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## Relationship between Lifestyle and Self-Reported Smartphone Addiction in adolescents in the COVID-19 pandemic: A mixed-methods study<sup>☆</sup>

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### ABSTRACT

**Objectives:** 1) To verify the association between Lifestyle and Self-Reported Smartphone Addiction in adolescents; and 2) to analyze the adolescents' perception of this relationship in the context of the COVID-19 pandemic.

**Method:** A mixed-methods research study with a sequential and explanatory design, developed with Brazilian adolescents aged between 15 and 18 years old. In the first phase, a quantitative, observational and cross-sectional study was carried out with 479 participants and, in the second, a qualitative approach of an exploratory and descriptive nature, with 16 participants.

**Results:** An association was verified between Lifestyle and Self-Reported Smartphone Addiction by adolescents ( $p < 0.01$ ), with a large size effect ( $d=0.98$ ). All the domains related to lifestyle were associated with Self-Reported Smartphone Addiction, with greater effects evidenced in the following aspects: high effect for sleep, seat belt, stress and safe sex ( $d=0.85$ ); and moderate effect for insight ( $d=0.74$ ) and career ( $d=0.71$ ). Subsequently, the qualitative analysis resulted in a category that describes how the adolescents understand this relationship in the face of the COVID-19 pandemic.

**Conclusion:** More problematic lifestyles were evidenced among the adolescents classified as dependent. In addition to that, it was understood that the COVID-19 pandemic exerted a considerable impact on the lifestyle and behavior established by the adolescents with their smartphones.

**Implications for the practice:** Nurses and other health professionals are essential in the promotion of healthy lifestyles and adaptive behavior in smartphone use, especially in the face of this pandemic scenario and, thus, mitigating the harms to the adolescents' health.

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### Introduction

Lifestyle (LS) is defined as the way in which people or groups experience reality and make choices, which are determined by social, economic, cultural and environmental factors (Ministry of Health of Brazil, 2013). Therefore, it concerns the set of habits and customs that are influenced and modified, and which can contribute to health promotion. They present complex and deeply rooted patterns, which are associated with prevalent problems in public health and which are objects of the scientific productions and practices carried out in the health area (Madeira et al., 2018).

The COVID-19 pandemic has resulted in considerable changes in lifestyle and the adoption of health risk behaviors by adolescents (Malta et al., 2021), such as the increased use of smartphones (Elhai et al., 2020). Such repercussions arise from domestic quarantine, a measure adopted to control the transmissibility of the disease. In this context, adolescents engaged in more activities on smartphones for educational, entertainment and affective purposes during periods of distancing and physical isolation due to the impossibility of attending schools and meeting freely with their peers in leisure spaces.

Despite the convenience offered by smartphones in the pandemic context, their dysfunctional use can exert negative effects on psychosocial functioning and lead to dependence, influencing routines, habits, social behaviors, family relationships and social interactions (Birenboim & Shoval, 2016; Duke & Montag, 2017).

When this dependence is measured using self-reported instruments, the use of the term Self-Reported Smartphone Addiction (SRSA) (Panova & Carbonell, 2018) is recommended, which was adopted in this study. It is behavioral dependence, which involves man-machine

<sup>☆</sup> This article was taken from my doctoral thesis.

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interaction, causing neglect in other life areas (Griffiths, 1996). Many scholars conceptualize it as non-adaptive or obsessive-compulsive smartphone use (Yu & Sussman, 2020).

A number of studies indicate that SRSA is related to a more harmful LS (Alosaimi et al., 2016; Won & Shin, 2018). Some studies analyzed the relationship between some isolated attributes corresponding to LS and SRSA, finding an association of SRSA with poor relationship with parents (Santana-Vega et al., 2019) and friends (Kwak et al., 2018), less physical activity (Haug et al., 2015), unhealthy eating habits (Kim et al., 2017), problematic use or abuse of alcohol and other psychoactive substances such as cigarettes (Yayan et al., 2019), poor sleep quality (Cha & Seo, 2018), stress (Liu et al., 2018), depressive states (Kim, Park, et al., 2019) and low satisfaction with school life (Kim & Chun, 2018).

Faced with this complex phenomenon in health, it is essential to understand the relationship between LS and SRSA becomes essential, as well as the adolescents' perception in this regard in an unprecedented pandemic context, valuing the adolescents' listening to the construct of interest. This mixed approach will allow for a deeper understanding of this health issue, with a view to offering more qualified nursing care for this population. Such being the case, the current study aimed at: 1) verifying the association between Lifestyle and Self-Reported Smartphone Addiction in adolescents; and 2) analyzing the adolescents' perception of this relationship in the context of the COVID-19 pandemic.

## Method

### Study design

This is a mixed-methods study with a sequential and explanatory design. In the first phase (QUAN), an observational and cross-sectional study was carried out and, in the second, an exploratory research with a qualitative (qual) approach. Subsequently, data connection and interpretation (QUAN-qual) was performed (Creswell, 2012). The diagram representing the study design is shown in Figure 1.

### Participants and setting

The study participants were adolescents from 21 public schools and four private institutions in Cuiabá, Capital of Mato Grosso, Brazil. Those aged between 15 and 18 years old were included, as well as those who agreed to participate in the research, with due authorization from their parents or guardians, and those who had a smartphone with Internet access. The sample was probabilistic

and stratified, calculated by the finite population, considering a 95% confidence level, 50% for the phenomenon, a population size of 21,164 and an error of 5%, resulting in a minimum expected sample of 377 individuals (287 from public schools and 90 from private institutions). Thus, there was participation of 479 adolescents, 27.1% above the expected.

