



The use of digital platforms and physical activity practice in a population from southern Brazil: Findings from the PAMPA Cohort

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ABSTRACT

Objective: We aimed to identify the factors associated with using digital platforms for physical activity during the COVID-19 pandemic among adults living in Southern Brazil. We also compared the trajectory of physical activity between users and non-users and by type of digital platform used.

Methods: We analyzed data from the PAMPA (Prospective Study About Mental and Physical Health in Adults) cohort. The study started in June 2020, and tracked participants through three waves (December 2020, June 2021, and June 2022). The exposure variable was using digital platforms for physical activity. The outcome measure was minutes per week of physical activity. We employed a generalized linear model with robust variance to explore the interaction between time and the use of digital platforms, adjusting for sociodemographic covariates and the presence of chronic diseases.

Results: The proportion of participants using digital platforms for physical activity declined from 36.8% in 2020 to 25.6% in 2021 and further to 13.5% in 2022. Using digital platforms for physical activity was associated with a higher mean daily physical activity during the COVID-19 pandemic. Participants who used digital platforms were more likely to be physically active when compared to their inactive counterparts throughout the entire study period. Notably, social media emerged with greater influence in the physical activity practice among digital platforms.

Conclusion: Using these platforms had a positive impact on increasing the level of physical activity among the participants.

1. Introduction

The COVID-19 pandemic resulted in 6.9 million deaths, disrupted public health services, and brought several indirect consequences for physical and mental health (IHME, 2023). During the first two years, public health strategies, such as social distancing, were adopted to

control virus transmission and reduce the number of cases, hospitalizations, and deaths associated with COVID-19 (Masseti et al., 2022). Although the effectiveness of this strategy, restrictions on public and private spaces for physical activity (e.g., public parks and fitness centers) led to a decline in physical activity levels (Viero, 2022; Wunsch et al., 2022). There was a 72 % reduction in commuting physical activity

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and a 145 % increase in physical inactivity when compared to before and during the pandemic (Viero, 2022). This sharp decline in physical activity was associated with worse mental and physical health outcomes, including anxiety and depressive symptoms, and an increased cardiovascular risk (Wang and Boros, 2021). In response, the scientific community has made efforts to emphasize the importance of approaches promoting healthy lifestyle habits, including the practice of physical activities (Pitanga et al., 2020; Martinelli et al., 2020).

The emergence of digital platforms has proven to be a viable option for mitigating the impact of COVID-19 on physical activity levels (Liu et al., 2022). Home exercises using virtual reality emerged as an alternative when public gyms and private group fitness programs were not available during the first pandemic wave, contributing for physical, psychological, and overall well-being. Virtual reality fitness technology can alleviate many of the challenges brought by the pandemic, resulting in increased utilization (Peng et al., 2022). Furthermore, the demand has led to an increase in the use of these tools, especially by exercise professionals (Liu et al., 2022; Menezes et al., 2021). For instance, streaming services [YouTube®, Skype®, Zoom®], social networks [Instagram®, Facebook®, WhatsApp®], and fitness mobile apps have been widely utilized as a supportive strategy to promote an active lifestyle to the population (Peng et al., 2022; Fang et al., 2022; Yang et al., 2022). Due to their convenience, low cost, and accessibility, these platforms have become essential instruments for promoting healthy habits (Menezes et al., 2021; Parker, 2021; Menhas et al., 2023).

Previous cross-sectional studies have shown that using digital platforms for physical activity is associated with increased activity levels (Fang et al., 2022; Parker, 2021). However, whether these platforms can be a viable and low-cost alternative to promote long-term physical activity remains unknown. Additionally, the factors associated with digital platforms for physical activity remains unknown. Most studies were conducted in Europe and North America, where the availability of fitness apps and internet access is superior when compared to low- and middle-income countries (Parker, 2021; Newbold et al., 2021). Thus, we aimed to identify the factors associated with using digital platforms for physical activity during the COVID-19 pandemic among adults living in southern Brazil. In addition, we aimed to compare the trajectory of physical activity between users and non-users as well as between the type of digital platform.

