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Brief Report

Brief report: The impact of the COVID-19 pandemic on health behaviors in adolescents with Autism Spectrum Disorder



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ABSTRACT

Background: There is concern that the COVID-19 pandemic may negatively affect health behaviors in youth, especially youth diagnosed with Autism Spectrum Disorder (ASD).

Objective: The purpose of this paper was to examine changes in physical activity, screen-time, and sleep in adolescents with ASD due to the COVID-19 pandemic.

Methods: Nine adolescents with ASD completed surveys measuring physical activity, screen-time, and sleep duration prior to and during the pandemic.

Results: A significant decrease in days of physical activity (4.17 vs 2.27; $p = 0.0006$), and a significant increase in hours of both weekday (3.69 vs 6.25; $p = 0.007$) and weekend screen-time (5.94 vs. 7.39; $p = 0.004$) was observed during the pandemic. No changes regarding sleep duration was observed.

Conclusions: Although preliminary, results suggest that physical activity and screen-time may be negatively affected by the COVID-19 outbreak in youth with ASD. The development of interventions to promote health behaviors in ASD populations during long periods of less-structured time (quarantine) should be considered.

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Introduction

Autism Spectrum Disorder (ASD), a neurodevelopmental disorder, characterized by impaired communication and difficulties with social interaction, has been increasing in prevalence over the past decade.^{1,2} In fact, most recent surveys indicate that 1 in 54 children are diagnosed with ASD, making this disorder one of the most commonly diagnosed childhood disorders in the U.S.³ Although characteristics of this disorder tend to vary, youth with ASD often display behavioral and socio-emotional symptoms, such as inattentiveness, high anxiety, and a preference for routine and repetition.²

Unfortunately, with the recent outbreak of COVID-19, most U.S. individuals were forced to remain in quarantine for a duration of several weeks to months, resulting in a complete disruption of daily routines for most school-age children and adolescents.^{4,5} Such a

disruption to education, therapy, and daily activities may be a source of considerable stress to youth with ASD, who tend to prefer routine and schedules.^{5,6}

For youth with ASD, there is growing research that suggests that increasing participation in physical activity (PA), decreasing levels of screen time (ST), and getting adequate amounts of sleep may help to improve ASD-related symptoms, and could potentially attenuate feelings of stress and anxiety related to the COVID-19 outbreak.^{7,8} Unfortunately, the COVID-19 pandemic may also negatively affect health behaviors in youth with ASD, serving as a possible barrier to participation in PA, while increasing levels of sedentary behavior and screen-time, due to the stay-at-home order placed on the majority of the U.S.⁷ As recent research continues to show benefits of PA participation, including decreases in anxiety and improvements in social skills and language deficits, it is critical for youth with ASD to continue to engage in PA, while limiting ST.^{9–11} Furthermore, low levels of PA, coupled with high levels of ST, can negatively affect sleeping patterns, which may be particularly problematic for individuals with ASD, who are already prone to sleep disruptions and disorders.^{12,13}

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Although there is considerable concern over the negative impact that the pandemic may have on health behaviors in youth, only one study to date, has examined the effects of COVID-19 on neurotypical (NT) youth, with parents reporting that their child participated in less PA and increased their ST during the pandemic.¹⁴ There are no studies, however, that have examined the impact of COVID-19 on health behaviors in adolescents with ASD. Given the importance of health behaviors, such as PA, in adolescents with ASD, it is critical to determine whether health behaviors may be affected by the pandemic. Therefore, the purpose of this study is to examine the effects of the COVID-19 pandemic on health behaviors in adolescents with ASD. It is hypothesized that adolescents with ASD will show reductions in PA participation, increases in ST, and shorter sleep duration as a result of the pandemic. By determining whether such changes occur, researchers can then focus on interventions that can be developed to promote health behaviors during long periods of time where children are removed from a structured environment, such as during this COVID-19 pandemic.

Methods

Study design and setting

This observational study took place at a private school in Central Florida, which only enrolled children and adolescents with a physician-based diagnosis of ASD.