### Quantitative data collection and analysis

Data collection was conducted through an electronic form containing personal questions (name, age, gender, school and telephone contact), the 25 questions from the Fantastic Lifestyle (FLS) instrument (Añez et al., 2008) and the 26 from the Smartphone Addiction Inventory (SPAI-BR) (Khouri et al., 2017). SPAI-BR presents a dichotomous format (yes and no), has four domains and the ideal score for SRSA classification is 10, which was adopted in this study (Andrade et al., 2021).

In turn, FLS was adapted and validated for use in Brazil (Añez et al., 2008), being one of the most used to estimate such construct. It is presented in a Likert-type scale format, distributed into nine domains. The items have five answer options with a numerical value from zero to four and the questions that only have two alternatives score as follows: zero points for the first column and 4 points for the last column. The total score varies from 0 to 100, where the lower the score, the greater the need for changes in LS (Añez et al., 2008).

The adolescents were invited to participate in the study through group messages on instant messaging apps run by the schools or through email messages directed to the 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. Quantitative data collection took place from April to July 2021.

These data were imported into the R software, where all the statistical analyses were performed. 5% was adopted as significance level. For the statistical analysis of the relationship between LS and SRSA, the *t*-test with bootstrap (Johnston & Faulkner, 2021; Zhao et al., 2021) was performed in the comparisons of the means of all the FLS items and domains with SRSA. Cohen *d* statistics was calculated (Cohen, 1988) for the size effect of the difference between mean values, where:  $0.2 \leq |d| < 0.5$  indicates small effect,  $0.5 \leq |d| < 0.8$  indicates moderate effect and  $|d| \geq 0.8$  suggests large effect. 95% BCa bootstrap confidence intervals were calculated for the Cohen *d* statistics (Kirby & Gerlanc, 2013). The Cronbach's alpha values of SPAI-BR and of FLS were calculated, obtaining 0.88 and 0.81, respectively.

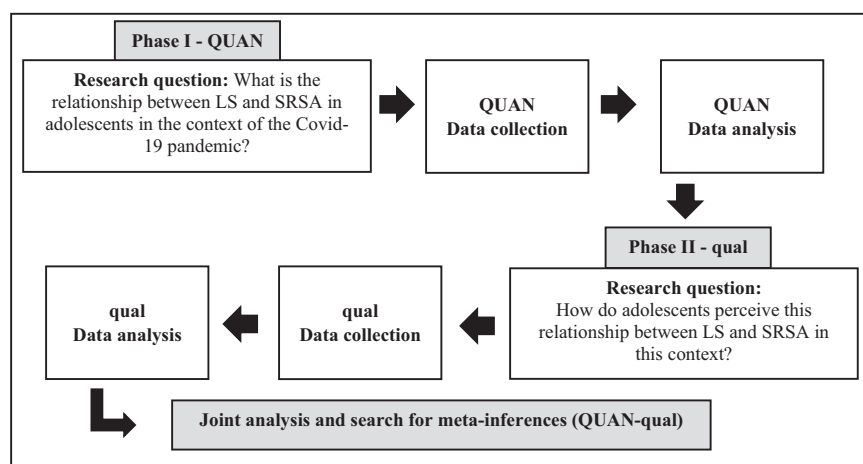


Fig. 1. Diagram representing the study design.

Qualitative data collection and analysis

After the quantitative analysis, sequenced data collection was carried out in July 2021 with 16 adolescents already investigated in the first phase, intentionally and for convenience, through interviews with five focus groups (FGs). Initially, groups with six adolescents were assembled; however, some of them did not attend the virtual meeting, resulting in different numbers across the groups. Therefore, recruitment was terminated due to reaching sufficient information power to meet the objective proposed (Malterud et al., 2016).

The interview was carried out by a nurse with previous experience in this type of data collection, who acted as moderator, and by two undergraduate Nursing students, who acted as reporters of the FGs and received prior training. While the moderator had the role of focusing on the theme, promoting everyone’s participation and inhibiting monopolizes of the word, the reporter 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 the instant messaging app to conduct the interviews via videocalls. It is noteworthy the adolescents were at their homes during the interviews.

A meeting was held with each group, consisting of the following key moments based on a previous research study: 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 interview lasted between 51 and 106 min across the groups, and was guided by a semi-structured script available in Table 1. The script went from the general to the specific, taking into account the quantitative results, with the provocative intention of allowing for an enthusiastic and participatory debate that generated a deepening of the ideas presented.

The interviews were transcribed in full and later organized by codes and submitted to deductive content analysis, with the FLS domains pre-established as categories for coding data (Bardin, 2016). The analysis was supported by the Atlas.ti 9.1.5.0 software. The participants’ statements were presented according to the order of participation (example: participant 1), their age and the score obtained in SPAI-BR.

Integration of quantitative and qualitative data

Subsequently, after collecting and analyzing the quantitative and qualitative data, in clear and separate stages, their integration was carried out to produce strong meta-inferences along with discussion of the findings, through the connection and joint assessment of the quantitative and qualitative results interpreted.

