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Self-care activities to buffer stress and gain psychological well-being during COVID-19 lockdown: a transnational mediation model

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ABSTRACT

OBJETIVE: to examine the mediation role of self-care between stress and psychological well-being.

DESIGN: a cross-sectional study.

PARTICIPANTS: A sample (N = 1,082) of confined general population from four Ibero-American countries: Chile (n = 261), Colombia (n = 268), Ecuador (n = 282) and Spain (n = 271) balanced by gender and five age-groups (18- 60 years).

PRYMARY OUTCOMES MEASURES: Perceived Stress Scale-10, Ryff's scales of Psychological Wellbeing-14 and Selfcare Activities Screening Scale- 14.

RESULTS: self-care mediated the relationship between stress and well-being during COVID-19 confinement in the analyzed sample.

CONCLUSION: The present study provides the first transnational evidence of the positive influence of adopting self-care activities to reduce stress and gain psychological well-being in a general population during the earlier stages of COVID-19 lockdown.

KEYWORDS: self-care, stress, well-being, lockdown, COVID-19, cross-sectional and cross-cultural study.

STRENGTHS AND LIMITATIONS OF THE STUDY

- This study explores the mediational role of the adoption of self-care activities in the relationship between stress and psychological well-being in a general population at the beginning of COVID-19 lockdown and considering the influence of gender, age and socio-economic factors in this relationship.

- Data is derived from a well-balanced sample by gender, country and age-groups.
- Results have broad implications for public health, highlighting the importance of promoting people's active role in their own care and health behaviour in order to reduce stress perception and as long as social determinants of health are addressed (gender, age, employment situation, income level, being in charge of other people, etc.)
- Results from a sample of people with similar high socio-economic situations may not be representative for more disadvantaged or vulnerable social groups.
- Cross-sectional design precludes the demonstration of a causal relationship between stress, self-care and psychological well-being.
- Self-reported outcomes variables can be inherently biased and confounding.

Introduction

The current coronavirus outbreak has forced many countries to separate, isolate and restrict the mobility of their citizens to decrease potential contact with the infection. Lockdown restrictions have had (and are having) an inevitable negative impact on people's mental health and well-being (1–3). The major negative psychological outcome of the current pandemic is the anxiety and distress caused by it (4, 5). In contrast, the adoption of self-care activities and health behaviors could play a critical role in the prevention of immediate and subsequent complications (6). However, its role has been especially studied in patients with chronic conditions, women and healthcare professionals and none in general population (7,8, 9,10, 11).

The relationship between stress, self-care and psychological well-being

Regarding the relationship between stress, self-care and well-being, prior studies have showed psychological well-being is associated with a lower risk of cardiovascular disease (12, 13) and protects against mental illness through components such as positive relationships with others, autonomy, environmental mastery and psychological flexibility (14, 15, 16). Meanwhile, less perceived stress is related to higher satisfaction with life and happiness (17). As for self-care, it has been found that the adoption of self-care practices is associated to decreased levels of perceived stress (18).

However, none study has explored the potential mediational role of self-care between stress and psychological well-being in non-clinical or non-healthcare samples, and particularly during the current COVID-19 pandemic. Moreover, considering the influence of some cultural and socio-economic factors in this relationship, addressing these variables in such relationship can be critical in order to promote effectively people's healthy behaviours.

Therefore, this study seeks to address knowledge gaps that may positively benefit understanding the role of self-care in a general population during the COVID-19 pandemic and across four different countries. Understanding the contribution of adopting self-care activities may clarify how far promoting healthy behaviours can serve as a worldwide critical strategy to reduce people's stress perception and increase their psychological well-being for the present COVID-19 wave and future pandemics.

Purpose of the Present Study

Firstly, this study is aimed to investigate whether psychological well-being can be predicted by people's stress perception, which other socio-demographics variables can be implied in this relationship and are in common in four Ibero-American countries: Chile, Colombia, Ecuador and Spain. Secondly, it seeks to determinate whether the adoption of self-

care activities mediates this relationship and lastly, if this mediation role reminds similar across these four countries (Figure 1).

Methods

Sample

This study obtained 3452 records of participants from the general population of four countries (Ecuador, Spain, Chile and Colombia) with different average days of confinement (21, 25, 17.5, and 17 days, respectively). Baseline data collection took place between 31 March and 14 April 2020. After reviewing the correct registration of data for all the participants, a stratified sample (n = 1082 participants) was extracted by randomizing cases by gender (female, male), country (Colombia, Ecuador, Chile, Spain) and age. Ethical approval was granted by the Research Ethics Committee (REC) of the responsible university (Project ID: 2020.058). In the case of the groups from Colombia, Ecuador and Chile, approval was given by their local Ethics Committee.

Instruments

Socio-demographic questionnaire

This questionnaire is composed of several questions regarding socio-demographic information, such as: age, gender, city, country, socio-economic status, level of studies completed, professional group, adults and minors in charge and employment situation both before and after the COVID-19 lockdown, along with information related to the COVID-19 lockdown, such as number of days in quarantine, number of people with whom the individuals live, attitude towards the search of information related to COVID-19 and health status, including past psychological and physical illnesses and substance use.

Perceived Stress Scale

The Spanish version of the Perceived Stress Scale (PSS-10) (19) was employed to assess individuals' perceived stress. The PSS-10 is a self-report instrument that consists of 10 items ranging from 0 = never to 4 = very often. A higher score on this scale corresponds to a higher level of perceived stress. Regarding its psychometric properties, the Spanish version of the PSS-10 showed adequate reliability (internal consistency, $\alpha = 0.82$, and test-retest, $r = 0.77$) and sensitivity. Concurrent validity was measured between the PSS and distress and anxiety scores with the Hospital Anxiety and Depression Scale (HADS-T and HADS-A) in a clinical sample, finding positive correlation between variables (20).

Self-care Activities Screening Scale

The Self-care Activities Screening Scale (SASS-14) (21) was administered to assess self-care. This tool is composed of four dimensions (health consciousness, nutrition and physical activity, sleep quality and inter and intrapersonal coping strategies) with 14 items ranging from 1=Never to 6= Always, giving a score per dimension scale and a total score. The higher the total score, the greater the level of self-care activities in which the person engages. The scale has shown good psychometric properties, with good internal consistency (Cronbach's alpha = 0.80) and convergent validity with stress and well-being measures.

Psychological Well-being

The Ryff Psychological Well-being scale (PWBS) (22) was administered to assess well-being. The PWBS has 29 items ranging from 1 to 6, with a minimum score of 29 and a maximum score of 174. This scale is grouped into 6 subscales: self-acceptance, positive relationships with others, autonomy, environmental mastery, purpose in life and personal growth. The scale showed an excellent level of fit to the theoretical model proposed by D. van Dierendonck, with high internal consistency (Cronbach alpha's 0.71 to 0.84) (22).

Procedure

The sample data were obtained on the basis of an online survey shared on social media in each of the countries (taking approximately 15 to 20 minutes) by snowball sampling. Participants first received both written consent and study instructions. Participation in the study was anonymous, voluntary and without economic compensation. From 3452 participants, a stratified sample was extracted by randomizing cases from the four countries by gender and age. The final sample was comprised of 1082 participants.

Statistical analysis

SPSS version 24 was used for data entry and analyses. Descriptive statistics analysis was used to summarize the socio-demographic data (age, gender, country, education level, and income level) and the COVID-19 variables (days of confinement, absence/presence of being in charge of children or elderly people, accompaniment in confinement, professional area, changes related to work situation, health risk for COVID-19 disease, and community resources). Four analyzes of variance (ANOVAs) were carried out separately to compare differences in relation to age, stress, well-being and self-care between countries.

Preliminary analyses were conducted to determine whether socio-economic variables associated with confinement would significantly predict the levels of stress, well-being and self-care. In order to do so, three separate multiple linear regression analyses were performed using the stepwise method (three-step hierarchical). The step 1 included the socio-demographic variables as predictors (with the country included as a dummy variable); in step 2 was included the COVID-19 variables as predictors and in step 3, stress, self-care or well-being were included as predictors according to the respective regression analysis. Once the common variables that significantly predict stress, well-being, and self-care had been identified, a fourth multiple regression analysis was conducted on well-being, with stress, self-care and the previous common predictors as independent variables.

The relationship between stress, well-being, self-care, and the variables resulting from the regression analysis was evaluated using bivariate Pearson correlations corrected for multiple comparisons (Bonferroni method). Lastly, a mediation analysis was performed in order to verify the relationship between stress, self-care, and well-being, where stress (X) was included as an explanatory variable, well-being as a criterion variable (Y), and self-care was added between them as a mediating variable (M). Additionally, the covariates that significantly alter this relationship were considered in this model. The bias correction bootstrap method was used to verify the mediating effect of self-care on the relationship between perceived stress and psychological well-being (a total of 5000 bootstrap samples were extracted from the original data for indirect estimation). In all statistical tests, a p-value of .05 was considered. Finally, the software used for the mediation analysis was PROCESS 3.4.1 (Hayes, 2012).

Results

Descriptive Statistics

The data of 1,082 participants was obtained in four countries: Chile (n = 261), Colombia (n = 268), Ecuador (n = 282) and Spain (n = 271). The mean age of participants was 43.8 years old (SD = 15.1; age ranged from 18 to 95), and 49% (551) of participants were female (Table 1). With regards to educational level, 73.6% (796) of participants had university education; 11.3% (122) technical studies; 14.1 % (153) secondary education and 1% (11) elementary education. In addition, a high percentage of participants were found to have medium and high-income levels (measured in statutory minimum monthly wage [mmw] in American dollars; 1 = 300 USD) in all countries: 30.3% (328) earned more than 5 times the mmw; 16.2% (175) earned 4 times the mmw; 17.5% (189) earned 3 times the mmw;

13.4% (145) earned 2 times the mmw; 8% (87) earned less than the mmw and 14.6% (158) of the sample had no income. The highest percentages of income in the four countries were reported for men.

As for the sociodemographic factors associated with COVID-19, the average number of days of confinement was higher in Ecuador and Spain, with 25 (SD = 4.5) and 21 (SD = 1.0) days, respectively. Meanwhile, Chile and Colombia, with 17.5 (SD = 6.5) and 17 (SD = 4.0) days, respectively, presented a similar period of confinement. For the total sample, 90.8% (982) of participants were accompanied during lockdown, and 26.5% (287) and 31.1% (337) had elderly people and children in charge, respectively. In total, 86.5% (936) reported having community support resources. Finally, 33.9% (367) of the total sample considered themselves a front-line worker and 31.1% (337) expressed a potential risk of contagion from SARS-CoV-2 virus in the last month, while 25% (271) had suffered negative changes in their employment conditions.

The results did not show differences between the countries for the variables age, well-being and self-care. However, there were differences on the stress variable explained by a lower perception of stress and Spain (Table 1).

Table 1. *Descriptive Socio-demographic variables.*

	Spain		Colombia		Chile		Ecuador		*ANOVA*	Total	
	n = 271		n = 268		n = 261		n = 282		*p*	N = 1082	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		Mean	SD
Age	43.8	15.7	44	14.8	43.9	14.5	44	14.8	0.99	43.8	15.1
Stress	17.0	6.1	15.2	6.3	16.9	6.6	16.1	6.3	0.001	16.3	6.3
Well-being	133.6	18.4	134.6	21.2	134.8	20.6	136.7	20.7	0.33	135.0	20.3
Self-care	58.5	9.1	59.8	9.3	58.1	11.0	59.0	10.0	0.22	58.9	9.9
Gender (female)	50.1%		48.8%		48.6%		48.5%			49.0%	

In addition, psychometric properties of the instrument were analyzed in this study. Regarding their reliability in our sample, the Perceived Stress Scale had a Cronbach's alpha of $\alpha = 0.85$; the Self-care Activities Screening Scale was $\alpha = 0.77$ and the Psychological Well-being had $\alpha = 0.91$.

