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Tracking or lacking? Health app engagement among young adults in Portugal

¿Seguimiento o desinterés? Uso de aplicaciones de salud entre jóvenes adultos en Portugal

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Abstract

While digital media have become integral parts of young adults' everyday lives, it remains unclear whether health-focused media, like health apps, hold the same importance. This study explores health app usage patterns among young adults in Portugal, analysing tracking data from 342 participants over 90 days. The main findings reveal that contrary to global trends, engagement with health apps remains relatively low. Although the COVID-19 pandemic led to increased adoption of certain public health-related apps, this surge did not translate into sustained engagement. Gender and regional disparities were the most evident, with women and young adults in Lisbon showing higher usage levels. Additionally, the study highlights that a portion of the health app usage is connected with the COVID-19 context, where those apps function more as tools for navigating institutional requirements—such as COVID-19 certifications—rather than for sustained self-care practices. Our findings challenge assumptions about the widespread adoption of health-tracking technologies and emphasise the need for further research on sociocultural factors shaping digital health engagement in Portugal and beyond.

***Keywords*:** applications, health apps, young adults, digital culture, Portugal.

Resumen

Aunque los medios digitales se han convertido en partes integrales de la vida cotidiana de los jóvenes adultos, aún no está claro si los medios centrados en la salud, como las aplicaciones, tienen la misma importancia. Este estudio explora los patrones de uso de aplicaciones de salud entre jóvenes adultos en Portugal, analizando datos de seguimiento de 342 participantes durante 90 días. Los principales resultados revelan que, contrariamente a las tendencias globales, el compromiso con las aplicaciones de salud sigue siendo relativamente bajo. Aunque la pandemia de COVID-19 llevó a una mayor adopción de ciertas aplicaciones relacionadas con la salud pública, este aumento no se tradujo en un uso sostenido. Las disparidades de género y región fueron las más evidentes, siendo las mujeres y los jóvenes adultos en Lisboa quienes presentaron mayores niveles de uso. Además, el estudio destaca que buena parte del uso de estas aplicaciones está relacionada con el contexto de la COVID-19, cuando éstas funcionaban más como herramientas para cumplir con requisitos institucionales — como los certificados de vacunación — que como medios para prácticas constantes de autocuidado. Nuestros hallazgos cuestionan las suposiciones sobre la adopción generalizada de tecnologías de seguimiento de la salud y destacan la necesidad de seguir investigando los factores socioculturales que configuran el compromiso sostenido con la salud digital en Portugal y en otros contextos.

Keywords: *aplicaciones, apps de salud, jóvenes adultos, cultura digital, Portugal.*

Summary

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1. Introduction

The pervasive integration of mobile applications into daily life has transformed how individuals engage with health and wellbeing. Among young adults, applications from fitness monitors to mental health platforms are not merely tools for health management but also dynamic nodes within a digitally mediated lifestyle. As "digital natives" (Prensky, 2001), young adults often demonstrate adeptness in navigating these technologies, commonly considering them as extensions of their identity and social connectivity (Amaral *et al.*, 2022; Amaral *et al.*, 2023). The interplay between self-tracking and digital culture raises critical questions about how these technologies shape perceptions of self, health, and community. In a society increasingly driven by quantification, data-based validation has become central to personal and social experiences (Lupton, 2016). Some scholars have underscored the dual role of digital technologies in health behaviour modification and social interaction. For instance, Whitson (2013) explores the concept of "gamification" in tracking technologies, noting how elements such as badges and streaks motivate and sustain app engagement. Bitrián *et al.* (2021) highlighted the gamification trend for engagement in general mobile apps despite their category, while Cechetti *et al.* (2019) explored the potential of gamification in health technologies, particularly to assist patients' health management. Similarly, but associating that idea with the rising popularity of health-tracking apps among young adults, research by Pink *et al.* (2018) reveals that these apps often blur the boundaries between personal health and public performance as users share achievements on social media platforms. This sharing culture fosters what Bucher (2018) describes as "algorithmic awareness", wherein users become conscious of and adapt to the algorithmic mechanisms that mediate their online interactions. These dynamics situate these apps at the intersection of personal agency and algorithmic governance, particularly for young adults who increasingly turn to digital spaces for self-expression and health guidance.

The cultural and social implications of self-tracking technologies in the lives of young adults are profoundly influenced by a society that equates data with authenticity and value. As Lupton (2014) observes, self-tracking practices align with neoliberal ideals, promoting individual responsibility for health and productivity through constant self-monitoring. For young adults navigating both their formative years and a digitally saturated world, engagement with these technologies often mirrors broader societal trends toward data-driven decision-making and self-optimisation (Zuboff, 2019). While these practices can be empowering, they also raise significant concerns about surveillance, data privacy, and the potential for increased self-comparison and anxiety. The latter may be included in the notion of mental health-related issues that have been gaining the interest and attention of young adults in general, particularly in Portugal, although not necessarily translated into health app usage (Alcaire *et al.*, 2024; Antunes *et al.*, 2023a).

The paper adopts an exploratory methodology to critically examine the social contexts surrounding mobile app usage, focusing on health-related apps. The empiric study was employed during the untypical period of the COVID-19 pandemic, which has been previously studied as a time when media and digital technologies arose to a perceived higher importance to the maintenance of people's overall health and wellbeing (Lemenager *et al.*, 2021). For a 90-day period, smartphone usage data from 342 young adults from 18 to 30 years old were collected across 40 mobile applications. Through descriptive statistical analysis, this study aims to address a gap in the existing literature by providing a deeper understanding of app usage patterns among young adults in Portugal. General app usage patterns were studied, although the focus of this paper concerned health apps, their usage, and engagement metrics. This paper intends to find sociodemographic factors impacting such usage that underline the idea of young adults taking care of themselves.