Participants

Recruitment took place in March of 2020, a few weeks prior to the quarantine due to COVID-19. A total of nine adolescents diagnosed with ASD were included in this study. To be eligible for the current study, adolescents had been previously enrolled in one of the health promotion classes offered at the school. It was decided to recruit students from the health promotion programs as both the school staff and investigative team felt that these students would be able to accurately report their health behaviors. To participate in the health promotion programs, individuals had to be between the ages of 14–19, diagnosed with ASD, absent of severe psychological or physical disorders that would limit their participation in the programs. Both parent consent and child assent were ascertained prior to the initiation of this study, and all study procedures were approved by the investigative team's Institutional Review Board (IRB).

Procedures

An electronic survey was sent to participants the week the quarantine went into effect. The survey consisted of questions that asked about their current physical activity, screen time, and sleep duration. Participants were asked to reflect on previous weeks, and not to consider the current circumstances surrounding the pandemic. The survey was administered a second time, approximately six weeks later at the end of April. Participants were asked to consider the period during the quarantine when providing their responses.

Demographic survey

Parents of participants were asked to complete a demographic survey that contained six items asking about their child's age, sex, race/ethnicity, height/weight, current medication status, and presence of additional health conditions. Body mass index (BMI) was calculated based on child's height and weight, reported by parents, which was then converted into BMI percentiles based on

age and gender-specific criteria. BMI percentiles $\geq 85\%$ were classified as "overweight", while BMI percentiles $< 85\%$ were classified as "normal weight".¹⁵

Lifestyle survey

Participants completed a survey that contained items measuring health behaviors adapted from the National Survey of Children's Health.¹⁶

Physical activity (PA). PA was assessed with the single item "How many days per week do you participate in at least 60 min of physical activity?". Participants could respond with 0–7 days.

Screen Time (ST). Hours per day of screen time was assessed with the item, "how many hours of screen time (television, computer, iphone, ipad, etc.) did you spend on a typical weekday?". The same question was also asked for a typical weekend. It should be noted that participants were instructed not to count the hours they were using electronic devices, such as computers, for school activities.

Sleep Duration. Participants were asked to estimate the average time they went to sleep and the time they awakened on both a typical weekday and weekend. Average hours of sleep were calculated separately for both weekdays and weekends by calculating the amount of time between the reported sleep and wake times.

Time point 2: during the pandemic

At the end of April, the same questions were administered to participants, and they were instructed to base their answers on their behaviors during the quarantine.

Additional questions. Two additional questions were included in the survey distributed during the pandemic: 1) As a result of the pandemic and quarantine, do you feel your physical activity increased/decreased/did not change?; and 2) As a result of the pandemic and quarantine, do you feel your screen time habits increased/decreased/did not change? Participants were provided with extra space on their survey to expand on their answers. There was an additional space at the end of the survey where participants could provide any further comments regarding perceived changes in their health behaviors.

Statistical analysis

Descriptive statistics were calculated for demographic and behavioral characteristics of participants. Paired samples t-tests were conducted to determine differences between health behaviors pre-pandemic and during the pandemic. All analyses were conducted using SAS 9.4 with a significance level set at $p < 0.05$.

Results

Participant characteristics

Out of nineteen eligible participants, 11 adolescents with ASD (16.87 ± 1.36 years of age; 89% male) participated in the current study. Two students failed to complete the follow-up surveys, and therefore, nine participants were included in the final analysis. [Table 1](#) provides the characteristics of the sample.

Changes in health behaviors

Participants reported a greater number of days where they participated in 60 min or more of PA prior to the pandemic compared to during the pandemic (4.17 days vs. 2.27 days; $p = 0.0006$). Additionally, participants reported engaging in a

Table 1
Participant characteristics (n = 9).

Factors	N (%)	Mean (SD)
Male	8 (89%)	
Age		16.87 (1.36)
White	7 (78%)	
Overweight	6 (67%)	
Currently on Medication	5 (56%)	
Diagnosed Comorbidity	7 (78%)*	

*Diagnoses included Attention Deficit Hyperactivity Disorder, anxiety disorders, and sensory processing disorders.

greater number of activities prior to the pandemic compared to during the pandemic (3.4 activities vs 2.11 activities; $p = 0.007$). Participants also reported spending less hours per day watching television pre-pandemic during both weekdays (3.69 h vs 6.25 h; $p = 0.007$) and weekends (5.94 h vs. 7.39 h; $p = 0.004$). No differences were found for sleep duration between pre-pandemic assessments and assessments taken during the pandemic. **Table 2** displays the means and standard deviations for the reported health behaviors for both time points.