The predictive value of socio-demographics factors, stress and self-care on psychological well-being

The multiple linear regression analyzes on stress contemplated nominal variables such as: gender, work situation changes, accompaniment in confinement; the country variable was coded as dummy and, for its part, education level and income as ordinals. These analyzes showed that age, gender, education level, income level, Colombia, work situation changes, and accompaniment in confinement were statistically significant, predicting 9% of stress variability. The multiple linear regression analysis on well-being showed that age, education level, income level and accompaniment in confinement were statistically significant, predicting 6% of well-being variability. The multiple linear regression analysis on self-care showed that age and gender were statistically significant, predicting 1% of self-care variability. From the three previous multiple regression analyzes, it suggests that age and gender are variables that significantly predict the three main variables: stress, well-being and self-care. The fourth regression analysis performed on well-being and including age, gender, stress and self-care as independent variables, showed that only age was statistically significant, predicting 2% of well-being variability and therefore, age should be included as a covariate in the mediation model (see Table 2)

Table 2. *Linear regression models between socio-demographics variables and stress, well-being, and self -care.*

	1. Stress					2. Well-being					3. Self-care				
Variable	ß standard	*E*	*95% CI* *LL*	*UL*	*p*	ß standard	*E*	*95% CI* *LL*	*UL*	*p*	ß standard	*E*	*95% CI* *LL*	*UL*	*p*
Age	-.134	.01	-.08	-.03	.0001	.10	.42	.05	.21	.001	.09	.02	.02	.1	.001
Gender	-.071	.38	-1.65	-.16	.01	-.06	1.2	-4.9	-.13	.01					
Education	-.107	.27	1.42	-.35	.001	.07	.87	.30	3.7	.01					
Colombia	-.115	.43	-2.5	-.84	.0001										
Income level	-.114	.12	-.66	-.16	.001	.14	.30	.91	2.48	.0001					
Accompaniment in confinement	-.092	.64	-3.3	-.7	.001	.07	2.0	.99	9.18	.01					
Work situation changes	.067	.44	.12	1.8	.01										

	4. Well-being				
	ß standard	E	*LL*	*UL*	*p*
Age	0.15	0.04	0.12	0.28	0.0001
Stress	-0.63	0.07	-2.12	-1.85	0.0001
Self-care	0.22	0.04	0.37	0.54	0.0001

f

Finally, table 3 shows the significative correlations between the variables to be investigated (stress, self-care, psychological well-being and age).

Table 3. *Pearson's correlations between the variables.*

Variables		1	2	3	4
1. Stress	r				
	Sig.				
2. Well-being	r	-.677-			
	Sig.	<.001			
3. Self-care	r	-.213-	-		
	Sig.	<.001	<.001		
4. Age	r	-.182-	.153-	.092-	
	Sig.	<.001	<.001	.014	

Note: Corrected by multiple comparisons with Bonferroni method.

Mediating role of self-care activities between stress and well-being

Results from the mediation model assessing the effect of self-care on the relationship between perceived stress and psychological well-being with age as a covariate showed that a lower level of perceived stress was significantly associated with a greater level of self-care (*a'*=-0.20, p<.0001), which in turn was significantly associated with higher levels of well-being (*b'*=0.22, p<.0001). Furthermore, the 95% confidence interval of the indirect (mediated) effect of Stress - Self-care was [-0.40, -0.22], and in the case of Well-being - Self-care it was [0.37, 0.54], which indicates the existence of significant mediation. On the other hand, a lower level of perceived stress was associated with higher levels of psychological well-being (*c'*= -0.63, p<.0001). The 95% confidence interval of the direct effect was [-2.1, -1.84], which points to a partial mediating effect (see Figure 2). Regarding age, the analysis showed a significant effect only on stress (p<.001), but not on self-care and well-being. Thus, stress, self-care and age variables predict 50.7% of well-

being variability (see standardized coefficients in Figure 2 and non-standardized coefficients in Table 4).

SELF-CARE ROLE BETWEEN STRESS AND WELL-BEING

Table 4. *Estimated coefficients for mediation model by country*

Variables	M (Self-care) a			p	Y (Well-being) c'			p
	Coef *	SE	95% CI		Coef*	SE	95% CI	
Total sample								
X (Stress)	-0.31	0.04	[-0.40, -0.22]	0.0001	-1.98	0.07	[-2.12, -1.84]	0.00001
Covariable (Age)	0.03	0.01	[-0.002, -0.07]	0.06	0.02	0.02	[-0.03, 0.08]	0.39
M (Self-care) b					0.45	0.04	[0.37, 0.54]	0.0001
R2 Stress / F		0.04/27.3		0.0001		0.50/370.0		0.0001
Spain sample								
X (Stress)	-0.21	0.09	[-0.39, -0.03]	0.01	-1.73	0.14	[-2.02, -1.45]	0.00001
Covariable (Age)	-0.03	0.03	[-0.10, 0.03]	0.34	-0.03	0.05	[-0.15, 0.07]	0.48
M (Self-care) b					0.33	0.09	[0.14, 0.52]	0.001
R2 Stress / F		0.02/2.9		0.05		0.39/56.6		0.0001
Colombian sample								
X (Stress)	-0.25	0.08	[-0.43, -0.07]	0.001	-2.16	0.14	[-2.45, -1.88]	0.00001
Covariable (Age)	0.06	0.03	[-0.01, 0.13]	0.09	0.03	0.06	[-0.08, 0.15]	0.60
M (Self-care) b					0.55	0.09	[0.36, 0.74]	0.0001
R2 Stress / F		0.05/6.4		0.001		0.54/105.0		0.0001
Chilean sample								
X (Stress)	-0.48	0.09	[-0.67, -0.28]	0.00001	-1.84	0.14	[-2.45, -1.88]	0.00001
Covariable (Age)	0.11	0.04	[0.02, 0.20]	0.01	0.03	0.06	[-0.08, 0.15]	0.58
M (Self-care) b					0.50	0.08	[0.33, 0.67]	0.0001
R2 Stress / F		0.11/17.4		0.00001		0.53/96.4		0.0001
Ecuadorian sample								
X (Stress)	-0.26	0.09	[-0.45, -0.06]	0.001	-2.25	0.13	[-2.51, -1.98]	0.00001
Covariable (Age)	0.02	0.04	[-0.05, 0.10]	0.54	0.04	0.53	[-0.06, 0.14]	0.43
M (Self-care) b					0.44	0.08	[0.28, 0.60]	0.00001
R2 Stress / F		0.03/4.53		0.001		0.58/131.12		0.00001

Note. *Non-standardized coefficients

These results were replicated in the four participant countries, given that self-care activities operated in the same way as a mediator of the relationship between stress and psychological well-being in the samples from Spain, Colombia, Chile and Ecuador (see Table 4).

Discussion

The aim of this study was to identify the role of self-care activities in a situation of COVID-19 confinement. Results described above indicate that self-care activities significantly operate as a mediating mechanism in the association between perceived stress and psychological well-being in a confinement situation, regardless of the country and other socio-demographics factors (e.g. age, gender, income or education level). This result indicates that people from different countries at the beginning of COVID-19 lockdown implement self-care activities not only as a mitigation strategy of the potential risk of contagion by COVID-19, but also as a strategy to mitigate perceived stress and its negative impact on well-being.

Therefore, the results suggest that the more a person engages in self-care activities, the lower their level of perceived stress and the greater their sense of well-being. The present results are in line with those studies conducted in psychology students (10) or professionals (7), that have shown the relationship between personal care and well-being. Thus, these results highlight the essential role of people in creating their own health and well-being, since self-care can be considered as an important individual health asset for the maintenance of one's own health and that of society in general (24, 25,26).

One possible explanation of this mediation role of self-care is that the manifestation of self-care activities is linked to the adoption of healthy habits, which is associated with

cognitive, emotional and behavioral processes (27,28). And these processes are significantly involved in stress and well-being perception (29,30). This implies that a person who makes use of this type of activities when perceiving a stressful situation, can use it as a strategy to take control over the situation (31) and play an active role in the maintenance of their health, and the recovery of their well-being (32). This would be in line with recent research that has highlighted that it is not the type or amount of stress that determines its impact, but rather the mindset used to appraise the situation of perceived stress (29). Therefore, depending on a person's mindset, a stressful situation can increase her/his physiological response or use it as a personal growth opportunity.

In line with the above, the border between normative, tolerable and toxic stress is highly subjective and the way in which a person signifies reality is crucial. Thus, certain self-care resources, such as a healthy diet, sleep or exercise, do not have an automatic beneficial lasting effect, but rather it is also necessary to work on other personal aspects, such as how the events experienced are meant and understood. It would therefore be worthwhile to support self-care resources with a process of personal resignification.

Similarly, although adherence to health guidelines such as the use of masks, social distancing and hygiene measures, followed by these self-care activities may be perceived at first as bigger stressors, as long as these activities can lead to consolidated health behaviors, they could be used as main mechanisms to reduce stress and regain well-being, and eventually, these healthy behaviors can serve as important protective factors to reduce SARS-Cov-2 comorbidities (33–35).

Regarding the contributions of the present study, it should be highlighted that it is the first research to explore the mediating role of self-care activities between stress and well-being, and the first applied during a COVID-19 lockdown. However, the present study presents some limitations. First, our sample was composed of people with a similar high

socio-economic situation in the four countries. Therefore, these findings may not be representative for more disadvantaged or vulnerable social groups. Second, the use of self-report instruments and social desirability may have influenced the results. Third, the study has a cross-sectional design, and thus, it is not possible to conclude causal relations between the assessed variables.

As future lines of research, on the one hand, it is suggested to conduct longitudinal studies in order to ascertain cause-effect relationships between the measured variables, and explore differences on self-care, stress and well-being at different measurement times. Based on this, it would be appropriate to design intervention programs or strategies to improve self-care activities as a possible pathway to reduce stress and keep healthy during extraordinary situations such as a lockdown.

Figure 1. Hypothetical mediation model.

Figure 2. Mediation model with standardized coefficients.

Ethics approval and consent to participate

All procedures performed in this work involving human participants were in accordance with the ethical standards of the Research Ethics Committee.

Availability of data and materials

The data are not publicly available due to privacy or ethical restrictions.

Patient and Public Involvement

Nonspecific patients were involved in this study.

Conflict of interests

The authors declare they have no competing interests.

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None.

Authors' contributions

EOL, EB, ASP and PFB: contributed to the conceptualization, data curation, formal analysis, investigation, methodology and writing — original draft; EOL, EB and PFB: supervision; MM: data curation, formal analysis and methodology; ASP, EYO, CC, MSG and JVO: investigation, methodology and resources. All authors contributed to reviewing and editing the final manuscript.

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SELF-CARE ROLE BETWEEN STRESS AND WELL-BEING

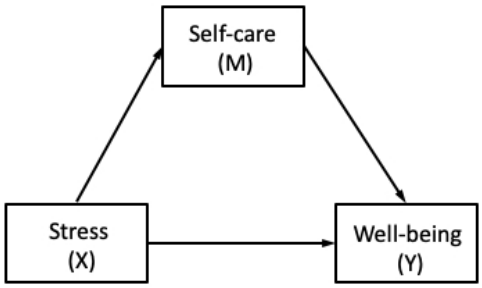

Figure 1. Hypothetical mediation model

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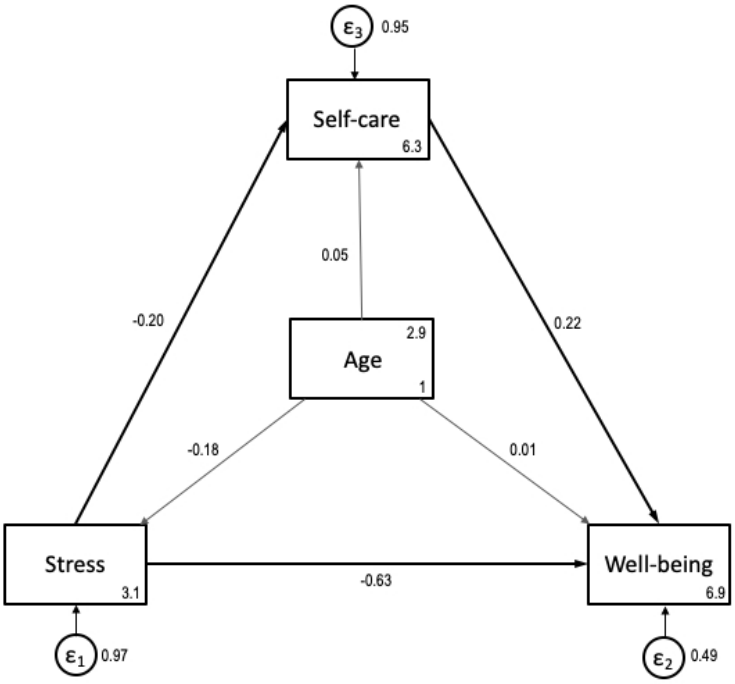

Figure 2. mediation model with standardized coefficients

254x190mm (72 x 72 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page n.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7
		(*e*) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	8-9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-16

		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	16
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Relationship between self-care activities, stress and well-being during COVID-19 lockdown: a cross-cultural mediation model

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Relationship between self-care activities, stress and well-being during COVID-19 lockdown: a cross-cultural mediation model

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Keywords: self-care, stress, well-being, lockdown, COVID-19

Word count: 3990

ABSTRACT

OBJECTIVES: to examine the mediation role of self-care between stress and psychological well-being in the general population of four countries, and to assess the impact of socio-demographic variables on this relationship.