2. Methods

2.1. Study population and design

We conducted a longitudinal analyzes using data from the PAMPA (Prospective Study on Mental and Physical Health in Adults) cohort. Eligible participants should reside in the state of Rio Grande do Sul (Brazil) and be 18 and older. The sample size was calculated based on the prevalence of the cohort primary outcomes (i.e., low back pain, mental health, and access to healthcare). Additionally, this sample size was proportionally distributed across six different mesoregions of the state. To reach the target sample size ($N = 1,767$), a four-arm approach was employed, with daily monitoring of data collection progress in each mesoregion. Prior to data collection, each researcher provided contact lists from universities and colleges, and a standardized email containing information about the research and the questionnaire link was sent out. Social media campaigns on Instagram® and Facebook® promoted the questionnaire link with daily posts and weekly adjustments. Additionally, local media were contacted to inform the population about the study. Researchers also shared the questionnaire link with their personal contacts throughout the state. The recruitment phase lasted four weeks. More details of the study protocol can be found elsewhere (Feter et al., 2020).

This research involves human participants and was carried out in accordance with the relevant guidelines and regulations of the Declaration of Helsinki. The study protocol was approved by the local

research ethics committee (Certificate of Presentation for Ethical Review: 31.906.920.7.0000.5313). This research complies with the specific resolution of the National Health Council (466/2012), and informed consent was obtained from all subjects in accordance with the resolution of the Free and Informed Consent Term of the National Health Council.

2.2. Exposure

Using digital platforms was assessed in wave 2 (December 2020), wave 3 (June 2021/3245 participants), and wave 4 (June 2022/2553 participants). Participants were asked about their use of digital platforms for physical activity practice (yes or no) and how often they used them (i.e., the number of days per week, categorized as “one to three” or “four to seven”). We also asked participants about the type of platform they used, including streaming services [YouTube®, Skype®, Zoom®], social media [Instagram®, Facebook®, WhatsApp®], mobile apps, and others, as well as whether this activity was prescribed by an exercise professional through the following question: “*Did any exercise professional prescribes the physical activity [practiced on digital platforms]?*”. Furthermore, participants were asked on their perspectives of using digital platforms in the future, with the following question: “*Do you intend to use digital platforms in the future to engage in your home-based physical activities?*” (yes or no).

2.3. Outcome

We assessed physical activity based on participants’ self-reports on days per week and minutes per day of leisure-time physical activities practiced in the last seven days (Milton et al., 2011). Physical activity was analyzed in minutes per day, and participants were categorized as inactive (i.e., engaging in less than 150 min per week) or active (engaging in 150 or more minutes per week) (World Health Organization, 2020). We also analyzed physical activity on its continuous form (minutes per day).

2.4. Covariates

We included age (18–30; 31–59; 60 years old or more), sex (female; male), educational achievement (high school or less; university degree or higher), marital status (living alone; living with a partner), and the presence of chronic diseases (e.g., hypertension, diabetes, cancer) (yes; no) as covariates in the adjusted analyzes.

2.5. Statistical analysis

Descriptive data were reported as percentages with their respective 95 % confidence interval (95 % CI). All analyses were performed using Stata 17.1 (Stata Corp, College Station, Texas, USA). The sample was analyzed by year according to age, sex, marital status, and educational achievement.

We used a generalized linear model (GLM) to investigate the interaction between physical activity in each year and the use of digital platforms. For the continuous outcome (physical activity in minutes/day), we conducted GLM with Gaussian distribution and robust variance; for the dichotomous outcome (meeting the World Health Organization criteria for physical activity), we conducted GLM with Poisson distribution. All analyses were conducted with an identity link function and were adjusted for sex, age, skin color, marital status, education, comorbidities, and platform type. From the GLM coefficients, the predicted values of physical activity at each moment were estimated using the “margins” command. A statistical significance level of 5 % was defined.