Participant perspectives on health behavior change

For the question regarding whether participants felt their PA increased/decreased/stayed the same, 7 (78%) of the 9 participants felt that their PA decreased, while 1 participant reported no change, and 1 participant felt his activity levels increased (**Table 3**). The open-ended responses revealed that the participant who reported the increase in PA commented that his family purchased bicycles and had started riding together as a family. For the participants who reported a decrease in PA, open-ended responses attributed that decrease to the inability to attend PA programs at school, and a fear of exercising outside due to the pandemic. For the question regarding whether participants felt their ST increased/decreased/stayed the same, 7 (78%) of the 9 participants felt that their ST increased, while the remaining 1 (11%) reported no change in ST levels and 1 (11%) reported a decrease in ST during the pandemic. The open-ended responses revealed that boredom and a lack of other options were the primary reasons for the increase in ST. The one participant who reported a decrease in ST during the pandemic chose not to expand on his response. Although there was no formal question asking about sleep behavior, 4 (44%) of the 9 participants remarked that they felt they were going to bed later than usual, and 3 of the 4 participants reported waking up later in the day as well. The remaining 5 participants did not comment on their sleep habits.

Table 2
Means (SD) of activity & sleep variables pre-pandemic & during pandemic (n = 9).

Activity	Pre-pandemic	During pandemic	p-value
Days per week of 60 + min of PA	4.17 (1.52)	2.27 (2.22)	0.0006
Average number of PA-related activities*	3.4 (1.24)	2.11 (1.36)	0.007
Hours of screen time/weekday	3.69 (2.66)	6.25 (4.24)	0.007
Hours of screen time/weekend	5.94 (3.58)	7.39 (3.93)	0.004
Hours of sleep/weekday	8.72 (1.77)	9.36 (1.5)	0.16
Hours of sleep/weekend	9.47 (2.03)	10 (1.37)	0.2

Bolded values denote significance.

PA: Physical activity.

*Activities reported prior to the pandemic: walking/hiking (n = 6); running (n = 7); biking (n = 3); swimming (n = 3); weightlifting (n = 2); playing sports (n = 4). Activities reported during the pandemic: walking (n = ; running (n = 3); biking (n = 3); swimming (n = 1); weightlifting (n = 1).

Discussion

The purpose of this brief report was to explore changes in health behaviors during the pandemic in adolescents diagnosed with Autism Spectrum Disorder (ASD). Our initial hypothesis that adolescents with ASD would have less days of PA participation and greater amounts of screen time during the pandemic was upheld. However, results indicated that there were no significant differences in sleep duration, which is in contrast to our initial hypothesis that adolescents would have less sleep during the pandemic.

This novel study highlights the concern regarding differences in health behaviors in adolescents with ASD prior to and during the COVID-19 pandemic. Although preliminary, the findings from the current study provide initial support for the concern that health behaviors, particularly PA, are negatively impacted by the pandemic in adolescents with ASD.⁷ A reduction in the number of activities the adolescents participated in was observed during the pandemic, with less of the sample reporting activities, such as swimming, running, and playing sports compared to before the outbreak. Although the current study only provided a brief opportunity for participants to expand on their reported changes in PA and ST, it appeared that limited opportunities, boredom, and fear of the pandemic were the primary factors related to their decreased levels of PA and increased amount of ST. While only one participant reported an increase in PA during the pandemic, it is interesting to note that family participation in exercise was the reason given by the participant. Although more research into family support for PA during the pandemic is clearly warranted, this preliminary finding is supported by a recent study that reported family environment as an important influence on PA participation during COVID-19 for NT populations.¹⁴ Additionally, previous work has found that family support may be an important factor for promoting positive behavior change in youth ASD populations.^{17,18}

