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COVID-19 infection: Positive mental health, psychological vulnerability and sex: Cross-sectional study

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Abstract

Since mid-March 2020, a state of emergency was decreed in Portugal due to the COVID-19 pandemic and, consequently, measures were implemented to protect public health, such as social isolation, which will certainly have a notable impact on the mental health of the population, especially in the most vulnerable groups. Positive Mental Health (PMH) is essential to deal with adversity, in this case with the pandemic, and to live better and with greater satisfaction. We consider it relevant to investigate how PMH was used as a resource to deal with the pandemic, depending on the level of vulnerability and sex. A, cross-sectional study was carried out whose the aim was to evaluate the levels of PMH and psychological vulnerability in people with COVOD-19 infection and analyze the association between PMH and psychological vulnerability among men and women.

Methods: The instruments used were a sociodemographic characterization questionnaire, the Positive Mental Health Questionnaire, and the Psychological Vulnerability Scale (PVS), that were sent and filled out online. A quantitative, cross-sectional, descriptive, and correlational study was carried out.

Results: After analyzing the results, it was found that approximately 50.4% of the respondents ($n = 387$) had global PMH values that place them in quartile 50. There was also a statistically significant difference between female and male PMH, with women showing greater psychological vulnerability and lower overall PMH.

Conclusions: We conclude that the women present a greater psychological vulnerability and a lower level of PMH when compared to men.

Relevance to clinical practice: Considering the study's statistically significant results, when we talk about mental health, we should always consider the sex variable as a vulnerability factor, in a pandemic or non-pandemic phase.

KEYWORDS
pandemic, positive mental health, psychological vulnerability, sex

INTRODUCTION

In recent years, there has been a growing interest in the concept of Positive Mental Health (PMH), highlighting the way in which mental health can be influenced by the positive dimensions of experiences. Thus, PMH can be defined as a value in itself or as the ability to perceive, understand and interpret the context, adapting to it whenever necessary, in order to promote autonomy, integration, and adaptation (Sequeira & Sampaio, 2020).

The concept of PMH is used to describe more than the absence of disease, it is a terminology directed and specifically dedicated to the promotion of mental health in a perspective of strengthening and developing the optimal functioning of human beings, reinforcing and enhancing mental health in general (Lluch, 2008; Teixeira et al., 2021).

One of the most relevant conceptual approaches is the Multifactorial Model of Positive Mental Health (MMPMH) by Lluch Canut et al. (1999), which addresses PMH as a construct with six dimensions or factors: Factor 1: Personal satisfaction (self-concept / self-esteem; satisfaction with personal life; optimistic perspective of the future); Factor 2: pro social attitude; active predisposition for the social / for society; altruistic social attitude/help-support attitude towards others; acceptance of others and different social factors); Factor 3: self-control (ability to face stressful/conflict situations; emotional balance/emotional control; tolerance to frustration, anxiety and stress); Factor 4: autonomy (ability to have its own criteria; independence; self-regulation of one's own conduct; personal safety / self-confidence); Factor 5: problem solving and personal fulfillment (ability to analyze; ability to make decisions; flexibility / ability to adapt to change; attitude of continuous growth and continuous personal development) and Factor 6: interpersonal relationship skills (ability to establish interpersonal relationships; empathy / ability to understand the feelings of others; ability to provide emotional support; ability to establish and maintain intimate interpersonal relationships).

Lluch Canut et al.'s (1999) MMPMH is assessed using a questionnaire (Positive Mental Health Questionnaire) by the same author which is described in more detail in the methodology section of this article. Both the conceptual model and the PMH questionnaire were applied to different populations and in different health conditions: people with schizophrenia (Ruiz & Dolores, 2014), people with chronic physical health problems (Lluch-Canut et al., 2013; Puig Llobet et al., 2020), caregivers of family members with schizophrenia (Pinho et al., 2021; Riobóo, 2015), pre-hospital emergency medical services professionals (Mantas Jiménez et al., 2015), university students (Roldán-Merino et al., 2017), and university teachers (Hurtado-Pardos et al., 2017). In addition, the questionnaire was also translated into Portuguese (Sequeira et al., 2014) and in Turkey (Teke & Arabacı, 2018).