Ethical considerations

The current 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

**Table 1**  
Semi-structured script of the qualitative phase.

| Semi-structured script                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Tell me what you think about the relationship between your lifestyle and intense smartphone use during the COVID-19 pandemic.                        |
| 2. Tell me what you think about the relationship between heavy smartphone use and your feelings and behaviors.                                          |
| 3. Has the intense use of the smartphone interfered with your relationships? Do you tend to be more isolated when you are connected on your smartphone? |
| 4. Do you think smartphone use interferes with your physical or leisure activities?                                                                     |
| 5. Does intensive smartphone use interfere with your food and sleep?                                                                                    |
| 6. How is your relationship with cigarettes, alcohol and other drugs?                                                                                   |
| 7. Do you think that the intense use of the smartphone interferes with your studies?                                                                    |
| 8. Do you stop doing other activities to stay connected to your smartphone?                                                                             |

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.

Rigor and trustworthiness

This study was guided by the Mixed Methods Appraisal Tool, what is an instrumental resource used to appraise mixed methods research and strengthen the methodological rigor in planning and conducting in nursing research with this approach (Hong et al., 2018).

Results

Quantitative phase

The study participants were 479 adolescents with a mean age of 16.03 years old, most of them were female (74.11%) and from the public teaching network (81.00%). The prevalence of SRSA among the adolescents was 56.37% and the FLS mean score was 64.31 (SD = 13.03; Maximum = 94; Minimum = 25).

A difference was found between the FLS mean scores of the groups of adolescents, classified as with and without SRSA ( $p < 0.01$ ), with a large size effect ( $d=0.98$ ). There was also an association between all the FLS domains and SRSA in the adolescents, as presented in Table 2. However, the difference between the means that obtained a large size effect stand out: sleep, seat belts, stress and safe sex ( $p < 0.01$  and  $d=0.85$ ); and moderate size effect: insight ( $p < 0.01$  and  $d=0.74$ ) and career ( $p < 0.01$  and  $d=0.71$ ).

Table 3 shows the FLS items associated with SRSA among the adolescents researched, in which only five items did not present significant mean differences between the groups with and without SRSA. The items that presented differences between the means ( $p < 0.01$ ) with moderate effect size stand out ( $d \geq 0.5$ ): sleeping well, being able to deal with stress, relaxing in leisure time, feeling angry and hostile, thinking positively, feeling tense and disappointed, feeling sad and depressed, and satisfaction with work/study.

Qualitative phase

Understanding the relationship between LS and SRSA in adolescents in the face of the COVID-19 pandemic

It was found that the COVID-19 pandemic generated a “total turnaround” in the adolescents’ lives, restricting them to the home environment and making them spend more time than usual with their families. Thus, they had to adapt their routines and coexistence, which sometimes tends to be superficial. The relationships between peers were affected, marked by distancing from many friends. Given the restriction of home confinement and social isolation imposed by the COVID-19 pandemic, the adolescents started to spend more time connected to their smartphones. They acknowledge that, the longer the stay connected to their devices, the more they distance from people, which keeps them involved with the smartphones. They also report that such situation also happens with their family members:

*The pandemic in my life was a total turnaround, because one day you're leading your normal life, like other days, going through the things that life normally brings, and then out of nowhere you find yourself isolated inside your house, having to live with yourself and with people you don't live with all the time, because you're working, you're far away because of the routine. Suddenly, everyone is together in a house and there's nowhere to run, you have to solve your pending issues there, it's difficult. [...] I used to go out more with my family [...], then we tried to do other kinds of things and forget a little about everything. There's now way now, it's 100% connected! (Participant 10, 16, SPAI-BR 19).*

**Table 2**  
Association between FLS domains and SRSA in adolescents (n = 479).

| FLS domains (scores)                           | SRSA           |                | p-Value | Cohen's d (95% CI) |
|------------------------------------------------|----------------|----------------|---------|--------------------|
|                                                | No             | Yes            |         |                    |
|                                                | Mean (±SD)     | Mean (±SD)     |         |                    |
| F. Family and Friends (0–8)                    | 5.34 (±2.27)   | 4.31 (±2.40)   | <0.01   | 0.44 (0.24; 0.61)  |
| A. Activity (0–8)                              | 3.56 (±2.65)   | 2.47 (±2.40)   | <0.01   | 0.44 (0.24; 0.61)  |
| N. Nutrition (0–12)                            | 6.33 (±3.10)   | 5.44 (±2.81)   | <0.01   | 0.30 (0.12; 0.49)  |
| T. Tobacco and Toxics (0–16)                   | 14.73 (±1.37)  | 13.87 (±2.43)  | <0.01   | 0.43 (0.28; 0.57)  |
| A. Alcohol (0–12)                              | 11.49 (±1.28)  | 11.15 (±1.87)  | 0.02    | 0.21 (0.03; 0.36)  |
| S. Sleep, Seatbelt, Stress and Safe Sex (0–20) | 14.66 (±3.21)  | 11.70 (±3.67)  | <0.01   | 0.85 (0.65; 1.05)  |
| T. Type of behavior (0–8)                      | 4.85 (±1.96)   | 3.84 (±2.18)   | <0.01   | 0.48 (0.28; 0.65)  |
| I. Insight (0–12)                              | 7.31 (±3.14)   | 4.96 (±3.18)   | <0.01   | 0.74 (0.55; 0.95)  |
| C. Career (0–4)                                | 2.50 (±1.23)   | 1.58 (±1.34)   | <0.01   | 0.71 (0.51; 0.90)  |
| Total (0–100)                                  | 70.77 (±10.89) | 59.31 (±12.35) | <0.01   | 0.98 (0.77; 1.16)  |

Note: SD = Standard deviation; CI = Confidence Interval.

