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GENDER DIFFERENCES IN MENTAL HEALTH AND COPING STRATEGIES AMONG MEDICAL STUDENTS DURING THE SOCIAL ISOLATION IMPOSED BY COVID-19: A CROSS-SECTIONAL STUDY

DIFERENÇAS DE GÊNERO NA SAÚDE MENTAL E ESTRATÉGIAS DE ENFRENTAMENTO ENTRE ESTUDANTES DE MEDICINA DURANTE O ISOLAMENTO SOCIAL IMPOSTO PELA COVID-19: UM ESTUDO TRANSVERSAL

DIFERENCIAS DE GÉNERO EN SALUD MENTAL Y ESTRATEGIAS DE AFRONTAMIENTO ENTRE ESTUDIANTES DE MEDICINA DURANTE EL AISLAMIENTO SOCIAL IMPUESTO POR COVID-19: UN ESTUDIO TRANSVERSAL

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ABSTRACT:
The isolation imposed by COVID-19 interfered with the health-related quality of life (HRQoL) of medical students, reducing healthy habits such as physical activity (PAF). This study sought to determine the impact of the first wave of COVID-19 on the HRQoL of medical students and establish the relationship between the use of e-Health tools for PAF in mental health. This cross-sectional study involved medical students who responded to an online questionnaire during the social isolation caused by the COVID-19 pandemic in Brazil to report their sociodemographic data, health status, use of e-Health tools for PAF and HRQoL through the Short-Form Healthy Survey (SF-36). Multiple linear regression was performed to identify potential predictors. Medical students' mental health was affected during social isolation and gender differences were observed in most SF-36 domains. Women had lower levels of perception for social aspects, emotional performance, mental health and general HRQoL. The use of e-Health tools for PAF was positively associated with quality of life related to mental health. The results demonstrate that interventions through public policies are necessary to help vulnerable people who face mental health problems.

KEYWORDS: COVID-19; Social isolation; Medical students.

RESUMO:
O isolamento imposto pela COVID-19 interferiu na qualidade de vida relacionada à saúde (QVRS) dos estudantes de medicina, reduzindo hábitos saudáveis como a prática de atividade física (PAF). Este estudo buscou determinar o impacto da primeira onda de COVID-19 na QVRS de estudantes de medicina e estabelecer a relação entre o uso de ferramentas e-Saúde para PAF na saúde mental. Este estudo transversal envolveu estudantes de medicina que responderam a um questionário online durante o isolamento social causado pela pandemia de COVID-19 no Brasil para relatar seus dados sociodemográficos, estado de saúde, uso de ferramentas e-Saúde para PAF e a QVRS por meio do Short-Form Healthy Survey (SF-36). A regressão linear múltipla foi realizada para identificar potenciais preditores. A saúde mental dos estudantes de medicina foi afetada durante o isolamento social e diferenças de gênero foram observadas na maioria dos domínios do SF-36. Mulheres apresentaram níveis menores de percepção para aspectos sociais, desempenho emocional, saúde mental e QVRS geral. O uso de ferramentas e-Saúde para PAF esteve positivamente associado a qualidade de vida relacionada à saúde mental. Os resultados demonstram que intervenções por meio de políticas públicas são necessárias para auxiliar pessoas vulneráveis que enfrentam problemas de saúde mental.

PALAVRAS-CHAVE: COVID-19; Isolamento social; Estudantes de medicina.

RESUMEN:
El aislamiento impuesto por el COVID-19 interfirió en la calidad de vida relacionada con la salud (CVRS) de los estudiantes de medicina, reduciendo hábitos saludables como la actividad física (PAF). Este estudio buscó determinar el impacto de la primera ola de COVID-19 en la CVRS de estudiantes de medicina y establecer la relación entre el uso de herramientas de e-Salud para FAP en salud mental. Este estudio transversal involucró a estudiantes de medicina que respondieron a un cuestionario en línea durante el aislamiento social causado por la pandemia de COVID-19 en Brasil para reportar sus datos sociodemográficos, estado de salud, uso de herramientas de e-Salud para PAF y CVRS a través del cuestionario Short- Formulario de Encuesta de Salud (SF-36). Se realizó una regresión lineal múltiple para identificar posibles predictores. La salud mental de los estudiantes de medicina se vio afectada durante el aislamiento social y se observaron diferencias de género en la mayoría de los dominios del SF-36. Las mujeres tuvieron niveles más bajos de percepción de aspectos sociales, desempeño emocional, salud mental y CVRS general. El uso de herramientas de e-Salud para PAF se asoció positivamente con la calidad de vida relacionada con la salud mental. Los resultados demuestran que las intervenciones a través de políticas públicas son necesarias para ayudar a las personas vulnerables que enfrentan problemas de salud mental.