Apps related to health, productivity, and social connection are particularly influential, fostering an ecosystem where technology mediates both individual behaviours and collective norms. These interactions underscore the dual role of mobile apps as facilitators of personal wellbeing and contributors to broader societal trends, such as the pursuit of self-optimisation and datafication (Lupton, 2016). One significant dimension of mobile app usage among young adults is the interplay between self-tracking technologies and behavioural psychology. Health-related apps, such as those for physical fitness or meditation, utilise gamified mechanisms to sustain engagement (Cechetti *et al.*, 2019; Whitson, 2013). Badges, leaderboards, and progress streaks are not mere functionalities; they appeal to intrinsic motivations and create extrinsic social incentives. Studies highlight how this gamification can promote adherence to health routines, yet it may also contribute to stress and over-reliance on external validation for success (Pink *et al.*, 2018).

Furthermore, the societal valorisation of constant improvement exacerbates these dynamics, encouraging users to view health not as a state but as a perpetual project requiring technological mediation (Lupton, 2014).

Also, De Nadai *et al.* (2019) investigated the constraints on human behaviour in both physical and digital spaces. Despite the vast array of available applications, individuals tend to limit the number of apps they use regularly. This behaviour indicates a fragmented usage pattern, where each app serves specific purposes and functionalities.

The integration of wellbeing-focused apps into the lives of young adults also reflects broader cultural phenomena. Ashton (2011) describes a "culture of upgrade" wherein technological advancements fuel a cycle of obsolescence and renewal. This culture extends beyond physical devices to encompass digital wellbeing tools, framing self-improvement as an ongoing necessity. Apps targeting mindfulness, productivity, or fitness are frequently marketed as indispensable aids for achieving an idealised version of selfhood. However, as McLaughlin (2021) notes, these offerings often carry neoliberal undertones, framing health and productivity as individual responsibilities while downplaying systemic factors that impact wellbeing. This dynamic can create a paradoxical pressure to achieve balance through technology, sometimes leading to adverse psychological outcomes such as anxiety or burnout.

Additionally, the rise of the "appification of wellbeing" exemplifies how digital platforms transform traditional conceptions of health into commodifiable experiences. Alcaire *et al.* (2024) observed that young adults in Portugal increasingly mainly use health apps for their functionality and as tools for social signalling and identity expression. Sharing app-mediated achievements on social media reinforces social bonds while also exposing users to algorithmic pressures and performance anxieties (Bucher, 2018). This shift raises critical questions about the commodification of wellbeing and its implications for mental health, particularly in contexts where societal expectations of constant improvement intersect with the immediate gratifications offered by mobile platforms.

The relationship between mobile app usage and mental health deserves particular scrutiny. Excessive engagement with social media and wellbeing apps has been linked to the release of dopamine, which fosters addictive behaviours and reduces attention spans (Meshi *et al.*, 2015). This phenomenon aligns with the broader crisis of curiosity identified by Christensen (2020), wherein the ease of access to information and instant gratification diminishes genuine interest in learning and exploration. For young adults, this creates a challenging environment where the pursuit of wellbeing through technology may inadvertently contribute to mental health issues, such as body dysmorphia, anxiety, or depression (Marks *et al.*, 2020). Addressing these concerns requires individual awareness and systemic interventions to promote healthier digital ecosystems.

Going beyond the scope of wellbeing and mobile apps, previous studies concerning medical sociology have focused on the link between rural-urban populations and digital usage for health concerns. Even when comparing only internet users from rural and urban areas, Hale *et al.* (2010) found that the more urban population was more likely to engage in online health activities. Health apps may include interactive and psychoeducational tools addressing various health-related concerns. In a digitalised world, there is a clear and linear possibility of those being or becoming integral to managing health and general wellbeing. Some apps, focused on wellbeing, enable users to monitor and manage their physical activity, diet habits, and stress levels. Others may compile and present medical information about symptoms and available treatments online. According to Fortune Business Insight (2025), the health app ecosystem is projected to grow to 88.70 billion dollars by 2032. Tarricone *et al.* (2021) highlight that health apps represent a mature and rapidly expanding market. Just like as with all app markets, sociodemographic targets arise, including based on gender (Antunes, 2024), like women's higher need to find digital spaces of wellness and wellbeing (Radrigán & Duque, 2022). COVID-19 brought a particular shift towards broader and more considerable attention, including academics, to people's overall wellness and wellbeing needs.

The COVID-19 pandemic raised a context of mandatory social distancing that affected the way people connect, increasing overall consumption of digital media and mobile applications, arguably in order to combat corporeal isolation (Antunes *et al.*, 2023a; Antunes *et al.*, 2023b; Banerjee & Rao, 2021; Gomes *et al.*, 2022; Lemenager *et al.*, 2021; Nekliudov *et al.*, 2020; Simões *et al.*, 2022). COVID-19 has accelerated the adoption of health apps, but their integration into healthcare systems hinges on organisations and professionals' adaptability to these technologies. Proper regulatory oversight and inclusive digital strategies will determine whether health apps achieve their promise of bridging healthcare gaps or exacerbate existing inequalities (Tarricone *et al.*, 2021). Cases like the Portuguese one may reveal a quick way to integrate such apps into a national public healthcare system. *SNS24* is a Portuguese government-funded mobile app, which, according to Mendes *et al.* (2022), allows an approximation to health services, although facing some challenges to the inclusion of the elderly population. Even when compared to other health apps included in healthcare systems in Portugal (therefore, of the private healthcare), *SNS24* is the "only retaining a full history of vaccinations, allergies, and chronic conditions, as well as renewable prescriptions" (Viana *et al.,* 2023, p. 89). Thus, it is a clear

example of the datafication of health, which, according to Ruckenstein and Schüll (2017, p. 272), can play a role in "generating new power asymmetries and disrupting traditional regulatory and ethical mechanisms". Some parts of the health data may translate people's everyday rhythms regarding managing individual and social/work needs and expectations (Pantzar & Ruckenstein, 2017; Mehta & Nafus, 2016). In those cases, health apps relying on a self-tracking basis may have a case for their potential to uncover inequalities, collective environmental exposures, or disparities in quality of life (Gabrys, 2014). The datafication of health may relieve health-related concerns (even the complex aggregation of health exams, analysis, and monitoring), although they are not part of the health system by themselves.

