases, 149–88,122), and most of the responses came from countries with reported deaths (98.6%). Most of the countries represented had lockdown measures already in place with a mean OxGRSI of 85.5 (SD 4.4). The country RSV was 60.4 (SD 22.1), and the mobility data collected showed a reduction of approximately 50% (data not shown).

The mean of the PSS-10 score was 17.4 (SD6.5). No significant changes were observed in the score during the study. Significantly higher scores were found among women, young adults, students, and those who expressed concern about becoming infected by COVID-19 and those who perceived increased susceptibility to the coronavirus. The difference appreciated between women vs. men was 2.9 ($p < 0.001$, CI95% 2.2–3.6), and the difference between people $\geq$60 vs. $<$60 years old was 3.1 ($p < 0.001$ CI95% 2.1–4.1) (Table 2). In students vs. others, the difference was 3.4 ($p < 0.001$, CI95% 1.9–4.9). People in countries with high HDI compared to very high HDI had greater PSS-10 scores ($p = 0.031$). Ibero/Latin culture (which includes Spain and Latin American countries) scored lower stress levels compared to all the other cultures ($p = 0.015$). By comparison, no significant differences were observed between the HCWs and the general population. In the sub-analysis between cultures, HCWs from Ibero/Latin culture showed significantly higher scores than the general population ($p = 0.045$).

Avoiding crowded places and hand hygiene was significantly more frequent among those who scored higher in the questions related to worry, showing no significant association with susceptibility questions. None of those behaviors were statistically associated with higher PSS-10 scores. During the study,

Table 1. Sociodemographic characteristics.

	Frequencies (%)
Sex	
– Female	1019 (66.9%)
– Male	504 (33.1%)
Age	
– <30 yr.	330 (21.7%)
– 30–59 yr.	1029 (67.6%)
– 60+ yr.	162 (10.6%)
Employment Status	
– Employed	1140 (74.9%)
– Unemployed	98 (6.4%)
– Student	93 (6.1%)
– Other	192 (12.6%)
Healthcare professional	
– Yes	364 (23.9%)
– No	1159 (76.1%)
Region	
– Southern Europe	709 (46.6 %)
– South Eastern Asia	487 (32%)
– South America	171 (11.2%)
– North America	40 (2.6%)
– Western Europe	32 (2.1 %)
– Northern Europe	26 (1.7%)
– Western Asia	19 (1.2%)
– National quarantine	
– Yes	1402 (92.1%)
– No	112 (7.4%)
Anticipatory worry	
– Yes	990 (65%)
– No	533 (35%)
Experienced worry	
– Yes	1095 (71.9%)
– No	428 (28.1%)
Current worry	
– 0–5	256 (16.8%)
– 6–10	1267 (83.2%)
Perceived susceptibility to COVID	
– Likely	245 (16.1%)
– Unlikely	1278 (83.9%)
Perceived relative susceptibility to COVID-19	
– Higher	309 (20.3%)
– Lower	1214 (79.7%)

(continued)

Table 1. Continued.

	Frequencies (%)
Avoiding crowded places due to COVID-19	
– Yes	823 (54%)
– No	700 (46%)
Hand hygiene measures	
– Often or very often	1032 (67,8%)
– Less frequent	491 (32.2%)
Culture	
– Ibero/Latin	852 (55.9%)
– Indo/Asia	495 (32.5%)
– Euro/Anglo	136 (8.9%)
– Others	40 (2.6%)
HDI	
– Very high	852 (55.9%)
– High	657 (43.1%)
– Other	14 (1%)
Urbanicity	
– <10,000	59 (3.9%)
– 10–100,000	162 (10.6%)
– 100,000	1267 (83.2%)

there were no changes found concerning the possible precautionary measures facing COVID-19.

No significant correlation was found between the results depending on the urbanicity, the number of reported cases or deaths per country, the OxGRSI, the RSV in Google Trends, and the score obtained in the PSS-10. A fragile significant association was found between the mobility trends in Google "Parks" and Apple "walking" with PSS-10. As expected, a significant and stronger association (rho > 0.7) was found between all mobility trends and OxGRSI.

In the linear regression, the items that perform as variable predictors of the PSS-10 were age (B-0.1 $p < 0.001$), female gender (B 2.0 $p < 0.001$), reported worry (B1.9 $p < 0.001$), susceptibility (B 0.6, $p < 0.001$), Ibero/latin culture (B −0.9, $p = 0.003$) and student (B 2.2, $p = 0.001$). Those variables explained 23% of the variance ($R^2 = 0.23$).

Discussion

These results describe heightened affective symptoms due to COVID-19 in the very early stages of the pandemic, 70% of the responses were given within 20 days after the pandemic declaration. This pandemic raises anxiety levels, just as suggested by some Chinese studies.[1] Overall, the sample showed a

Table 2. PSS-10 results divided by respondent's characteristics.