PALABRAS CLAVE: COVID-19; Aislamiento social; Estudiantes de medicina.

INTRODUCTION

The coronavirus disease (COVID-19) pandemic has drastically affected health services and compromised the well-being of populations. In Brazil, 33,250,117 cases and 675,090 deaths caused by COVID-19 and its complications were confirmed by July 15, 2022. Conversely, 169,602,261 Brazilians were fully vaccinated, equivalent to 79.79% of the total population (Dong et al., 2020). Since the beginning of the pandemic, the use of masks, social distancing rules, quarantine, and even territorial blockades have been recommended to reduce the transmission of the virus (Kaur et al., 2021). Social isolation has impacted the quantity and quality of relationships between couples, family members, and society (Hwang et al., 2020).

Despite the benefits it has brought as a result of effective controls, social distancing has triggered mental disorders. The experience of unpleasant situations and stressors such as fear of getting sick, grief, interruption of daily life habits, financial problems, separation from friends and family, uncertainty about the time of distancing, and the behaviors in the “new normal” have increased the risks of anxiety, depression, and signs of suicidal behavior (Galea et al., 2020; Clair et al., 2021).

The reduction of social interaction in the first wave of COVID-19 forced Brazilian medical schools to suspend face-to-face classes. Students were removed from practical teaching activities in the pre-clinical environment and at the bedside in hospitals (Alsoufi et al., 2020; Tunçel et al., 2021). Conversely, strategies, such as the use of online resources and distance

learning, were implemented to compensate for the interruption of regular classes in Brazilian schools (Perissotto et al., 2021).

Changes in daily routine have resulted in changes in lifestyle and healthy habits. These behavioral changes may reflect in psychosomatic changes (Campos et al., 2021). In the pre-pandemic period, Brazilian medical students experienced psychological distress (Demenech et al., 2021), increasing their vulnerability to mental problems and affecting their academic performance, patient health care, and professionalism (Pacheco et al., 2017; Sarwar et al., 2019).

Feelings of inability or limitations to learn arose as a result of medical students having their social lifestyle impaired, along with reduced sensory stimulation and absence of usual academic activities at the beginning of the pandemic (Kaul et al., 2021). Brazilian medical students and those who did not have a preexisting mental illness reported psychological and behavioral changes (Teixeira et al., 2021). Excessive information about COVID-19 and family distancing has been associated with mental stress and anxiety (Ferreira et al., 2021). However, students who routinely had healthy habits reported better well-being and health-related quality of life (HRQoL), making it easier to cope with the stressful situations of the pandemic (Kobbaz et al., 2021). Studies have reported gender differences in mental health during COVID-19 among university students, showing a negative impact on both men and women (Gestsdottir et al., 2021; Amerio et al., 2022).

The practice of physical activity (PPA) has been associated with a lower rate of mental disorders (Wolf et al., 2021) and is indicated as a strategy to avoid complications from COVID-19 (Sallis et al., 2021). Miranda et al. (2020) found that medical students involved in PPA had a better perception of HRQoL. In this context, digital, online, or web-based tools such as apps, social media, websites, and videos that help and encourage people to engage in PPA have been classified as eHealth interventions, as they cover electronic health care during the pandemic (Marchant et al., 2021). Our group observed that PPA-eHealth tools were associated with positive HRQoL patterns during social distancing (Barreto et al., 2021). However, the impact of the use of these tools on vitality, social functioning, emotional role, and aspects of mental health related to the well-being of university students remains little explored in Brazil. Considering this gap, the current study investigated the impact of the use of PPA-eHealth tools on the mental health of medical students during social isolation in the first wave of COVID-19 in Brazil.

