



The use of mental health promotion strategies by nurses to reduce anxiety, stress, and depression during the COVID-19 outbreak: A prospective cohort study

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ABSTRACT

Objectives: To evaluate and compare nurses' depression, anxiety and stress symptoms at the beginning of the COVID-19 pandemic and after six months; to evaluate and compare the frequency of use of mental health promotion strategies during the same period; and to identify the relationship between the frequency of use of mental health promotion strategies, during the same period, with nurses' depression, anxiety and stress symptoms.

Methods: Data collection was carried out in two moments: at baseline and after six months. An online questionnaire was applied to nurses to assess the frequency of use of some mental health promotion strategies and their depression, anxiety, and stress symptoms (through the Depression Anxiety Stress Scales – short version (DASS-21)).

Results: The anxiety and stress symptoms significantly decreased over time. The physical activity increased, and a decrease was observed in the remote social contacts after six months. The stress, anxiety and depression scores were significantly lower in nurses who frequently or always used all strategies compared to participants who never or rarely used them, except for one strategy (rejecting information about COVID-19 from unreliable sources).

Conclusions: Mental health promotion strategies, such as physical activity, relaxation activity, recreational activity, healthy diet, adequate water intake, breaks between work shifts, maintenance of remote social contacts, and verbalization of feelings/emotions, are crucial to reduce nurses' stress, anxiety and depression symptoms during the COVID-19 outbreak.

1. Introduction

The first diagnosis for the Corona Virus Disease (COVID-19) was reported in Wuhan, China, in December 2019. On January 1, 2021, the World Health Organization (WHO) estimated a total of 81, 947, 503 confirmed cases of COVID-19 and 1,808,041 deaths from this disease (World Health Organization, 2021). According to the WHO (2020b) this

current pandemic is the largest global public health emergency, exerting extreme pressure on health systems. Thus, health professionals are providing care in unprecedented borderline conditions, likely to affect their mental health (Lai et al., 2020). The dimensions of these borderline conditions are, for example, an increase in the number of patients attending health institutions; insufficient knowledge about the disease; social alarm; fear of infection leading to withdrawal from family

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support; and contradictory guidelines.

According to current evidence, health professionals are particularly at high risk of developing mental health problems and high incidence of sleep disorders, fear, anxiety, depression, somatization and obsessive-compulsive symptoms amidst this pandemic of COVID-19 (Huang and Zhao, 2021; Lu et al., 2020). Nurses are at the frontline of providing care during a pandemic and highly exposed to mental health problems (Lai et al., 2020; Said and Chiang, 2020; Sampaio et al., 2020).

According to the recent report from the Society of Occupational Medicine, released before the pandemic outbreak, nurses' mental health was already strongly compromised from high levels of occupational-related stress due to poor working conditions, work overload, intimidation, and lack of support (Kinman et al., 2020; Lai et al., 2020). This report also suggests that the change in these professionals' mental health is very likely to hinder the delivery of quality and safe care (Kinman et al., 2020). Nurses' work environments can be complex and very stressful, often leading to mental health problems. This situation may be partly explained by the lack of prioritizations in nursing education, aiming at developing resilience and other skills essential to effectively respond to these challenges (Hurley et al., 2020).

Thus, nurses are considered a group at high risk of developing occupational mental health problems (Office for National Statistics, 2017). To substantiate this idea, the suicide rates are higher among nurses than among the general population and other professionals. In the United Kingdom, the suicide rate is 23% higher for nurses than the national average, and over half these nurses have not received any mental health care (Office for National Statistics, 2017).

The profound impact of the COVID-19 outbreak on nurses' mental health is now widely acknowledged (Hu et al., 2020; Sampaio et al., 2020, 2021). A study conducted in February 2020, with 2014 nurses working with patients with COVID-19 from hospitals in Wuhan, aiming at assessing mental health and its associated factors, showed that these nurses experienced mental health problems mostly associated with burnout, anxiety, depression, and fear. The authors concluded that interventions at the organizational level are crucial to improving mental health during the current pandemic, by developing skills to improve self-efficacy, resilience, promotion of social support, and guarantee quality and safe care (Hu et al., 2020). A cross-sectional study carried out in Portugal with 767 nurses during the pandemic outbreak of COVID-19, concluded that Portuguese nurses showed more depression, anxiety and stress symptoms than the general population. It also revealed that the perception of inadequate quantity and quality of personal protective equipment contributed to that symptomatology (Sampaio et al., 2020). Also, a prospective cohort study with 829 Portuguese nurses revealed that the COVID-19 outbreak seems to have had an immediate impact on nurses' mental health, who experienced depression, anxiety, stress, fear of infecting others, and fear of being infected (Sampaio et al., 2021).