3. Results

Overall, 36.8 % (95 % CI 34.9, 38.9) of participants reported using platforms for physical activity in 2020, 25.6 % (95 % CI 24.0, 27.2) in 2021, and 13.5 % (95 % CI 11.6, 15.7) 2022 (Table 1). Most participants reported using digital platforms for up to three days with the prevalence ranging from 67.8 % to 72.3 %. In 2020, the guidance provided by an exercise professional was 55.0 % (95 % CI 51.7; 58.2); followed by 49.1 % (95 % CI 45.5; 52.7) in 2021 and 54.8 % (95 % CI 46.6; 62.7) in 2022. Intention of using digital platforms in the future was reported by 57.7 % (95 % CI 54.4; 60.9) participants in 2020 and 64.9% (64.9 % 95 % CI 61.4; 68.2) in 2021.

Table 1 shows the prevalence of using digital platforms by sex, age, marital status, and education. Women reported used more in 2021 (29.6 95 % CI 25.6, 33.8). In all waves, people aged 18–30 years reported using platforms more frequently when compared to other age groups. Participants with a university degree or higher showed a higher prevalence of digital platform use in 2020 and 2021.

In Fig. 1 the trajectory of physical activity during the COVID-19 pandemic based on the use and type of digital platforms is described. Physical activity decreased across waves; however, participants who used digital platforms for physical activity showed a increased physical activity (Fig. 1a). In 2022, a significant difference was observed, since using digital platforms was associated with 11.1 (95 % CI 2.3, 20.0) minutes more of physical activity per day (p = 0.014) (Supplementary Table 1). Participants who engaged with social media demonstrated a consistent trajectory of physical activity. However, those who did not use decreased their daily mean of physical activity substantially decreased (Fig. 1c). During 2022, participants who used social media for physical activity engaged in 17.9 (95 % CI 8.6; 27.2) more minutes per

Table 1
Prevalence of the use of digital platforms according to sex, age, marital status, and education achievement during the Covid-19 pandemic among adults participating in the Pampa Cohort (southern Brazil, 2020–2022).

	Use of digital platforms % (95 % CI)		
	2020 (n = 2744) % (95 % CI)	2021 (n = 3245) % (95 % CI)	2022 (n = 2553) % (95 % CI)
Total	36.9 (34.9, 38.9)	25.6 (24.0, 27.2)	13.5 (11.6, 15.7)
Sex			
Male	20.8 (14.6, 28.7)	16.7 (11.2, 24.1)	11.8 (8.2, 16.7)
Female	46.0 (41.7, 50.4)	29.6 (25.6, 33.8)	15.2 (12.6, 18.3)
Age (years)			
18–30	45.3 (41.7, 49.0)	32.1 (29.1, 35.2)	20.0 (15.6, 25.2)
31–59	34.5 (32.1, 37.0)	23.2 (21.3, 25.2)	12.5 (9.9, 15.7)
≥60	18.1 (13.2, 24.5)	19.2 (15.0, 24.3)	4.3 (1.4, 12.9)
Marital status			
Without partner	44.1 (38.1, 50.3)	25.0 (19.9, 30.9)	12.9 (9.5, 17.1)
With partner	38.8 (34.0, 43.7)	27.6 (23.4, 32.4)	15.0 (12.2, 18.3)
Educational achievement			
High school or less	32.1 (27.7, 37.0)	20.6 (16.9, 23.9)	20.8 (12.8, 31.9)
University degree or higher	37.8 (35.7, 39.9)	26.7 (25.0, 28.5)	13.6 (11.4, 16.2)

day compared to non-users (p < 0.001) (Supplementary Table 1).

