



Self-Reported Smartphone Addiction Among Brazilian Adolescents in the COVID-19 Pandemic Context: a Mixed-Method Study

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Abstract

This study intended to (1) estimate the prevalence of Self-Reported Smartphone Addiction among adolescents and (2) know the adolescents' perspective on smartphone addiction in the COVID-19 pandemic context. The research is a sequential explanatory mixed-method study conducted with adolescents aged from 15 to 18 years old. In the first phase, a cross-sectional study was carried out with 479 adolescents and, in the second, an exploratory research with a qualitative approach was conducted with 16 participants, who were in the Focus Groups sessions. The estimated prevalence of self-reported smartphone addiction was 56.37%. The most prevalent symptoms were those related to the tolerance. Sequentially, from the qualitative analysis, two categories were identified that reveal how adolescents perceive smartphone addiction in the COVID-19 pandemic context, as well as how they unveil the elements that characterize this addiction. It can be concluded that most adolescents were classified as smartphone addicted and this is admitted by most of them during the sessions. The addictive relationship established with the device was intensified by the consequences of the pandemic. Thus, health professionals must implement actions aimed at an adaptive behavior towards smartphones and that promote mental health in adolescence.

Keywords Smartphone addiction · Adolescents · Adolescents' behavior · COVID-19 pandemic

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Introduction

The popularity of smartphones is impressive, and they are increasingly ubiquitous in the lives of human beings. In June 2021, there were already 242 million smartphones in use in Brazil, corresponding to 1.1 devices per inhabitant (Meirelles, 2021). The country is considered the first in the world with the highest daily mean hours spent on smartphones (5.4 h a day) (App Annie, 2022).

Adolescents stand out among the supporters of these devices. They are digital natives and, therefore, deal with their contents in different ways. Frequently, they cease to be mere consumers and become content producers as well. This communication media convergence has altered the logic by which the media industry operates and by which consumers process news and entertainment (Coutinho, 2015). All of this interactive media, it becomes fascinating to them and provides a fertile environment for normative development tasks, such as seeking life experiences, exploring one's identity and prestige, establishing autonomy, and connecting with peers (Rich et al., 2019).

The last National Continuous Household Sample Survey, in 2018, found that the percentages of Brazilian adolescents who had a cell phone for personal use were 75.0% in the age group from 10 to 13 years old, 87.7% between 14 and 17 years old and 90.3% between 18 and 19 years old (Instituto Brasileiro de Geografia e Estatística, 2020). A Brazilian study that collected data from adolescents in 2019 revealed that the time connected to smartphones was nearly 5.8 h on weekdays and 8.8 h during the weekend (Nunes et al., 2021). This prominent role of smartphones in modern everyday life has raised questions from parents, teachers, health professionals, and researchers regarding their dysfunctional use, especially in the COVID-19 pandemic context.

In this pandemic, as the virus is highly transmissible and potentially fatal, closure of schools, home quarantine, and physical distancing were implemented in order to mitigate its spread. Many schools have adopted the emergency remote teaching regime, which leads to increased use of electronic devices by the students (Shin & Al-habaibeh, 2020). A study has found that there was a considerable increase in smartphone use during the pandemic (nearly 1730 min, equivalent to an approximate mean of 29 h a week) (Xiang et al., 2020). The amount of daily hours that Brazilians, on average, have spent on their smartphones has grown in recent years: the country went from 4.1 h a day, in 2019, to 5.2 h a day, in 2020, until reaching 5.4 daily hours in 2021 (App Annie, 2022).

Data transmission by digital means has become the only way to not completely interrupt social and work interactions, in an attempt to simulate and re-establish a "new normality" given the pandemic (Deslandes & Coutinho, 2020). In this perspective, a research study has shown that adolescents in different parts of the planet have increased their smartphone use, with many of them reporting resorting to social media to keep in touch with their peers (Fernandes et al., 2020).

However, the generalized and widespread use of these devices has become a social norm, exposing adolescents to various risks, as they are fast and enthusiastic adopters of this technology (Rich et al., 2019). Thus, despite the

convenience of smartphones in times such as the COVID-19 pandemic, their dysfunctional use can lead to addiction, being understood as their non-adaptive or obsessive–compulsive use, a state of immersion in the uncontrollable use of the devices, to the point of suffering adverse consequences in everyday life (Yu & Sussman, 2020). It is a technological addiction, that is, non-chemical behavioral addiction, involving man–machine interaction and causing negligence in other life areas (Griffiths, 1996).