METHODS

This is a descriptive, cross-sectional study, carried out between August and September 2020. The study was designed following the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative (Malta et al., 2010). Medical students from the Federal University of Tocantins, Palmas, Tocantins, Federal University of

Campina Grande, and Santa Maria University, both in Cajazeiras, Paraíba were recruited via convenience sampling.

Students answered a self-administered online questionnaire in Google Forms. They were invited through their institutional email, digital media, and messaging applications (apps). To avoid multiple submissions, participants provided their email addresses. Questionnaires answered by those who were not undergraduate medical students from the universities included in the study or who did not respond to the questionnaire completely were excluded. A total of 205 participants answered the questionnaire, 43 (20.97%) of which were excluded, and the final sample consisted of 162 students. Participation was voluntary, requiring digital consent by signing the Informed Consent Form.

The variables investigated were gender, age, sexual orientation, marital status, family income, smoking habits, alcohol consumption, and previous respiratory diseases. Body weight and height were captured for the calculation of Body Mass Index (BMI). BMIs were classified as underweight (< 18.5), normal weight (18.5 to 24.9), overweight (25 to 29.9), and obese (≥ 30). Students spent 8-12 h, 12-16 h, 16-20 h, or 20-24 h indoors. Participants indicated whether they used PPA-eHealth tools and which of the following digital tools: apps, YouTube, and remote classes with a physical education teacher (Barreto et al., 2021).

HRQoL was assessed using the validated Brazilian version of the SF-36 questionnaire (36-Item Short Form Survey) (Ciconelli et al., 1999). Mental Health, Role-Emotional, Social Functioning, and Vitality were summarized via the Mental Component Score (MCS), which measures mental functioning. Decreased MCS can be used as an indirect indicator of depressive symptoms and predict depression and mood disorders (Kennedy et al., 2015). The answers to the SF-36 items were assigned fixed values, obtaining scores from 0 to 100, with higher scores associated with better HRQoL (Baker et al., 2020). A score equal to or less than 42 is the cut-off point for the diagnosis of depressive disorder (Tavella et al, 2010; LINS et al, 2015).

Participants completed the International Physical Activity Questionnaire Short Form (IPAQ-SF) adapted and validated in Brazilian Portuguese, which allowed participants to be classified into sufficient levels (active or very active) and low levels of physical activity (insufficiently active or sedentary) (Pardini et al., 2001).

Data were analyzed using descriptive statistics. Explanatory variables including sociodemographic characteristics, health conditions, and lifestyle were expressed as relative and absolute frequencies. The individual domains of MCS and the clustering of this component were expressed as mean and standard deviation. Normality of the data was assessed with Kolmogorov-Smirnov test. Mann-Whitney U and Kruskal-Wallis-tests were applied to analyze the relationships between explanatory variables and MCS. The association between gender, PPA-

eHealth tools, and possible depressive disorder was assessed using the X2 test or Fisher's test. In the multiple linear regression models, each domain of the MCS was included as a dependent variable; the explanatory variables with $p < 0.2$ were included (Miranda et al., 2020). The standardized beta coefficient (β), the 95% confidence interval (CI), and the coefficient of determination (R2) were calculated. Associations with $p \leq 0.05$ were considered significant in all analyses. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM CORP., ARMONK, NY).

The research was approved by the National Research Ethics Committee of the Ministry of Health in Brazil (CAAE 33567120.2.1001.5519).

RESULTS

The sociodemographic characteristics, lifestyle, the averages of the MCS domains, and the overall average of the MCS are reported in Table 1. Most participants were female (58%), aged between 20 and 24 years (64%), heterosexual (84.1%), single (93.3%), and had a family income greater than 3 minimum wages (61.6%). A total of 39.1% consumed alcohol and 95.1% did not smoke. A total of 20.8% reported having respiratory disease. A total of seven (4.3%) students were underweight, 37 (22.6%) were overweight, and 12 (7.3%) were obese. A total of 72.8% reported spending at least 16 hours/day indoors during social isolation (Table 1).

Each dimension of MCS was then compared with the explanatory variables in Table 1. Except for the vitality dimension, female students had a lower average for social functioning, emotional role, mental health, and overall average ($p < 0.05$). Smokers had a lower average in the mental health dimension ($p < 0.05$). Those who spent less time indoors had a higher average for the emotional performance dimension and overall average of the MCS ($p < 0.05$). Statistical analysis revealed that family income, marital status, BMI, and respiratory diseases were not associated with differences in the average of the MCS (Table 1).