The trajectory of the likelihood of engaging in the recommended levels of physical activity can be observed in Fig. 2. Users were more likely to meet the World Health Organization (WHO) criteria in all waves compared to non-users, showing a difference of approximately 12 percentage points in 2020 and 2021, and 16 points in 2022 (95 % CI: -0.05, 0.27) (Fig. 2a and Supplementary Table 2). The probability of reaching the WHO criteria was significantly higher for participants who engaged with social media in all waves (Fig. 2c), especially in 2022 when the users had a 25 % higher probability (95 % CI: 0.14, 0.36) compared to non-users of social media for physical activity (p < 0.001) (Supplementary Table 2).

4. Discussion

Our findings indicate that using digital platforms for physical activity was associated with an attenuated decline in physical activity levels during the COVID-19 pandemic. Using social media for physical activity was associated with a higher probability of meeting the WHO criteria for physical activity. The prevalence of using digital platforms for physical activity was higher among women, people aged 18–30 years, and those with a university degree or higher.

Using digital platforms for physical activity was associated with a higher level of daily physical activity. The closure of gyms, parks, and sports facilities forced people to look for alternative strategies to remain physically active during social distancing restrictions. Thus, the internet and associated digital platforms became a strong tool to reduce the damage of social isolation on physical activity during the COVID-19 pandemic (Douglas, 2020; Wackerhage, 2020). Using digital platforms can be a very effective strategy to promote physical activity. Research based on the self-determination theory suggests that the strength of enthusiasm predicts people’s levels of physical activity (Ryan and Deci, 2000). Digital platforms might have an important role in this enthusiasm through motivational regulations directed by goals distinct from the behavior but in line with the individual’s identity and values (Ng et al., 2012; Nurmi et al., 2016). Previous studies that analyzed the association between physical activity practice with the use of technology have demonstrated that these platforms are effective in the short term; however, people lose engagement over time (Schoeppe et al., 2016; Davies et al., 2012). On the other hand, our findings revealed that the trajectory of physical activity among users was higher than non-users across an 18-month follow-up.

A previous study in Australia found greater adherence to physical activity recommended levels among adults who used some digital platform to practice physical activity compared to non-users (Parker, 2021). Similar results were also reported before the pandemic in Germany, with a significant association between using fitness apps, healthy behavior, and physical activity (Ernsting et al., 2017).

We revealed that women used more digital platforms for physical activity than men. Women had lower chances of engaging in physical activity due to a heavy load of household chores and childcare, in addition to work-related tasks (Wenham et al., 2020). Our hypothesis is that using digital platforms helped women in engaging in physical activity, considering the challenges posed by the pandemic scenario.

Young adults were more likely to use digital platforms compared to older adults. However, we observed that older adults increased their use of digital platforms for physical activity in 2022. This may have happened because young adults are more proficient in using technology (da Silva et al., 2470). Furthermore, in 2022 social distancing measures were eased and the transition from online to in-person activities happened naturally. For all age groups, using digital platforms is a promising option, potentially increasing adherence and engagement for an active lifestyle (Elavsky et al., 2017). In the pandemic context, older adults were identified as a risk group (Mueller et al., 2020) for infection, and therefore remained active was an important way to protect their health (Bentlage et al., 2020). Previous evidence have shown that digital