Although most research studies use the “addiction” terminology (Yu & Sussman, 2020), researchers propose the use of alternative terms such as self-reported smartphone addiction (SRSA) when the studies use self-reporting measures (Panova & Carbonell, 2018). Specifically, the term addiction is defined by the World Health Organization as the continuous use of something for the purpose of obtaining relaxation, comfort, or stimulation, usually accompanied by discomfort through its absence. Behavioral addiction, in turn, is understood as a habitual impulse or compulsion to continue to repeat a behavior, despite its negative impact on well-being (World Health Organization, 2006). Among them, the SRSA seems to be the most recent (Freitas et al., 2021). The SRSA is characterized by withdrawal symptoms (anxiety, irritability, and impatience), lack of control regarding use of the devices, longer use time than initially expected, tolerance symptoms, inferences in activities of daily living, positive anticipation, and maintenance of use frequency despite negative consequences (Khoury et al., 2017).

Transposing this conception of the compensatory satisfaction theory (TSC) to explain the role of satisfaction in pathological Internet use, the use of the smartphone would serve as a compensatory method to satisfy the socio-emotional needs of people. Furthermore, the TSC suggests that online psychological need satisfaction might compensate for the lack of offline psychological needs satisfaction and then become a prior choice for adolescents to satisfy themselves, increase the risk of SRSA. Therefore, adolescents who are not satisfied with their current conditions in real life are more likely to develop SRSA, because online interactions can offset their dissatisfaction (Liu et al., 2016). In this sense, the dissatisfaction with the, COVID-19 pandemic can be getting the adolescents to use their smartphone more in search of satisfying their needs, such as relieving boredom, loneliness, or frustration in search of an emotional elevation.

Publications regarding this theme in Brazil are still incipient, and they focus on the validation of scales. In addition to the importance of knowing the prevalence of the event among Brazilian adolescents, the relevance of investigating the perception of adolescents about SRSA and how the COVID-19 pandemic had an impact on it. The absence of data prior to the pandemic prevents the quantitative analysis of its impact on SRSA. Then, qualitative research is pertinent to the investigation of such aspects. Thus, it will be possible to think of strategies to reduce harm and promote the mental health of adolescents who live with this health risk.

That way, this study intended to: (1) estimate the prevalence of self-reported smartphone addiction among adolescents and (2) know the adolescents’ perspective on smartphone addiction in the COVID-19 pandemic context.

Method

Study Design

This is a mixed-method study with a sequential explanatory design, in which the research steps fall into clear and separate stages, although combined, as recommended by the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). In the first phase (QUAN), a cross-sectional study was carried out. Subsequently, the second phase was conducted, based on an exploratory research study with a qualitative approach (qual), helping to explore the quantitative results. In addition, this type of study makes it possible to detect whether there is disagreement, agreement, and qualitative explanations for the initial quantitative results (Creswell & Poth, 2016). Figure 1 shows the representative diagram of the study design.

Participants and Setting

The study participants were adolescents from 21 public schools and four private educational institutions. All public and private schools in the urban area from Cuiabá, Mato Grosso, Brazil were invited to participate in the study, but only those that authorized and supported the research were included. The adolescents aged between 15 and 18 enrolled in these schools and who had a smartphone with Internet access were eligible. The stratified sample size of the quantitative study was calculated by the finite population method. Considering a 95% confidence level, 50% for the phenomenon, a population size of 21,164, and a 5% error, this resulted in an expected minimum sample of 377 individuals (287 from public schools and 90 from private educational institutions). Although 495 young adolescents participated in the study, 16 answers were excluded due to duplicity. Therefore, the total sample consisted of 479 subjects (27.1% higher than expected), with 388 students from public schools and 91 from private educational institutions. In the qualitative phase, 16 adolescents already investigated in the first phase (QUAN) participated, intentionally selected.

Data Collection and Quantitative Analysis

Data collection took place through an electronic form containing personal questions (name, age, gender, school, and telephone contact) and the 26 items of the Smartphone Addiction Inventory for Brazil (SPAI-BR) (Khoury et al., 2017). We opted for the electronic form because schools were closed, maintaining emergency remote teaching in the initial period of data collection. SPAI-BR has four domains: compulsive behavior, functional impairment, withdrawal, and tolerance (Khoury et al., 2017). In 2021, the same scale was validated with Brazilian adolescents and presented good internal consistency ($\alpha=0.88$), with reliable time stability values (intraclass correlation coefficient=0.83) (Andrade et al., 2021). The authors