On the other hand, the impact of health-related apps may advise cautiousness. Namely, Pantzar & Ruckenstein (2017) dispute the idea that such apps work with "mechanical objectivity" despite developers promoting health-related apps as tools of mechanical objectivity (for example, by counting the exact number of steps taken during a day). Pantzar & Ruckenstein (2017) suggest working with the notion of "situated objectivity", as the approach of such app users "is not methodical and systematic –it might not even be logical– but, rather, combines knowledge in a selective manner that follows a different course of knowledge formation" (2017, p. 3). Pantzar & Ruckenstein's (2017) "situated objectivity" conceptualisation highlights the interpretation, adaptiveness and context between human-machine interaction on health apps, although recognising that such datafied measurements may help people gain health knowledge regarding the specific app communicative processes of their goals and health promotions. Thus, this idea of "situated objectivity" may be relevant to a critical understanding of those apps that apply gamification principles to promote engagement (Bitrián *et al*., 2021; Whitson, 2013).

Another focus of criticism of health apps requires visiting the theoretical rationale that van Dijck (2017) employed towards datafication, which she characterises as a phenomenon that spawns a new paradigm in science and society. In van Dijck's particular view, datafication must also be questioned due to data storage's central role in today's scientific understanding of society and behaviour –which does not exclude the logic of health data. According to van Dijck (2017, 2014), the datafication process computerises human practices and transforms them into digital information that can be stored, processed and analysed. This transformation of mundane aspects of social and individual life into quantifiable data generates new scientific and ideological paradigms. The author critically reflects on the fact that the process of datafication simultaneously represents a conflict between the empowerment derived from self-tracking technologies and a broader ideological and cultural logic of constant surveillance and the transformation of life into information, from which there is no escape.

The proliferation of smartphones, mobility, and the accessibility of a wide range of mobile apps have made digital-based health technologies increasingly pervasive. As the work of Tarricone *et al.* (2021) underscores, the COVID-19 pandemic significantly amplified this trend, with a global surge of 65% in the downloads of health apps in 2020 alone. Despite the worldwide trends suggesting increased usage of health apps involved in a significant scope sense of digital wellbeing (Burr & Floridi, 2020; Tarricone *et al*., 2021), the Portuguese case may reveal different patterns. In our previous research, mainly focused on young adults' perceptions of their digital patterns, the data of a questionnaire was applied to a representative sample of 1500 young adults (Antunes *et al*., 2023b). Such results showed not only an indication of low usage of those health-focused apps but also low perceived importance of those apps. That study found a gender imbalance, as women revealed to use more health apps on a more frequent basis and even consider such apps as more critical than men. Thus, reinforcing hegemonic gender roles, which associate the idea of taking care of oneself as a feminine interest.

2. Methodology

The approach followed in this paper is exploratory-based and intends to critically reflect on the social contexts of mobile app usage by exploring the particular case of health app usage. We have identified a need to contribute to a better understanding of the general app usage patterns of young adults (18 to 30 years old) in Portugal, as national academia and statistical outputs do not tend to conceptualise young adulthood as a generational category. This paper was done in the scope of the "MyGender—Mediated young adults' practices: advancing gender justice in and across mobile apps" project (PTDC/COM-CSS/5947/2020). That research project was the first-ever in Portugal aimed to investigate how young adults engage with the technicity and imaginaries

of mobile applications, incorporating them into their daily lives, embodying them in their everyday practices, and (re)negotiating from it their gender and sexual identities. Thus, aligned with the research project, in this paper, we have adopted a feminist and critical perspective (Barad, 2014; Bennett, 2010; Braidotti, 2016, 2019; Haraway, 2008, 2016) of contemporary digital media, namely by analysing mobile apps' usages, appropriations, and embodiments. Accordingly, in this study, we focus on conceptualising young adulthood as a generation of citizens between 18 and 30 years old. Therefore, stretching the conceptual bridge between studies focused on youth/adolescence and/or adulthood. The empirical basis relies on 342 young adults' smartphone usage tracking data for 90 days, from March 2020 to July 2021. The data collection process was performed by an external company (Netquest) and occurred during three separate 30-day periods to minimise the risk of skewing the data. The data collection coincided with the worldwide health threat of the COVID-19 pandemic. Behavioural data for this study were collected in collaboration with Netquest, a company specialising in online panels and passive digital behaviour monitoring. Operating under the international ISO 26362 standard, Netquest provides access to high-quality behavioural data through a closed panel. Participants voluntarily installed tracking software on their mobile devices, enabling the collection of accurate usage data over time. On Android, the tracker is embedded in an app that records app usage (including offline activity), visited URLs, search terms, session duration and start times. On iOS, data are captured via a proxy configuration that monitors internet-based app and browser activity. Only highly engaged panel members are invited by Netquest to join their behavioural tracking programme and are incentivised accordingly. All data are anonymized and collected exclusively for research purposes, in compliance with data protection and informed consent regulations, including the applicable European GDPR. This method provides a more accurate picture of digital habits in real-life contexts, overcoming limitations associated with self-reported data.

The quantitative analysis focused mainly on exhaustive descriptive analyses. Occasionally, bilateral comparison tests (*z*-tests or *t*-tests, depending on whether the sample > 30) of relative difference were used, with a significance level of 0.05, which means that for where there are statistically significant differences, *z*-score > 1.96. The two-sided tests were only used to compare metrics that are a total or a proportion of a total (namely the 'Total Users', 'Daily Average Users' and 'Total Visits' metrics). These tests are not applied to the other metrics, as those are averages calculated from usage data by category, which are more suitable as instruments for the purely descriptive analysis carried out in this study. For the metrics to which the bilateral comparative tests are applied, a letter is allocated to each row. Those are identified in Table 2 for each category of apps, in Table 3 for each possibility within the sociodemographic characteristics, and in Table 4 for each app. The existence of statistical superiority is indicated by the letter corresponding to the row to which that metric is statistically significantly superior.