*After this pandemic started, I stopped talking to 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. [...] Almost nobody talks here in the house [...], to tell you the truth, everywhere here in the house has something to do in their smartphones (Participant 7, 17, SPAI-BR 12).*

The smartphone is preferred in detriment to people, as reported in the following excerpt: “I prefer to stay with my cell phone than with people”. For them, the device turned into a “friend”, even more in a setting in which socialization was impaired. Thus, use of the device was considered as “more than usual”:

*I prefer to stay with my cell phone than with people [...], it's my friend [...] (Participant 9, 15, SPAI-BR 16).  
I'm not quite the socializing type of person, talking to other people, I prefer to stay on the cell phone (Participant 15, 16, SPAI-BR 13).  
I'm pretty antisocial, you know? I rarely meet to talk [...], then the routine changed, right? fiddling with the cell phone more than usual (Participant 14, 17, SPAI-BR 14).*

The impact exerted by the pandemic on some adolescents' physical activity is also evident. There are reports that this entire situation influenced the practice of physical activities, forcing the adolescents to prioritize the smartphone screen. This involvement with the device makes them lose the notion of time and spend more time than planned, which compromises the adoption of an active LS:

*I used to do exercise there at school, which also freed up the court in the afternoon, I went with my friends and played volleyball, played on the court and other stuff. Them after the pandemic came, everyone stayed at their homes and I had no way to do it anymore. Then I stopped. [...] We lose time... We say: Ah, I'll see here, just a few minutes and then I start. Then when I go see it's already night and it's no use doing anything (Participant 15, 16, SPAI-BR 13).  
I do prefer [staying on the smartphone], I don't like sports very much, physical exercise. Before the pandemic I even tried some or other thing in the physical education classes, now... (Participant 10, 16, SPAI-BR 19).*

Eating habits are considered as “awful” by the adolescents. In their view, the pandemic has made them “eat more” or “eat less” than

**Table 3**  
Association between FLS items (scores 0 to 4) and SRSA in adolescents (n = 479).

| FLS items                                                    | SRSA         |              | p-Value | Cohen's d (95% CI)  |
|--------------------------------------------------------------|--------------|--------------|---------|---------------------|
|                                                              | No           | Yes          |         |                     |
|                                                              | Mean (±SD)   | Mean (±SD)   |         |                     |
| 1. Communication with others is open, honest and clear       | 2.67 (±1.35) | 2.13 (±1.47) | <0.01   | 0.38 (0.20; 0.55)   |
| 2. I give and receive affection                              | 2.68 (±1.24) | 2.18 (±1.27) | <0.01   | 0.40 (0.22; 0.59)   |
| 3. Active exercise: 30 min running, cycling, fast walking    | 1.39 (±1.56) | 0.75 (±1.25) | <0.01   | 0.46 (0.26; 0.64)   |
| 4. Moderately active (gardening, walking, working from home) | 2.18 (±1.61) | 1.72 (±1.65) | <0.01   | 0.28 (0.10; 0.47)   |
| 5. Balanced meals                                            | 2.08 (±1.41) | 1.49 (±1.44) | <0.01   | 0.41 (0.22; 0.59)   |
| 6. Excess sugar, salt, animal fats, junk food                | 1.73 (±1.32) | 1.39 (±1.29) | <0.01   | 0.27 (0.09; 0.44)   |
| 7. Ideal weight                                              | 2.52 (±1.58) | 2.56 (±1.60) | 0.79    | −0.03 (−0.21; 0.16) |
| 8. Tobacco use                                               | 3.89 (±0.41) | 3.69 (±0.81) | <0.01   | 0.30 (0.16; 0.44)   |
| 9. Use of illicit drugs                                      | 3.92 (±0.55) | 3.82 (±0.83) | 0.10    | 0.14 (−0.05; 0.28)  |
| 10. Drug abuse                                               | 3.75 (±0.65) | 3.36 (±1.10) | <0.01   | 0.42 (0.27; 0.57)   |
| 11. Coffee, Tea and cola                                     | 3.16 (±0.83) | 2.99 (±1.00) | 0.04    | 0.18 (0.00; 0.35)   |
| 12. Alcohol consumption per week                             | 3.92 (±0.47) | 3.79 (±0.83) | 0.02    | 0.18 (0.01; 0.32)   |
| 13. Alcohol consumption on one occasion                      | 3.59 (±0.80) | 3.43 (±1.03) | 0.06    | 0.17 (−0.01; 0.35)  |
| 14. Alcohol and driving                                      | 3.98 (±0.28) | 3.93 (±0.54) | 0.10    | 0.12 (−0.07; 0.22)  |
| 15. Sleep well and feel rested                               | 2.55 (±1.18) | 1.81 (1.34)  | <0.01   | 0.58 (0.39; 0.77)   |
| 16. Wear seat belts                                          | 3.44 (±0.88) | 3.01 (±1.10) | <0.01   | 0.42 (0.24; 0.60)   |
| 17. Being able to handle stress                              | 2.65 (±1.17) | 1.84 (±1.36) | <0.01   | 0.63 (0.45; 0.84)   |
| 18. Enjoy leisure time                                       | 2.67 (±1.12) | 1.85 (±1.32) | <0.01   | 0.66 (0.46; 0.85)   |
| 19. Practice of safe sex                                     | 3.35 (±1.32) | 3.10 (±1.45) | 0.17    | 0.12 (−0.06; 0.30)  |
| 20. Be in a hurry                                            | 2.19 (±1.31) | 1.89 (±1.32) | 0.02    | 0.22 (0.03; 0.42)   |
| 21. Feeling angry and hostile                                | 2.66 (±1.25) | 1.94 (±1.33) | <0.01   | 0.55 (0.36; 0.74)   |
| 22. Think positively                                         | 2.55 (±1.23) | 1.87 (±1.30) | <0.01   | 0.53 (0.35; 0.72)   |
| 23. Feeling tense and disappointed                           | 2.35 (±1.20) | 1.54 (±1.29) | <0.01   | 0.65 (0.46; 0.82)   |
| 24. Feeling sad and depressed                                | 2.41 (±1.34) | 1.54 (±1.29) | <0.01   | 0.66 (0.47; 0.86)   |
| 25. Satisfaction with work/study                             | 2.50 (±1.23) | 1.58 (±1.34) | <0.01   | 0.71 (0.52; 0.91)   |