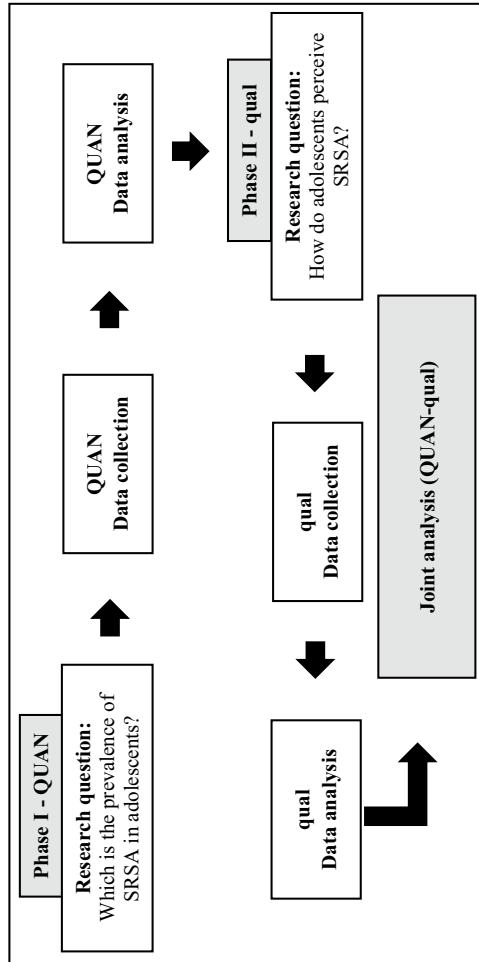


Fig. 1 Diagram representing the study design

identified that the ideal SPAI-BR cutoff score for adolescents to be considered smartphone addicts is ten, being adopted in this research.

The students were invited to participate in the study through group messages on instant messaging apps administered by the schools or through email messages directed to the his parents or guardians. The invitation to participate in the research, sent by the school management, contained information and clarifications regarding the research and the access link to the electronic form, as well as the contact of the main researcher of the study. Quantitative data collection took place from April to July 2021. Then, a descriptive analysis was performed, and the Cronbach's alpha of SPAI-BR was calculated, which presented good internal consistency ($\alpha=0.88$). The analyses were performed using the STATA 11.1 software.

Data Collection and Qualitative Analysis

After the quantitative analysis, sequential data collection (qual) was carried out in July 2021 with selected adolescents already investigated in the first phase, classified as smartphone addicted, in five Focus Groups (FGs) sessions. A priori, groups with six adolescents were assembled; however, some of them did not attend the virtual meeting, resulting in different numbers across the groups. Recruitment was terminated due to reaching sufficient Information Power to meet the objective proposed (Malterud et al., 2016).

The FGs were carried out by a nurse, who acted as moderator, and by two undergraduate nursing students, who acted as reporters of the FGs. While the moderator had the role of focusing on the theme, promoting everyone's participation and inhibiting monopolization of the word, the reporters took down notes and recorded the FGs in audio and video. Due to the physical distancing imposed by the pandemic, it was decided to use an instant messaging app to carry out the virtual meetings, as it is well accepted among the adolescents and includes the option to establish video calls with up to eight participants.

A virtual meeting was held with each group, consisting of the following key moments: opening of the session, welcoming of the participants, clarification on the dynamics of participatory discussion, definition of the setting, debate, synthesis, and closure of the session (Kinalski et al., 2017). The interviews lasted between 51 and 106 min across the groups. To achieve the objectives of this study, a semi-structured script was elaborated based on the following triggering questions: "Tell me about your relationship with the smartphone these days" and "Why do you consider yourself addicted to your smartphone?". The script went from the general to the specific, to allow for an enthusiastic and participative debate, as well as to generate deepening of the ideas. We opted for the virtual meeting because public schools were closed, maintaining emergency remote teaching in the period of data collection. Only private schools were operating face-to-face during the qualitative data collection period; however, students had the option of maintaining emergency remote teaching and many were not attending face-to-face classes.

The recording of the sessions was fully transcribed and subjected to content analysis by Bardin (2016). First, we carried out the pre-analysis, establishing the

initial contact with the texts, allowing ourselves to be invaded by impressions and guidelines, in a phase called “floating reading.” Sequentially, the texts were selected for analysis according to the research objectives. Then, the material was explored, with the organization of the content into units through a new reading of it. The domains of the instruments used were predefined as initial units. Then, the units were classified into categories, grouping data taking into account what they had in common. After defining the categories and identifying the constituent material of each one, the findings were described (Bardin, 2016). The Atlas.ti 9.1.5.0 software was used as an aid in this analysis. The participants’ statements were presented with the fictitious names chosen by them, their age, and the score obtained in SPAI-BR.

Combination of Quantitative and Qualitative Data

After collecting and analyzing the quantitative and qualitative data, in clear and separate stages, data were combined together with the discussion, through the connection and joint assessment of the quantitative and qualitative results interpreted.

Ethical Considerations

This study is part of a matrix survey approved in April 2021 by the Research Ethics Committee, under opinion No. 4,661,013. There was authorization and support from the participating schools for data collection. Authorization was also requested from the parents or guardians of participants under 18 years of age, via the Informed Consent Form, as well as that of the participants through the Free and Informed Assent Form.