Factors, such as overwhelming work, fear of exposure to COVID-19, the perception of a life-threatening situation for health professionals and their families, the constant increase in diagnosed cases, insufficient and inadequate personal protective equipment, death of patients and co-workers due to COVID-19, the lack of knowledge about effective therapeutics to control and stop the virus, including a vaccine, and the media coverage, have largely contributed to the decline of nurses' mental health (Lai et al., 2020).

The visible impact of this pandemic on nurses' mental health has urged these professionals to adopt strategies to promote their mental health, thus minimizing potential consequences. In this domain, the WHO released a set of mental health promotion strategies to be adopted by health professionals to maintain their mental health (World Health Organization, 2020a).

In response to this pandemic crisis, we have witnessed the historical progress in developing a vaccine. However, a phased administration of the vaccine should be carefully addressed considering its availability. Thus, it is crucial to preserve the mental health of healthcare

professionals, particularly nurses.

This view opened a new perspective in assessing the use of mental health promotion strategies recommended by the WHO and how they impact nurses' mental health.

This study aimed to evaluate and compare nurses' depression, anxiety and stress symptoms at the beginning of the COVID-19 pandemic and after six months; to evaluate and compare the frequency of use of mental health promotion strategies during the same period; and to identify the relationship between the frequency of use of mental health promotion strategies, during the same period, with nurses' depression, anxiety and stress symptoms.

2. Materials and methods

2.1. Study design and sample

A prospective cohort study was conducted with a sample of 199 nurses working in clinical practice in Portugal, following the STROBE guidelines.

The snowball sampling method was used. The inclusion criteria were: frontline nurses involved directly with suspected or confirmed COVID-19 patients, performing diagnostic tests and/or providing nursing care. Exclusion criteria were: nurses engaged in teleworking; nurses not working in clinical practice; and nurses absent from work due to medical discharge or other reasons.

2.2. Data collection and variables' measures

An online questionnaire was emailed to a list of nurses working in the Portuguese territory, made available by the researchers.

Data collection was carried out in two moments. In moment one (M1), data were collected from March 31, 2020, to April 14, 2020. At the time, the state of emergency had already been declared - March 18, 2020 (Decree no. 2-A/2020), and confinement restrictions due to the COVID-19 outbreak were in-force. At the beginning of data collection, Portugal registered 7443 infected patients and 160 deaths (Directorate-General of Health DGH, 2020).

In moment two (M2), data collection was conducted after six months, from October 19 to November 4. The state of calamity due to the COVID-19 pandemic had been declared (Resolution of the Council of Ministers n.º 88-A/2020), meaning that confinement was no longer mandatory. On October 19, Portugal reported 101,860 infected patients and 2198 deaths (Directorate-General of Health DGH, 2021).

The data on sociodemographic characteristics, included gender, age, schooling and marital status. The Depression Anxiety Stress Scale (short version DASS-21) was used to assess stress, anxiety, and depression variables. Data on the frequency of use of mental health promotion strategies were gathered through a specific questionnaire developed for this study (based on the mental health promotion strategies recommended by the WHO at the beginning of the COVID-19 outbreak) (World Health Organization, 2020a).

- The Depression Anxiety Stress Scale short version (DASS-21)

The DASS-21 has a total of 21 items and includes three scales with seven items each, that evaluate depression, anxiety, and stress symptoms. Each item consists of a 4-point scale of severity/frequency. The stress scale evaluates difficulty in relaxing, nervous arousal, being easily upset/agitated, irritable/over-reactive, and impatient. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The depression scale evaluates dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia. The depression, anxiety, and stress scores are calculated by summing the scores of the respective items. The higher the score, the more stress, anxiety and/or depression symptoms (Lovibond and Lovibond, 1995). The DASS-21 was

validated for the Portuguese population with a Cronbach’s alpha of 0.81 for the stress scale, 0.74 for the anxiety scale and 0.85 for the depression scale (Pais-Ribeiro et al., 2004).

- Mental health promotion strategies

The mental health promotion strategies questionnaire was developed based on the WHO’s recommendations (World Health Organization, 2020a). An ordinal scale was applied to evaluate the frequency of using strategies, through questions with options ranging between never, rarely, sometimes, often, and always.

A question was formulated: *How often have you adopted the following mental health promotion strategies in the last 7 days?*

- Strategy 1 - Break between work shifts.
- Strategy 2 - Healthy diet.
- Strategy 3 - Adequate water intake.
- Strategy 4 - Physical activity.
- Strategy 5 - Relaxation activities.
- Strategy 6 - Recreational activities (e.g., reading, listening to music, watching movies/series).
- Strategy 7 - Maintenance of remote social contacts.
- Strategy 8 - Verbalization of feelings/emotions.
- Strategy 9 - Rejecting information about COVID-19 from unreliable sources.

2.3. Data analysis

The sample characteristics were obtained using absolute and relative frequencies (for qualitative variables) or mean and standard deviation (SD) (for quantitative variables).

Comparison of the use of strategies, between baseline and after six months, was performed using the McNemar test.