This is the first study that we are aware of, which is carried out in people affected by COVID, using the MMPMH model by Lluch Canut et al. (1999).

In late December 2019, the first cases of atypical pneumonia of unknown origin were reported in Wuhan – China with suspicion of possible zoonosis. In January 2020, Chinese authorities identified the infectious agent as a new coronavirus, naming it SARS-COV 2 – COVID-19. On January 30, 2020 the World Health Organization declared the outbreak of COVID-19 a health emergency international public calling on all countries to take rapid action to combat the virus (World Health Organization, 2020). In Portugal, a study carried out by the National Institute of Health Doctor Ricardo Jorge (Mental Health in times of pandemic), which aimed to assess the impact of COVID-19 on the mental health and well-being of the population in general, revealed that it is mainly the women who present, more often, symptoms of psychological distress, anxiety and depression (Almeida et al., 2020).

It appears that currently the majority of the population faces daily high loads of stress that generate situations of great fear and/or anxiety, which in turn can make individuals more vulnerable to mental health problems. Anxiety disorders are among the most frequent psychiatric disorders in the general population. According to Apóstolo et al. (2011), of the 870 million people who live in Europe, it is estimated that approximately 100 million suffer from anxiety and depression. Extensive research in studies conducted all over the world reveals that the female sex is the most vulnerable to mental health problems during the pandemic or even worsening of previously diagnosed mental health problems. Thus, pandemic events affect the general population, but many stressors affect especially women, identifying sex as a vulnerability factor (Almeida et al., 2020; Broche-Pérez et al., 2020; Connor et al., 2020; Liu et al., 2020; Özdin & Bayrak Özdin, 2020; Qiu et al., 2020).

The aim of this study was to evaluate the PMH of individuals from the district of Bragança – Portugal, who were tested for suspected infection by COVID-19 and to relate the issue of psychological vulnerability with the sex variable.

It should also be noted that the district of Bragança is located in the Northeast region of Portugal, belongs to the traditional province of Trás-os-Montes and Alto Douro. It is limited to the north and east by Spain, to the south by the districts of Guarda and Viseu, and to the west by the district of Vila Real. The District has a total area of 6608 km^2 and is the fifth largest Portuguese district, inhabited by 33,597 inhabitants corresponding to 63.5% of the working - age population (between 15 and 65 years old) and 25.1% of the elderly population (65 years old or even older) (Fundação Francisco Manuel dos Santos, 2011).

METHODS

A quantitative, cross-sectional, descriptive, and correlational study was carried out. The sample consisted of 770 users selected by a convenience sample, who agreed to participate voluntarily, suspected of infection by COVID-19, screened in the testing units created specifically for COVID-19 testing belonging to the Macedo de Cavaleiros health center that is part of the Northeast Local Health

Unit. All those who were in contact with positive cases were tested. Only participants with positive test result or with a high-risk were in isolation or quarantine.

Inclusion criteria were: age 18 years or older; availability to participate and with informed consent and having been tested for suspected infection by COVID-19. As exclusion criteria: not knowing how to communicate in Portuguese and not having access to computer resources with internet to respond to the assessment instruments.

In a first phase, each user was sent a free and informed consent to participate in the study. Subsequently, a sociodemographic questionnaire, the Positive Mental Health Questionnaire (Sequeira & Carvalho, 2009) and the PVS (Nogueira et al., 2017) were sent. All instruments were sent by email and completed on an online platform between October 2020 and January 2021.