DESIGN: cross-sectional, online survey.

PARTICIPANTS: A stratified sample of confined general population (N = 1,082) from four Ibero-American countries: Chile (n = 261), Colombia (n = 268), Ecuador (n = 282), and Spain (n = 271) balanced by age and gender.

PRIMARY OUTCOMES MEASURES: Socio-demographic information (age, gender, country, education and income levels), information related to COVID-19 lockdown (number of days in quarantine, number of people with whom the individuals live, absence/presence of adults and minors in charge, attitude towards the search of information related to COVID-19), Perceived Stress Scale-10, Ryff's Scale of Psychological Well-Being Scale-29, and Self-care Activities Screening Scale-14.

RESULTS: Self-care partially mediates the relationship between stress and well-being during COVID-19 confinement in the general population in the total sample [$F(3,1078)=370.01$, $p<0.001$, $R^2=0.507$] and in each country. On the other hand, among the evaluated socio-demographic variables, only age affects this relationship.

CONCLUSION: Results have broad implications for public health, highlighting the importance of promoting people's active role in their own care and health behaviour in order to reduce stress perception and as long as social determinants of health are addressed. The present study provides the first transnational evidence of the positive influence of adopting self-care activities to reduce stress and gain psychological well-being in a general population during the earlier stages of COVID-19 lockdown.

KEYWORDS: self-care, stress, well-being, lockdown, COVID-19, cross-sectional and cross-cultural study.

STRENGTHS AND LIMITATIONS OF THE STUDY

- This study explores the role of the adoption of self-care activities on the relationship between perceived stress and psychological well-being in a general population of four countries at the beginning of COVID-19 lockdown while considering the influence of socio-demographic, socio-economic, and COVID-19 related factors.
- Data is derived from a well-balanced sample by gender and age.
- A large part of the sample consisted of university population and frontline covid workers with high incomes, which may bias the interpretations of the results as they cannot be representative for more disadvantaged or vulnerable social groups.
- Cross-sectional design precludes the demonstration of a causal relationship between stress, self-care and psychological well-being.
- Self-reported outcomes variables can be inherently biased and confounding.

Introduction

The Coronavirus Disease 19 (COVID-19) outbreak has forced many countries to separate, isolate and restrict the mobility of their citizens to decrease potential contact with the infection.The coronavirus outbreak and its subsequent mitigation measures have had mental health consequences for the world's population (1–3). Measures such as confinement have led to social isolation, increased telework, increased time spent caring for dependent

people such children and elders, and negative socioeconomic consequences, among other aspects. These changes have had an impact on people's lifestyles during and after the lockdown. The major negative psychological outcome of the COVID-19 lockdown is the anxiety and distress caused by it (4-5). An interesting study developed in Italian population evaluated the differences in stress, anxiety and depression in two time frames during confinement (between 28th April and 3rd May 2021), finding a causal relationship between the pandemic situation and the manifestation of negative psychological outcomes in anxiety and anguish (6). Likewise, other physical and mental health problems such as increased feelings of loneliness, exacerbated fear of the Coronavirus, panic responses, sleep disturbances, and symptoms of post-traumatic stress, among others, have been reported in the literature (7-11).

In contrast, the adoption of self-care activities and health behaviors could play a critical role in the prevention of immediate and subsequent complications (12). However, its role has been especially studied in patients with chronic conditions, women and healthcare professionals (13-18) and none in the general population.

The relationship between stress, self-care and psychological well-being

According to Antonovsky (19) salutogenesis is defined as a concept of stress oriented to coping resources. The author questions and explains why some people remain healthy despite the influence of many stressful situations and risk factors (20, 21). In this regard, the model argues that both health and illness can be the result of stressors. Consequently, in this salutogenic model, health is understood as a dynamic self-regulation process (21) that allows us to face everyday situations, understanding that the absolute control that the person can have over its determinants is unfeasible. Still, this model assumes that people are capable of improving their health (22).

Taking into account that stress can be the result of situations such as the potential risk of contagion by COVID-19 as well as the personal repercussions that confinement has, it could be thought that the implementation of self-care activities oriented to improve health (such as physical activity, an adequate diet, a support network, etc.) could imply an effect on the relationship between stress and well-being. Recently, two proposals have provided evidence of how the assessment that the person makes of stressor experiences can influence the implementation of effective strategies (23). The Theory of Mentality (24) and the Biopsychosocial Model of challenge and threat (25) propose that when making assessments of the functionality of the stress, people can interpret stressful situations as challenges or threats, and therefore, they implement more or less effective behaviors depending on their appraising. This vision leads to the question: what is the potential role of self-care in the already known negative relationship between stress and well-being? From Orem's perspective, self-care is defined as a practice that has therapeutic effects on the development and functioning of people (26). For this reason, self-care is the result of the configuration of agency capacity, which requires awareness, the detection and interpretation of the psychological, emotional and physical problem, that ends with the achievement of an appropriate repertoire of behaviors (27). Prior studies have shown psychological well-being is associated with a lower risk of cardiovascular disease (28,29) and protects against mental illness through components such as positive relationships with others, autonomy, environmental mastery and psychological flexibility (30-32). Meanwhile, less perceived stress is related to higher satisfaction with life and happiness (33). But although it is widely known that self-care involves various activities that potentially influence the health and well-being of people, as far as is known, the research associated with stress, well-being and self-care in the general population is scarce and much more in a situation of confinement.

Recently, a study has proposed a possible mediating role of self-care between stress and self-assessment of perceived health status (understood as the experimentation of well-being) in a population of 223 black women, showing that self-care mediates the negative relationship between stress and self-rated health (34). However, no study has explored the potential mediational role of self-care between stress and psychological well-being in non-clinical or non-healthcare samples, and particularly during COVID-19 pandemic. Moreover, considering the influence of some cultural and socio-economic factors in this relationship, addressing these variables in that relationship can be critical in order to effectively promote people's healthy behaviours.

Therefore, this study seeks to address knowledge gaps that may positively benefit understanding the role of self-care in a general population during the COVID-19 pandemic and across four different countries. Understanding the contribution of adopting self-care activities may clarify how far promoting healthy behaviours can serve as a worldwide critical strategy to reduce people's stress perception and increase their psychological well-being for the present COVID-19 wave and future pandemics.

Purpose of the Present Study

Firstly, this study is aimed to investigate whether psychological well-being can be predicted by people's stress perception, which other socio-demographics variables can be implied in this relationship and are common in four Ibero-American countries: Chile, Colombia, Ecuador and Spain. Secondly, it seeks to determine whether the adoption of self-care activities mediates the relationship between stress and well-being and lastly, if this mediation role remains similar across these four countries.

Methods

Sample

This study obtained 3,452 records of participants from the general population of four countries (Ecuador, Spain, Chile and Colombia) with different average days of confinement (25, 21, 17.5, and 17 days, respectively). Baseline data collection took place between 31st March 2020 and 14th April 2020. After reviewing the correct registration of data for all the participants, a stratified sample (n = 1,082 participants) was extracted by randomizing cases from the four countries by gender and age (see Supplementary Figure 1). Ethical approval was granted by the Research Ethics Committee (REC) of the responsible university (Project ID: 2020.058). In the case of the groups from Colombia, Ecuador and Chile, approval was given by their local Ethics Committee.

Instruments

Socio-demographic questionnaire

This questionnaire is composed of several questions regarding socio-demographic information, such as: age, gender, country, socio-economic status, level of studies completed, professional group, adults and minors in charge and employment situation both before and after the COVID-19 lockdown, along with information related to the COVID-19 lockdown, such as number of days in quarantine, number of people with whom the individuals live, attitude towards the search of information related to COVID-19 and health status, including past psychological and physical illnesses and substance use.

Perceived Stress Scale

The Spanish version of the Perceived Stress Scale (PSS-10) (35) was employed to assess individuals' perceived stress. The PSS-10 is a self-report instrument that consists of 10 items ranging from 0 = never to 4 = very often. Subjects are asked to rate statements such as "In the past month, how often have you been upset because of something that happened unexpectedly?", or "In the last month, how often have you felt that things were going your way?". A higher score on this scale corresponds to a higher level of perceived stress.

Regarding its psychometric properties, the Spanish version of the PSS-10 showed adequate reliability (internal consistency, $\alpha = 0.82$, and test-retest, $r = 0.77$) and sensitivity. Concurrent validity was measured between the PSS and anxiety and distress scores with the Hospital Anxiety and Depression Scale (anxiety subscale: HADS-A, and depression and anxiety combined scales: HADS-T, respectively) in a clinical sample, finding positive correlation between variables (36). Cronbach's alpha of 0.85 was obtained in our sample for the PSS-10.

Self-care Activities Screening Scale

The Self-care Activities Screening Scale (SASS-14) (37) was administered to assess self-care. This tool is composed of four dimensions (health consciousness, nutrition and physical activity, sleep quality and inter and intrapersonal coping strategies) with 14 items ranging from 1=Never to 6=Always, giving a score per dimension scale and a total score. Subjects are asked to rate statements such as "I reflect about my health a lot", or “I actively participate in the initiatives of my community (eg: clapping, singing, playing music, offering my support in what I could help, etc.)”. The higher the total score, the greater the level of self-care activities in which the person engages. The scale has shown good psychometric properties, with good internal consistency (Cronbach’s alpha = 0.80) and convergent validity with stress and well-being measures. Cronbach’s alpha of 0.77 was obtained in our sample for the SASS-14.

Psychological Well-being

The Spanish version (38) of the Ryff Psychological Well-being scale (PWBS) (39,40) was administered to assess well-being. The PWBS has 29 items ranging from 1 to 6, with a minimum score of 29 and a maximum score of 174. Subjects are asked to rate statements such as "Some people wander aimlessly through life, but I am not one of them", or “When I look at the story of my life, I am pleased with how things have turned out so far”. This scale is grouped into 6 subscales: self-acceptance, positive relationships with others,

autonomy, environmental mastery, purpose in life and personal growth. The scale showed an excellent level of fit to the theoretical model proposed by D. van Dierendonck (38), with high internal consistency (Cronbach alpha's 0.71 to 0.84). Cronbach's alpha of 0.91 was obtained for the PWBS in our sample.

Procedure

The sample data were obtained on the basis of an online survey shared on social media in each of the countries (taking approximately 15 to 20 minutes) by snowball sampling. Participants first received both written consent and study instructions. Participation in the study was anonymous, voluntary and without economic compensation. Considering that the countries evaluated were at the beginning of the pandemic, the psychological instruments asked the subjects about the assessment of the items in the last month.

Statistical analysis

SPSS version 24 was used for data entry and analyses. Descriptive statistics analysis was used to summarize the socio-demographic data (age, gender, country, education level, and income level) and the COVID-19 variables (confinement days, frontline workers, health risk, employment changes, accompanied during lockdown, community resources, and absence/presence of being in charge of children or elderly people). Four analyses of variance (ANOVAs) were carried out separately to compare differences in relation to age, stress, well-being and self-care between countries.