Linear mixed-effects models were used to evaluate the effect of each strategy and the effect of time in changes of each outcome (depression, anxiety and stress). For each outcome, ten models were performed: one model included only time as a fixed effect, and for the remaining models, each included one strategy and time as fixed effects. All models included random effects of intercept (individual level).

Analyses were performed using SPSS and R software, with a

significance level set at 0.05.

2.4. Ethical considerations

Ethical approval was granted by the Ethics Committee of the School of Health of the Polytechnic Institute of Setúbal (56/AFP/2020) and the Ethics Committee of University Fernando Pessoa (FCS/PI-63/20). The research followed the principles enunciated by the Declaration of Helsinki of 1964 and its subsequent amendments (World Medical Association, 2013). Before responding to the questionnaire, participants were informed of the study’s objectives and were asked to sign informed consent to participate in the study and authorize the use of data for research purposes.

3. Results

3.1. Sample characteristics

The sample comprised 199 participants, with an overall mean age of 38.3 (SD = 8.4, min-max = 23–60). From these participants, 160 (80.4%) were female, 126 (63.3%) were married, and 60 (30.2%) single. The majority (n = 138, 69.3%) had a licentiate degree, 60 (30.2%) a master degree and only 1 (0.5%) hold a PhD.

3.2. Depression, anxiety and stress over time

Fig. 1 displays the trajectory of depression, anxiety, and stress over time, showing a decreasing tendency for all outcomes.

Based on the linear mixed model results (Table 1), anxiety and stress symptoms decreased significantly over time, while depression

Table 1

Changes on depression, anxiety and stress over time.

	Baseline	After 6 months	p
	Mean estimate (95% CI)	Mean estimate (95% CI)	
Depression	3.63 (3.08–4.17)	3.52 (2.47–4.58)	0.684
Anxiety	3.78 (3.25–4.31)	3.15 (2.15–4.14)	0.008
Stress	7.20 (6.55–7.85)	6.32 (5.05–7.59)	0.006

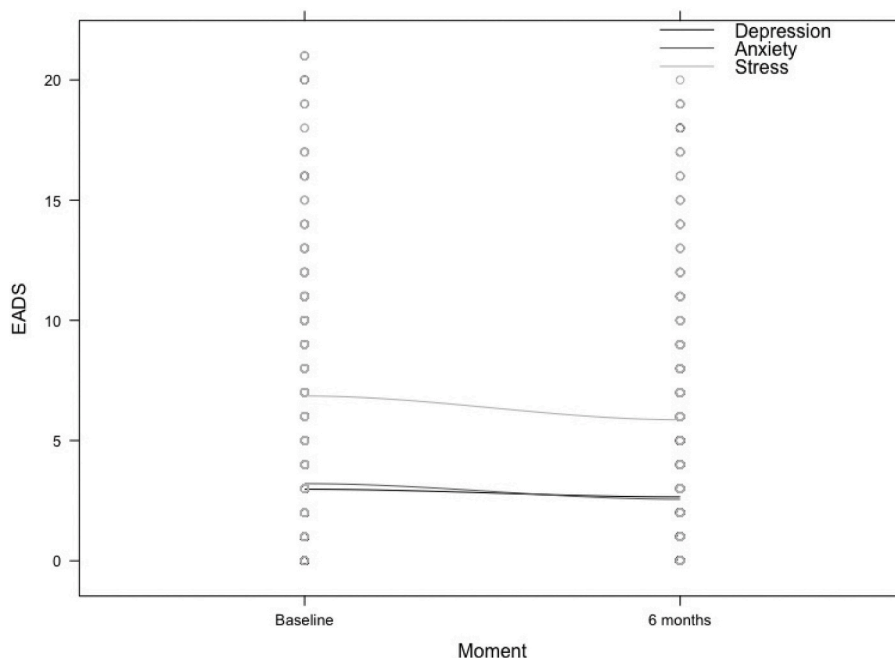


Fig. 1. Trajectories of depression, anxiety and stress.

symptoms did not vary significantly.

A more expressive decrease was observed in the stress outcome.

3.3. Mental health promotion strategies

Table 2 displays the use of mental health promotion strategies, at baseline (M1) and after six months (M2). Differences were found for “physical activity” and “maintenance of remote social contacts”.

From the analysis of Fig. 2, the following conclusions were drawn: i) for physical activity - the percentage of nurses who increased the use of this strategy was higher than the percentage of nurses who reduced its use; ii) for maintenance of remote social contacts - the percentage of nurses who increased the use of this strategy was lower than the percentage of nurses who reduced its use.

3.4. Effects of mental health promotion strategies in changes on depression, anxiety and stress

Table 3 depicts the effects of mental health promotion strategies and time on each outcome (depression, anxiety, and stress symptoms).