Assessment instruments

The Positive Mental Health Questionnaire that was applied is based on the multifactorial model developed by Teresa Lluch (Lluch, 2008; Lluch Canut et al., 1999). This model is based on the evaluation of 6 factors that served as the basis for the construction of Teresa Lluch's PMH assessment instrument (Lluch Canut, 2003; Lluch Canut et al., 1999) translated into the Portuguese version by Sequeira and Carvalho (Sequeira & Carvalho, 2009; Sequeira et al., 2014). The questionnaire consists of 39 items evaluated on an ordinal scale, with a maximum score of 156 points and a minimum of 39 points, unevenly distributed among the 6 factors: F1: Personal Satisfaction (8 items); F2: Pro-social attitude (5 items); F3: Self-control (5 items); F4: Autonomy (5 items); F5: Problem Solving and Personal Fulfillment (9 items) and F6: Interpersonal Relationship Skills (7 items).

Items take the form of positive or negative statements that are answered on a scale of 1 to 4, according to how often they occur: always or almost always, quite often, sometimes, never or rarely. The questionnaire gives an overall score for PMH (sum of item scores) as well as specific scores for each factor. Thus, the higher the value obtained in this assessment instrument, the higher the PMH level.

The original questionnaire was validated in a population of students and in the general population, producing an internal consistency (Cronbach's alpha) between 0.89 and 0.90 and a test–retest correlation of 0.85. From the principal component analysis, six factors were derived that explained 46% of the total variance. All your items have a factor loading above 0.40. On this study, with this sample, Cronbach's alpha value is 0.88, thus presenting a very good internal consistency.

The PVS translated into the Portuguese version by Nogueira et al. (2017) consists of 6 self-completion statements rated on a Likert scale with five response possibilities ranging from 1 «does not describe me anything» to 5 «describe me very well». The total score is the sum of all items. The higher the score, the greater the psychological vulnerability. The Portuguese version has a good internal consistency (Cronbach's alpha 0.73) and a test–retest correlation of 0.88, $p < 0.0001$ at 5 weeks. On this study, with this sample, Cronbach's alpha value is 0.84, thus presenting a very good internal consistency.

Statistical analysis

All data were analyzed using the IMB SPSS v.22 program. Descriptive statistics were performed to describe the sociodemographic characteristics of the sample, and mean values stratified by sex were calculated from the Positive Mental Health Questionnaire.

Pearson's correlation was calculated between the total score of psychological vulnerability and the total score of Positive Mental Health (TPMH) and the different factors. The *T* Test for independent samples (Independent Samples Test) was used to compare the PMH and psychological vulnerability variables with the question of sex, with *p* values lower than 0.05 being considered statistically significant.

RESULTS

The sample was composed of 770 individuals suspected of infection by COVID-19, mostly females (64.3%; $n = 495$); the average age was 36.3 years (minimum of 18 and maximum of 74 years of age and SD of 12.3 years); married or cohabiting (48.8%; $n = 376$); without children (46.6%; $n = 359$); 40.5% ($n = 312$) had concluded secondary education, 39% ($n = 300$) had graduated from university, and most of them were working (64%; $n = 493$). Most of the respondents had completed isolation/quarantine ($n = 533$, corresponding to 69.2% of the sample) (Table 1).

As for the overall PMH, and to better interpret the results, we divided total PMH values obtained into quartiles: 25, 50, and 75. Consequently, TPMH values up to 123 correspond to the 25th percentile, TPMH values from 124 to 144 correspond to the 50th percentile, and TPMH values above 145 correspond to the 75th percentile. The overall PMH of the sample is in quartile 50, with a total mean value of 132.06, corresponding to a good level of PMH ($n = 387$).

Concerning the inferential analysis of PMH for sex, a statistically significant value was found in all PMH factors, except for factor 6 - Interpersonal relationship skills and factor 2 - Pro-social attitude - statistically non-significant value (Table 2). Thus, and comparatively, women present lower values than men in the dimensions Personal Satisfaction (F1), Self-control (F3), Autonomy (F4), and Problem-solving (F5), with *p* values lower than 0.05 and, therefore, statistically significant.