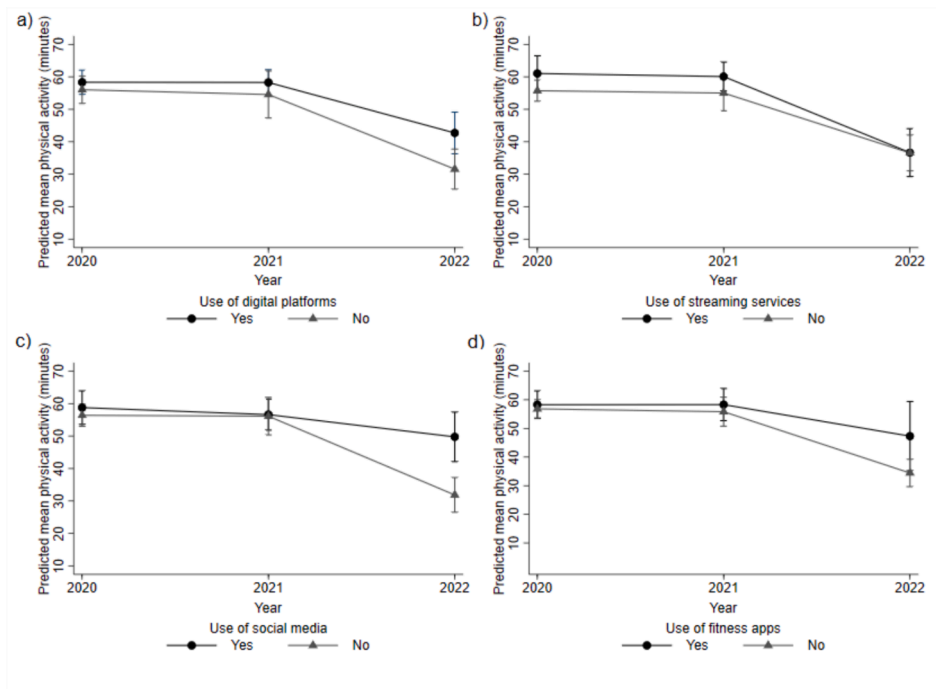


Fig. 1. Trajectory of physical activity per day according to the use of digital platforms for physical activity during the Covid-19 pandemic among adults participating in the Pampa Cohort (southern Brazil, 2020–2022).