From the analysis of data, it was possible to observe:

3.4.1. Depression

- The depression score was significantly lower in nurses who frequently or always used all strategies, compared to nurses who never or rarely used them, except for the strategy “rejecting information about COVID-19 from unreliable sources”.
- The depression score was significantly lower in nurses who sometimes used the strategies “physical activity”, “relaxation activities” and “recreational activities”, compared to nurses who never or rarely used them.

3.4.2. Anxiety

- The anxiety score was significantly lower in nurses who frequently or always used all strategies, compared to nurses who never or rarely used them, except for the strategy “rejecting information about COVID-19 from unreliable sources”.
- The anxiety score was significantly lower in nurses who sometimes used the strategies “physical activity” and “relaxation activities”, compared to nurses who never or rarely used them.

3.4.3. Stress

- The stress score was significantly lower in nurses who frequently or always used all strategies, compared to nurses who never or rarely used them, except for the strategy “rejecting information about COVID-19 from unreliable sources”.
- Concerning the strategy “rejecting information about COVID-19 from unreliable sources”, the stress score was significantly higher in nurses who frequently or always used this strategy, compared to nurses who never or rarely used it.
- The stress score was significantly lower in nurses who sometimes used the strategies “adequate water intake”, “physical activity” and “relaxation activities”, compared to nurses who never or rarely used them.
- Concerning the strategy “rejecting information about COVID-19 from unreliable sources”, the stress score was significantly higher in nurses who sometimes used this strategy, compared to nurses who never or rarely used it.

4. Discussion

This study showed similarities with the sample characteristics of another recent study carried out in Portugal (Sampaio et al., 2021). The

Table 2

Comparison of the use of strategies, between baseline and after six months.

Baseline	6 months					
	Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Always n (%)	
Break between work shifts						0.438
Never	1 (0.5)	1 (0.5)	1 (0.5)	2 (1.0)	1 (0.5)	
Rarely	1 (0.5)	5 (2.5)	3 (1.5)	3 (1.5)	0 (0.0)	
Sometimes	1 (0.5)	10 (5.0)	15 (7.5)	15 (7.5)	7 (3.5)	
Often	0 (0.0)	7 (3.5)	16 (8.0)	46 (23.1)	17 (8.5)	
Always	1 (0.5)	2 (1.0)	5 (2.5)	14 (7.0)	25 (12.6)	
Healthy diet						0.553
Never	0 (0.0)	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	
Rarely	0 (0.0)	2 (1.0)	10 (5.0)	5 (2.5)	0 (0.0)	
Sometimes	2 (1.0)	6 (3.0)	27 (13.6)	15 (7.5)	3 (1.5)	
Often	0 (0.0)	7 (3.5)	18 (9.0)	58 (29.1)	11 (5.5)	
Always	0 (0.0)	2 (1.0)	2 (1.0)	12 (6.0)	18 (9.0)	
Adequate water intake						0.583
Never	0 (0.0)	1 (0.5)	2 (1.0)	0 (0.0)	0 (0.0)	
Rarely	1 (0.5)	14 (7.0)	11 (5.5)	5 (2.5)	1 (0.5)	
Sometimes	0 (0.0)	8 (4.0)	38 (19.1)	18 (9.0)	5 (2.5)	
Often	0 (0.0)	9 (4.5)	15 (7.5)	33 (16.6)	13 (6.5)	
Always	0 (0.0)	0 (0.0)	3 (1.5)	8 (4.0)	14 (7.0)	
Physical activity						0.019
Never	31 (15.6)	15 (7.5)	6 (3.0)	3 (1.5)	0 (0.0)	
Rarely	9 (4.5)	24 (12.1)	21 (10.6)	8 (4.0)	3 (1.5)	
Sometimes	4 (2.0)	17 (8.5)	20 (10.1)	9 (4.5)	0 (0.0)	
Often	0 (0.0)	0 (0.0)	2 (1.0)	14 (7.0)	3 (1.5)	
Always	0 (0.0)	1 (0.5)	1 (0.5)	3 (1.5)	5 (2.5)	
Relaxation activities						0.059
Never	18 (9.0)	16 (8.0)	6 (3.0)	0 (0.0)	0 (0.0)	
Rarely	9 (4.5)	35 (17.6)	23 (11.6)	5 (2.5)	2 (1.0)	
Sometimes	1 (0.5)	15 (7.5)	22 (11.1)	15 (7.5)	2 (1.0)	
Often	0 (0.0)	4 (2.0)	6 (3.0)	11 (5.5)	1 (0.5)	
Always	0 (0.0)	2 (1.0)	0 (0.0)	4 (2.0)	2 (1.0)	
Recreational activities						0.553
Never	1 (0.5)	5 (2.5)	3 (1.5)	0 (0.0)	0 (0.0)	
Rarely	2 (1.0)	16 (8.0)	16 (8.0)	5 (2.5)	0 (0.0)	
Sometimes	2 (1.0)	11 (5.5)	22 (11.1)	27 (13.6)	3 (1.5)	
Often	1 (0.5)	7 (3.5)	19 (9.5)	37 (18.6)	5 (2.5)	
Always	1 (0.5)	2 (1.0)	4 (2.0)	3 (1.5)	7 (3.5)	
Maintenance of remote social contacts						<0.001
Never	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Rarely	2 (1.0)	11 (5.5)	6 (3.0)	4 (2.0)	0 (0.0)	
Sometimes	2 (1.0)	21 (10.6)	33 (16.6)	9 (4.5)	3 (1.5)	
Often	2 (1.0)	12 (6.0)	23 (11.6)	39 (19.6)	5 (2.5)	
Always	0 (0.0)	4 (2.0)	7 (3.5)	9 (4.5)	6 (3.0)	
Verbalization of feelings/emotions						0.909
Never	6 (3.0)	3 (1.5)	1 (0.5)	0 (0.0)	0 (0.0)	
Rarely	4 (2.0)	17 (8.5)	15 (7.5)	5 (2.5)	0 (0.0)	
Sometimes	1 (0.5)	22 (11.1)	27 (13.6)	18 (9.0)	3 (1.5)	