Results

Quantitative Phase

Among the 479 adolescents who participated in this study, 74.11% were female (=355) and 25.89% were male ($N=124$), with a mean age of 16.03 years old ($SD=1.01$), with 81.00% ($N=388$) of the students from public schools and 19.00% ($N=91$) from private educational institutions.

A 56.37% prevalence of SRSA was estimated among the adolescents investigated ($N=270$). Table 1 presents the prevalence of the characteristic symptoms of SRSA in adolescents from a capital city in the Brazilian Midwest region.

Table 2 shows the dispersion measures of the standardized SPAI-BR scores, as well as of its domains. The mean SPAI-BR score among the adolescents investigated was 11.04 ($SD=6.05$).

Table 1 Prevalence of SRSA in adolescents, according to SPAI-BR symptoms (N = 479)

Domains	Symptoms	N (%)
Compulsive behavior	I feel very vigorous upon smartphone use regardless of the fatigue experienced	273 (56.99%)
	I use the smartphone for a longer period of time and spend more money than I had intended	110 (22.96%)
	Although using the smartphone has exerted negative effects on my interpersonal relationships, the time spent on the Internet remains unreduced	217 (45.30%)
	I feel distressed or down once I stop using the smartphone for a certain period of time	158 (32.99%)
	I fail to control the impulse to use the smartphone	203 (42.38%)
	My recreational activities are reduced due to smartphone use	167 (34.86%)
	My life would be joyless if it wasn't for my smartphone	286 (59.71%)
	Surfing the smartphone has exerted negative effects on my physical health. For example, using the smartphone when crossing streets; fumbling with the smartphone while driving or waiting, which resulted in dangerous situations	67 (13.99%)
	I tried to spend less time on the smartphone, but the efforts were in vain	195 (40.71%)
	More than once, I have slept less than four hours due to using the smartphone	259 (54.07%)
Functional impairment	I find myself indulged on the smartphone at the cost of hanging out with friends	108 (22.55%)
	I feel aches and soreness in the back or eye discomforts due to excessive smartphone use	238 (49.69%)
	Using the smartphone has exerted certain negative effects on my school or job performance	171 (35.70%)
	My interaction with family members is decreased on account of smartphone use	145 (30.27%)
	I make it a habit to use the smartphone, and sleep quality and total sleep time decreased	204 (42.59%)
	I need to spend an increasing amount of time on the smartphone to achieve the same satisfaction as before	87 (18.16%)
	I feel tired during daytime due to late-night smartphone use	173 (36.12%)

Table 1 (continued)

Domains	Symptoms	N (%)
Withdrawal	I feel uneasy once I stop using the smartphone for a certain period of time	223 (46.56%)
	I feel restless and irritable when the smartphone is unavailable	200 (41.75%)
	The idea of using the smartphone comes as the first thought in my mind when I wake up every morning	277 (57.83%)
	I feel that I'm missing something after stopping using the smartphone for a certain period of time	200 (41.75%)
	I feel the urge to use the smartphone again immediately after I stopped using it	220 (45.93%)
Tolerance	I cannot have a meal without using the smartphone	124 (25.89%)
	I was told more than once that I spend too much time on the smartphone	372 (77.66%)
	I find that I have been hooking on the smartphone longer and longer	343 (71.61%)
	I have substantially increased my time using the smartphone per week in the last 3 months	267 (55.74%)
Total		270 (56.37%)

Table 2 Dispersion measures of the SPAI-BR scores, according to the domains ($N=479$)

Domains	Min	Max	Median	Mean	SD
1. Compulsive behavior	0	9	3	3.50	2.22
2. Functional impairment	0	8	3	2.89	2.17
3. Withdrawal	0	6	2	2.59	1.92
4. Tolerance	0	3	2	2.05	0.99
Total	0	26	11	11.04	6.05

Min, minimum; *Ma*, maximum; *SD*, standard deviation

Qualitative Phase

From the analysis of the qualitative data, it was possible to identify two categories that illustrate how the adolescents perceive smartphone addiction in the COVID-19 pandemic context, and unveil the characterizing elements of self-reported smartphone addiction, as explained below:

Perceiving Smartphone Addiction in the COVID-19 Pandemic Context

Some adolescents “considered themselves addicted to smartphones,” especially in the pandemic context. In their statements, it was possible to verify that this perspective is mainly due to the time they spend connected, to the affective relationship established with the device, to the ubiquity of the smartphone in their lives, and to the emotional need to use the device:

Yes, I’m addicted, because I, time that I have, I spend it on the phone, 24 hours [...]. It looks like it’s my son [...], I’m a real cell phone addict (Nayane, 17, SPAI-BR 22).