By using descriptive statistics, this exploratory quantitative study analyses overall app usage and usage frequencies while focusing on the usages of health apps and even other health and wellbeing-related apps, like fitness and self-tracking. Although the sample of 342 young adults was not composed according to the distribution of the population in Portugal, that amount of respondents represents a ±5% margin of error for a 95% confidence level, with a *z*-score of 1.96. In total, 40 apps were tracked and categorised by the research team according to the app stores used, with eight being considered health apps, seven of which were fitness apps, and five of which were self-tracking apps. The remaining half were mostly social media and messaging apps. By reflecting insights into social-based practices of health app usage in young adults in Portugal, this study is guided by the following research questions:

RQ1: How are social and demographic factors linked to using health apps among young adults in Portugal?
RQ2: Does health app usage translate the popularity of health-related topics during the COVID-19 pandemic?

The sample distribution is presented in Table 1 according to gender, age cohort, region of Portugal and socioeconomic class. The four possibilities of socioeconomic class correspond to an adaptation of Nielsen Admosphere's (2020) classification for socioeconomic class, which initially categorises eight different classes. The sample comprises 201 women (58.77%) and 141 men (41.23%). Of the total sample, 105 individuals (30.70%) are young adults aged 18 to 24, while the remaining 237 (69.30%) fall within the 25 to 30 age range. The sample predominantly represents three Portuguese geographical regions, as no other regions contributed more than 9%. The most represented areas, in order of prevalence, are the North, with 107 participants (31.29%); the Centre, with 95 participants (27.78%); and the Lisbon region, with 83 participants (24.27%). In terms of socioeconomic classification, divided into four levels, the majority of the sample consists of young

adults from the middle class (C1), comprising 163 participants (47.66%). This is followed by individuals from the merged upper and upper-middle classes (AB), totalling 130 participants (38.01%).

Table 1. Sample distribution

Sociodemographic Categories		*N*	%
Gender	Women	201	58.77%
	Man	141	41.23%
Age	18-24	105	30.70%
	25-30	237	69.30%
Region of Portugal	Azores	1	0.29%
	Alentejo	24	7.02%
	Algarve	28	8.19%
	Centre	95	27.78%
	Lisbon	83	24.27%
	Madeira	4	1.17%
	North	107	31.29%
Socioeconomic class	AB (upper/upper-middle class)	130	38.01%
	C1 (middle class)	163	47.66%
	C2 (lower-middle class)	38	11.11%
	D (low class)	11	3.22%
Total		*342*	*100.00%*

Source. Own elaboration.

3. Results

The 40 apps considered in the tracking process were the most popular apps according to the analysis of Google PlayStore and Apple's App Store during the first data collection period (March 2020). Out of those 40 apps, eight were considered to be health apps by the research team according to Google PlayStore and Apple's App Store's categories of apps. In the context of this study, health apps are defined as mobile applications primarily designed to support users in managing various aspects of their health and wellbeing. This includes mental health, physical health, and general lifestyle improvements. These apps often provide users with tools for monitoring, tracking, or enhancing their health-related activities, sometimes integrating features for data visualisation, reminders, or expert guidance. The eight health apps included in this study represent diverse functionalities aimed at supporting users' physical and mental wellbeing. *Calm*, for instance, is a mindfulness and mental health app designed to promote relaxation and stress reduction through guided meditations, sleep stories, and breathing exercises. Similarly focused on personal wellbeing, *Fabulous* helps users develop healthier routines by offering personalised plans for hydration, exercise, and mindfulness, fostering long-term lifestyle improvements. Apps like *Clue* and *Fastic* cater to more specific health needs; *Clue* is a menstrual cycle tracker providing insights into ovulation, symptoms, and hormonal patterns to help users manage their reproductive health. *Fastic*, on the other hand, focuses on intermittent fasting, guiding users through fasting periods with timers, progress tracking, and educational tools to support their goals.

Two apps in the group emphasise fitness and physical health tracking. *Huawei Health* is a comprehensive platform often integrated with Huawei brand devices, allowing users to monitor physical activities, heart rate, and sleep patterns through wearable technology. Similarly, *Jejum Intermitente – Rastreador em Jejum Zero-Cal*[1] offers localised intermittent fasting tracking tailored to Portuguese-speaking users, combining fasting

[1] A direct translation to English would be: "Intermittent Fasting - Zero-Calorie Fasting Tracker".

timers with practical tips to align with individual health objectives. The remaining apps address public health needs and societal challenges. *Passe Covid*[2] was developed during the COVID-19 pandemic to assist users in managing health compliance, offering features such as vaccination status tracking and real-time guidelines for navigating health restrictions. Meanwhile, *SNS24*, Portugal's national health service app, connects users to telehealth services, medical guidance, and symptom checkers, reinforcing accessibility to healthcare resources. Together, these apps highlight the broad scope of health-related technologies, reflecting how young adults use digital tools to manage their personal and public health in diverse ways.

Table 2 shows the key app usage metrics divided into six app categories. Social media and messaging apps were the most used, with every participant in the sample using them. Such amount of users is statistically significantly superior to the total users of all the other categories of apps (z-score > 1,96). Likewise, the social media and messaging total number of visits (177335) is statistically significantly superior to the numbers registered by all the other categories. On average, 39.39% of the sample daily used those social media & messaging apps, thus being statistically significantly superior to the daily average users (DAU) of fitness (8.73%), health (5.29%) and self-tracking apps (6.56%). The average time spent per day per user on social media and messaging apps was more than 1 hour (65.18 minutes). While health apps had the second most significant number of total users (91 young adults, representing 26.61% of the sample), only 5.29% of the health app users had daily averagely used such category. Therefore, having a total number of users which is statistically significantly higher than the registered by fitness (30 users, 8.77%), dating (42 young adults, 12.28%) and self-tracking (36 respondents, 10.53%) apps. At the same time, the DAU of health apps is not statistically significantly superior to any other category. Nonetheless, the category of health apps also has the most minor average numbers of visits/user (7), pageviews/user (15) and minutes/user (0.12) – which implies that each person spent more than 500 times more, on average, per day on social media and messaging apps than in health apps. Compared to the other metrics, which mainly concern averages, we may find some nuances while casting aside the social media and messaging apps. Fitness apps had the lowest total users (30 young adults), thus being statistically significantly inferior to the numbers registered by the app categories of social media and messaging, health and games (70 users, 20.47%). Self-tracking apps had the lowest total of visits (364), being statistically significantly inferior to the total visits of every other category. Games and dating apps usage displayed in Table 2 suggest a more engaged audience than those using fitness, self-tracking or health apps. Games and dating apps have average daily users of 10.67% and 19.71% (in this case, being statistically superior to the DAU of health and self-tracking apps), respectively; total visits of 2004 and 3522 (both registering several statistically significantly superiorities), respectively; and average minutes per day per user of around 6 minutes. For comparison, fitness, self-tracking and health apps have daily average users of between 5.29% to 8.73% of each category's users, between 364 and 657 total visits, and neither of those categories registered an average time spent per day per user of even 1 minute.