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Table 2 (continued)

Baseline	6 months				
	Never	Rarely	Sometimes	Often	Always
	n (%)	n (%)	n (%)	n (%)	n (%)
Often	0 (0.0)	5 (2.5)	23 (11.6)	27 (13.6)	6 (3.0)
Always	0 (0.0)	1 (0.5)	2 (1.0)	5 (2.5)	8 (4.0)
Rejecting information about COVID-19 from unreliable sources					0.356
Never	2 (1.0)	0 (0.0)	3 (1.5)	0 (0.0)	3 (1.5)
Rarely	4 (2.0)	2 (1.0)	5 (2.5)	4 (2.0)	5 (2.5)
Sometimes	2 (1.0)	4 (2.0)	19 (9.5)	11 (5.5)	5 (2.5)
Often	3 (1.5)	3 (1.5)	11 (5.5)	27 (13.6)	26 (13.1)
Always	5 (2.5)	4 (2.0)	5 (2.5)	15 (7.5)	31 (15.6)

present study findings revealed that most participants were women (80.4%), in comparison with 82.2% in Sampaio et al. (2021). The mean age of the present sample was 38.3 (SD = 8.4) compared to 39.9 (SD = 9.4) in the study by Sampaio et al. (2021). Also, in the present study, most of the participants were married (63.3%), in comparison with 62.8% in Sampaio et al. (2021). Finally, concerning schooling, most of the present study participants had a licentiate degree (69.3%), and 30.2% had a master degree. The findings by Sampaio et al. (2021) showed 70% with a licentiate degree and 28.3% with a master degree.

Notwithstanding, there is no sufficient evidence to assess nurses' mental health during the COVID-19 outbreak in light of this emerging reality. However, a study carried out in Spain concluded that more than 90% of nurses admitted that clinical practice during the COVID-19 outbreak affected their mental health and triggered feelings of physical exhaustion and emotional overload (Del Pozo-Herce et al., 2021). Also, a meta-analysis that included studies about the prevalence of anxiety in healthcare workers during the COVID-19 pandemic

concluded that nurses and other frontline healthcare workers were those reporting higher anxiety levels (Santabarbara et al., 2021).

The present study results showed a significant decrease in anxiety and stress symptoms over time. Also, depression symptoms showed a decrease, although with no statistical significance. Anxiety showed a decrease of -0.63 in the mean value. Similar results were observed in another study with a sample of nurses (-0.61) one month after the first moment of data collection (Sampaio et al., 2021). In the present study, stress showed a decrease of -0.88 in the mean value six months after the first assessment, while in the study by Sampaio et al. (2021), the decrease in stress symptoms was even lower (-0.51). Thus, nurses' stress symptoms have been found to significantly decrease over time. A study conducted in China with a sample of nurses, from January 28, 2020, to February 2, 2020, also showed that anxiety levels decreased and were stable from February 26, to February 28, 2020 (Cai et al., 2020). However, a study conducted in Japan concluded that healthcare workers' anxiety levels increased between March and May 2020 (Sasaki et al., 2020). In India, a study involving the general population, showed that anxiety, stress, and depression increased over time (March 29 to May 24, 2020). Also, a study carried out in China, found levels of anxiety, stress and depression in the general population to be stable over four weeks (January 31 to March 1, 2020) (Wang et al., 2020a, 2020b). Interestingly, these findings show that the levels of anxiety, stress, and depression differ between countries, which might be explained by the different pace of evolution of the pandemic and the strategies adopted by each country. Importantly, different levels of human resilience are also very likely to influence these results.