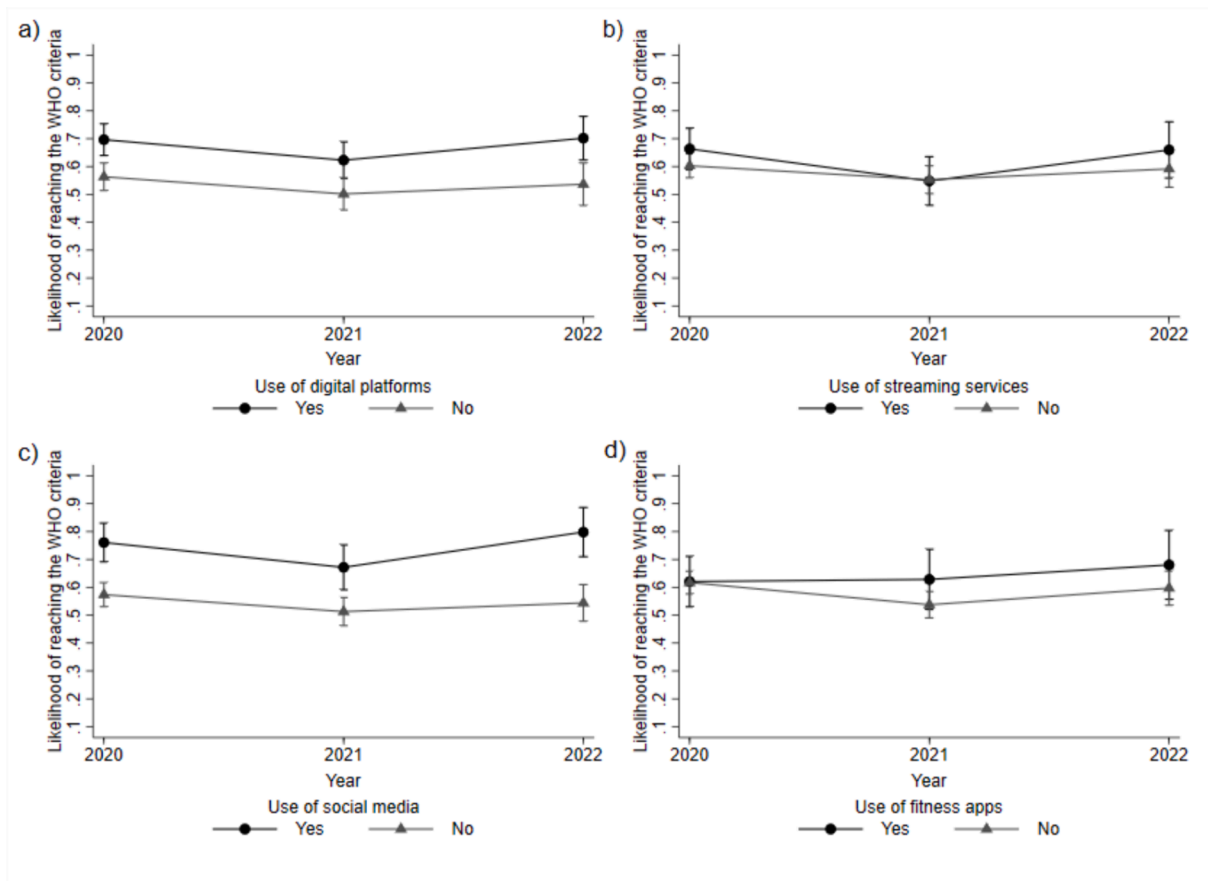


Fig. 2. Trajectory of the likelihood of reaching the WHO criteria for physical activity according to the use of digital platforms for physical activity during the Covid-19 pandemic among adults participating in the Pampa Cohort (southern Brazil, 2020–2022).

interventions are effective in increasing the level of physical activity among older adults (Kwan et al., 2020). Furthermore, digital platforms can be a useful strategy to promote physical activity in this population.

Finally, our data have important implications for public health. Considering the challenges in promoting physical activity aiming to tackle physical inactivity, digital platforms emerge as an important strategy. In addition to promoting greater access to public spaces and physical activity programs, using digital platforms seems to be an interesting option, especially in the context of ongoing pandemic recovery efforts (Whitsel et al., 2023).

Our study has some limitations that need to be acknowledged. First, the cohort design stands out among other advantages, rendering the study less susceptible to memory bias. However, some residual confounding cannot be ruled out. Second, we used self-reported measures. Such methods are frequently affected by recall and response biases (e.g., social desirability, inaccurate memory) and fail to capture the absolute level of physical activity (Prince et al., 2008). Third, in-person interviews or assessments were not allowed by the National Research Ethics Committee. Furthermore, it should be noted that the study sample does not fully represent the population of Rio Grande do Sul. To our knowledge, this is the first study in Brazil that assesses the association between digital platforms and the trajectory of physical activity during the COVID-19 pandemic.

5. Conclusions

Our findings suggest that using digital platforms for physical activity was associated with increased levels of physical activity during the COVID-19 pandemic. Consequently, the adoption of digital platforms must be recognized as a significant large-scale strategy for promoting physical activity. With the increasing integration of technology into daily routines, further studies must be carried out to assess the impact of using these platforms on health outcomes in the post-pandemic period.

6. Statement regarding informed consent

Informed consent was obtained from all individual participants included in the study.

7. Statement regarding ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

CRediT authorship contribution statement

Juliana Quadros Santos Rocha: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Luísa Silveira da Silva:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Matheus Pintanel Freitas:** Writing – review & editing, Investigation. **Felipe Mendes Delpino:** Writing – review & editing. **Airton J. Romaldini:** Writing – review & editing. **Isabel de Almeida Paz:** Writing – review & editing. **Natália Schröder:** Writing – review & editing. **Jayne Santos Feter:** Writing – review & editing. **Carine Nascimento da Silva:** Writing – review & editing. **Larissa Leal da Cunha:** Writing – review & editing. **Júlia Cassuriaga:** Writing – review & editing. **Natan Feter:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Marcelo Cozzensa da Silva:** Writing – review & editing, Project administration. **Yohana Pereira Vieira:** Writing – review & editing. **Eduardo Lucia Caputo:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Felipe Fossati Reichert:** Writing –

review & editing.

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.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2024.102816>.

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