Ah, I consider addicted myself, right?, because I always go out with it [...]. But kind of, I’m still very addicted, I have to stop this [...]. Today, with the pandemic and such, I am, I’m addicted, yes, if it broke I think I would be very sad (laughs) (Apolo, 17, SPAI-BR 12).

Yes, it really is an addiction (Jaqueline, 16, SPAI-BR 13).

Other adolescents, although they consider themselves addicted to smartphones, believe that their scores are low due to slightly more control in use, when compared to their FG peers:

If I have it, I think it’s a very low level (Marco, 15, SPAI-BR 11).

Oh, I also think I’m a bit short of an addict, because kind of, when the battery runs out, sometimes when I’m on the street, I don’t get desperate like that to go back to charge it (Alexandre, 16, SPAI-BR 11).

On the other hand, some adolescents, even though they talked about different elements that characterize smartphone addiction during the FGs, did not consider themselves more addicted. This perception seems to be related to certain improvement

they noticed regarding most recent use of the smartphones, such as being able to go out of the house without them, spending some time without being connected to the devices, or simply associating that, as the smartphones make them feel well, it is not characterized as an addiction, as illustrated in the following reports:

Not anymore now, but there was a time when it was so. I had, kind of, I couldn't go out of the house if I didn't have a cell phone in my pocket, sometimes I felt it vibrated, kind of, I had to look, no matter what situation I was in, in the middle of a class [...] but it's calmer now, so much so that I can now go out of the house without picking up the cell phone (Pedro, 18, SPAI-BR 19).
Ah, I was quite addicted, now I don't consider one myself, because I've been without a cell phone for a long time [...] (Gabriel, 17, SPAI-BR 12).
Look, I don't consider myself addicted to the smartphone, because for me, whether I'm with it or not, I feel normal, I feel good (Júlia, 15, SPAI-BR 16).

According to the adolescents, the COVID-19 pandemic exerted a considerable influence on the addictive relationship they established with their smartphones. They attribute this to the change in the routine, to the feeling of boredom, to physical distancing and isolation, to the closure of schools, and to the interruption of leisure activities because of the preventive measures established during the pandemic, as well as the plethora of resources in the device for everything they need:

We want to get away from reality a little (Emily, 17, SPAI-BR 14).
I need the phone, there's nowhere else to run, everything is there, then you end up becoming more addicted in the end (Luiza, 16, SPAI-BR 19).
Boredom too, sometimes like this, I have nothing to do, so I say: I'm going to the cell phone! [...] then only the COVID thing, then it leaves us even more down, because knowing that there's death and those things, then I stay on the cell phone (Mary, 17, SPAI-BR 13).
Yeah, before the pandemic we had another routine, right, because then I went to school, I was disconnected, I had were those moments, I went out more with my family [...], then we tried to do other types of things and we forgot about everything. There's no way now, it's 100% connected! (Luiza, 16, SPAI-BR 19).

Unveiling the Characterizing Elements of Self-Reported Smartphone Addiction

The statements by the adolescents unveiled the elements that characterize SRSA, such as compulsive behavior, as they stated spending the entire day connected to their smartphones and not living without them, taking the devices everywhere with them. As with the impulse and lack of self-control in use, with permanent attraction towards the device, longer use than expected, and even in the face of interference in activities of daily living, such as leisure:

Without it, I can't survive [...]. I spend the whole day on the cell phone (Nayane, 17, SPAI-BR 22).

I use it all the time (laughs), I take it everywhere too [...]. Then kind of, I start fiddling with it and I can't stop. [...] It seems that the cell phone calls me [...] when I pick it up, I don't let go of it anymore (Mary, 17, SPAI-BR 13).

I forget, I don't see the time, kind of, I stay on the cell phone and lose notion of time (Luiza, 16, SPAI-BR 19).

Using the cell phone is such a deep-rooted habit that it's like a routine, you know? So, I don't even think about using the cell phone (Marco, 15, SPAI-BR 11).

Sleep changes were also one of the functional impairments revealed by the adolescents in view of the behavior established with the smartphone. They asserted the occurrence of sleep time inversion and that, when they stay connected until late at night, they tend to feel sleepy in the morning and to sleep during the day. In addition to that, physical symptoms such as headache, eyestrain, and musculoskeletal disorders in the neck, back, and hands have been reported. See below:

In the morning I feel sleepy, I feel very sleepy, but at dawn I'm not sleepy at all, you know? Exchanging day for night. So, that's basically it (Emily, 17, SPAI-BR 14).

I usually go to sleep at 1 am, 2 hours, fiddling with the cell phone. [...] I have a lot, a lot, a lot of headaches, when I use the cell phone, I have neck pain, I have sight problems, even with glasses I get really tired, because I use the cell phone a lot (Liana, 17, SPAI-BR 19).