Regarding the strategies potentially used by nurses to promote their mental health during the COVID-19 outbreak, we found few studies addressing this topic. However, a qualitative study with a sample of 20 nurses, carried out in China, concluded that during the COVID-19 outbreak nurses used strategies such as physical exercise, sleep adjustment, resort to mutual help between colleagues, writing diary and letters, relaxation activities, music meditation techniques, and emotional

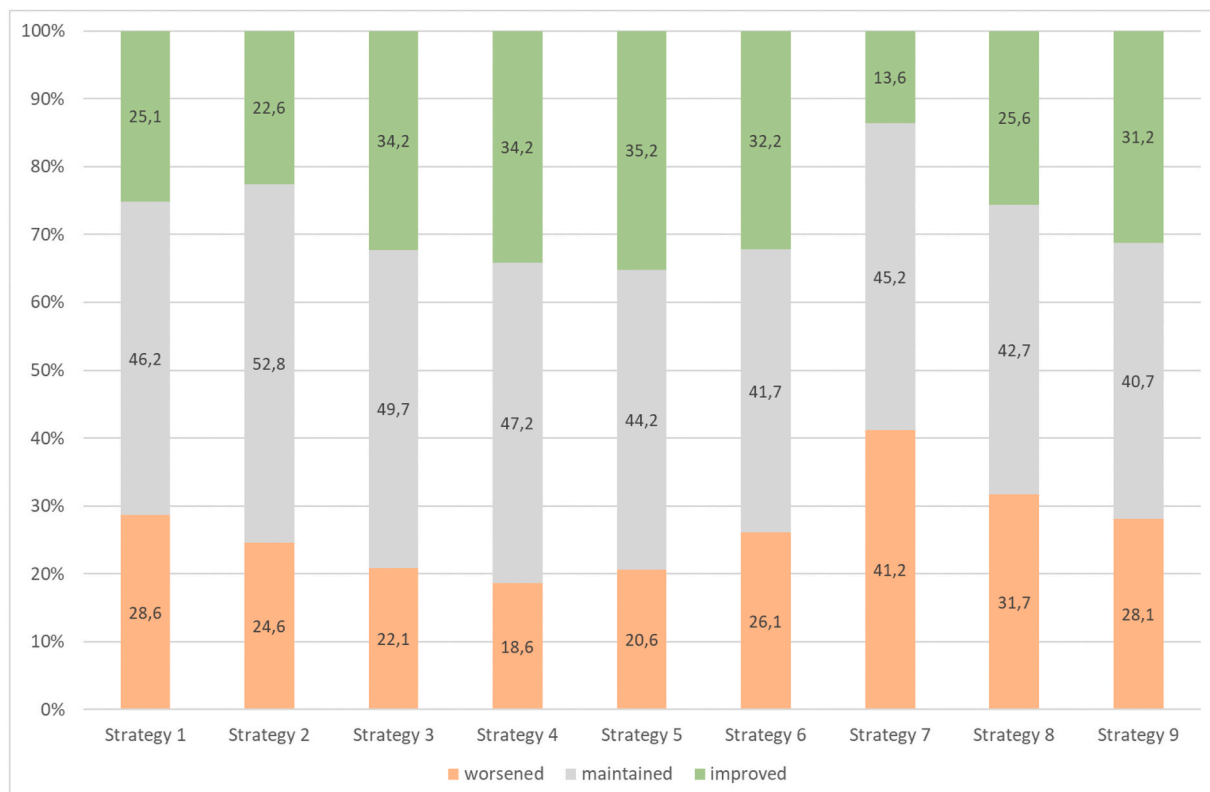


Fig. 2. Changes in the use of strategies.

Table 3
Effects of mental health promotion strategies in depression, anxiety, and stress symptoms.