Results from the current study lend support to a phenomenon known as the “Structured Days Hypothesis” (SDH), which proposes that children and adolescents demonstrate positive health behaviors (increased PA, decreased ST) when they follow a structured schedule throughout the day.¹⁹ While the majority of research examining the SDH focuses on NT youth, a recent study reported that children with developmental disabilities participated in greater levels of PA and improved sleep duration during days they attended a structured day-camp program compared to “unstructured” days where they did not attend the camp.²⁰ This suggests that the disruption of structured school days may be a critical factor accounting for the decrease in PA and increase in ST. As youth with ASD tend to prefer a familiar routine and structure, this disruption to their daily lives may have even greater adverse effects on their health behaviors compared to NT youth.^{5,6} A better understanding of how the SDH may help to explain the impact of the pandemic affects health behaviors in youth with ASD is warranted.

Table 3
Participant responses on activity change during the pandemic (n = 9).

Question	Response Options		
During the pandemic, how did the following activities change?	Decreased	No change	Increased
Physical Activity	7 (78%)	1 (11%)	1 (11%)
Screen Time	1 (11%)	1 (11%)	7 (78%)

The findings from the current study are highly similar to the previous study that examined health behaviors during the outbreak in a sample of 1503 NT children living in Canada.¹⁴ This study found that NT adolescents reported an average of 2.59 days per week of PA and 6.53 h per day of ST during the pandemic. Although the previous study did not assess actual PA and ST levels prior to the pandemic, NT youths reported decreases in PA and increases in ST during the outbreak, which is in line with the current study.¹⁴ In contrast to our current study, however, there was a reported increase in sleep duration during the pandemic for NT children.¹⁴ Although results from our study cannot determine the exact reasons for the lack of change in sleep duration, it is possible that the small sample size of the current study limited the ability to detect sleep differences. It is also possible that the transition from in-person to online learning may have provided additional time for sleep, which would be more in line with the previous research.¹⁴ Although based on anecdotal evidence, findings from the current study suggest that sleep and wake times may have shifted as a result of the pandemic, with participants going to bed later in the evening, and waking up later during the day. Given the high prevalence of sleep disturbances reported in this population, more research is warranted to determine whether the COVID-19 pandemic may impact sleep duration in adolescents with ASD.¹³

Limitations

Several limitations of the current study should be noted. First, the small sample size is a limitation, however, we intend to recruit a larger sample of youth with ASD to examine health behaviors throughout the pandemic. Second, data were collected via self-report which may be prone to bias, however, the use of objective measures (e.g. accelerometers) would not be feasible given the social distancing and stay-at-home orders. Third, the brief nature of the surveys provided minimal details on behaviors, although participants were able to expand on their responses. The brevity of the survey was advised by teachers at the school site, who felt it was best to minimize any additional burden, given the current situation.

Adolescents who were currently enrolled in a health promotion program at the school were recruited for the study, since they had previously tracked their health behaviors in the program. While this may have increased the accuracy of their assessment of their health behaviors, their prior experience and interest in their own health may have biased the results.

Implications

The results from the current study have several implications. First, although preliminary, this study provides evidence to support the concern that health behaviors in youth with ASD may be negatively impacted by the COVID-19 pandemic.⁷ Given the additional benefits of increasing PA and decreasing ST in youth with ASD, coupled with the potential for a pandemic or other event of a similar magnitude to impact a population over a long period of time, a decline in activity could result in an increased risk of adverse physical and psychosocial health in youth ASD populations. It is imperative that further research be conducted to better understand

both the short and long-term impact that the COVID-19 outbreak may have on health behaviors, and that strategies to promote PA and discourage ST behavior, while addressing barriers brought on by the pandemic, be developed for youth with ASD.

Conclusion

Although preliminary, this study is the first to provide evidence that adolescents with ASD may experience significant decreases in physical activity, and increases in levels of screen time during the COVID-19 outbreak. As the duration of the pandemic is unknown, it is critical to understand the effects of COVID-19 on health behaviors in youth with ASD, so that effective strategies can be developed to attenuate the negative impact and protect against possible long-term health risks from the current outbreak, and future events of similar magnitude.

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Research involving human participants

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

No research was performed on animals in this study.

Informed consent

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

Declaration of competing interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dhjo.2020.101021>.

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