After analyzing the results, we infer that the women scores for PVS are higher (M = 15.72; SD = 5.7) than men (M = 13.66; SD = 5.07), which indicates a greater psychological vulnerability in the female participants and a lower TPMH values (130.39) when compared to men (135.07) (Table 2).

There was also a strong negative correlation between PMH, overall and factor-based, and psychological vulnerability (through the calculation of Pearson's Correlation between the TPMH and the PVS). Therefore, we concluded that these variables are inversely proportional (Table 3), i.e., the higher the PMH, the lower the psychological vulnerability, and vice versa.

TABLE 1 Demographics of the sample ($n = 770$)

Variable		N	%
Sex	Feminine	495	64.3
	Masculine	275	35.7
Marital status	Single	339	44
	Married	376	48.8
	Divorced	51	6.6
	Widow(er)	4	0.5
Children	0	359	46.6
	1	189	24.5
	2	186	24.2
	3 or more	36	4.7
Education	Primary Education First Cycle	13	1.7
	Primary Education second/third Cycle	37	4.8
	Secondary Education	312	40.5
	Bachelor's degree	20	2.6
	Licentiate	300	39
	Master	80	10.4
	Doctorate degree	8	1
Employment situation	Employed	493	64
	Employer/entrepreneur	70	9.1
	Unemployed	41	5.3
	Retired	7	0.9
	Student	154	20
Quarantine/confinement	Yes	533	69.2
	No	237	30.8
Total		770	100

DISCUSSION

As in previous pandemics, the COVID-19 has greatly impacted the population's health, namely mental health. The pandemic can be considered a traumatic event, generating severe consequences on the population's mental health (Shigemura et al., 2020).

Some of our results are similar to those found in other studies conducted during the COVID-19 pandemic concerning the PMH dimensions of Personal Satisfaction and Self-control. For example, a study conducted in 2021 in Poland with a sample of mostly female individuals (75.24%) revealed a significant average decrease in happiness and life satisfaction during the COVID-19 pandemic compared to the pre-pandemic period (Gawrych et al., 2021).

Regarding the self-control dimension, several studies have concluded that self-control is a resilience factor between the perceived severity of the COVID-19 infection and mental health, with the most vulnerable population having the least self-control (Li et al., 2020; Schnell & Krampe, 2020). Thus, we can infer that mental health problems are attenuated when these dimensions of PMH increase.

Recent reports indicate that in situations of infection by COVID-19, women are at a lower risk of serious illness and death than men (Gebhard et al., 2020; Richardson et al., 2020). However, we also found that recent studies carried out all over the world suggest that the symptomatology of post-traumatic stress disorders, the levels of anxiety and depression, and in general, the impact of the COVID-19 pandemic on mental health is more evident, and with statistically significant results, in women (Almeida et al., 2020; Liu et al., 2020; Özdin & Bayrak Özdin, 2020), which corroborates this research.

On the other hand, we found studies carried out in contexts unrelated to the pandemic that also indicate that there were already significant differences in PMH between men and women. A study conducted in Mexico with young university students revealed that men show better cognitive-emotional well-being, control of the environment, and physical well-being. In contrast, women show better social skills, empathy, and social sensitivity, but on the other hand, greater psychological distress (Barrera Guzmán & Flores Galaz, 2020) (Barrera & Flores, 2020).

Another study conducted in Mexico on higher education students aged 14 to 20, aiming to analyze the differences between the PMH of men compared to women, revealed somewhat different

TABLE 2 Correlational analysis of TPMH, sex and psychological vulnerability ($n = 770$)

SEX		PVS	F1	F2	F3	F4	F5	F6	TPMH
Feminine	Mean	15.72	25.81	18.30	15.36	15.70	31.41	23.81	130.39
	SD	5.71	4.71	1.81	3.02	3.34	3.76	3.35	16.10
Masculine	Mean	13.66	27.82	18.05	16.68	16.72	31.97	23.84	135.07
	SD	5.07	3.73	1.85	2.55	2.51	3.45	3.21	13.84
	p	<0.000	<0.000	0.069	<0.000	<0.000	0.039	0.903	<0.000
Total	Mean	14.98	26.53	18.21	15.83	16.06	31.61	23.82	132.06
	SD	5.57	4.49	1.83	2.93	3.11	3.66	3.30	15.49