	Mean (SD)	Sig
Sex		<0.001
– Female	18.3 (6.4)	
– Male	15.4 (6.3)	
Age		<0.001
– <30 yr.	−19.9 (6.5)	
– 30–59 yr.	−17.0 (6.4)	
– ≥60 yr.	−14.6 (5.8)	
Employment Status		<0.001
– Employed	−17.4 (6.3)	
– Unemployed	−17.1 (6.9)	
– Student	−20.6 (6.9)	
– Other	−15.8 (6.8)	
Healthcare professional		0.267
– Yes	−17.7 (5.9)	
– No	−17.3 (6.7)	
Region		
– Southern Europe	−17.1 (6.8)	0.635
– South-Eastern Asia	−18 (6.2)	
– South America	−17.1 (6.3)	
– North America	−16.8 (5.2)	
– Western Europe	−16.7 (7.3)	
– Northern Europe	−19.2 (7.9)	
– Western Asia	−16.1 (5.7)	
National quarantine		0.316
– Yes	−17.4 (6.6)	
– No	−16.8 (5.9)	
Anticipatory worry		<0.001
– Yes	−18.6 (6.4)	
– No	−15 (6.0)	
Experienced worry		<0.001
– Yes	−18.5 (6.2)	
– No	−14.5 (6.5)	
Current worry		<0.001
– 0–5	−14.1 (6.2)	
– 6–10	−18.0 (6.4)	
Perceived susceptibility to COVID-19		<0.001
– Likely	−19.1 (6.3)	
– Unlikely	−17.0 (6.5)	
Perceived relative susceptibility to COVID-19		<0.001
– Higher	−19.1 (6.3)	
– Lower	−16.9 (6.5)	

(continued)

Table 2. Continued.

	Mean (SD)	Sig
Avoiding crowded places due to COVID-19		
– Yes	−17.6 (6.5)	0.123
– No	−17.1 (6.5)	
Hand Hygiene measures		0.249
– Often or very often	−17.5 (6.7)	
– Less frequent	−17.1 (6.1)	
Culture		P = 0.025
– Ibero/Latin	−17.0 (6.7)	
– Indo/Asia	−18.0 (6.2)	
– Euro/Anglo	−17.5 (6.6)	
HDI		P = 0.031
– Very high	−17.1 (6.7)	
– High	−17.8 (6.2)	
Urbanicity		P = 0.213
– <10,000	−17.8 (5.9)	
– 10–100,000	−16.5 (7.2)	
– 1,00,000	−17.4 (6.5)	

PSS-10 score of 17.4, which is considered as a moderate score however it is significantly higher than reported in the general population in studies done in US and European countries years before this pandemic.[9,18,19] The score reached in this cohort reveals similar values reported during the SARS outbreak in 2003, placed it at 18.5, or in patients recently diagnosed with oral cancer 16.7, or with ovarian cancer 17.9.[20–22] High levels of perceived stress have been related to mental and organic diseases. For example, high perceived stress has been associated with a higher risk of suffering from peptic ulcers, cancer, or coronary heart disease.[23–25]

The study results show the affective and cognitive alterations people are going through. Mackay et al. described adjective mood checklists as a popular method of gathering data about an individual's phenomenological perception of his reaction's behavioral and cognitive components to different situations.[26]

This study identified a negative correlation between age and the score given on the scale; the proportion of PSS-10 over 14 declined with age: below 30 years old (78%), between 30–59 years old (62.8%), and over 59 years old (49.4%). The decrease in the perception of stress in older people and HCWs was already reported in the SARS pandemic.[10,18,19,27] Additionally, a study using the SAS score also reported this decrease in people over 50 during this pandemic.[6] It could seem contradictory to find that older respondents showed lower levels of anxiety and worry, knowing that this age group presents more frequently severe pneumonia. The infection fatality ratio is higher than ten-fold higher.[28]

Carstensen et al. offered reasons for this decline of stress with age, from the selectivity of positive aspects to reduced physical reactivity due to physical and health limitations.[29] Frazier et al. emphasized three key components to explain the changes in integration for social decisions in aging: theory of mind, emotion regulation, and memory for past experience.[30] In the multivariate study, being a student also showed a higher score in the PSS-10. This could be related to recent studies in college students, which showed a high mental disorder rate.[31]

Even if the COVID infection outline shows higher mortality in men, the results present women with higher stress scores. This finding has already been described in the general population.[18,19,32] The reasons for this finding may be related to sex differences in coping with stress. The findings in this paper point out higher levels of anxiety and worry in women. Numerous studies show how women report a higher intensity of the symptoms than men and display gender and sensitivity to stressful life events' depressogenic effect, where women reported higher stress rates.[33,34] Dalgard et al.'s study explains why with a more affiliative style and a more substantial involvement in household and family matters, women are more exposed to social networks.[35] Based on this, women are more likely than men to report events in the social network, as it shows the contribution of each gender to this survey.