First, a 3-step procedure was conducted to determine whether socio-economic variables associated with confinement would significantly predict the levels of stress, well-being and self-care. In order to do so, three separate multiple linear regression analyses were performed using the stepwise method (three-step hierarchical). Step 1 included the socio-demographic variables (age as continuous, gender and country as nominals, and education and

income levels as ordinals) as predictors with the country included as a dummy variable; step 2 included the COVID-19 variables (accompaniment in confinement and work situation changes as nominals) as predictors; and in step 3, stress, self-care or well-being were included as predictors according to the respective regression analysis. Once the common variables that significantly predict stress, well-being, and self-care had been identified, a fourth multiple regression analysis was conducted on well-being, with stress, self-care and their common predictors as independent variables. Finally, the relationship between stress, well-being, self-care, and their common predictors were evaluated using bivariate Pearson correlations in order to check for significant associations between them.

Lastly, mediation analyses were performed for each country and for the total sample in order to examine the mediation role of self-care in the relationship between perceived stress and psychological well-being, where stress was included as the dependent variable (X), well-being as the independent variable (Y), and self-care was added between them as a mediating variable (M). Additionally, the covariates that significantly alter this relationship were considered in this model to account for confounding effects. The bias correction bootstrap method was used to verify the mediating effect of self-care on the relationship between stress and well-being (a total of 5,000 bootstrap samples were extracted from the original data for indirect estimation). In all statistical tests, a p-value of 0.05 was considered. Finally, we used PROCESS 3.4.1 software (41,42) to perform the mediation analysis (Model 4).

Results

Descriptive Statistics

The data of 1,082 participants was obtained in four countries: Chile (n = 261), Colombia (n = 268), Ecuador (n = 282) and Spain (n = 271). The mean age of participants was 43.8 years old (SD = 15.1; age ranged from 18 to 95), and 49% (551) of participants were

female (Table 1). With regards to educational level, 73.6% (796) of participants had university education; 11.3% (122) technical studies; 14.1% (153) secondary education and 1% (11) elementary education. In addition, a high percentage of participants were found to have medium and high-income levels (measured in statutory minimum monthly wage [mmw] in American dollars; 1 = 300 USD) in all countries: 30.3% (328) earned more than 5 times the mmw; 16.2% (175) earned 4 times the mmw; 17.5% (189) earned 3 times the mmw; 13.4% (145) earned 2 times the mmw; 8% (87) earned less than the mmw and 14.6% (158) of the sample had no income. The highest percentages of income in the four countries were reported for men.

As for the sociodemographic factors associated with COVID-19, the average number of days of confinement was higher in Ecuador and Spain, with 25 (SD = 4.5) and 21 (SD = 1.0) days, respectively. Meanwhile, Chile and Colombia, with 17.5 (SD = 6.5) and 17 (SD = 4.0) days, respectively, presented a similar period of confinement. For the total sample, 90.8% (982) of participants were accompanied during lockdown, and 26.5% (287) and 31.1% (337) had elderly people and children in charge, respectively. In total, 86.5% (936) reported having community support resources. Finally, 33.9% (367) of the total sample considered themselves a front-line worker and 31.1% (337) expressed a potential risk of contagion from SARS-CoV-2 virus in the last month, while 25% (271) had suffered negative changes in their employment conditions.

The results of ANOVAs did not show differences between countries for the variables age, well-being and self-care. However, there were differences between countries for stress. Post-hocs analyses indicated that Chile and Spain had higher stress in comparison with Colombia (Table 1).

Table 1. *Descriptive values of socio-demographic variables, stress, well-being, and self-care scores in the four countries and in the total sample.*

	Spain	Chile	Colombia	Ecuador	Total	ANOVA p
Sample size	271	261	268	282	1082	
Age M (SD)	43.8 (15.7)	43.9 (14,5)	44 (14,8)	44 (14,8)	43,8 (15,1)	0.99
Gender: n (%)						
Female	136 (50,2)	127 (48,7)	131 (48,9)	137 (48,6)	531 (49,1)	
Male	135(49.8)	134 (51.4)	137 (51.1)	145 (51.4)	551 (50,9)	
Psychological variables: M (SD)						
Stress	17.0 (6.1)	17 (6.2)	15.3 (6.3)	16.2 (6.3)	16.4 (6.4)	0.001
Well-being	30.6 (5.8)	31.5 (5.9)	32.6 (5.4)	32.2 (5.7)	31.7 (5.7)	0.33
Self-care	58.5 (9.1)	58.2 (11)	59.9 (9.3)	59.1 (10.1)	58.9 (9.9)	0.22
Income level: n (%)						
No salary	45 (16.6)	27 (10.3)	43 (16)	43 (15.2)	158 (14.6)	
One mw*	9 (3.3)	22 (8.4)	37 (13.8)	19 (6.7)	87 (8)	
Two mw	30 (11)	36 (13.8)	37(13.8)	42 (15)	145 (13.4)	
Three mw	50 (18.5)	35 (13.4)	68 (25.3)	36 (12.7)	189 (17.5)	
Four mw	59 (21.7)	34 (13)	30 (12)	52 (18.4)	175 (16.2)	
Five mw	78 (28.8)	107 (41)	53(19.7)	90 (32)	328 (30.3)	
Educational Level: n (%)						
Elementary	4 (1.48)	4 (1.53)	1(0.4)	2 (0.7)	11 (1)	
High School	42 (15.5)	28 (7.0)	35 (13.5)	48 (17.0)	153 (14.1)	
Technical	37 (13.7)	33 (12.7)	40 (15.3)	12 (4.3)	122 (11.3)	
University	188 (69.3)	196 (75.1)	192 (74.5)	220 (78)	796 (73.6)	
COVID–19 variables: n (%)						
Confinement days	21 (4.6)	17.5(6.5)	17(4.0)	25 (0.6)	20.24(5.51)	
Front–line workers (yes)	80 (29.5)	80 (30.7)	131(48.9)	76 (27)	367 (33.9)	
Health risk (yes)	89 (32.8)	84 (32.2)	77(28.7)	87 (30.9)	337 (31.1)	
Employment changes (yes)	46 (17)	51 (19.5)	87(32.4)	87 (31)	271 (25)	
Accompanied during lockdown (yes)	231 (85.2)	237 (91)	266(99.2)	248 (88)	982 (90.8)	
Community resources (yes)	245 (90.4)	233 (89.2)	225(84)	251 (89)	936 (85.5)	
Children in charge (yes)	63 (23.2)	86 (33)	93(34.7)	95 (33.6)	337 (31.1)	
Older people in charge (yes)	29 (10,5)	57(22)	106(39.5)	95 (33.6)	287 (26.5)	

Note: *Age, stress, well-being and self-care were coded as continuous variables, gender was coded as a nominal variable, and income and education levels were coded as ordinal variables. All the COVID-19 variables were nominal in exception of the number of confinement days, which was continuous. M: mean; SD: standard deviation.*

The predictive value of socio-demographics factors, stress and self-care on psychological well-being

Multiple linear regression analyses on stress, well-being, and self-care contemplated nominal variables such as: gender, work situation changes, accompaniment in confinement; the country variable was coded as a dummy, and education and income levels were treated as ordinals. The multiple linear regression on stress showed that age, gender, education level, income level, country, work situation changes, and accompaniment in confinement were statistically significant ($F_{7,1080}$=15.379, p<0.001), predicting 9.1% of stress variability. The multiple linear regression analysis on well-being indicated that age, gender, education level, income level and accompaniment in confinement were statistically significant ($F_{6,1074}$=12.021, p<0.001), predicting 6.3% of well-being variability. The multiple linear regression analysis on self-care showed that age, genre, country, and income level were statistically significant ($F_{6,1074}$=4.335, p<0.001), predicting 2.4% of self-care variability. Thus, the three previous multiple regression analyses indicated that age, genre, and income level commonly and significantly predicts the three main variables: stress, well-being and self-care. In consequence, a multiple regression analysis was performed on well-being while including age, genre, income level, stress and self-care as independent variables resulted in statistically significant ($F_{5,1075}$=221.42, p<0.001), and only demonstrated significance age, stress, and self-care predicting 50% of well-being variability. Therefore, age was the only socio-demographic variable included as a covariate in mediation models (see Table 2).

Table 2. *Information of the multiple linear regression models on stress, well-being, and self -care based on socio-demographics and COVID-19 related variables.*

	1. Stress					2. Well-being					3. Self-care				
			95% CI					95% CI					95% CI		
Variable	*β*	*SE*	*LL*	*UL*	*p<*	*β*	*SE*	*LL*	*UL*	*p<*	*β*	*SE*	*LL*	*UL*	*p<*
Age	-0.134	0.01	-0.08	-0.03	0.001	0.10	0.42	0.05	0.21	0.001	0.07	0.02	0.01	0.09	0.02
Education level	-0.107	0.27	1.42	-0.35	0.001	0.07	0.87	0.30	3.7	0.01					
Income level	-0.114	0.12	-0.66	-0.16	0.001	0.14	0.30	0.91	2.48	0.001	0.07	0.18	0.04	0.77	0.02
	b				*p<*	*b*				*p<*	*b*				*p<*
Gender	0.91				0.01	2.47				0.01	-1.84				0.002
Country	-0.169				0.001						1.52				0.02
Accompaniment in confinement	-2.042				0.001	5.21				0.01					
Work situation changes	0.99				0.01										

	4. Well-being				
	β	*SE*	*LL*	*UL*	*p<*
Age	0.16	0.04	0.13	0.30	0.001
Stress	-0.62	0.07	-2.12	-1.84	0.001
Self-care	0.22	0.04	0.37	0.54	0.001

Note: *β: standardized coefficients are reported for continuous and ordinal variables; b: unstandardized coefficients are reported for nominal variables; SE: standard error; CI: confidence interval; LL: lower limit CI; UL: upper limit CI; p: p-value.*

Table 3 shows the pairwise correlations between the variables included in mediation analyses: perceived stress, self-care, psychological well-being, and age.

Table 3. *Pearson's correlations between the variables included in mediation analyses.*

Variables		1	2	3	4
1. Stress	*r*				
	p				
2. Well-being	*r*	-0.677			
	p	<0.001			
3. Self-care	*r*	-0.213	0.359		
	p	<0.001	<0.001		
4. Age	*r*	- 0.182	0.153	0.092	
	p	<0.001	<0.001	0.014	

Mediating role of self-care activities between stress and well-being

Results from the mediation model assessing the effect of self-care on the relationship between perceived stress and psychological well-being with age as a covariate showed that a lower level of perceived stress is significantly associated with a greater level of self-care, which in turn is significantly associated with higher levels of well-being [$F(3,1078)=370.01$, $p<0.001$, $R^2=0.507$]. The indirect effect of perceived stress on well-being through self-care is negative and statistically different from zero ($a*b = -0.144$, $p<0.001$, with a 95% bootstrap confidence interval of -0.20 to -0.095). The direct effect is weaker than it was prior to this control in the negative direction ($c=-0.672$), but remained statistically significant ($c'=-0.626$, $p<0.001$). These results indicate that self-care partially mediates the effect of perceived stress on well-being (see Figure 1). Regarding age, the mediation analysis showed a significant effect only on stress ($p < 0.001$), but not on self-care and well-being, reflecting an association between high stress with lower age, and vice versa. Thus, stress, self-care and age variables predict 50.7% of well-being variability (see standardized coefficients in Figure 1 and non-standardized coefficients in Table 4).