Note: SD = Standard deviation; CI = Confidence Interval.

usual, mainly because they eat while connected to their smartphones, which makes them not focus on food. As they inverted their circadian rhythm due to intense smartphone use, the adolescents suffered changes in their eating habits. In addition to that, the omnipresence of the smartphones made the adolescents “miss the times” to eat or cease to “be hungry”:

*[...] after the pandemic I started to eat a whole lot more. [...] I eat while fiddling with the cell phone, I know it's a horrible habit, but I do it [...], then I end up eating a lot (Participant 13, 15, SPAI-BR 19).*

*It's, kind of, I forget, I don't see the time, kind of I stay on the phone and miss the time, when I go to see it's already very late, or sometimes I'm checking the time, but I didn't go to eat because I didn't want to, or I wasn't hungry. [...] I have it either in my hand or by my side, it's basically that, it's always around me (Participant 10, 16, SPAI-BR 19).*

*It's because sometimes I'm so concentrated there fiddling in the social network that I sometimes end up forgetting even what time it is (Participant 11, 16, SPAI-BR 11).*

*I used to eat a lot of shit, during the afternoon, mainly, at night, because I started to swap day and night. [...] sometimes I eat too much, sometimes I eat too little, I really kind of lose track of it [when he's connected to the smartphone] (Participant 6, 18, SPAI-BR 19).*

There was a change in the adolescents' sleep pattern with the arrival of the COVID-19 pandemic. By getting “glazed” on their smartphones, they became “addicted to going to bed very late”. This change in the circadian rhythm made them feel sleepier in the mornings, and also more tired:

*At the beginning of the pandemic, I was very addicted to the cell phone, I was always addicted to going to bed very late, staying up all night (Participant 5, 17, SPAI-BR 12).*

*I wake up feeling a little sleepy (Participant 7, 17, SPAI-BR 12).*

*[...] At dawn I'm not sleepy at all, you know? Exchanging day for night. Then it's basically that! (Participant 14, 17, SPAI-BR 14).*

Certain fixation to the smartphone is noticed in the adolescents, mainly when they feel low. There are reports indicating that they isolated more “after the quarantine”, preferring to stay alone in their rooms, connected to their smartphones. In this sense, the device started to be “a shelter” for them after the COVID-19 outbreak. As “everything is chaos out there”, they stay with their devices because it is where they feel that they “can be what they want”:

*When I feel sad, I use the cell phone more than usual. [...] I stay more in my room fiddling with the cell phone (Participant 1, 17, SPAI-BR 19).*

*[...] I also started to lock the door, stay more time with myself (Participant 5, 17, SPAI-BR 12).*

*[...] I don't need to talk to anyone, I can keep it all to myself and in the cell phone, and then nobody's going to know what I'm going through (Participant 9, 15, SPAI-BR 16).*

*[...] The pandemic was quite a big blow, both in the general world and inside people, then I believe that it's for this reason that it affected cell phone use. When it's all chaos out there, the world's on fire, I'm with my cell phone, because it's where I can be what I want [...] (Participant 3, 15, SPAI-BR 13).*

Consumption of chemical substances seems to follow a similar pattern as that of smartphone use; they are cited as with more accessibility and essential to escape from the problems:

*Regarding the substances, like legal ones, I can't say, I think that I was drinking more at that time, no, certainly compared to today I was drinking more, but kind of... yeah... it was, it was complicated. [...] booze was actually kind of, it's kind of easy to access... (Participant 6, 18, SPAI-BR 19).*

*No, never, used, Godspeed. No. But I learned to drink, I started to go out more. [...] I believe that what he meant is that he used booze to escape from problems, I did so too. Most of the times, most of the people use booze to escape from problems. I also drank a lot last year, this year I drink less, but I still do (Participant 7, 17, SPAI-BR 12).*

Due to the situation imposed by the COVID-19 pandemic, the adolescents portrayed that idleness made them spend more time connected to their devices, after all, “there wasn't much to do, right?”. Interruption of the activities of daily living, specifically due to closure of the leisure spaces, limited the possibilities for entertainment and for having fun. They also reported being tired of “staying home all the time” and “loss of important moments” inherent to adolescence. Consequently, they resort to the smartphone to have something to do, because “it's no use staring at the ceiling”. Certain difficulty dealing with idleness is verified, making them develop varied activities in the device seeking to fill time:

*[...] staying home all the time like this is tiring, you know? It's very tiring! And, kind of, we're losing moments of our life, we could be doing a lot of things and we can't because of the disease. Anyway, it's pretty bad! (Participant 13, 15, SPAI-BR 19).*