	Depression		Anxiety		Stress	
	B (se)	p	B (se)	p	B (se)	p
Time months [ref: baseline]	-0.18 (0.26)	0.480	-0.69 (0.24)	0.004	-0.97 (0.32)	0.002
Break between work shifts [ref: never/rarely]						
Sometimes	-1.08 (0.60)	0.074	-0.68 (0.56)	0.228	-1.29 (0.73)	0.078
Often/always	-2.36 (0.56)	<0.001	-1.91 (0.52)	<0.001	-2.62 (0.67)	<0.001
Time months [ref: baseline]	-0.17 (0.26)	0.505	-0.69 (0.23)	0.004	-0.95 (0.31)	0.002
Healthy diet [ref: never/rarely]						
Sometimes	-0.52 (0.60)	0.380	-0.53 (0.55)	0.339	-0.57 (0.72)	0.425
Often/always	-2.56 (0.58)	<0.001	-2.20 (0.54)	<0.001	-2.88 (0.70)	<0.001
Time months [ref: baseline]	-0.09 (0.26)	0.724	-0.62 (0.24)	0.010	-0.85 (0.31)	0.007
Adequate water intake [ref: never/rarely]						
Sometimes	-0.30 (0.52)	0.571	-0.76 (0.49)	0.121	-1.69 (0.62)	0.007
Often/always	-1.37 (0.52)	0.009	-1.57 (0.49)	0.001	-2.92 (0.61)	<0.001
Time months [ref: baseline]	0.11 (0.26)	0.679	-0.44 (0.24)	0.063	-0.62 (0.32)	0.053
Physical activity [ref: never/rarely]						
Sometimes	-1.49 (0.41)	<0.001	-1.35 (0.38)	<0.001	-2.00 (0.49)	<0.001
Often/always	-2.24 (0.51)	<0.001	-1.98 (0.49)	<0.001	-2.69 (0.61)	<0.001
Time months [ref: baseline]	0.03 (0.26)	0.904	-0.53 (0.24)	0.028	-0.73 (0.32)	0.025
Relaxation activities [ref: never/rarely]						
Sometimes	-1.25 (0.40)	0.002	-1.32 (0.38)	0.001	-1.46 (0.49)	0.003
Often/always	-2.07 (0.51)	<0.001	-1.42 (0.48)	0.003	-2.27 (0.61)	<0.001
Time months [ref: baseline]	-0.10 (0.26)	0.692	-0.63 (0.24)	0.009	-0.88 (0.32)	0.007
Recreational activities [ref: never/rarely]						
Sometimes	-1.40 (0.45)	0.002	-0.75 (0.43)	0.080	-0.27 (0.55)	0.628
Often/always	-1.97 (0.46)	<0.001	-1.29 (0.44)	0.003	-1.66 (0.56)	0.003
Time months [ref: baseline]	-0.43 (0.27)	0.113	-0.84 (0.25)	0.001	-1.21 (0.33)	<0.001
Maintenance of remote social contacts [ref: never/rarely]						
Sometimes	-0.50 (0.48)	0.295	0.01 (0.45)	0.979	-0.47 (0.58)	0.415
Often/always	-2.04 (0.49)	<0.001	-1.26 (0.46)	0.006	-2.08 (0.59)	<0.001
Time months [ref: baseline]	-0.16 (0.26)	0.527	-0.68 (0.24)	0.004	-0.93 (0.31)	0.003
Verbalization of feelings/emotions [ref: never/rarely]						
Sometimes	-0.85 (0.43)	0.050	-0.60 (0.40)	0.140	-0.44 (0.52)	0.396
Often/always	-1.84 (0.47)	<0.001	-1.47 (0.45)	0.001	-1.94 (0.57)	<0.001
Time 6 months [ref: baseline]	-0.11 (0.26)	0.663	-0.64 (0.24)	0.008	-0.88 (0.31)	0.006
Rejecting information about COVID-19 from unreliable sources [ref: never/rarely]						
Sometimes	0.75 (0.58)	0.198	0.30 (0.54)	0.579	1.83 (0.70)	0.009
Often/always	-0.08 (0.50)	0.867	0.08 (0.47)	0.869	1.19 (0.61)	0.049

expression and venting (Sun et al., 2020). Another study conducted in the USA with a sample of healthcare workers considered the use of coping strategies such as physical exercise, talk therapy, yoga, faith-based practice/spirituality, meditation, and virtual support group (Shechter et al., 2020). A study involving eight European countries assessed the use of coping strategies during the COVID-19 outbreak by doctors and nurses, including strategies such as online communication, recreational and relaxation activities, health-promoting activities (healthy eating, physical exercise, rest), limited viewing of COVID-19 information, acquiring mental health knowledge, venting emotions (Hummel et al., 2021). Thus, most of the mental health promotion strategies recommended by the WHO (World Health Organization, 2020a), which were assessed in our study, are aligned with these previous studies.

In our study, from the analysis of the frequency of use of each mental health promotion strategies, it was possible to observe that the participants increased “physical activity” practices. A possible explanation relies on the confinement period already in force during this data collection period. This confinement suspended most group activities, such as dance, soccer, gymnasium, and Pilates, among others. In moment two of data collection, those activities were allowed to resume operation since Portugal was no longer subject to mandatory confinement. For this reason, nurses were able to restart their usual physical activities. Moreover, participants showed a decrease in the frequency of the “maintenance of remote social contacts”, probably due to the non-mandatory confinement period and fewer social distancing restrictions.

The participants who most frequently used all mental health promotion strategies, except for the “rejecting information about COVID-19 from unreliable sources”, showed less depression, anxiety, and stress symptoms. Similar results were found when comparing nurses who sometimes used the strategies “physical activity” and “relaxation activities” with the participants who never or rarely used them. These findings are in line with other studies showing that during the COVID-19 outbreak there was a large decrease in physical activity with associations between the decrease in physical activity and worse mental health (Callow et al., 2020; Duncan et al., 2020; Meyer et al., 2020; Pieh et al., 2020). Moreover, a review concluded that physical activities and relaxation activities were beneficial to mental health during the COVID-19 outbreak (Puyat et al., 2020). Also, concerning depression, the participants who sometimes used “recreational activities” had fewer depression symptoms than those who never or rarely used it. A different literature review concluded that physical activity, social relationships, dietary modification, sleep, and recreational activities improved depression symptoms (Toghyani et al., 2018). Regarding stress, participants who sometimes used the “adequate water intake” also had fewer stress symptoms than those who rarely or never drank water. However, a cause-effect relationship regarding this strategy cannot be ascertained because increased water intake is likely due to increased physical activity, and not an isolated event.