While mainly focusing on the category of health apps, Table 3 displays the same key usage metrics concerning the sociodemographic factors presented in Table 1. Since the sample is not distributed in a representative manner, statistical (z-tests and t-tests) results should not be particularly enhanced, and it is the comparisons between the percentages that reveal interesting nuances, as for the 30.85% of women (62 out of a total of 201 sampled women) compared to the 20.57% of men (29 out of 141 men). Although such percentages of total users may suggest a higher prevalence of women using health apps, the remaining metrics are quite similar, including the daily average users. In fact, there is only a statistically significant superiority in the case of total visits, between women (559) and men (98). An average of 6.40% of the 62 women who use health apps do use them daily (4 women daily), while the daily average number of men users is 5.55% (2 men) of the 29 men users of health apps. The metric of average visits per user also translates to a possible higher popularity of health apps in the sampled women (an average of 9 visits per woman during the 90 days in comparison to an average of three visits of men, thus revealing the triple amount of average visits per woman in regards to per man). Similar results can be found regarding average pageviews per user, as the average pageviews per woman is 17, while per man is 10. Results considering the age subgroups are more similar than the previously mentioned regarding gender. 29.52% of the younger age group (18 to 24 years old) used health apps (31 out of 105), with a daily average of 5.39% (2 users) in comparison to 25.32% of the sampled young adults aged between 25 and 30 years old (60 out of 237), with a daily average of 5.93% (4 users). Again, only on the total visits did we find a statistically significant superiority, by the older young

[2] A direct translation to English would be: "COVID Pass".

adults (490) in comparison to the group aged between 18 and 24 years old (167 visits). Although not as prominent as the gender differences, Table 3 reveals higher averages of visits per user with 25 to 30 years old (8, in comparison to 5) and pageviews per user (16, in comparison to 13) of the young adults aged between 18 and 24 years old.

Table 2. Key metrics of usage by app category

App Category	Total Users		Daily Average Users (per Categ.)		Total Visits	Avg. Visits per User	Avg. Page views per User	Avg. Minutes per Day per User
	N	% Total	*N*	% Category	*N*	*N*	*N*	*N*
Fitness (A)	30	8.77%	3	8.73%	457 F	15	47	0.67
Games (B)	70	20.47% ACF	8	10.67%	2004 AEF	29	132	6.74
Dating (C)	42	12.28%	8	19.71% EF	3522 ABEF	84	365	5.98
Social media & messaging (D)	342	100.00% ABCEF	135	39.39% AEF	177335 ABCEF	519	2840	65.18
Health (E)	91	26.61% ACF	5	5.29%	657 AF	7	15	0.12
Self-tracking (F)	36	10.53%	2	6.56%	364	10	21	0.19

Source. Own elaboration.

In terms of the region of Portugal, the results of the archipelagos of Azores and Madeira should not be remarkably focused, even due to the lower amounts of respondents in the sample of such archipelagos (1 and 4, respectively). Bilateral comparison tests (*z*-tests or *t*-tests) are not carried out when there are 0 or 1 cases. Excluding Madeira implies excluding the only case of Table 3 in which the average minutes per day per user reached 1 minute. The remaining regions analysed may still reveal nuances according to more or less urbanized or populated regions. Although the North, Centre and Lisbon regions are the most populated of our sample, results of the Algarve region may suggest a particular popularity of health apps among the young adults living in that region. 39.29% (11 respondents) out of the 28 sampled young adults who had been living in the Algarve have used health apps during the 90 days, thus being statistically significantly superior to the total users of Lisbon and Madeira. The percentages of total users per sampled young adults of each region revolve around 25% to 30% for the regions of Alentejo, Centre and North. The exception was the Lisbon area, Portugal's capital and most urbanized region, with only 19.51% (16 young adults) of the 83 Lisbon residents of the sample using health apps. In terms of daily average users, the outliers are the Alentejo and North, with those being the regions with, respectively, higher (15.43%) and lower (5.59%) percentages of DAU, in comparison to the health-app users that live in those regions. The 259 total visits registered by Centre users were statistically significantly superior to every region that it was compared to. Similarly, the Lisbon region totalled 203 visits, which is statistically significantly superior to the visits of the regions of Alentejo (35), Algarve (42), Madeira (2), and North (116). Although the Algarve region registered a surprising number of health app users, that popularity did not translate to the following metrics, such as average visits per user, average pageviews per user and average minutes per day. While the results for the average pageviews per user per region were more approximate, the Lisbon region had the higher average visits per user (13) and average minutes per day per user (0.38), thus suggesting that the smaller number of users of health apps that live in Lisbon are more frequent users of this category of apps than the young adults living in other regions of Portugal.

As for the adaptation of Nielsen's scale for socioeconomic classes, the analysis should not overexpose the results of the lower class ("D"), as the total number of respondents in the sample of this socioeconomic class is only 11 – although such proportion (45.45%) is statistically significantly superior to the remaining socioeconomic classes. The majority of the metrics presented in Table 3 do not reveal highly relevant differences, with the special case of total visits, of which the registered by C1 class (322) is statistically significantly superior to every other category. AB class's number of total visits (258) is statistically significantly superior to the registered by C2 and D, although C2 also totalled a number of visits (55) which is statistically significantly superior to the registered by the D class (22). Setting aside the results of the lower class ("D"), it can also be highlighted the 13.88% of daily average users of the lower-middle class ("C2") regarding the eight users of that socioeconomic class, compared to the percentages of DAU of the higher-positioned classes.