Sometimes there's that pain in the back, right, crooked spine and, sometimes, the eyes also burn a little too (Jaqueline, 16, SPAI-BR 13).

[...] Pain in the fingers, because sometimes I keep typing, right, on the cell phone all the time, pain in the body, sometimes, when I'm lying down a lot, sitting, right (Mary, 17, SPAI-BR 13).

It was also noticed that the adolescents sometimes preferred to stay connected to their smartphones for longer periods of time than to be with their peers. They consider the device as a "friend" and perceive that the more intense their smartphone use, the lower the offline engagement with people. For them, interpersonal relationships tend to be difficult, which is why smartphones end up being a more pleasant company:

Look, I can't explain it well, after this pandemic started, I stopped talking to all of my friends and started spending more time on the cell phone, and it's hard, because the longer I stay on the cell phone, the more I keep getting away from people (Antonio, 15, SPAI-BR 11).

I'd rather stay with my cell phone than with people, because I don't know, it's my thing, because I prefer a thousand times to be on my cell phone and access things than in a circle of people or in some corner [...]. It's my friend, kind of, my virtual friend (Júlia, 15, SPAI-BR 16).

People are difficult to deal with, some have no idea, not the cell phone, the cell phone is, when you get tired of it, you put it aside like that, and that's it (Emily, 17, SPAI-BR 14).

Other important functional impairments mentioned by the adolescents were worse performance in studies and impairment of activities of daily living. Sometimes, they stop doing school activities, homework, physical activities, and many leisure activities to spend more time on their smart devices:

I waste a lot of time, kind of, mainly in the matter of studying, I've had a lot of difficulty studying because of lack of focus and soon I end up getting lost, like that... and I don't see time pass, kind of... Complicated, I think that, kind of, it stopped being something good to become something that actually takes up my time, you know? [...] I become an observer and, kind of, I'm there and the real world is just happening in automatic mode (Pedro, 18, SPAI-BR 19).

[...] I should be studying, even because I'm going to take ENEM now right and, kind of, ENEM is everything, then I stay on the cell phone all the time and it takes a lot of time from me [...], then I feel bad (Mary, 17, SPAI-BR 13). I was used to doing physical exercise [...], only that, with the pandemic, I got discouraged, even because of the cell phone, even on the social networks, or videos that I watch [...] (Mary, 17, SPAI-BR 13).

Presence of withdrawal symptoms was noticed, such as anxiety about use, irritation when not using the smartphone, and using it immediately after waking up and during meals. It is possible to identify the presence of a feeling of anger due to restriction of the device, inattention, and an incessant need to occupy the mind with the various activities offered by the smartphone, in a search to fill the existential void:

Because the minute I wake up, it's already at my side [...], to pass time faster I fiddle a little. [...] I get grounded due to the cell phone, she hides it from me, then I ask: Mom, where's my cell phone? [...] I get angry because my mom takes my cell phone away from me. There are times that my mom fights with me to eat and to get off the cell phone because I like to eat while fiddling with it [...] (Nayane, 17, SPAI-BR 22).

There's that sensation that, kind of, you can't just enjoy the present to do something, you have to occupy your mind with something you know, because otherwise you feel unproductive [...], it's more or less this situation of not being able to stand still and do nothing (Pedro, 18, SPAI-BR 19).

I can't be without it, everything I do is in it, most of the things, not everything, right?, then I get crazy, I get changed in my head (Aria, 16, SPAI-BR 23).

I can't live without my cell phone anymore. [...] If I don't use the cell phone, something is missing, I feel as if there's a hole like that in the day, you know? [...] I spend all day on the cell phone, and when I'm not with it, I miss it, it's strange, very strange... (Emily, 17, SPAI-BR 14).

Finally, tolerance symptoms were also mentioned by the adolescents, such as third parties expressing concerns about their intense smartphone use, especially evidenced by the longer connection time after the beginning of the COVID-19 pandemic.

Before, I already used the cell phone a lot and with the pandemic it only increased now, what was 90% turned into 100% cell phone, all day long (Liana, 17, SPAI-BR 19).

After the beginning of the pandemic I started to use it a lot, more than normal (Emily, 17, SPAI-BR 14).

[...] during the pandemic everything seems to have become more intense. [...] Everyone says that I spend a lot of time on the cell phone (Luiza, 16, SPAI-BR 19).

[...] my family says that I spend a lot of time on the cell phone (Isis, 15, SPAI-BR 19).

My friends also complain sometimes (Jaqueline, 16, SPAI-BR 13).

Discussion

This study estimated that most of the adolescents were classified as smartphone addicted and that there was predominance of some of the characteristic symptoms of dependence, mainly those of tolerance. According to a literature review, the prevalence of SRSA among adolescents has varied from 4.3 to 70% in various countries around the world (Freitas et al., 2021), mainly due to the several methodologies, instruments, and samples used, which hinders comparisons (Gutiérrez et al., 2016).