TABLE 3 Pearson's correlation between the TPMH and the PVS ($n = 770$)

		PVS	F1	F2	F3	F4	F5	F6
	r							
	p							
F1	*r*	−0.551**						
	p	<0.000						
F2	*r*	−0.132**	0.333**					
	p	<0.000	<0.000					
F3	*r*	−0.499**	0.642**	0.319**				
	p	<0.000	<0.000	<0.000				
F4	*r*	−0.502**	0.691**	0.312**	0.594**			
	p	<0.000	<0.000	<0.000	<0.000			
F5	*r*	−0.436**	0.638**	0.421**	0.675**	0.619**		
	p	<0.000	<0.000	<0.000	<0.000	<0.000		
F6	*r*	−0.304**	0.565**	0.537**	0.512**	0.531**	0.633**	
	p	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	
TPMH	*r*	−0.538**	0.860**	0.551**	0.801**	0.810**	0.858**	0.793**
	p	<0.000	<0.000	<0.000	<0,000	<0.000	<0.000	<0,000

Abbreviations: F1, Personal Satisfaction; F2, Pro-social Attitude; F3, Self-control; F4, Autonomy; F5, Problem Solving and Personal Fulfillment; F6, Interpersonal Relationship Skills; PVS, psychological vulnerability scale; TMPH, total score of positive mental health.

** Correlation is significant at the 0.01 level.

results. The results showed that 38.3% of the sample has a high level and 16.1% at a very high level of PMH. There were significant differences in four of the six dimensions: Personal Satisfaction, Pro-social Attitude, and Interpersonal Relationship skills, with higher scores for women and self-control in men (Toribio Pérez et al., 2018).

However, it should be noted that all these studies were conducted with different instruments, populations, and contexts.

In Spain, another research (Lluch-Canut et al., 2013) conducted with chronically ill adults over 45 years of age reports significant differences between men and women. Women show more pro-social attitudes and interpersonal relationship skills, and men more personal satisfaction and autonomy. Thus, considering that we used the same evaluation instrument, i.e., the Positive Mental Health Questionnaire by Lluch Canut et al. (1999), we can explain these differences in our study by the differences in contexts and between age groups.

As far as the mental health impact is concerned, in general, the results of the scientific evidence are unanimous. In line with our findings, several studies show evidence of a negative impact on the mental health of the population during events such as the one currently being experienced. A study conducted in China during the initial phase of the COVID-19 outbreak found that more than half of the stakeholders rated the psychological impact of the pandemic as moderate to severe and that the female sex was associated with a greater psychological impact of the outbreak and higher levels of stress, anxiety and depression (C. Wang, Pan, et al., 2020).

In Australia, another study conducted four weeks after the pandemic shutdown came to two similar conclusions: that the COVID-19 appears to have a major impact on mental health and that young adults (<35 years), women, unemployed, and those on low incomes have significantly lower mental health (Pieh et al., 2020). It should also be noted that relatively high rates of symptoms of psychiatric disorders were reported in the general population during the COVID-19 pandemic in China, Spain, Italy, Iran, the United States, Turkey, Nepal and Denmark (Xiong et al., 2020). Thus, in the light of the psychosocial implications of the COVID-19 in the general population and specific groups, the promotion and primary prevention of mental health acquires great relevance. It is paramount to enhance the mental health of those who are well and to detect the risk of any potential mental health problem as early as possible.