Table 3 also includes the results distributed per moment of the day (morning, afternoon, evening, weekday and weekend). In this case, the percentage of total users corresponds to the percentage of those users compared to 91 health-app users. The moment of the day is not a paramount aspect of engaged usage of health apps, as the key metrics of Table 3 suggest different nuances and comparisons. Even so, the proportion of users during the afternoon (63.13%, 62 young adults) and during the evening (65.93%, 60 users) is statistically significantly superior to the registered during the morning (46.15%, 42 young adults). The number of users during weekdays (82, thus 90.11%) is also statistically significantly superior to the other moments of the day, including the weekends (54 young adults, 59.34%). That means that for total users, the results indicate that the usage of health apps appears to be concentrated on weekdays and during the afternoons and evenings. Nonetheless, the daily average users are remarkably similar between mornings, afternoons and evenings, as well as between weekdays and weekends (with 9.13% of daily average users out of the 54 weekend health app users being the prominent result), thus not registering a case of statistical significance. There were statistical significances in the case of the superiority of total visits during weekdays (470) in comparison to every other moment of the day, but also during afternoons (234) compared to mornings and weekends, and by evenings (227) in comparison to weekends. As for the average visits per user, the results on weekdays (6) are double the average on weekends (3). Comparing usage on weekdays and weekends implies considering that weekdays include 5 days a week, while weekends are only 2 days. Thus, a comparison that separates the results per day may clear the analysis. That metric may be the average minutes per user per day, in which the higher results are on weekends (0.22 minutes) in comparison to the time spent on weekdays (0.13 minutes).

Although health apps registered 91 total users, thus being the second category of apps with the most users (26.61%), it may be interesting to detail the usage data of each of the eight health apps considered in this tracking study. Table 4 presents the same key usage metrics as the previous tables. However, in this case, the results are shown for each health app. If the total number of users of each health app is added up, health apps reach 105 added users. Discarding repeated users, there are 91 health app users, hence, there are only 14 repeated users of health apps, which means that only 14 respondents (4.09% of the sample) have used more than one health app during the 90 days.

Table 3. Key metrics of health app usage per sociodemographic categories

Sociodemographic Categories		Total Users		Daily Average Users (per Categ.)		Total Visits	Avg Visits per User	Avg Pageviews per User	Avg Minutes per Day per User
		N	% Total	*N*	% Categ.	*N*	*N*	*N*	*N*
Gender	Women (A)	62	30.85%	4	6.40%	559 B	9	17	0.15
	Men (B)	29	20.57%	2	5.55%	98	3	10	0.14
Age	18-24 (A)	31	29.52%	2	5.39%	167	5	13	0.10
	25-30 (B)	60	25.32%	4	5.93%	490 A	8	16	0.15

Continuation Table 3

Sociodemographic Categories		Total Users		Daily Average Users (per Categ.)		Total Visits	Avg Visits per User	Avg Pageviews per User	Avg Minutes per Day per User
		N	% Total	*N*	% Categ.	*N*	*N*	*N*	% Total
Region of Portugal	Azores (A)	0	0.00%	0	0.00%	0	0	0	0
	Alentejo (B)	7	29.17%	1	15.43%	35 F	5	2	0.29
	Algarve (C)	11	39.29% EF	1	9.36%	42 F	4	4	0.18
	Centre (D)	27	28.42%	2	8.00%	259 BCEFG	10	7	0.15
	Lisbon (E)	16	19.51%	2	11.19%	203 BCFG	13	5	0.38
	Madeira (F)	1	25.00%	1	100%	2	2	3	1.00
	North (G)	29	27.10%	2	5.59%	116 BC	4	4	0.10
Socioeconomic class	AB (upper/upper-middle class)	33	25.38%	2	6.61%	258 CD	8	7	0.18
	C1 (middle class) (B)	45	27.61%	2	5.31%	322 ACD	7	8	0.13
	C2 (lower-middle class) (C)	8	21.05%	1	13.88%	55 D	7	2	0.13
	D (low class) (D)	5	45.45% ABC	1	20.00%	22	4	2	0.20
Moment of the day	Morning (A)	42	46.15%	2	4.83%	201	5	9	0.07
	Afternoon (B)	62	68.13% A	2	3.73%	234 AE	4	9	0.10
	Evening (C)	60	65.93% A	3	4.17%	227 E	4	8	0.07
	Weekday (D)	82	90.11% ABCE	5	5.80%	470 ABCE	6	12	0.13
	Weekend (E)	54	59.34%	5	9.13%	188	3	7	0.22
Total		*91*	*26.61%*	*5*	*5,28%*	*657*	*7*	*15*	*0.12*

Source. Own elaboration.

Table 4 reveals the level of influence of specific apps in the totals recorded for health apps. *Calm* (1 user), *Fastic* (2 users), *Fabulous* (3 users) and *Jejum Intermitente – Rastreador em Jejum Zero-Cal* (4 users), at first, seem to play a minor role in the results of health apps. Nonetheless, *Jejum Intermitente* totalled 116 visits, which is statistically significantly higher than the total visits of *Calm* (5), *Fabolous* (6), *Fastic* (55) and *Passe Covid* (16), while those 55 total visits of *Fastic* were also statistically significantly superior to the numbers of *Calm*, *Fabolous* and *Passe Covid* (although *Fastic* has only one-third of the users of *Passe Covid*). If we add up the total users of those four less-used health apps, we only get 10 users (10,99% of the total users of health apps). Thus, we highlight the remaining four apps in the health category. Between those, *Huawei Health* (34 users, 37.36% of health app users) and *SNS24* (37 users, 40.66%) are the biggest contributors in terms of total users. *SNS24* has a statistically significant superiority in comparison to every other health app that it was compared to, while *Huawei Health* is statistically significantly superior to *Fabolous*, *Fastic*, *Jejum Intermitente* and *Passe Covid*. However, those two apps with higher numbers of users do not register other results that could imply an idea of consistent engagement. Although registering statistically significant superiorities of total visits in comparison to the other apps in Table 4, both are the two health apps with lower average minutes spent per day per user (*Huawei Health* with 0.12, *SNS24* with 0.16 minutes). The sampled health app with the

most total visits is *Clue* (205), being statistically significantly superior to the total visits of the remaining apps, except for the 116 of *Huawei Health* (which is also statistically significantly superior in manners of total visits in comparison to the remaining apps of this category). At the same time, *Jejum Intermitente* and *Fastic* have the most engaging metrics of average visits per user (29 and 28, respectively), average page views per user (49 and 42, respectively) and average minutes per day per user (2.00 and 1.50, respectively, which equates to being between 16 and 9 times more minutes spent in those two apps in comparison to the two with higher numbers of total users, *Huawei Health* and *SNS24*).