The highest rates were identified in countries with high technological penetration among the younger population, for example, South Korea with 70% (Freitas et al., 2021). Therefore, the fact that Brazil is considered the first country in the world with the highest daily mean of hours spent on smartphones (App Annie, 2022) can be directly related to the prevalence identified in this study. So much so that the findings of two studies carried out with adolescents in São Paulo, Brazil, are similar to those identified in this survey, with prevalence values of 53.2% and 56.1%, respectively (Andrade et al., 2020, 2021).

Another survey carried out with adolescents in Ceará, Brazil, estimated a higher prevalence (70.3%). Although the authors have used the same scale in this study, a cutoff point of seven was considered, which can explain this higher prevalence (Nunes et al., 2021). It is noteworthy that the cutoff point of ten achieved the best sensitivity (79.87) and specificity (78.15) with the adolescent population (Andrade et al., 2021), reason why it was adopted in this research.

In this sense, the sequential qualitative research study allowed noticing that, in general, the adolescents showed awareness about such condition, as described in the “[Perceiving smartphone addiction in the COVID-19 pandemic context](#)” category. In addition, this category elucidates the impact of the COVID-19 pandemic on SARS. The absence of quantitative data prior to the COVID-19 pandemic makes it impossible for us to make a comparison between the pre and pandemic period. Thus, the qualitative findings were important for revealing the adolescents’ perception of the repercussions of the pandemic on the addiction relationship they established with their smartphones in this scenario.

The adolescents who admitted addiction at lower levels presented scores of 11, closer to the cutoff point. However, those who expressed recent changes in behaviors

related to smartphone use did not consider themselves addicted at the time of the FGs, although they were classified as such through SPAI-BR. By changing their behavior, previously acknowledged as addictive and identified by the scale, the adolescents began to perceive themselves as non-addicts, taking into account the evolution they observed. Even not declaring the addictive condition when asked, these adolescents portrayed several symptoms during the sessions, which are also reputed for the SRSA classification by SPAI-BR.

The symptoms listed were related to compulsive behavior, functional impairment, withdrawal, and tolerance, such as those considered in SPAI-BR. Therefore, the qualitative results from the FGs and presented in the “[Unveiling the characterizing elements of Self-Reported Smartphone Addiction](#)” category converge with quantitative findings obtained in relation to the SRSA symptoms, as well as they better contextualize their occurrence.

The most prevalent symptoms related to compulsive behavior converge with those mentioned by the adolescents in the sessions, such as longer time spent on the smartphone, its ubiquity, impulsiveness and lack of control in use, longer use than expected, and emotional attachment to the device. The individuals with greater search for reward and high impulsiveness are more likely to be harmfully involved with smartphones. Impulsiveness has been related to addictive behavior, and decreased control and impulse by the device is an essential characteristic of SRSA (Kim et al., 2016).

The results of the qualitative phase in relation to functional impairment are in line with the prevalence noticed in the quantitative phase, in which sleep changes, harms in personal relationships, and physical symptoms are observed. A previous study also pointed out that SRSA leads to complaints related to pain in the cervical region, upper back and wrist, in addition to changes in the sleeping pattern (Nunes et al., 2021). These impacts on the adolescents’ sleep regime, personal relationships, and physical conditions are worrying, as they can trigger physical and mental disorders, which makes it important to encourage conscious and monitored use.

In addition, other functional impairments disclosed by the adolescents were worse performance in studies and impairment in activities of daily living. These losses or the possibility of harms in various life areas arising from SRSA have already been identified in other studies (Abi-Jaoude et al., 2020; Khoury et al., 2019). It was found that the adolescents are distracted by their smartphones and lose focus on their studies and other activities of daily living, devoting all their attention to the devices. Although they sometimes feel guilty and wish to stop using it, they feel unable to achieve such a feat.

The perspective of being mere spectators of real life stands out, immersed in a digital world that takes place in automatic mode, that is, being very involved with their smartphones and only watching “real life” go by. A previous study had already detected that addicted subjects tended to prefer the virtual world through the device to the detriment of real life (D. Kim et al., 2014). This automatic habit can significantly strengthen the link between rewards for reinforcement (perceived satisfaction and mood regulation) and SRSA (Chen et al., 2019).

In the quantitative study, most of the symptoms referring to withdrawal presented prevalence values above 41%, manifested by anxiety about use, irritation when not

using the smartphone, and using it immediately after waking up; although use during meals has presented low prevalence in the quantitative study, in the qualitative phase it was indicated by most of the sessions. A number of researchers reiterate the presence of unhealthy eating habits among smartphone addicts (Lee et al., 2017).