Table 4. *Information of the estimated mediation models (corresponding to the indirect and direct paths) for the total sample and differentiated by country.*

Variables	Stress (X) and Self-care (M)				Self-care (M) and Well-being (Y)				Stress (X) and Well-being (Y)			
	Coef*	SE	95% CI	p<	Coef*	SE	95% CI	p<	Coef*	SE	95% CI	p<
Total sample												
a	-0.32	0.05	[-0.41, -0.22]	0.001								
b					0.46	0.04	[0.37, 0.55]	0.001				
c									-1.98	0.07	[-2.13, -1.85]	0.001
c'									-2.13	0.07	[-2.27, -1.99]	0.001
Stress and self-care as predictors of well-being, R^2 / F					0.51 / 370.01		Stress as a predictor of well-being, R^2 / F				0.46 / 223.34	
Spanish sample												
a	-0.21	0.09	[-0.39, -0.34]	0.01								
b					0.33	0.09	[0.14, 0.53]	0.001				
c									-1.73	0.14	[-2.02, -1.45]	0.001
c'									-1.81	0.14	[-2.10, -1.52]	0.001
Stress and self-care as predictors of well-being, R^2 / F					0.39 / 56.6		Stress as a predictor of well-being, R^2 / F				0.36 / 75.76	
Chilean sample												
a	-0.48	0.09	[-0.67, -0.28]	0.001								
b					0.50	0.08	[0.33, 0.67]	0.001				
c									-1.84	0.07	[-2.12, -1.56]	0.001
c'									-2.08	0.14	[-2.37, -1.80]	0.001
Stress and self-care as predictors of well-being, R^2 / F					0.52/ 96.45		Stress as a predictor of well-being, R^2 / F				0.46 / 112.47	
Colombian sample												
a	-0.25	0.08	[-0.43, -0.07]	0.001								
b					0.55	0.09	[0.36, 0.74]	0.001				
c									-2.16	0.14	[-2.44, -1.88]	0.001
c'									-2.30	0.14	[-2.60, -2.01]	0.001
Stress and self-care as predictors of well-being, R^2 / F					0.54 / 105.09		Stress as a predictor of well-being, R^2 / F				0.48 / 125.88	
Ecuadorian sample												
a	-0.26	0.09	[-0.45, -0.06]	0.001								
b					0.44	0.08	[0.29, 0.60]	0.001				
c									-2.25	0.13	[-2.51, -1.98]	0.001
c'									-2.36	0.13	[-2.63, -2.09]	0.001
Stress and self-care as predictors of well-being, R^2 / F					0.58 / 131.12		Stress as a predictor of well-being, R^2 / F				0.54 / 163.78	

*Note. * Unstandardized coefficients; SE: standard error; CI: confidence interval; p: p-value.*

These results were replicated in the four participant countries, given that self-care activities operated in the same way as a mediator of the relationship between perceived stress and psychological well-being in the samples from Spain, Colombia, Chile and Ecuador (see Table 4).

Discussion

The aims of this study were to identify the role of self-care activities on the relationship between stress and well-being in the general population in a situation of COVID-19 confinement and to assess the impact of socio-demographic and COVID-19 variables on this relationship. The results described above indicate that self-care activities significantly operate as a mediating mechanism in the association between perceived stress and psychological well-being in a confinement situation, regardless of the country and other socio-demographics factors but not age, which was negatively associated with stress and is in accordance with several works on general population at the first stages of the pandemy (43,44). These findings indicate that people from different countries at the beginning of COVID-19 lockdown implement self-care activities not only as a mitigation strategy of the potential risk of contagion by COVID-19, but also as a strategy to mitigate perceived stress and its negative impact on well-being.

Therefore, our results suggest that the more a person engages in self-care activities, the lower their level of perceived stress and the greater their sense of well-being. The present results are in line with those studies conducted in psychology students (16) or professionals (13), which have shown the relationship between personal care and well-being. In the same way, in the context of COVID-19 pandemic, the improvement in personal resources seems to be relevant to overcome stress and its associated health problems (45). Thus, these results highlight the essential role of people in creating their own health and well-being, since self-

care can be considered as an important individual health asset for the maintenance of one's own health and that of society in general (46-48).

One possible explanation of this mediation role of self-care is that the manifestation of self-care activities is linked to the adoption of healthy habits in the general population, which is associated with cognitive, emotional and behavioral processes (49,50). And these processes are significantly involved in stress and well-being perception (51,52). This implies that persons who make use of this type of activities when perceiving a stressful situation, can use it as a strategy to take control over the situation (53) and play an active role in the maintenance of their health, and in the recovery of their well-being (54). This would be in line with recent research that has highlighted that it is not the type or amount of stress that determines its impact, but rather the mindset used to appraise the situation of perceived stress (48), which is congruent with the Theory of Mentality (24) and with the Biopsychosocial Model of Challenge and Threat (25). Therefore, depending on a person's mindset, a stressful situation can increase her/his physiological response or use it as a personal growth opportunity.

In line with the above, the border between normative, tolerable and toxic stress is highly subjective and the way in which a person interprets reality is crucial. Thus, certain self-care resources, such as a healthy diet, sleep or exercise, do not have an automatic beneficial lasting effect, but rather it is also necessary to work on other personal aspects, such as how the events experienced are meant and understood. It would therefore be worthwhile to support self-care resources with a process of personal resignification.

Additionally, an optimal level of self-care has implications not only for personal growth and stress-management but also to improve Public Health guidelines adherence and reduce SARS-Cov-2 comorbidities. It is due to the fact that being involved in self-care activities implies a certain level of health consciousness which facilitates the adoption of

health protective measures (e.g. using mask, social distance) and in turn conduct healthy behaviors (e.g. diet, adequate levels of vitamin D and exercise) could serve as important protective factors for SARS-Cov-2 contagion and health complications (55-57).

Nevertheless, we need to take in account some considerations related with the mediation of self-care in the relationship between stress and well-being in the general population. First, a partial mediation indicates that self-care does not explain the totality of the perceived stress effect on well-being. Although recent works claim that partial mediation has little value and should be abandoned (58- 59), others support that a more realistic goal in psychological studies dealing with phenomena that have multiple causes may be to seek mediators that significantly decrease the direct path rather than eliminating the relation between the independent and dependent variables altogether (60). From a theoretical perspective, a significant reduction demonstrates that a given mediator is indeed potent, albeit not both a necessary and a sufficient condition for an effect to occur.

Although the Perceived Stress Scale is the most widely used psychological instrument for measuring the perception of stress, most of its items associate stress with negative emotions and "threat" characterized by situational demands exceeding coping resources (61). Moreover, despite the Self-care Activities Screening Scale considers four important dimensions of self-care (health consciousness, nutrition and physical activity, sleep, and intra-personal and inter-personal coping skills) and it was validated on general population at the beginning of the COVID-19 context (when coping strategies were not probably fully established), it is supposed that psychological, emotional, professional and spiritual components may also participate in the mediating effect between stress and well-being. Furthermore, considering that not all stressors that explain well-being can be explained by self-care, it is not surprising that self-care cannot explain the totality of such a relationship by

itself. For this reason, it is crucial to identify the factors that can act as promoters and maintainers of well-being (62).

Regarding the contributions of the present study, it should be highlighted that it is the first research to explore the mediating role of self-care activities between stress and well-being in the general population during COVID-19 lockdown. However, the present study presents some limitations. First, our sample was composed of people with a similar high socio-economic situation in the four countries. Therefore, these findings may not be representative for more disadvantaged or vulnerable social groups. Second, the use of self-report instruments and social desirability may have influenced the results. Third, the study has a cross-sectional design, and thus, it is not possible to conclude causal relations between the assessed variables.

As future lines of research, it would be of great value to continue this research line to understand better which specific dimensions of self-care are the most important mechanisms to explain the relationship between stress and psychological well-being. Furthermore, it would be critical to conduct longitudinal studies to ascertain cause-effect relationships between the measured variables, and explore differences on self-care, stress, and well-being at different measurement times. Based on this, it would be appropriate to design intervention programs or strategies to improve self-care activities as a possible pathway to reduce stress and keep healthy during extraordinary situations such as a lockdown. Lastly, it is worth noting that our general population sample was confined in their respective countries at the data collection moment, but one third were workers of health and basic services (i.e., frontline COVID-19 workers). Considering that some front-line workers, while confined, worked longer hours than usual (e.g., health workers) or fewer hours (e.g. supermarket workers) and that these could be exposed to a greater risk of contagion, it would be interesting to address

the impact of self-care on the relationship between stress and well-being in this population in future research.

Figure 1. Mediation model of self-care in the relationship between stress and well-being controlled by age with standardized coefficients.

Ethics approval and consent to participate

All procedures performed in this work with human participants were in accordance with the ethical standards of the Research Ethics Committee of the University of Navarra (Spain, project ID: 2020.058) and the University of San Francisco de Quito (Ecuador, P2020 -024M) for Latin-American samples.

Availability of data and materials

The data are not publicly available due to privacy or ethical restrictions.

Patient and Public Involvement

Nonspecific patients were involved in this study.

Conflict of interests

The authors declare they have no competing interests.

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Authors' contributions

EOL, EB, ASP and PFB: contributed to the conceptualization, data curation, formal analysis, investigation, methodology and writing — original draft; EOL, EB and PFB: supervision; MM: data curation, formal analysis and methodology; ASP, EYO, CC, MSG and JVO: investigation, methodology and resources. All authors contributed to reviewing and editing the final manuscript.

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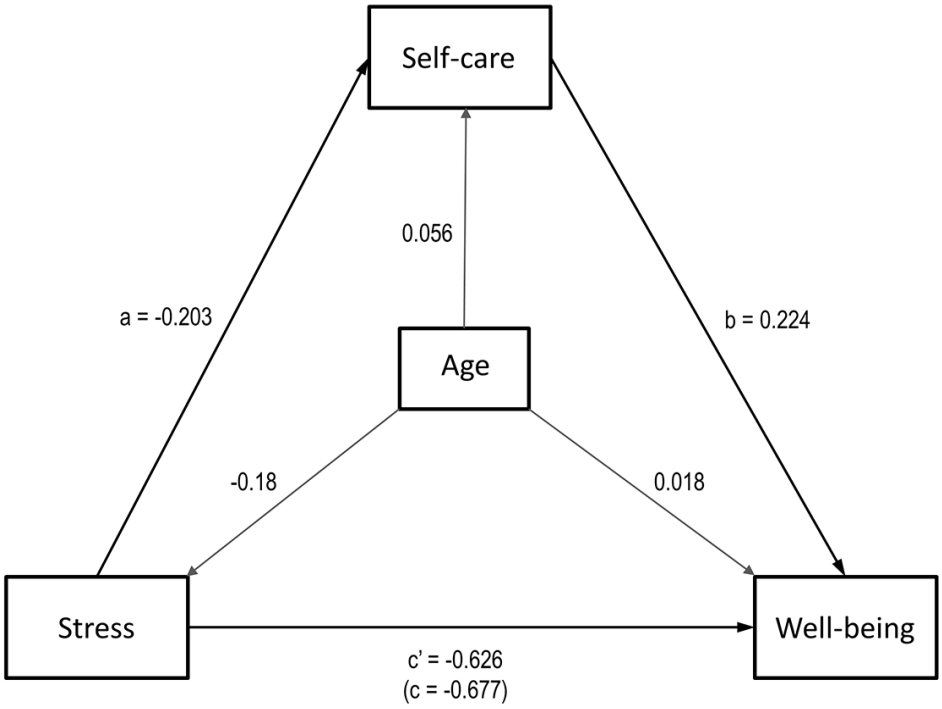

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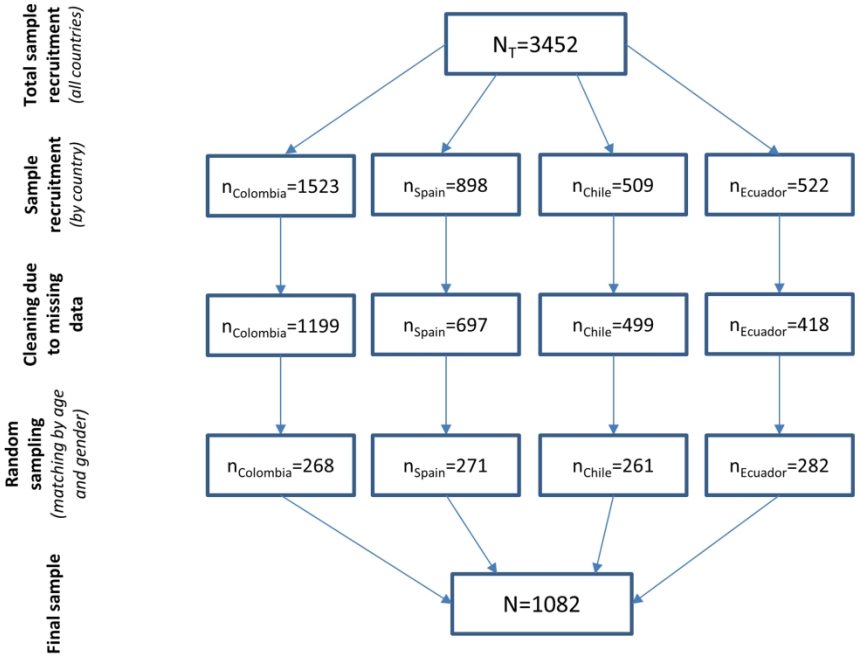

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page n.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7
		(*e*) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	8-9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-16

		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	16
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Relationship between self-care activities, stress and well-being during COVID-19 lockdown: a cross-cultural mediation model

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Relationship between self-care activities, stress and well-being during COVID-19 lockdown: a cross-cultural mediation model

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Keywords: self-care, stress, well-being, lockdown, COVID-19

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ABSTRACT

OBJECTIVES: To examine the mediation role of self-care between stress and psychological well-being in the general population of four countries, and to assess the impact of socio-demographic variables on this relationship.