Healthcare professionals are a high-risk group due to the continuous exposure to patients with COVID-19 and the ongoing changes in the health system.[36] However, our findings reflect that HCWs do not show statistically significant different stress levels than the general population. This result is like the ones described in the SARS pandemic, where the general population and HCWs scored 18.3 and 18.6, respectively.[20] A possible explanation for this is that these professionals are more accustomed to managing higher stress levels because of the nature of their jobs or because of a denial mechanism.[27] The survey was also carried out at the beginning of the outbreak, and the distress may arise subsequently. Although, as mentioned before, the HCW showed higher scores than the general population in the Ibero/Latin culture. This could be influenced by the higher number of respondents in Spain, a country that has stated that more than 20% of the cases declared are health professionals. To examine whether the stress level rises in time, alongside the pandemic's progression, would be interesting.

Furthermore, in our cohort, those who reported concern or susceptibility to COVID-19 were those with higher scores. These results are similar to the latest outcomes in Southwest China.[6] Their results show that those who are "very worried" have higher anxiety levels and depression, and it can predict the SAS and SDS scores in the population who are not infected by COVID-19. On the other hand, studies of SARS 2003 show a quick decline (from April to May) of the percentage of Americans and Canadians who were "concerned" this did not appear in this survey.[37] This could maybe be explained by the short course of the pandemic that could influence the results. On the other hand, the

medical and socioeconomic consequences of SARS 2003 were not as severe as the effects of COVID-19; this could explain why the levels of worry are maintained.

The main finding in Liao et al. is that affective measures of risk perception generally had stronger associations with reported modification of health-protective behaviors.[12] The behaviors examined in this survey to reduce the exposure to the infection were: the more profound concern in avoiding crowded places and performing hand sanitizing conducts almost all the time. These precautionary behaviors taken against COVID-19 are higher than those described in Canada and the USA during the 2003 outbreak.[37]

Concerning the other epidemiological data, the Ibero/Latin culture shows a lower PSS-10 than the rest. These results are like the ones described in the literature. The Ibero/Latin population showed an OR of 0.7 (0.6–0.9) for anxiety disorders than the Anglo/Euro population.[13] On the other hand, the PSS-10 reported in this survey on Asian culture is higher than expected since previous studies showed lower anxiety levels among Asians. This finding could maybe be related to the fact that the pandemic started in Asia. The relation between HDI and the PSS-10 showed that the higher the stress scores, the lower HDI. A possible explanation could be, like Qiu et al. explains, that areas with an efficient health system show fewer anxiety levels even if they have a higher risk of COVID-19 infection.[2]

An exploratory analysis was performed using the data from different sources: the government's response to the pandemic reflected in OxCGSI, the search volume of Google Trend, or the mobility reports of Google and Apple. In them, no relevant correlation was found between the PSS-10 results and the GT values. It would be reasonable to think that the degree of confinement and the exposure to a higher degree of information about the disease could increase the stress levels. Recently, a study confirmed that spending $\geq$2 hours a day on COVID-19 news via social media was associated with probable anxiety and depression in community-based adults.[5] It would be interesting for future studies to explore the relationship between readily available and real-time information and the degrees of stress, which would allow a first approach to treating mental health if needed. Our response to mitigate the affective and cognitive consequences of the quarantine can be based on Brooks et al. recommendations: giving people as much information as possible, providing adequate supplies, reducing boredom, and improving communication.[4]

Finally, the results of this study should be interpreted with caution, given the online survey nature. First, while acceptable in this setting, the snowball sampling is not a randomized sampling method; therefore, the sample may not represent the general population. Second, our findings depend on self-report data that can bear a certain degree of ambiguity. Therefore, they are much more vulnerable to the interpreter's scope of accuracy. Third, although the responses come from multiple countries, over three-quarters of them came

from three countries: Colombia, Spain, and the Philippines, which, nevertheless, we believe provide valuable information on the emotional impact of COVID on different continents and cultures at the beginning of the pandemic. Finally, other factors may be influencing the perceived stress, such as socioeconomic or comorbidities that were not recorded. Notwithstanding the above, our study delivers valuable information about the impact of COVID-19 in mental health, using a validated score in a large sample from different countries and cultures, identifying groups at higher risk of distress that may benefit future psychological interventions.

Conclusions

The COVID pandemic outbreak has had a medical and socioeconomic impact around the world. This study has identified elevated stress levels in respondents from different countries in the earlies stages of the pandemic. Our findings showed that some groups (women, students, and younger adults) with higher PSS-10 might be handling this outbreak with more distress. One of the future objectives is to assist those high-risk groups and the general public in managing emotional stress and related personal, professional, and family issues during the COVID-19 pandemic.

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Supplemental material

Supplemental material for this article is available online.

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