In this sense, and taking into account the scientific evidence, there are several studies that show the importance of the need to take care of the PMH considering it as a protective factor of mental health, both in the general population (Buitrago Ramírez et al., 2020; Keyes, 2007; Keyes et al., 2010; Keyes & Simoes, 2012; Moreno et al., 2020; Murray et al., 2020; Paulino et al., 2021; Teismann et al., 2019; Tizón, 2020), and especially in health professionals (Alonso et al., 2021; Dosil Santamaría et al., 2021; Romero et al., 2020; Sampaio et al., 2021).

In addition to being a protective factor, PMH should also be considered as a predictive factor and/or mediator of adaptive/dysadaptive coping responses, both in the specificity of the pandemic and in the potential for mental health, suicide or addiction problems (Brailovskaia et al., 2019; Murray et al., 2020; Teismann et al., 2019).

Thus, taking into account the situation that is being experienced all over the world, and given that sex vulnerability issues are

somewhat transversal to various themes and not only to health in general, there is an urgent need for further research to substantiate the need to implement measures and strategies that minimize the impact of the pandemic on mental health, particularly in the most vulnerable groups, to ensure that public health policies take into account the sex perspective. However, the results that relate PMH with sex remain controversial since, in some studies, the differences are statistically significant, while in others, the differences are not significant regardless of the study context.

In this way, it was verified that the study carried out was in line with several previous studies reporting on women as most vulnerable (Broche-Pérez et al., 2020; Connor et al., 2020; Qiu et al., 2020).

Learned lessons and policy recommendations following the COVID-19 pandemic

The pandemic caused by the COVID-19 virus has shown that in no part of the world the government institutions, hospitals or even properly trained human resources were prepared to easily overcome this great challenge (Han et al., 2020; Scotti et al., 2022; Wang, Duan, et al., 2020). The impact of this pandemic was not only noticeable on the world economy, but also reinforced the constant need for better preparation in the area of health, namely in its response capacity and in the training of health professionals and society itself to better deal with a similar event in the future. Health policies should include specific plans for more effective action with the provision of qualified professionals in sufficient numbers to avoid exhaustion (Rossi et al., 2022) More and more investment should be made in specific training that contemplates demands and contingency plans standardized by health organizations, so that there is a better preparation and response to emerging infectious diseases (Wu et al., 2020).

LIMITATIONS

The authors did not perform a sample size calculation. The study was conducted in an area in the northeast of Portugal, where the population is aged and not everyone has computer or internet resources. Our sample size was a result of those who were able to fill out the instruments online. We consider this a limitation because the population tested was much larger than our sample size.

The questionnaires were filled out on line and although the participants were instructed to fill out the questionnaire only once, due to anonymity this cannot be guaranteed.

CONCLUSIONS

The results of this study corroborate international research indicating that women are the sex with the highest rates of psychological vulnerability during the COVID-19 pandemic and have a greater negative impact on their PMH.

Psychological vulnerability is a good indicator of lower PMH, so it can be used in association with sex to identify the persons who should be given priority in terms of intervention. Consequently, it is paramount to recognize the need to implement health policies that contemplate specific interventions that minimize the negative psychological impact on the mental health of the most vulnerable groups, namely women, not neglecting the post-pandemic period.

CLINICAL RESOURCES

Mental health & COVID-19: Coronavirus disease (Source: World Health Organization). https://www.who.int/teams/mental-health-and-substance-use/mental-health-and-covid-19

Mental health and psychosocial considerations during the COVID-19 outbreak (Source: World Health Organization) https://www.who.int/publications/i/item/WHO-2019-nCoV-MentalHealth-2020.1

One in 5 COVID-19 patients develop mental illness within 90 days –study (Source: Reuters) https://www.reuters.com/article/health-coronavirus-mental-illness-idUKL8N2HS4ND

Coronavirus disease (COVID-19) (Source: American Nurses Association) https://www.nursingworld.org/practice-policy/work-environment/health-safety/diseae-preparedness/coronavirus/

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CONFLICT OF INTERESTS

All co-authors have contributed significantly and agree with the contents of the manuscript and there is no financial interest to report.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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