Table 1. Comparisons of sociodemographic characteristics during social isolation due to COVID-19 on the mental component summary score of the SF-36 in medical students.

Variable	**n(%)**	**MCS**				
		Vitality	**Social Functioning**	**Role-Emotional**	**Mental Health**	**Overall MCS**
Gender						
Female	94 (58.0)	49.31 ± 12.82	**57.31 ± 22.63**	**20.21 ± 32.14**	**53.28±14.89**	**45.03±15,55**

Male	68 (42.0)	53.01 ± 16.42	**69.30 ± 26.04$**	**46.08 ± 42.33#**	**59.65±17.29***	**57.01±22.44$**
Age						
18 - 19	12 (7.4)	44.58 ± 16.98	62.50 ± 31.08	27.78 ± 39.78	53.00 ± 18.69	46.97 ± 23.65
20 - 24	103 (63.6)	51.75 ± 13.77	63.71 ± 24.64	33.01 ± 40.02	56.74 ± 14.50	51.30 ± 19.38
> 24	47 (29.0)	50.53 ± 15.33	59.31 ± 23.81	27.66 ± 36.33	54.98 ± 19.08	48.12 ± 19.22
Sexual orientation						
Heterosexual	135 (833.)	50.96 ± 13,90	62.87 ± 24.09	31.36 ± 38.58	56.00 ± 16.01	50.30 ± 19.24
Sexual minority	27 (16.7)	50.37 ± 17.54	59.72 ± 28.24	29.63 ± 40.65	55.70 ± 17.40	48.86 ± 21.70
Single						
No	11 (6.8)	50.00 ± 10.25	63.64 ± 18.92	15.15 ± 17.41	54.18 ± 17.00	45.74 ± 10.53
Yes	151 (93.2)	50.93 ± 14.79	62.25 ± 25.19	32.23 ± 39.71	56.08 ± 16.19	50.37 ± 20.09
Family income						
Up to 3	60 (37.0)	50.67 ± 14.48	61.67 ± 24.56	24.44 ± 34.64	56.20 ± 16.64	48.24 ± 18.89
> 3	102 (63.0)	50.98 ± 14.59	62.75 ± 25.00	34.97 ± 40.72	55.80 ± 16.01	51.12 ± 20.03
Smoking habit						
No	154 (95.1)	51.33 ± 14.19	62.50 ± 24.92	32.03 ± 39.22	56.55 ± 15.70	50.60 ± 19.50
Yes	8 (4.9)	41.88 ± 18.50	59.38 ± 22.90	12.50 ± 24.80	44.50 ± 22.06	39.56 ± 19.85
Alcohol consumption						
No	98	**52.70 ±**	62.37 ±	33.33 ±	57.55 ±	51.49 ±

	(60.5)	**14.38**	26.53	40.05	15.63	20.31
Yes	64	**48.05 ±**	62.30 ±	27.60 ±	53.50 ±	47.86 ±
	(39,5)	**14.35***	21.99	36.88	16.86	18.41
Respiratory disease						
No	128	51.13 ±	63.15 ±	32.55 ±	56.13 ±	50.75 ±
	(79.0)	14.23	25.11	38.67	16.18	19.71
Yes	34	49.85 ±	59.19 ±	25.49 ±	55.29 ±	47.46 ±
	(21.0)	15.69	23.50	39.41	16.49	19.27
BMI						
Underweight	7 (4.3)	44.29 ±	67.86 ±	19.05 ±	52.57 ±	45.94 ±
		15.39	22.66	32.53	15.39	17.79
Normal	106	51.98 ±	63.09 ±	32.70 ±	57.51 ±	51.32 ±
	(65.4)	13.92	25.73	40.36	16.36	20.17
Overweight	37	50.68 ±	58.11 ±	25.23 ±	53.84 ±	46.96 ±
	(22.9)	14.59	23.97	34.61	14.44	17.98
Obese	12	45.62 ±	65.63 ±	41.67 ±	50.67 ±	50.84 ±
	(7.4)	18.27	20.03	40.51	19.91	21.28
Duration of time spent indoors						
8-12h	18	59.17 ±	68.06 ±	**55.56 ±**	65.56 ±	**62.08 ±**
	(11.1)	12.75	26.51	**41.22**	15.71	**20.92**
12-16h	26	48.85 ±	62.98 ±	**41.03 ±**	56.15 ±	**52.25 ±**
	(16.1)	15.58	23.31	**39.22**	15.74	**19.83**
16-20h	41	50,73 ±	61.28 ±	**26.83 ±**	55.12 ±	**48.49 ±**
	(25.3)	15,31	21.25	**38.89**	14.52	**18.93**
20-24h	77	49,68 ±	61.36 ±	**24.24 ±**	54.08 ±	**47.34 ±**
	(47.5)	13,68	26.76	**35.72**$^{\$}$	16.80	**18.81***