Surprisingly, nurses who frequently, always or sometimes used the strategy “rejecting information about COVID-19 from unreliable sources” exhibited more stress symptoms when compared to nurses who never or rarely used it. Nevertheless, Wang and colleagues stress the importance of evidence-based information on COVID-19 to avoid adverse psychological reactions (Wang et al., 2020a, 2020b). Additionally, this finding may also have been influenced by the potentially misleading question about “unreliable sources”. Moreover, this finding might also be explained by the fact that nurses’ answers like - rarely or never rejected information about COVID-19 from unreliable sources -, were indicative of their lack of concern about rejecting or seeking information about COVID-19. Thus, those who responded to frequently, always or sometimes have tried to avoid such sources of information are probably those seeking more accurate information, and therefore, more concerned with seeking information. A study in China showed that healthcare workers that spent more time thinking about the COVID-19 outbreak had more mental health problems than those who spent less

time (Huang and Zhao, 2021). Also, a study carried out in Singapura concluded that excessive information about COVID-19 might have adverse effects on healthcare workers' mental health (Tahara et al., 2020). However, future research is needed to enable drawing substantial conclusions.

In addition to the strategies assessed in our study, other authors suggest that organizational conditions, such as human and material resources and coordinated work, are fundamental to protect nurses' mental health (Del Pozo-Herce et al., 2021). Furthermore, a study carried out in Singapura with a sample of healthcare workers indicated other factors likely to have increased resilience and improve mental health, such as satisfaction with work, satisfaction with new activities started during the COVID-19 outbreak (e.g. online communication), emotional support, health management and productive activities (Tahara et al., 2020).

This study was subject to an important limitation, the sampling method (snowball sampling). This technique can be viewed as a limitation since it attracts respondents who are already interested in the topic and well engaged, potentially leading to sampling bias and, consequently, limit the potential generalisability of the findings. Another limitation of this study was how the question about rejecting information about COVID-19 from unreliable sources was handled. Moreover, although our study assessed the strategies recommended by the WHO ("Mental health and psychosocial considerations during the COVID-19 outbreak"), we believe that using a structured instrument would enable assessing coping strategies/styles in general and examine their impact on mental health outcomes. Finally, the absence of collected data using the same measurement tool and in the same population (Portuguese nurses), before the COVID-19 outbreak, poses difficulties in identifying the direct impact of the pandemic on nurses' mental health.

5. Conclusions

The use of mental health promotion strategies is cardinal to reduce stress, anxiety, and depression symptoms in nurses. Strategies such as physical activity, relaxation activity, recreational activity and adequate water intake were found to have a more significant impact even when used only sometimes, compared to nurses who rarely used these strategies. Breaks between work shifts, healthy diet, maintenance of remote social contacts and verbalization of feelings/emotions have also positively impacted nurse's mental health, with participants who frequently or always used these strategies presenting less stress, anxiety, and depression symptoms.

Measures to prevent the consequences of the COVID-19 outbreak on nurses' mental health are critical, and health organizations need to provide nurses and other healthcare professionals with the conditions for adopting these mental health promotion strategies. For example, it would be interesting to create privileged spaces in health institutions for physical, relaxation and recreational activities. Also, the cantinas and bars of these organizations should provide healthy food. Another plausible proposal is hiring mental health professionals to help other health professionals verbalize their concerns and positively contribute to improving their mental status. Therefore, future research should concentrate on identifying the influence of institutional support/incentive to nurses and other healthcare professionals in adopting mental health promotion strategies.

Finally, improving nurses' skills and implementing a professional development model compatible with the current demands are crucial to effectively and efficiently respond to future health challenges and preserve the professionals' mental health.

Author contributions

Lara Guedes de Pinho: Conceptualization, Methodology, Validation, Investigation, Writing – original draft, Writing – review & editing. Tânia

Correia: Validation, Writing – original draft, Writing – review & editing. Francisco Sampaio: Conceptualization, Methodology, Validation, Investigation, Resources, Writing – review & editing, Project administration. Carlos Sequeira: Conceptualization, Methodology, Investigation, Writing – review & editing, Supervision, Funding acquisition. Laetitia Teixeira: Methodology, Software, Formal analysis, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization. Manuel Lopes: Supervision, Writing – review & editing. César Fonseca: Validation, Writing – review & editing.

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Ethics approval

This study was approved by the Ethical Committee of the School of Health of the Setúbal Polytechnic Institute and by the Ethical Committee of University Fernando Pessoa, and all participants provided informed consent.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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