Users who are addicted to their smartphones see their anxiety increase when the device is away from them, even when they know it will be in their possession soon, and they grow significantly more anxious as time passes by (Cheever et al., 2014). These same authors point out that it may be about separation anxiety, in which users experience a sense of loss when their device is absent. Since adolescents rely on their smartphones for everything, as mentioned by them, the devices take on the role of substitute “friends” that satisfy their needs and desires. When the device is removed from them or even placed out of sight, addicted individuals are then faced with separation anxiety (Cheever et al., 2014).

Tolerance was the domain with the highest score in this research, marked by the increase in the time spent with the device and the concern of third parties about increasingly intense use by the adolescents. These findings were also evidenced in the qualitative phase, which added recognition of the impacts of the COVID-19 pandemic on these symptoms, as revealed by the adolescents investigated. A previous study conducted with parents of adolescents found that 82% of them stated that their children’s screen time was increased during home confinement and 30% said that their children were having four or more extra hours a day of non-school screen time (Shin & Al-habaibeh, 2020). Therefore, this perception of increased screen time during the COVID-19 pandemic is not unique to adolescents, as parents also express it.

Furthermore, it was possible to understand the adolescents’ experience and perception of this incessant need to occupy their minds with the various activities offered by the smartphone, in an attempt to fill the existential void. Using devices offers the adolescents fun and the feeling of less distress, so that they can divert their attention from other life adversities, even more those linked to the pandemic. Such behavior can help them temporarily feel relieved and provide them an escape from their problems, but it is not beneficial in the long term because the real setbacks remain unsolved and can result in mental disorders (Alhassan et al., 2018; Ting & Chen, 2020).

Practical Implications

Thus, limiting the adolescents’ smartphone time to 2–3 h/day, suspending use during meals, avoiding it from 1 to 2 h before bedtime and not having it available in their rooms at night, as well as encouraging sport activities, games, exercising outdoors or in direct contact with nature, and establishing rules in relation to smartphone use, including moments of disconnection and more family life, are recognized as measures for harm reduction (Abi-Jaoude et al., 2020; SBP, 2019).

However, to be effective, these measures must be established together with the adolescent, school, and family, seeking to reduce the risk factors and to increase the protective factors. In addition to that, health and education professionals must train the adolescents so that they become emotionally competent to adopt healthy digital

behaviors. Health professionals who care for children and adolescents throughout their development, such as nurses, physicians and psychologists, can be the first to detect problems related to smartphone use and to implement activities aimed at adaptive behavior, developing socio-emotional and self-regulation skills.

Therefore, it becomes important to monitor excessive smartphone use by the adolescents and to disclose the possible harms to this population and to society, especially in view of this pandemic context; as well as the need is emphasized to develop prevention/interprofessional health care programs for adolescents in the smartphone age, especially aimed at schools, families, teachers, and the community (SBP, 2019).

Limitations

It is noted that this study is limited to a local survey, in a capital city of the Brazilian Midwest region, and developed through the collection of virtual data. However, as the invitation was made through the schools and, later, telephone contacts were established with most of the participating adolescents, their identities were confirmed and, thus, there was lower risk of bias in relation to reliability of the answers to the quantitative data collection instruments. Also, the self-report questionnaires used are susceptible to social desirability bias, so future studies, including other sources of information, can help to minimize it.

Conclusions

Most of the adolescents were classified as smartphone addicts, with predominance of the tolerance symptoms. In general, the qualitative findings converged with the quantitative, as they evidence the presence of several symptoms related to compulsive behavior, functional impairment, withdrawal, and tolerance. The qualitative research allowed for a better understanding of the phenomenon from their perspective, in addition to the assessment with the self-reporting instrument.

In their statements, they pointed out that the addictive relationship established with the device was intensified during the COVID-19 pandemic, mainly due to the restriction to the home environment and to their distancing from school and leisure routines. They use it in order to fill the existential void and escape the problems arising from the crisis installed in the country. In this sense, it is up to the health professionals to work in promoting mental health and preventing excessive smartphone use by the adolescents.

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Author Contribution Bruna Hinnah Borges Martins de Freitas: conceptualization, methodology, investigation, data curation, formal analysis, visualization, project administration and writing—original draft preparation. Maria Aparecida Munhoz Gaiva: supervision, writing- reviewing and editing. Paula Manuela Jorge Diogo: supervision, writing—reviewing and editing. Juliano Bortolini: formal analysis, writing—reviewing and editing. All authors read and approved the final manuscript.

Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics Approval and Consent to Participate The research was approved by the Research Ethics Committee, under opinion No. 4,661,013. There was authorization and support from the Department of Education of Mato Grosso and schools for the research, as well as from the participants and their parents or guardians, via the Informed Consent Form.

Conflict of Interest The authors declare no competing interests.

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