DESIGN: Cross-sectional, online survey.

PARTICIPANTS: A stratified sample of confined general population (N = 1,082) from four Ibero-American countries: Chile (n = 261), Colombia (n = 268), Ecuador (n = 282), and Spain (n = 271) balanced by age and gender.

PRIMARY OUTCOMES MEASURES: Socio-demographic information (age, gender, country, education, and income levels), information related to COVID-19 lockdown (number of days in quarantine, number of people with whom the individuals live, absence/presence of adults and minors in charge, attitude towards the search of information related to COVID-19), Perceived Stress Scale-10, Ryff's Scale of Psychological Well-Being Scale-29, and Self-care Activities Screening Scale-14.

RESULTS: Self-care partially mediates the relationship between stress and well-being during COVID-19 confinement in the general population in the total sample [$F(3,1078)=370.01$, $p<0.001$, $R^2=0.507$] and in each country. On the other hand, among the evaluated socio-demographic variables, only age affects this relationship.

CONCLUSION: Results have broad implications for public health, highlighting the importance of promoting people's active role in their own care and health behaviour to improve psychological well-being if stress management and social determinants of health are jointly addressed first. The present study provides the first transnational evidence from the earlier stages of COVID19 lockdown, showing that the higher perception of stress, the less self-care activities are adopted and, and in turn, the lower the beneficial effects on wellbeing.

KEYWORDS: self-care, stress, well-being, lockdown, COVID-19, cross-sectional and cross-cultural study.

STRENGTHS AND LIMITATIONS OF THE STUDY

- This study explores the role of the adoption of self-care activities on the relationship between perceived stress and psychological well-being in a general population of four countries at the beginning of COVID-19 lockdown while considering the influence of socio-demographic, socio-economic, and COVID-19 related factors.
- Data is derived from a well-balanced sample by gender and age.
- A large part of the sample consisted of the university population and frontline covid workers with high incomes, which may bias the interpretations of the results as they cannot be representative for more disadvantaged or vulnerable social groups.
- Cross-sectional design precludes the demonstration of a causal relationship between stress, self-care, and psychological well-being.
- Self-reported outcomes variables can be inherently biased and confounding.

Introduction

The Coronavirus Disease 19 (COVID-19) outbreak has forced many countries to separate, isolate and restrict the mobility of their citizens to decrease potential contact with the infection. The coronavirus outbreak and its subsequent mitigation measures have had mental health consequences for the world's population (1–3). Measures such as confinement have led to social isolation, increased telework, increased time spent caring for dependent people such as children and elders, and negative socioeconomic consequences, among other aspects. These

changes have had an impact on people's lifestyles during and after the lockdown. The major negative psychological outcome of the COVID-19 lockdown is the anxiety and distress caused by it (4-5). An interesting study developed in the Italian population evaluated the differences in stress, anxiety, and depression in two-time frames during confinement (between 28th April and 3rd May 2021), finding a causal relationship between the pandemic situation and the manifestation of negative psychological outcomes in anxiety and anguish (6). Likewise, other physical and mental health problems such as increased feelings of loneliness, exacerbated fear of the Coronavirus, panic responses, sleep disturbances, and symptoms of post-traumatic stress, among others, have been reported in the literature (7-11).

In contrast, the adoption of self-care activities and health behaviors could play a critical role in the prevention of immediate and subsequent complications (12). However, its role has been especially studied in patients with chronic conditions, women, and healthcare professionals (13-18) and none in the general population or in extraordinary situations such as COVID-19 pandemic.

The relationship between stress, self-care, and psychological well-being

According to Antonovsky (19) salutogenesis is defined as a concept of stress oriented to coping resources. The author questions and explains why some people may remain healthy despite the influence of many stressful situations and risk factors (20, 21). In this regard, the model argues that both health and illness can be the result of stressors. Consequently, in this salutogenic model, health is understood as a dynamic self-regulation process (21) that allows us to face everyday situations, understanding that the absolute control that the person can have over its determinants is unfeasible. Still, this model assumes that people are capable of improving their health (22).

Taking into account that stress can be the result of situations such as the potential risk of contagion by COVID-19 as well as the personal repercussions that confinement has, it can

drive changes in the way people implement self-care activities (such as physical activity, an adequate diet, or a support network) as a coping mechanism and as a result, influence on their wellbeing. Thus, self-care could explain in part the effects of stress on psychological well-being. On one hand, less perceived stress is related to higher satisfaction with life and happiness (23). Likewise, psychological well-being is associated with a lower risk of cardiovascular disease (24,25) and protects against mental illness through components such as positive relationships with others, autonomy, environmental mastery, and psychological flexibility (26,27). On the other hand, two proposals have recently provided evidence of how the assessment that the person makes of stressor experiences can influence the implementation of effective coping strategies (28). In this line, the influence of stress perception on self-care behaviours has been considered as a driver that explains gender differences of health promotion behavior adoption; that is, women with higher levels of stress refrain more often from healthy behaviours than men, which could lead to worse levels of health and well-being (29,30). This has been supported by a recent study that showed that self-care mediates the negative relationship between stress and self-rated health status (understood as the experimentation of well-being) in a sample of 223 black women (31).

This process can be explained from the Theory of Mentality (32) and the Biopsychosocial Model of challenge and threat (33), which propose that when making assessments of the functionality of the stress, people can interpret stressful situations as challenges or threats, and therefore, they implement effective behaviors to keep or improve their well-being depending on their stress appraising. From Orem's perspective, self-care is defined as a practice that has therapeutic effects on the development and functioning of people (34). For this reason, self-care is the result of the configuration of agency capacity, which requires awareness, the detection, and interpretation of the psychological, emotional, and

physical problems that give rise to the achievement of an appropriate repertoire of behaviors (35).

All the above leads to the question: what is the potential role of self-care during the COVID-19 lockdown in the already known negative relationship between stress and well-being? Although it is widely known that self-care involves various activities that potentially influence the health and well-being of people, as far as is known, the research exploring its role as a mechanism that explains the effects of stress on psychological well-being in the general population is scarce and, much more, in a situation of confinement.

Moreover, considering the influence of some cultural and socio-economic factors in this relationship, addressing these variables in that relationship can be critical to effectively promote people's healthy behaviours.

Therefore, this study seeks to address knowledge gaps that may positively benefit understanding how changes in people's psychological wellbeing can be explained by the joint effect of stress perception in self-care activities adoption. Understanding the mediation role of self-care activities in this relationship during the COVID-19 pandemic and across four different countries may clarify how far promoting healthy behaviours can serve as a worldwide critical strategy to keep people's optimal well-being levels when experiencing a stressful event such as COVID pandemic.

Purpose of the Present Study

Firstly, this study is aimed to investigate whether psychological well-being can be predicted by people's stress perception, which other socio-demographic variables can be implied in this relationship and are common in four Ibero-American countries: Chile, Colombia, Ecuador, and Spain. Secondly, it seeks to determine whether the adoption of self-care activities mediates the relationship between stress and well-being and lastly if this mediation role remains similar across these four countries.

Methods

Sample

This study obtained 3,452 records of participants from the general population of four countries (Ecuador, Spain, Chile, and Colombia) with different average days of confinement (25, 21, 17.5, and 17 days, respectively). Baseline data collection took place between 31st March 2020 and 14th April 2020. After reviewing the correct registration of data for all the participants, a stratified sample (n = 1,082 participants) was extracted by randomizing cases from the four countries by gender and age. Ethical approval was granted by the Research Ethics Committee of the responsible university (Project ID: 2020.058). In the case of the groups from Colombia, Ecuador, and Chile, approval was given by their local Ethics Committee.

Instruments

Socio-demographic questionnaire

This questionnaire is composed of several questions regarding socio-demographic information, such as age, gender, country, socio-economic status, level of studies completed, professional group, adults and minors in charge, and employment situation both before and after the COVID-19 lockdown, along with information related to the COVID-19 lockdown, such as the number of days in quarantine, the number of people with whom the individuals live, attitude towards the search of information related to COVID-19 and health status, including past psychological and physical illnesses and substance use.

Perceived Stress Scale

The Spanish version of the Perceived Stress Scale (PSS-10) (36) was employed to assess individuals' perceived stress. The PSS-10 is a self-report instrument that consists of 10 items ranging from 0 = never to 4 = very often. Subjects are asked to rate statements such as "In the past month, how often have you been upset because of something that happened unexpectedly?", or "In the last month, how often have you felt that things were going your

way?". A higher score on this scale corresponds to a higher level of perceived stress. Regarding its psychometric properties, the Spanish version of the PSS-10 showed adequate reliability (internal consistency, $\alpha = 0.82$, and test-retest, $r = 0.77$) and sensitivity. Concurrent validity was measured between the PSS and anxiety and distress scores with the Hospital Anxiety and Depression Scale (anxiety subscale: HADS-A, and depression and anxiety combined scales: HADS-T, respectively) in a clinical sample, finding a positive correlation between variables (37). Cronbach's alpha of 0.85 was obtained in our sample for the PSS-10.

Self-care Activities Screening Scale

The Self-care Activities Screening Scale (SASS-14) (38) was administered to assess self-care. This tool is composed of four dimensions (health consciousness, nutrition, and physical activity, sleep quality, and inter and intrapersonal coping strategies) with 14 items ranging from 1=Never to 6=Always, giving a score per dimension scale and a total score. Subjects are asked to rate statements such as "I reflect about my health a lot", or “I actively participate in the initiatives of my community (eg: clapping, singing, playing music, offering my support in what I could help, etc.)”. The higher the total score, the greater the level of self-care activities in which the person engages. The scale has shown good psychometric properties, with good internal consistency (Cronbach’s alpha = 0.80) and convergent validity with stress and well-being measures. Cronbach’s alpha of 0.77 was obtained in our sample for the SASS-14.

Psychological Well-being

The Spanish version (39) of the Ryff Psychological Well-being scale (PWBS) (40,41) was administered to assess well-being. The PWBS has 29 items ranging from 1 to 6, with a minimum score of 29 and a maximum score of 174. Subjects are asked to rate statements such as "Some people wander aimlessly through life, but I am not one of them", or “When I look at the story of my life, I am pleased with how things have turned out so far”. This scale is grouped

into 6 subscales: self-acceptance, positive relationships with others, autonomy, environmental mastery, purpose in life, and personal growth. The scale showed an excellent level of fit to the theoretical model proposed by D. van Dierendonckwith high internal consistency (Cronbach alpha's 0.71 to 0.84) (41). Cronbach's alpha of 0.91 was obtained for the PWBS in our sample.

Procedure

The sample data were obtained on the basis of an online survey shared on social media in each of the countries (taking approximately 15 to 20 minutes) by snowball sampling. Participants first received both written consent and study instructions. Participation in the study was anonymous, voluntary and without economic compensation. Considering that the countries evaluated were at the beginning of the pandemic, the psychological instruments asked the subjects about the assessment of the items in the last month.