MCS: Mental Component Summary; BMI: Body Mass Index; Bold values denote statistical significance at *$p < 0.05$, $^{\#}p < 0.001$ or $^{\$}p \leq 0.01$. Source: author

A total of 87 (53.1%) participants used PPA-eHealth tools during social isolation, of which 38.4% and 32.9% used YouTube and apps, respectively (Table 2). Remote access to physical education teachers was reported by 7.3%. The association between PPA-eHealth tools and the MCS components indicated that the use of YouTube contributed to higher averages in

vitality and emotional performance ($p < 0.05$). Participants who used apps had higher means for vitality, mental health and overall average of the MCS ($p < 0.05$). Remote access to physical education teachers contributed to higher averages in social functioning ($p < 0.05$) (Table 2).

Table 2. Association between PPA-eHealth tools and the mental component summary of the SF-36 in medical students.

Variable	**n (%)**	**MCS**				
		Vitality	**Social Functioning**	**Role-Emotional**	**Mental Health**	**Overall MCS**
YouTube						
No	102 (63.0)	**48.77 ± 14.70**	62.38 ± 24.91	**26.14 ± 36.82**	54.08 ± 16.46	47.84 ± 19.13
Yes	60 (37.0)	**54.42 ± 13.56***	62.29 ± 24.73	**39.44 ± 40.94***	59.13 ± 15.36	53.82 ± 19.99
Apps						
No	111 (68.5)	**48.47 ± 14.77**	61.49 ± 25.01	27.63 ± 37.03	**53.44 ± 16.53**	**47.86 ± 19.24**
Yes	51 (31.5)	**55.20 ± 13.04**$^{\$}$	64.22 ± 24.37	38.56 ± 41.83	**61.41 ± 14.13**$^{\$}$	**54.85 ± 19.72***
Virtual meeting						
No	150 (92.6)	50.37 ± 14.36	**61.08 ± 24.81**	29.56 ± 38.14	55.47 ± 16.00	49.12 ± 19.24
Yes	12 (7.4)	57.08 ± 15.59	**78.13 ± 18.56***	50.00 ± 43.81	62.00 ± 18.17	61.80 ± 21.19

MCS: Mental Component Summary; Bold values denote statistical significance at $^{*}p < 0.05$ or $^{\$}p \leq 0.01$. Source: Author

The results of the multiple linear regression analysis are reported in Table 3. Being a woman was the main predictive factor negatively associated with social functioning ($\beta = -0.23$; $p = 0.003$), emotional development ($\beta = -0.33$; $p < 0.001$), mental health ($\beta = -0.17$; $p = 0.033$), and the overall average of the MSC ($\beta = -0.29$; $p < 0.001$). In contrast, using PPA-eHealth tools was positively associated with HRQoL in the first wave of COVID-19. Practicing physical activity online with a physical education teacher was positively associated with social functioning ($\beta = 0.19$; $p = 0.012$) and the general score ($\beta = 0.18$; $p = 0.017$). Similarly, participants using YouTube had positive perceptions of role-emotional functioning ($\beta = 0.18$; $p = 0.026$).

Table 3. Multiple linear regression analysis for mental component summary of the SF-36 during social isolation due to COVID-19.