*[...] but you use the cell phone because you have nothing else to do, to occupy the mind, you need to do something because it's no use staring at the ceiling [...] (Participant 7, 17, SPAI-BR 12).*

*[...] I can't go out, I'm doing nothing, then the cell phone is a way, so to say, to have fun, right? (Participant 14, 17, SPAI-BR 14).*

On the other hand, when establishing this dependence relationship with the smartphone, the adolescents stop practicing leisure activities that previously satisfied them, such as “playing the guitar”, “writing music” and “going out with their parents”. This immersion into the device results in “a state of apathy”, “of inertia”, interfering in the development of the activities of daily living expected for this life phase:

*I noticed that, kind of, the cell phone ended up taking, in that issue, even the same time that I had for myself, for my leisure activities, for example, playing the guitar, I stopped. I totally stopped writing music, recording, anyway, in this area that I love, that I'm passionate about and I just, kind of, stopped! Because I no longer had the will power, kind of... no will power to, kind of, ah: I want to do it! I wanted to, but I just didn't have it, I don't know, I was in a state of real apathy, of inertia, it was, kind of, the cell phone that helped me to continue in that state (Participant 6, 18, SPAI-BR 19).*

*In my case, I already stopped going to several parties like this, more party's kind of, with my parents [...], I say: Oh no, I'll stay home, then I' stay on the phone. Many times, already (Participant 15, 16, SPAI-BR 13).*

It also reflects in their studies, because they use it to a great extent, even during classes. With the closure of schools in order to mitigate spread of the new coronavirus, Emergency Remote Teaching (ERT) was adopted, also influencing the increase in use of the devices. Even while attending classes via the computer, they kept “fiddling” with the smartphone. Consequently, they got distracted and their academic performance was impaired. There are reports that they started studying and “then they missed it” and went back to “getting lost” in the smartphone. According to them, then “a bad conscience comes”, because they are not dedicating themselves to their studies as they should, especially because they are in high school, about to take the university admission exam. For them, the smartphone “calls” them, making them feel “they want to pick it up” and “when they pick it up, they don't let go”:

*[...] and then ERT started and staying home all day, then I only fiddled with the cell phone. Studying like that, really studying, I didn't even study properly like that, you know? [...] I don't know, you start studying*

a little, then you miss fiddling with the cell phone [...] (Participant 15, SPAI-BR 13).

[...] because it's ERT, whether you like it or not, it requires a little more time on the cell phone, which is there on the screen and the teachers talking, and us talking on Telegram [...] Because when it was face-to-face I took my cell phone and at break time I used it [...] (Participant 9, 15, SPAI-BR 16).

Regarding the studies, you keep using the cell phone, then a bad conscience comes, I could use the time that I fiddle with the cell phone to study, but then, even having this conscience, I don't do what I'm thinking, I stay on the cell phone. [...] I start to ask myself if I'm wasting time, that I should be studying, because I'm going to take the ENEM [admission exam] now, right? [...]. Then conscience weighs, right? Then the other day I say: No, I'm going to pay attention now! Then I stay, I attend two classes, then I get lost again on the cell phone (Participant 16, 17, SPAI-BR 13).

The adolescents had another school LS before the COVID-19 pandemic. For being a face-to-face experience, the school did not require a smartphone connection during classes; on the contrary, this use was limited to school breaks. However, with arrival of the pandemic, they felt the need for the device and that “there is nowhere else to run”, except to it. The reason is that they have everything they need in their smartphones. Then they develop a relationship of dependence with the devices. There is also some dissatisfaction with this entire situation in which they are immersed. For them, this behavior “went from being a good thing to become something that takes time” and does not add anything positive to their studies, as expected.

There are also some reports that the resumption of face-to-face classes (in some of the educational institutions researched) resulted in a reduction in the connection time with the device, mainly due to the restriction of use during classes and to the reestablishment of a school calendar and scheduled activities. Because they consider idleness and lack of programmatic activities as some of the reasons for indiscriminate smartphone use:

I use my smartphone a lot, but with back to school, right? Because my school came back face-to-face for a while, I feel like it has reduced a lot, you know? (Participant 12, 15, SPAI-BR 11).

I waste a lot of time, kind of, mainly in the study issue, 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 it kind of went from being a good thing to become something that does take my time, you know. [...] And then, kind of now with back in school, for example, that we started to have a life again, kind of in the real world, so to speak, not just in the digital world, I think that was it, that's really what made me drop it so much. [...] So, in fact, I think that the school break was a thing that had a lot of influence because [...] it took a long time to get back to online classes and even then it wasn't like a fixed calendar, kind of a fixed one, kind of: well every morning you know. So that's for sure [...], the lack of something fixed to do helped a lot to contribute to this [...]. And I think that kind of I had more free time to do that, as if the time I spent on its kind of increased as well, proportionately (Participant 6, 18, SPAI-BR 19).

## Discussion

The current study verified a significant association between more harmful lifestyles and SRSA in its quantitative phase. According to the findings of the qualitative phase, the COVID-19 pandemic exerted a substantial influence on the adolescents' LS, making it more problematic. Given the so many changes caused by such circumstance, they sought a way to ensure personal satisfaction in their smartphones. However, a previous study indicates that the less healthy LS seems to be a consequence of SRSA (Alosaimi et al., 2016). Therefore, there seems to be a bidirectional relationship between LS and SRSA.