Statistical analysis

SPSS version 24 was used for data entry and analyses. Descriptive statistics analysis was used to summarize the socio-demographic data (age, gender, country, education level, and income level) and the COVID-19 variables (confinement days, frontline workers, health risk, employment changes, accompanied during lockdown, community resources, and absence/presence of being in charge of children or elderly people). Four analyses of variance (ANOVAs) were carried out separately to compare differences in relation to age, stress, well-being, and self-care between countries.

First, a 3-step procedure was conducted to determine whether socio-economic variables associated with confinement would significantly predict the levels of stress, well-being, and self-care. In order to do so, three separate multiple linear regression analyses were performed using the stepwise method (three-step hierarchical). Step 1 included the socio-demographic

variables (age as continuous, gender and country as nominals, and education and income levels as ordinals) as predictors with the country included as a dummy variable; step 2 included the COVID-19 variables (accompaniment in confinement and work situation changes as nominals) as predictors; and in step 3, stress, self-care or well-being were included as predictors according to the respective regression analysis. Once the common variables that significantly predict stress, well-being, and self-care had been identified, a fourth multiple regression analysis was conducted on well-being, with stress, self-care, and their common predictors as independent variables. Finally, the relationship between stress, well-being, self-care, and their common predictors was evaluated using bivariate Pearson correlations in order to check for significant associations between them.

Lastly, mediation analyses were performed for each country and for the total sample in order to examine the mediation role of self-care in the relationship between perceived stress and psychological well-being, where stress was included as the independent variable (X), well-being as the dependent variable (Y), and self-care was added between them as a mediating variable (M). Additionally, the covariates that significantly alter this relationship were considered in this model to account for confounding effects. The bias correction bootstrap method was used to verify the mediating effect of self-care on the relationship between stress and well-being (a total of 5,000 bootstrap samples were extracted from the original data for indirect estimation). In all statistical tests, a p-value of 0.05 was considered. Finally, we used PROCESS 3.4.1 software (42,43) to perform the mediation analysis (Model 4).

Results

Descriptive Statistics

The data of 1,082 participants was obtained in four countries: Chile (n = 261), Colombia (n = 268), Ecuador (n = 282) and Spain (n = 271). The mean age of participants was 43.8 years

old (SD = 15.1; age ranged from 18 to 95), and 49% (551) of participants were female (Table 1). With regards to educational level, 73.6% (796) of participants had university education; 11.3% (122) technical studies; 14.1% (153) secondary education, and 1% (11) elementary education. In addition, a high percentage of participants were found to have medium and high-income levels (measured in statutory minimum monthly wage [mmw] in American dollars; 1 = 300 USD) in all countries: 30.3% (328) earned more than 5 times the mmw; 16.2% (175) earned 4 times the mmw; 17.5% (189) earned 3 times the mmw; 13.4% (145) earned 2 times the mmw; 8% (87) earned less than the mmw and 14.6% (158) of the sample had no income. The highest percentages of income in the four countries were reported for men.

As for the sociodemographic factors associated with COVID-19, the average number of days of confinement was higher in Ecuador and Spain, with 25 (SD = 4.5) and 21 (SD = 1.0) days, respectively. Meanwhile, Chile and Colombia, with 17.5 (SD = 6.5) and 17 (SD = 4.0) days, respectively, presented a similar period of confinement. For the total sample, 90.8% (982) of participants were accompanied during the lockdown, and 26.5% (287) and 31.1% (337) had elderly people and children in charge, respectively. In total, 86.5% (936) reported having community support resources. Finally, 33.9% (367) of the total sample considered themselves front-line workers, and 31.1% (337) expressed a potential risk of contagion from SARS-CoV-2 virus in the last month, while 25% (271) had suffered negative changes in their employment conditions.

The results of ANOVAs did not show differences between countries for the variables age, well-being, and self-care. However, there were differences between countries for stress. Post-hocs analyses indicated that Chile and Spain had higher stress in comparison with Colombia (Table 1).

Table 1. *Descriptive values of socio-demographic variables, stress, well-being, and self-care scores in the four countries and in the total sample.*

	Spain	Chile	Colombia	Ecuador	Total	ANOVA p
Sample size	271	261	268	282	1082	
Age M (SD)	43.8 (15.7)	43.9 (14,5)	44 (14,8)	44 (14,8)	43,8 (15,1)	0.99
Gender: n (%)						
Female	136 (50,2)	127 (48,7)	131 (48,9)	137 (48,6)	531 (49,1)	
Male	135(49.8)	134 (51.4)	137 (51.1)	145 (51.4)	551 (50,9)	
Psychological variables: M (SD)						
Stress	17.0 (6.1)	17 (6.2)	15.3 (6.3)	16.2 (6.3)	16.4 (6.4)	0.001
Well-being	30.6 (5.8)	31.5 (5.9)	32.6 (5.4)	32.2 (5.7)	31.7 (5.7)	0.33
Self-care	58.5 (9.1)	58.2 (11)	59.9 (9.3)	59.1 (10.1)	58.9 (9.9)	0.22
Income level: n (%)						
No salary	45 (16.6)	27 (10.3)	43 (16)	43 (15.2)	158 (14.6)	
One mw*	9 (3.3)	22 (8.4)	37 (13.8)	19 (6.7)	87 (8)	
Two mw	30 (11)	36 (13.8)	37(13.8)	42 (15)	145 (13.4)	
Three mw	50 (18.5)	35 (13.4)	68 (25.3)	36 (12.7)	189 (17.5)	
Four mw	59 (21.7)	34 (13)	30 (12)	52 (18.4)	175 (16.2)	
Five mw	78 (28.8)	107 (41)	53(19.7)	90 (32)	328 (30.3)	
Educational Level: n (%)						
Elementary	4 (1.48)	4 (1.53)	1(0.4)	2 (0.7)	11 (1)	
High School	42 (15.5)	28 (7.0)	35 (13.5)	48 (17.0)	153 (14.1)	
Technical	37 (13.7)	33 (12.7)	40 (15.3)	12 (4.3)	122 (11.3)	
University	188 (69.3)	196 (75.1)	192 (74.5)	220 (78)	796 (73.6)	
COVID–19 variables: n (%)						
Confinement days	21 (4.6)	17.5(6.5)	17(4.0)	25 (0.6)	20.24(5.51)	
Front–line workers (yes)	80 (29.5)	80 (30.7)	131(48.9)	76 (27)	367 (33.9)	
Health risk (yes)	89 (32.8)	84 (32.2)	77(28.7)	87 (30.9)	337 (31.1)	
Employment changes (yes)	46 (17)	51 (19.5)	87(32.4)	87 (31)	271 (25)	
Accompanied during lockdown (yes)	231 (85.2)	237 (91)	266(99.2)	248 (88)	982 (90.8)	
Community resources (yes)	245 (90.4)	233 (89.2)	225(84)	251 (89)	936 (85.5)	
Children in charge (yes)	63 (23.2)	86 (33)	93(34.7)	95 (33.6)	337 (31.1)	
Older people in charge (yes)	29 (10,5)	57(22)	106(39.5)	95 (33.6)	287 (26.5)	

Note: *Age, stress, well-being, and self-care were coded as continuous variables, gender was coded as a nominal variable, and income and education levels were coded as ordinal variables. All the COVID-19 variables were nominal with exception of the number of confinement days, which was continuous. M: mean; SD: standard deviation.*

The predictive value of socio-demographic factors, stress, and self-care on psychological well-being

Multiple linear regression analyses on stress, well-being, and self-care contemplated nominal variables such as gender, work situation changes, accompaniment in confinement; the country variable was coded as a dummy, and education and income levels were treated as ordinals. The multiple linear regression on stress showed that age, gender, education level, income level, country, work situation changes, and accompaniment in confinement were statistically significant ($F_{7,1080}$=15.379, p<0.001), predicting 9.1% of stress variability. The multiple linear regression analysis on well-being indicated that age, gender, education level, income level, and accompaniment in confinement were statistically significant ($F_{6,1074}$=12.021, p<0.001), predicting 6.3% of well-being variability. The multiple linear regression analysis on self-care showed that age, gender, country, and income level were statistically significant ($F_{6,1074}$=4.335, p<0.001), predicting 2.4% of self-care variability. Thus, the three previous multiple regression analyses indicated that age, genre, and income level commonly and significantly predict the three main variables: stress, well-being, and self-care. In consequence, a multiple regression analysis was performed on well-being while including age, genre, income level, stress, and self-care as independent variables resulted in statistically significant ($F_{5,1075}$=221.42, p<0.001), and only demonstrated significance age, stress, and self-care predicting 50% of well-being variability. Therefore, age was the only socio-demographic variable included as a covariate in mediation models (see Table 2).

Table 2. *Information of the multiple linear regression models on stress, well-being, and self-care based on socio-demographics and COVID-19 related variables.*

	1. Stress					2. Well-being					3. Self-care				
			95% CI					*95% CI*					*95% CI*		
Variable	*ß*	*SE*	*LL*	*UL*	*p<*	*ß*	*SE*	*LL*	*UL*	*p<*	*ß*	*SE*	*LL*	*UL*	*p<*
Age	-0.134	0.01	-0.08	-0.03	0.001	0.10	0.42	0.05	0.21	0.001	0.07	0.02	0.01	0.09	0.02
Education level	-0.107	0.27	1.4	-0.35	0.001	0.07	0.87	0.30	3.7	0.01					
			2												
Income level	-0.114	0.12	-0.66	-0.16	0.001	0.14	0.30	0.91	2.48	0.001	0.07	0.18	0.04	0.77	0.02
	b				*p<*	*b*				*p<*	*b*				*p<*
Gender	0.91				0.01	2.47				0.01	-1.84				0.002
Country	-0.169				0.001						1.52				0.02
Accompaniment	-2.042					5.21				0.01					
in confinement					0.001										
Work situation	0.99				0.01										
changes															

	4. Well-being				
	ß	*SE*	*LL*	*UL*	*p<*
Age	0.16	0.04	0.13	0.30	0.001
Stress	-0.62	0.07	-2.12	-1.84	0.001
Self-care	0.22	0.04	0.37	0.54	0.001

Note: *ß: standardized coefficients are reported for continuous and ordinal variables; b: unstandardized coefficients are reported for nominal variables; SE: standard error; CI: confidence interval; LL: lower limit CI; UL: upper limit CI; p: p-value.*

Table 3 shows the pairwise correlations between the variables included in mediation analyses: perceived stress, self-care, psychological well-being, and age.

Table 3. *Pearson's correlations between the variables included in mediation analyses.*

Variables		1	2	3	4
1. Stress	*r*				
	p				
2. Well-being	*r*	-0.677			
	p	<0.001			
3. Self-care	*r*	-0.213	0.359		
	p	<0.001	<0.001		
4. Age	*r*	-0.182	0.153	0.092	
	p	<0.001	<0.001	0.014	

Mediating role of self-care activities between stress and well-being

Results from the mediation model assessing the explanatory role of self-care in the relationship between stress and well-being with age as a covariate showed that a higher level of perceived stress is significantly associated with a lower level of self-care, which in turn is significantly associated with lower levels of well-being [$F(3,1078)=370.01$, $p<0.001$, $R^2=0.507$]. The indirect effect of perceived stress on well-being through self-care is negative and statistically different from zero ($a*b = -0.144$, $p<0.001$, with a 95% bootstrap confidence interval of -0.20 to -0.095). The direct effect is weaker than it was prior to this control in the negative direction ($c=-0.672$) but remained statistically significant ($c'=-0.626$, $p<0.001$). These results indicate that self-care partially mediates the effect of perceived stress on well-being (see Figure 1 with standardized coefficients). Regarding age covariate, the mediation analysis showed non-significant effects on self-care nor well-being. Thus, stress, self-care, and age variables predict 50.7% of well-being variability (see Table 4).