Variable	MCS				
	Vitality	**Social Functioning**	**Role-Emotional**	**Mental Health**	**Overall MCS**
	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]
Gender	-0.11 [-7.96,1.28]	**-0.23 [-18.99,-4.02]****	**-0.33 [-37.37,13.98]****	**-0.17 [-10.68,-0.46]***	**-0.29 [-17.42,-5.44]****
Family income	----------		0.13 [-0.72,22.23]	----------	
Smoking habit	-0.11 [-17.48,3.37]	----------	-0.09[-42.30,9.37]	-0.13 [-21.48,1.57]	-0.12[-24.25,2.18]
Alcohol consumption	-0.12 [-8.05,1.11]	----------		-0.08 [-7.57,2.55]	----------
Duration of time spent indoors	-0.14 [-13.63,0.69]	----------	-0.14 [-35.56,1.01]	-0.14 [-15.32,0.52]	-0.13 [-17.16,1.41]
YouTube	0.13 [-1.22,8.91]	----------	**0.18 [1.81,27.44]***	0.08 [-2.89,8.31]	0.13 [-1.30,11.85]
Apps	0.11 [-1.59,8.57]	----------	0.03 [-10.68,15.08]	0.16 [-0.13,11.11	0.07 [-3.47,9.74]
Virtual meetings	0.11 [-2.30,14.47]	**0.19 [4.05,32.33]***	0.14 [-1.23,41.58]	0.10 [-3.01,15.54]	**0.18 [2.45,24.32]***
Adjusted R^2	9.5%	7.4%	18.1%	11.2%	15.5%

MCS: Mental Component Summary; β = indicates standardized β coefficient. Bold values denote statistical significance at *p < 0.05 or ** p ≤ 0.01. Source: Author

The association of gender, level of physical activity, and use of PPA-eHealth tools with the cutoff point for diagnosis of individuals with depressive disorders is described in Table 4. Women with a sufficient level of PPA and who used apps had a score higher than 42 compared to those who did not use these tools ($p < 0.05$) (Table 4). No significant difference was found for participants who had an insufficient level of physical activity, those who accessed YouTube, or reported accessing remote classes with a physical activity teacher.

Table 4. Association between accessing the PPA-eHealth apps, physical activity levels, and mental component summary cut-off of the SF-36 in medical students during isolation due to COVID-19.

		Applications	> 42 n(%)		p
			No	Yes	
Male	Sufficient level of PA	No	10 (43.5)	13 (56.5)	0.365
		Yes	4 (28.6)	10 (71.4)	
	Low level of PA	No	8 (33.3)	16 (66.7)	0.700*
		Yes	2 (25)	6 (75)	
Female	Sufficient level of PA	No	22 (59.5)	15 (40.5)	0.024
		Yes	6 (28.6)	15 (71.4)	
	Low level of PA	No	12 (44.4)	15 (55.6)	0.369
		Yes	5 (62.5)	3 (37.5)	

PA: Physical activity; *Fisher's test. Source: Author

DISCUSSION

This study assessed the association of sociodemographic factors and the use of PPA-eHealth tools with the mental health of Brazilian medical students during the social isolation imposed by the COVID-19 pandemic. First, we found that SF-36 MCS varied between men and women. Second, PPA-eHealth tools were positively correlated with the mental health domains in SF-36. Moreover, according to the SF-36 MCS cut-off point, participants with sufficient levels of PPA and who used apps had a lower risk of depressive disorders. Our study supports the evidence that the mental health of medical students was affected in Brazil (Perissotto et al., 2021; Teixeira et al., 2021; Ferreira et al., 2021; Cardoso et al., 2022) and worldwide (Imran et al., 2021; Seetan et al., 2021; Eleftheriou et al., 2021; Zis et al., 2021; Biswas et al., 2022) during the pandemic.

The lower scores of women on the SF-36 MCS dimensions indicate that the pandemic affected them more than men, corroborating Bermejo-Franco et al. (2022). Consistent with our findings, some studies reported that female Brazilian medical students had common mental disorders, depression, and anxiety (Perissotto et al., 2021), psychological distress, and psychiatric

comorbidities during social isolation (Teixeira et al., 2021; Ferreira et al., 2021). Several studies have reported gender differences in HRQoL and mental health, revealing the vulnerability of these students in the early stage of the COVID-19 pandemic (Campos et al., 2021; Imran et al., 2021; Eleftheriou et al., 2021; Biswas et al., 2022; Lyons et al., 2020; Xiao et al., 2020; Essangri et al., 2021; Harries et al., 2021).