Table 4. Key metrics of usage by the eight tracked health apps

App	Total Users		Daily Average Users (per Categ.)		Total Visits	Avg Visits per User	Avg Pageviews per User	Avg Minutes per Day per User
	N	% Total	*N*	% Categ.	*N*	*N*	*N*	*N*
Calm (A)	1	1.10%	1	100%	5	5	14	2.00
Clue (B)	18	19.78% CDFG	2	11.99%	205 ACDFGH	11	16	0.17
Fabulous (C)	3	3.30%	1	33.33%	6	2	5	1.00
Fastic (D)	2	2.20%	1	57.89%	55 ACG	28	42	1.50
Huawei Health (E)	34	37.36% CDFG	2	4.72%	154 ACDFGH	5	11	0.12
Jejum Intermitente (F)	4	4.40%	1	34.48%	116 ACDG	29	49	2.00
Passe Covid (G)	6	6.59%	2	28.57% EH	16 AC	3	9	0.33
SNS24 (H)	37	40.66% BCDFG	2	5.34%	100 ACDG	3	9	0.16

Source. Own elaboration.

4. Discussion

Health apps, according to the results of Table 2, show minimal engagement despite seemingly being the second most used category (26.61% of participants), only after social media and messaging apps. According to the bilateral statistical tests (*t*-tests for samples < 30; *z*-tests for samples > 30), the number of health app users is statistically significantly superior to the registered by fitness, dating and self-tracking apps. Only 5.29% of users engage daily (thus being statistically significantly inferior to the percentage of DAU of dating and social media and messaging apps), with an average of just 0.12 minutes per day. Interaction metrics, including visits (7/user) and pageviews (15/user), are the lowest among all categories. In contrast, social media apps dominate the key usage metrics among the sampled young adults in Portugal, with several statistically significant nuances, while even games and dating apps significantly outperform health apps in engagement. This highlights a gap in sustained user interaction with health apps, perhaps suggesting a need to improve their appeal and usability to enhance such engagement. This, possibly, highlights a higher need for the gamification of health apps (Cechetti *et al*., 2019; Whitson, 2013), which would solidify the idea of those apps dealing with "situated objectivity" (Pantzar & Ruckenstein, 2017).

The results of Table 3 shed a focus on health app usage, focused on the sociodemographic factors of the sample. Thus, answering "*RQ1*: How are social and demographic factors linked to using health apps among young adults in Portugal?". Such analysis of health app usage across sociodemographic groups highlights

notable differences. At first glance, we identify that women are slightly more likely to use health apps (30.85%) than men (20.57%), therefore reinforcing the conclusions of our previous work that pointed out traditional gender roles in health app usage, with health concerns and taking care of oneself being identified as a feminine characteristic (Antunes *et al.,* 2023a). However, the following metrics of usage do not translate such a notable gender imbalance, although women have some more engaged metrics such as visits per user (9 vs 3) and pageviews per user (17 vs. 10). Age-based differences are subtler, with young adults aged 25-30 years old showing slightly higher average usage metrics, including visits (8 vs 5) and pageviews (16 vs. 13), compared to those aged 18-24 years old.

As for the region of Portugal, some disparities were noticed. While the Algarve had the highest proportion of users (39.29%), Lisbon users demonstrated greater engagement, with the highest visits per user (13) and time spent per day (0.38 minutes). Nonetheless, the total number of Lisbon users was lower than that of the other Portuguese regions, suggesting higher engagement but lower popularity. The Lisbon area is the most urban region with the most significant metropolitan area in the country, which may suggest a link between engaged health app usage and metropolitan/urban young adults, corroborating the work of Hale *et al.* (2010). In terms of socioeconomic class, we found minimal differences, except for the lower-middle class ("C2"), which had a higher percentage of daily users (13.88%), or the statistically significantly higher proportion of lower-class ("D") total users (45.45%) in comparison to all the socioeconomic class. Nonetheless, the sample of D-class young adults is small, which suggests caution on the interpretation of these statistical differences. To highlight such results, it may be interesting to restate Gabrys's (2014) point that health apps can reduce inequalities in health information.

Temporal patterns were also found in the results of Table 3, suggesting that weekday usage dominates (90.11%) with statistical significance, with afternoons (68.13%) and evenings (65.93%) being peak times. These findings underscore nuanced patterns of health app usage, although analysis of consumptions according to the time of the day during COVID-19 should consider those schedules as beyond the rule, due to being periods of national lockdowns, occasional individual isolation periods and the technology-oriented management of the day (Antunes *et al.,* 2023a; Antunes *et al*., 2023b; Osler & Zahavi, 2023). Nonetheless, per-day comparisons reveal a more regular schedule-like higher engagement on weekends, with 0.22 minutes per user versus 0.13 minutes on weekdays.

In terms of comparing apps in the health-focused category, half of the health apps included in the study did not gather enough users for a thorough analysis. Although we had 91 health app users (26.61% of the sample), the sum of the users of each health app only reached 105 users, thus meaning there are only 14 repeated users. Therefore, only 14 young adults (4.09% of the sample and 15.38% of the health app users) have used more than one health app during the entire 90-day period. This points to fragmented usage patterns shaped by each app's specific purposes and functionalities. Thus, our results regarding health apps reinforced De Nadai *et al.* (2019) observations, suggesting that people self-impose limits to their digital usage, both in the amount of time per app and the number of apps used. That self-made imposition requires people to understand each app as a tool for particular purposes and functionalities (De Nadai *et al.,* 2019). In our study, although they do have different purposes and intentions, *SNS24* and *Huawei Health* are the ones of seemingly higher utility. Either serving as public health support or providing broad health tracking, these 2 apps have the largest user bases (both with more than 37% of the health app users), including statistically significant superiorities to most of the other health apps both regarding total users as well as total visits. Yet, *SNS24* and *Huawei Health Huawei Health* reveal low engagement metrics, reflecting their situational use rather than ongoing interaction.