Table 4. *Information of the estimated mediation models (corresponding to the indirect and direct paths) for the total sample and differentiated by country.*

Variables	Stress (X) and Self-care (M)				Self-care (M) and Well-being (Y)				Stress (X) and Well-being (Y)			
	Coef*	SE	95% CI	p<	Coef*	SE	95% CI	p<	Coef*	SE	95% CI	p<
Total sample												
a	-0.32	0.05	[-0.41, -0.22]	0.001								
b					0.46	0.04	[0.37, 0.55]	0.001				
c									-1.98	0.07	[-2.13, -1.85]	0.001
c'									-2.13	0.07	[-2.27, -1.99]	0.001
Age	0.04	0.01	[-0.01,0.08]	0.06	0.01	0.02	[-0.03,0.08]	0.39				
Stress and self-care as predictors of well-being, R^2 / F					0.51 / 370.01		Stress as a predictor of well-being, R^2 / F				0.46 / 223.34	
Spanish sample												
a	-0.21	0.09	[-0.39, -0.34]	0.01								
b					0.33	0.09	[0.14, 0.53]	0.001				
c									-1.73	0.14	[-2.02, -1.45]	0.001
c'									-1.81	0.14	[-2.10, -1.52]	0.001
Age	-0.03	0.03	[-0.10, 0.04]	0.34	-0.04	0.65	[-0.15,0.07]	0.49				
Stress and self-care as predictors of well-being, R^2 / F					0.39 / 56.6		Stress as a predictor of well-being, R^2 / F				0.36 / 75.76	
Chilean sample												
a	-0.48	0.09	[-0.67, -0.28]	0.001								
b					0.50	0.08	[0.33, 0.67]	0.001				
c									-1.84	0.07	[-2.12, -1.56]	0.001
c'									-2.08	0.14	[-2.37, -1.80]	0.001
Age	0.11	0.04	[0.03, 0.20]	0.01	0.03	0.06	[-0.08,-0.15]	0.59				
Stress and self-care as predictors of well-being, R^2 / F					0.52/ 96.45		Stress as a predictor of well-being, R^2 / F				0.46 / 112.47	
Colombian sample												
a	-0.25	0.08	[-0.43, -0.07]	0.001								
b					0.55	0.09	[0.36, 0.74]	0.001				
c									-2.16	0.14	[-2.44, -1.88]	0.001
c'									-2.30	0.14	[-2.60, -2.01]	0.001
Age	0.06	0.04	[-0.01, 0.14]	0.09	0.03	0.06	[-0.09,-0.15]	0.61				
Stress and self-care as predictors of well-being, R^2 / F					0.54 / 105.09		Stress as a predictor of well-being, R^2 / F				0.48 / 125.88	
Ecuadorian sample												
a	-0.26	0.09	[-0.45, -0.06]	0.001								

b					0.44	0.08	[0.29, 0.60]	0.001				
c									-2.25	0.13	[-2.51, -1.98]	0.001
c'									-2.36	0.13	[-2.63, -2.09]	0.001
Age	0.02	0.04	[-0.05, 0.10]	0.55	0.04	0.05	[-0.06,0.15]	0.43				
Stress and self-care as predictors of well-being, R^2 / F				0.58 / 131.12	Stress as a predictor of well-being, R^2 / F				0.54 / 163.78			

*Note. * Unstandardized coefficients; SE: standard error; CI: confidence interval; p: p-value.*

These results were replicated in the four participant countries, given those self-care activities operated in the same way as a mediator of the relationship between perceived stress and psychological well-being in the samples from Spain, Colombia, Chile, and Ecuador (see Table 4).

Discussion

The aims of this study were to identify the role of self-care activities on the relationship between stress and well-being in the general population in a situation of COVID-19 confinement and to assess the impact of socio-demographic and COVID-19 variables on this relationship. The results described above indicate that self-care activities significantly operate as a mediating mechanism in the association between perceived stress and psychological well-being in a confinement situation, regardless of the country and other socio-demographic variables. These findings indicate that people's stress perception across different countries during COVID-19 lockdown has compromised their self-care activities adoption and therefore, reducing its potential beneficial effect as a strategy to keep their psychological well-being.

Therefore, our results suggest that adopting self-care activities can improve people's well-being during the COVID-19 lockdown, but the higher the perceived stress of the situation, the more difficult it is to engage in self-care activities, resulting in a lower perception of psychological well-being. The present results are in line with those studies conducted in psychology students (16) or professionals (13), which have shown the relationship between personal care and well-being. In the same way, in the context of COVID-19 pandemic, the improvement in personal resources seems to be relevant to overcome stress and its associated health problems (44). These results highlight the essential role of people in creating their own health and well-being since self-care can be considered as an important individual health asset for the maintenance of one's own health and that of society in general (45,46). However, none

of these studies have considered this influence of self-care on well-being depending on a causal driver such as the stress perception related to the COVID-19 pandemic is.

One possible explanation of the mediation role of self-care is that the manifestation of self-care activities is linked to the adoption of healthy habits in the general population, which is associated with cognitive, emotional, and behavioral processes (47,48). And these processes are also significantly involved in stress and well-being perception (49-52). From a theoretical perspective, it may imply that a person who makes use of these types of activities when perceiving a stressful situation, might use it as a strategy to take control over the situation (51) and play an active role in the maintenance of their health, and in the recovery of their well-being (52). However, this study might suggest that when the situation is perceived as a threat as the perception of stress is high, the cognitive, emotional, and behavioral resources involved could determine the availability of resources that are needed to adopt healthy behaviours. As a result, implementing those behaviours could be seen by the person as an additional source of stress and reduce their engagement with health promotion behaviours, which turn on lower levels of well-being.

This would be in line with recent research that has highlighted that it is not the type or amount of stress that determines its impact, but rather the mindset used to appraise the situation of perceived stress (46), which is congruent with the Theory of Mentality (32) and with the Biopsychosocial Model of Challenge and Threat (33). Therefore, depending on a person's mindset, a stressful situation can increase her/his physiological response and compromise her/his coping skills or use it as a personal growth opportunity.

In line with the above, the border between normative, tolerable, and toxic stress is highly subjective, and the way in which a person interprets reality is crucial. Thus, certain self-care resources, such as a healthy diet, sleep, or exercise, do not have an automatic beneficial lasting effect, but rather it is also necessary to work on other personal aspects, such as how the events

experienced are meant and understood. It would therefore be worthwhile to support self-care resources with a process of personal resignification as well as explore other potentially beneficial effects from external resources such as social support (38), which have not been explored in this study.

Additionally, an optimal level of self-care has implications not only for personal growth and stress management but also to improve Public Health guidelines adherence and reduce SARS-Cov-2 comorbidities. It is due to the fact that being involved in self-care activities implies a certain level of health consciousness which facilitates the adoption of health-protective measures (e.g. using a mask or taking social distance) and in turn conduct healthy behaviors (e.g. diet, adequate levels of vitamin D and exercise) could serve as important protective factors for SARS-Cov-2 contagion and health complications (53-54). However, we should not overestimate the effect of the population's self-care on health and well-being without taking into consideration its negative relationship with stress perception and thus, the importance to deal first with this psychological appraisal process.

Nevertheless, we need to take into account some considerations related to the mediation of self-care in the relationship between stress and well-being in the general population. First, a partial mediation indicates that self-care does not explain the totality of the perceived stress effect on well-being. Although recent works claim that partial mediation has little value and should be abandoned (55- 56), others support that a more realistic goal in psychological studies dealing with phenomena that have multiple causes may be to seek mediators that significantly decrease the direct path rather than eliminating the relation between the independent and dependent variables altogether (57). From a theoretical point of view, a significant reduction demonstrates that a given mediator is indeed potent, albeit not both a necessary and a sufficient condition for an effect to occur.

Although the Perceived Stress Scale is the most widely used psychological instrument for measuring the perception of stress, most of its items associate stress with negative emotions and "threat" characterized by situational demands exceeding coping resources (58). Moreover, despite the Self-care Activities Screening Scale considers four important dimensions of self-care (health consciousness, nutrition, and physical activity, sleep, and intra-personal and inter-personal coping skills) and it was validated on the general population at the beginning of the COVID-19 context (when coping strategies were not probably fully established), it is supposed that psychological, emotional, professional and spiritual components may also participate in the mediating effect between stress and well-being. Furthermore, considering that not all stressors that explain well-being can be explained by self-care, it is not surprising that self-care cannot explain the totality of such a relationship by itself. For this reason, it is crucial to identify the factors that can act as promoters and maintainers of well-being.

Regarding the contributions of the present study, it should be highlighted that it is the first research to explore the mediating role of self-care activities between stress and well-being in the general population during COVID-19 lockdown. However, the present study presents some limitations. First, our sample was composed of people with a similar high socio-economic situation in the four countries. Therefore, these findings may not be representative of more disadvantaged or vulnerable social groups. Second, the use of self-report instruments and social desirability may have influenced the results. Third, the study has a cross-sectional design, and thus, it is not possible to conclude causal relations between the assessed variables.

As future lines of research, it would be of great value to continue this research line to understand better which specific dimensions of self-care the most important mechanisms are to explain the relationship between stress and psychological well-being. Furthermore, it would be critical to conduct longitudinal studies to ascertain cause-effect relationships between the measured variables and explore differences in self-care, stress, and well-being at different

measurement times. Based on this, it would be appropriate to design intervention programs or strategies aimed at reducing stress perception and promoting self-care strategies as a possible pathway to keep healthy during extraordinary situations such as a lockdown. Lastly, it is worth noting that our general population sample was confined in their respective countries at the data collection moment, but one-third were workers of health and basic services (i.e., frontline COVID-19 workers). Considering that some front-line workers, while confined, worked longer hours than usual (e.g., health workers) or fewer hours (e.g. supermarket workers) and that these could be exposed to a greater risk of contagion, it would be interesting to address the impact of self-care on the relationship between stress and well-being in this population in future research.

Figure 1. Mediation model of self-care in the relationship between stress and well-being controlled with standardized coefficients.

Ethics approval and consent to participate

All procedures performed in this work with human participants were in accordance with the ethical standards of the Research Ethics Committee of the University of Navarra (Spain, project ID: 2020.058) and the University of San Francisco de Quito (Ecuador, P2020 -024M) for Latin-American samples.

Availability of data and materials

The data are not publicly available due to privacy or ethical restrictions.

Patient and Public Involvement

Nonspecific patients were involved in this study.

Conflict of interests

The authors declare they have no competing interests.

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Authors' contributions

EOL, EB, ASP, and PFB: contributed to the conceptualization, data curation, formal analysis, investigation, methodology, and writing — original draft; EOL, EB, and PFB: supervision; MM: data curation, formal analysis, and methodology; ASP, EYO, CC, MSG, and JVO: investigation, methodology, and resources. All authors contributed to reviewing and editing the final manuscript.

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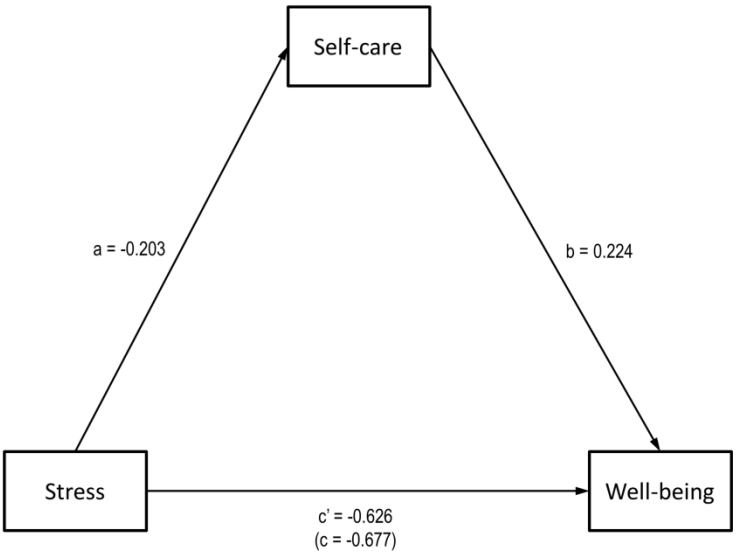

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page n.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7
		(*e*) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	8-9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-16

		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	16
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.