The quantitative findings point an association between SRSA and stress, anger, negative thoughts, tension, disappointment, sadness and depression. Most of the adolescents experienced feelings of fear, discouragement and anxiety that strongly affected their daily LS during the COVID-19 pandemic. In this sense, technology played a crucial role during the quarantine for young people who increased their daily use of technological devices to stay connected with the rest of the world, predisposing them to a risky behavior related to smartphone use (Salzano et al., 2021).

It was also identified that a more problematic LS with the family members and peers was associated to SRSA, such as not having anyone to talk to and lack of affection. In the qualitative analysis it was possible to verify that, for the adolescents, the COVID-19 pandemic reflected in their relationships with family members and peers. It made them distance from face-to-face coexistence with their peers and, therefore, they looked for a way to ensure social connection, distraction and entertainment in their smartphones. Family dysfunction was also significantly associated with SRSA in a previous study, as well as the quality of the friends was identified as a protective factor against SRSA in adolescents (Kim, Min, et al., 2019). The perception of love and affection received had already been associated with a lower probability of SRSA (Tangmunkongvorakul et al., 2020).

However, the longer the connection time on the smartphone, the greater the distance from people, while the adolescents tend to prefer to spend time on their smartphones to the detriment of people, having the former as substitute friends. A qualitative research study evidences that young people with SRSA reported deep attachment to their smartphones when compared to non-addicts. The smartphone is sometimes seen as an extension of your own self. In addition to that, they assert that SRSA exerted an impact on their relationships with family members and friends (Jameel et al., 2019).

The less active LS and the more harmful eating style were also associated with SRSA according to the quantitative results, such as less practice of physical activities and poorly balanced diet, with excess sugar, salt and fat. In turn, the qualitative findings indicate that there was a reduction in the practice of physical activities with the arrival of the pandemic and that, in this context, the adolescents prioritized connecting to their smartphones. Therefore, these findings are similar to those identified in another Brazilian study, which found that physically inactive adolescent students were more likely to present SRSA than those who were physically active (Pereira et al., 2020).

The COVID-19 pandemic was associated with an increase in food consumption and sedentary life (Abouzid et al., 2021). In turn, a survey developed with young people in Saudi Arabia verified that at least 30% of the study participants agreed that they had a less healthy LS since they started using their smartphones, characterized by greater consumption of fast food, body weight gain and less practice of physical exercise (Alosaimi et al., 2016; Haug et al., 2015). SRSA facilitates sedentary behavior, as the users tend to substitute time outdoors and physical activities for games, Internet browsing, and social media consultations in their smartphones (Kim et al., 2017).

The adolescents acknowledge deficient eating habits after the beginning of the COVID-19 pandemic, as presented in the qualitative phase of this study. They tend to eat while connected to their smartphones, resulting in inattention and in changes in the eating habits. Such findings had already been evidenced in a study developed with Korean adolescents, in which those with high SRSA skipped meals more frequently, ate faster and were more prone to weight gain. In addition, the adolescents from the group of low SRSA consumed more vegetables, milk and yogurt than their peers. Therefore, the researchers emphasize that SRSA is associated with unhealthy eating habits among adolescents (Kim et al., 2017). However, spending time on physical activities and maintaining nutritious eating routines during the pandemic are strategies that the adolescents can use to mitigate the association between the pandemic stressors and mental distress (Ren et al., 2021).

According to the results of the quantitative phase, there was a relationship between greater sleep problems and stress with SRSA, such as difficulty sleeping, dealing with stress and relaxing in leisure time. In this study, the findings from the qualitative phase also reinforce the change in the sleep pattern resulting from indiscriminate smartphone use during the COVID-19 pandemic. A change in the circadian rhythm and an increase in the stress level is verified in this period. Previous studies also verified a relationship between sleep deprivation and daytime fatigue and SRSA (Alosaimi et al., 2016; Cha & Seo, 2018). The results suggest that, in order to promote the adolescents' health and well-being, they should be encouraged to put limits on the use of smartphones, especially at bedtime and during rest periods, as poor sleep quality is associated with various physical and mental health problems.

In the quantitative phase lower scores of the insight were identified in individuals classified with SRSA, like the ones with difficulty to think positively, feeling tense, disappointed, sad and depressed. From the interviews, it was found that the adolescents were more isolated after the beginning of the pandemic, and that they developed a preference for being alone in their rooms, connected to their smartphones. The adolescents consider the device a resource to escape from the stressful factors, as well as to mitigate the negative emotions resulting from this period (Potas et al., 2021).

Greater problems with alcohol and other drugs were associated with SRSA in the quantitative phase, such as cigarette use and abuse in the use of medications, in contrast to the results of a previous study carried out in Switzerland, which pointed out that alcohol and tobacco consumption was not related to SRSA (Haug et al., 2015). In another study, carried out in South Korea, although the smoking habit and alcohol use were associated with SRSA, the result of the multivariate logistic regression analysis showed statistical significance only for smoking (Kim, Park, et al., 2019).

Consumption of chemical substances seems to follow a similar pattern as that of smartphone use: the adolescents consider them accessible and essential to escape from problems. Abuse of substances such as alcohol and nicotine are related to difficulties controlling impulses and to low self-esteem, and these factors can also play an important role in SRSA. It can be assumed that those individuals with vulnerability to dependence are more susceptible to develop other addictive behaviors, including smartphone and any other substances. Involvement in health risk behaviors can lead to other risk behaviors, resulting in complex health problems (Kim, Park, et al., 2019).