In contrast, niche apps like *Jejum Intermitente* and *Fastic*, both focused on intermittent fasting, stand out differently. Both reveal particularly high user engagement despite their lower user bases. These fasting-focused mobile apps have the most average visits (29 and 28), average pageviews per user (49 and 42) and average minutes per day per user (2.00 and 1.50). These apps cater to specific health goals, potentially fostering more dedicated usage patterns. *Clue* is a particular case out of the eight sampled health apps. A plausible way of understanding its usage metrics would be of a between case in comparison to both broader health support or tracking and also to niche health interests. As a menstrual cycle tracker, the results of *Clue* may reflect its utility for regular and specific health monitoring, particularly the fact that it is the health app with the highest total visits (205) despite being the third in terms of total users (18 users; 19.78%). The 18 users of Clue may reveal a further important aspect of the perceived genderisation of the use of health apps. Although a menstrual cycle tracker is not entirely limited to being used by women, the 18 people who used

Clue are expected to be women, which means that almost 20% of the total number of health app users is justified by using this app.

The key role of COVID-19 must not be ignored, as in fact, it may have played a part in the results found in our study. Therefore, answering "*RQ2*: Does health app usage translate the popularity of health-related topics during the COVID-19 pandemic?", indicates an influence but not to the point of generating highly engaged usage. Namely, the usage metrics of public health-oriented digital tools like *Passe Covid* and *SNS24* also underscore the role of digital health technologies in addressing societal challenges such as that pandemic. Such usages are similar in engagement metrics, although *SNS24* has a more extensive user base (37 users, representing 40.66% of the health app users), perhaps due to its broader utility. In common, they share quite a specific situational aspect, sometimes even more needed as a bureaucratic tool (for example, to get access to places, certifying either if you had COVID-19 previously or were vaccinated). As stated in Mendes *et al*. work (2022) *SNS24* did not face substantial challenges in getting younger generations to use it, but instead faced difficulties in the elderly population. Both *Passe Covid* and *SNS24* are public sector-created apps, designed to be tools for better information integration and management in the national healthcare systems. Therefore, there is no market need for having highly engaged users, unlike the privately owned, profit-minded remaining apps, despite some being more of a broad nature and others particularly niche.

5. Conclusion

Although this study adopts a critical feminist perspective (Barad, 2014; Bennett, 2010; Braidotti, 2016, 2019; Haraway, 2008, 2016), the empirical analysis considered only two gender categories (women/men), a limitation stemming from the dataset provided by the external data collection company (Netquest), whose panel does not include other gender identities. This methodological constraint highlights the need for future studies to demand greater gender inclusivity in data collection instruments. Furthermore, although the sample is statistically considerable (±5% margin of error, 95% confidence level), it does not have a representative distribution of the young adult population in Portugal, which limits generalisations of the findings. Lastly, and despite including some bilateral statistical tests, the mostly descriptive nature of the statistical analysis is justified by the study's exploratory design, the fragmented patterns of app usage (De Nadai *et al*., 2019), and the exceptional context of the COVID-19 pandemic, which challenges the assumptions of normality required for robust statistical inference.

The results of health app usage, combined with the contextual information about the apps included in the study, highlight the diversity and varied engagement levels within the category. Despite some idea of the peaked popularity of health apps, the context of COVID-19 mattered to the results of this study. Young adults in Portugal seem to not follow other nations' trends of high usage of health-related technologies despite recognising the importance of those issues, particularly mental health-related problems, as suggested in previous studies of our team (Alcaire *et al*., 2024; Amaral *et al*., 2023; Antunes *et al*., 2023a). Not surprisingly, social media and messaging apps outshined the remaining categories of apps, as every participant of the sample used them at least once during the 90 days, while 39.39% of the sample used them, on average, at least daily. Following the dominance of social media and messaging apps, health apps got the second biggest number of total users (91 young adults, which was 26.61% of the sample), although the remaining metrics revealed that such a user base was not engaged in health app usage. In fact, the category of health apps registered the lowest numbers of daily average users (5 users per day, 5.29%), average visits per user (7), average pageviews per user (15), and average minutes per day per user (0.12).

Whilst health app engagement usage was, overall low, results showed that a significant portion of those users arose from the particular time of COVID-19. Nonetheless, sociodemographic factors revealed nuances in particular usage metrics, both in the number of users and the level of engagement of those same users. Gender and region of Portugal seem to be the most impacting sociodemographic factors on the usage of health apps by young adults. Not surprisingly, the gender imbalance shows that women are both more likely to use and to be engaged in the usage of health-related apps. Although the region of Portugal results were less clear, the young adults of the Lisbon area seem to be the most engaged users. Therefore, aligned with the adopted feminist and critical perspective of digital media, those particular patterns both reinforce traditional gender roles that equate health concerns with femininity (Antunes *et al*., 2023a), and medical sociology previously studied ideas of people from urban areas being more likely to use digital-based technologies for their health concerns (Hale *et al*., 2010).

Our sample of health apps ranged mobile applications within a diverse array of concerns and goals, from mindfulness/mental health, to intermittent fasting or menstrual cycle trackers, some of the apps have a more fitness and physical health tracking logic, while the others intend to address public health needs and societal challenges, namely COVID-19. The last type of app had the one (*SNS24*) with the biggest user base out of the health app sample. Those apps, more than being instruments for young adults to take care of themselves, are mere tools for navigating the COVID-19 world, either to show that someone is vaccinated, has been infected or not, and overall, can proceed with its life. We suggest that this general trend of lower engagement may be tested continuously in Portugal but also in other geographical contexts after the COVID-19 period in order to reevaluate the pandemic weight on the popularity of health technologies.

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Conflict of interests

The authors confirm their compliance with the declaration of having no competing interests relevant to the content of this article.