In fact, Brazilian female medical students had a lower HRQoL in the psychological dimensions compared to men before the pandemic (Solis e Lotufo-Neto, 2019). Although we did not assess mental health changes in previous periods, college students reported that mental health was most affected during COVID-19 when they reflected on pre-pandemic situations, and students with pre-existing mental health conditions had higher levels of anxiety and stress associated with the pandemic period (Guo et al., 2021). Furthermore, the experience of social isolation resulted in domestic overloads for women, as they spent more time at home, which can affect HRQoL.

This study assessed the impact of access to PPA-eHealth tools on mental health. By analyzing each dimension of the SF-36 MCS, students who used YouTube, apps, or remote classes with a physical activity teacher were found to have higher scores in at least one dimension of the SF-36 MCS. Parker et al. (2021) demonstrated that digital tools acted as PPA-eHealth tools for youth and adults during the social isolation imposed by the COVID-19 pandemic.

In fact, viewing PPA videos available on YouTube increased significantly at the beginning of the pandemic (Sui et al., 2022). YouTube channels with fitness influencers are free resources with exercise tips. This platform induces positive emotional feelings (Kujur e Singh, 2018) and, as reported by McDonough et al. (2022), increases the motivation for PPA during the pandemic.

Accessing Mobile-based apps, which are available for free, can promote adherence to PPA practice at home and facilitate health information at any time (Srivastav et al., 2021; Petersen et al., 2021). Goodyear et al. (2021) found that people with sufficient levels of PPA began to access social media and apps that prioritized community and social aspects, and individuals with low levels sought information related to health and well-being, demonstrating that PPA during the isolation period was essential to their adaptation to the eHealth tools.

With the advent of the pandemic, several physical education teachers experimented with PPA-eHealth tools in the school environment and virtual groups to mitigate the negative effects of COVID-19 were organized (Gobbi et al., 2020; Parris et al., 2022; Ibrahim et al., 2021). Our data indicated that the remote practice of physical activity with a physical education professional can be an intervention with benefits to mental health. Although we have not observed the behavior of physical education professionals in practice, we believe that the effective training in these

digital technologies should be continuous to allow these platforms to promote young people's adherence to PPA.

Finally, several studies have observed that in addition to the deterioration of mental health, college students have experienced depression during the COVID-19 pandemic (Bermejo-Franco et al., 2022; Rogowska et al., 2020; Batra et al., 2021; Ochnik et al., 2021; Dosil-Santamaria et al., 2022). In the present study, women with sufficient levels of PPA and who accessed eHealth tools, mainly apps, had higher total scores than those with sufficient levels of physical activity, but who did not use PPA-eHealth tools during social isolation. These data demonstrate that eHealth interventions can contribute to mitigating mental harm caused in periods of social isolation. Conversely, we did not observe changes in men. According to Rodríguez-Larrad et al. (2021), women were more active in the PPA during social isolation because they depended less on external environments and used eHealth tools for this purpose. While our primary data indicate that women were more affected by the pandemic in terms of HRQoL than men, encouraging the use of PPA-eHealth tools can be an alternative during social isolation to prevent future mental complications. Moreover, PPA can be used as a complementary therapeutic approach (Kleemann et al., 2020) and eHealth interventions promote PPA and improve symptoms in mentally ill patients (Moran et al., 2018).

One of the limitations of this study was the administration of a self-reported questionnaire. As such, the respondent may be unaware that they have any mental health impairment that is not clinically diagnosed. As this is a cross-sectional study with a small sample of Brazilian medical students, the data cannot be generalized. Failure to investigate the frequency of access to PPA-eHealth tools is also a limitation. Thus, longitudinal studies and with a larger sample size could determine the real impact of the use of PPA-eHealth tools on the mental health of people experiencing a pandemic. Even with these limitations, social isolation during the COVID-19 pandemic impacted the mental health of medical students. One of the strengths of this study was the investigation of the use of PPA-eHealth tools to stimulate the maintenance of physical activity and better the perception of HRQoL.

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CONCLUSION

The present study revealed medical students' mental health was negatively impacted during the social isolation imposed by the COVID-19 pandemic, with evidence for gender differences. Conversely, the use of PPA-eHealth tools was positively associated with the self-perception of mental-health related HRQoL. Consequently, strategies to promote the practice of physical activity mediated by appropriate technologies and professionals during social isolation could contribute to health promotion among university students, increasing their mental well-being.

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