Impairment in the decision-making process in smartphone addicts, for example, is similar to that found in other chemical and behavioral addictions, such as alcoholism, gambling disorders and pathological shopping (Khoury et al., 2019). Thus, more research studies are needed to solidify the understanding of the relationship between SRSA and dependence on other substances, including alcohol and cigarettes, in order to establish preventive and management strategies for this health problem.

In addition to an escaping from problems, the adolescents got involved in such behavior due to the interruption of the activities of daily living and to the feeling of idleness resulting from the COVID-19 pandemic. With the change in LS, they sought to get more involved with their smartphones in an attempt to occupy themselves and fill the void experienced during this period. Sometimes, this immersion in the device reinforces the state of apathy perceived. In this case, the smartphone, which offers several functions and can be used almost anywhere and at any time, becomes an important and effective tool for those with a tendency to boredom to obtain experiences customized to their personal preferences (Yue et al., 2021). Therefore, it is recommended that families and schools provide adolescents with certain degree of autonomy and encourage them to self-manage their emotions and behaviors, which can reduce the tendency to boredom and other socio-emotional problems.

The greater career dissatisfaction was related to SRSA with a moderate effect in the quantitative phase. The arrival of the COVID-19

pandemic impacted mainly on the adolescents' studies as observed in the qualitative phase. It was necessary to implement ERT and, consequently, they started to enjoy more freedom to use their smartphones during classes; however, not always for academic purposes. Thus, the adolescents tend to get distracted and lose the focus on their studies, with negative repercussions in their academic performance (Alosaimi et al., 2016; Jameel et al., 2019).

It is expected that resumption of in-person classes will help them have an agenda and contribute to restricting use of the device and for them to focus more on their studies. The school is a favorable environment for the adolescents to establish relationships, face their peers, grow and become adults with better socio-emotional skills. It is therefore expected that, with the resumption of face-to-face classes and the reopening of leisure spaces, the adolescents will spend less time in front of screens and increase their social interactions and the time devoted to physical and leisure activities, with positive consequences on the sleep patterns and on the eating habits (Scarpellini et al., 2021).

#### *Implications for the practice*

The findings revealed showed the relevance of the pediatric nurses' performance in health promotion and in the monitoring of adolescents. Thus, health education strategies targeted at the socio-emotional competences are fundamental for the prevention of risk behaviors, such as those identified in this study. For this, it is fundamental that nurses work together with adolescents, parents and teachers, in order to optimize interventions and design programs focused on the needs identified. This work requires interdisciplinary, interprofessional and intersectoral attention.

In addition to that, in this pandemic scenario, it is important for pediatric nurses to be aware of the signs and symptoms presented by the adolescents during their health care appointments, in order to track harmful LS and detrimental smartphone use and propose health care measure that empower them for transformation and assist and accompany them in the necessary behavioral and attitudinal changes, promoting positive management of their health and well-being together with the family.

Nurses need to lead adolescents to be motivated to change and to believe that change is necessary and that it will be really effective. In this sense, nurses must establish a trust relationship with adolescents, in a school or consultation context, assuming a permanent posture of empowerment and in order to identify and meet their specific health needs, in partnership with them. Nurses should seek to identify the situations that lead them to such risk behaviors and respond to the priority objectives of adolescent health policies, enabling them to become emotionally competent to adopt healthy behaviors.

#### *Limitations*

This study is limited to a local survey, in a capital city of the Brazilian Midwest region, 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. Self-reporting questionnaires can be susceptible to social desirability bias and cross-sectional data do not imply causality; therefore, future longitudinal studies should explore the findings of the current research more in detail and using diversified measurement methods to further increase reliability of the results.

#### **Conclusion**

It is concluded that there was an association between a more problematic LS and SRSA among the adolescents researched, such as greater conflicts in family relationships and with peers, less practice of physical



activity, inadequate diet, use of psychoactive substances, problems with sleep, stress, dysfunctional behaviors, less insight and dissatisfaction with studies. However, greater effects related to the association of SRSA with problems such as sleep, stress, less insight and dissatisfaction with studies stand out, in this order.

Subsequently, it was possible to understand that the adolescents underwent considerable changes in their LS during the COVID-19 pandemic. Therefore, faced with the feeling of being shut away at their homes, separation from their peers, implementation of ERT and the fears and insecurities linked to the crisis experienced, they increased the time connected to their smartphones. This increase was based on the attempt to take refuge in the device and shield from reality, given the difficulty of coping, in addition to overcoming idleness and maintaining previous bonds with their peers and establishing new ones. However, the longer the connection time and the attachment to the smartphone, the greater the distance from people offline, the lower the availability to practice physical activities, the worse the eating habits, the greater the sleep deprivation, the levels of stress, the dysfunctional behaviors and the educational losses, according to the adolescents.

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### Ethics approval

The research was approved by the Research Ethics Committee, under opinion No. 4,661,013.

### Informed consent

Informed consent was obtained from all individual participants included in the study and from your legal guardians.

### Data availability statement

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

### Author contributions

Bruna Hinnah Borges Martins de Freitas: Conceptualization, Methodology, Investigation, Data Curation, Formal analysis, Visualization, Project administration and Writing- Original draft preparation. Maria Aparecida Munhoz Gaíva: 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.

### Declaration of Competing Interest

The authors have no relevant financial or non-financial interests to disclose.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pedn.2022.03.001>.

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