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Hunayara Lorena Sousa Tavares

ESTUDO DA RELAÇÃO ENTRE A DEPÊNDENCIA DE JOGOS DE INTERNET E SINTOMAS INTERNALIZANTES DURANTE A PANDEMIA DE COVID-19

Belo Horizonte

2022

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Tese apresentada ao Programa de Pós-Graduação em Saúde da Criança e do Adolescente, Faculdade de Medicina, Universidade Federal de Minas Gerais, como requisito parcial à obtenção do título de Doutora em Medicina da Saúde da Criança e do Adolescente.

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ATA DE DEFESA DE TESE

Às dez horas do dia vinte e oito de novembro de dois mil e vinte e dois, na Faculdade de Medicina da Universidade Federal de Minas Gerais, por meio de videoconferência da Plataforma Microsoft Teams, através do link: https://teams.microsoft.com, realizou-se a sessão pública para a defesa de tese da aluna **HUNAYARA LORENA SOUSA TAVARES**, número de registro 2018753759, graduada no curso de PSICOLOGIA, como requisito parcial para a obtenção do grau de Doutor em CIÊNCIAS DA SAÚDE pelo Programa de Pós-Graduação em Ciências da Saúde-Saúde da Criança e do Adolescente. A Presidência da sessão coube à Prof.ª Débora Marques de Miranda - Orientadora (UFMG). Inicialmente a Presidente após dar conhecimento aos presentes sobre o teor das Normas Regulamentares do trabalho final de Pós-Graduação, fez a apresentação da Comissão Examinadora, assim, constituída pelos seguintes Professores Doutores: Lorrayne Stephane Soares (TALK2YOU), Danielle Souza Costa (UFMG), Marco Aurélio Romano Silva (UFMG) e Jonas Jardim de Paula (UFMG). Em seguida a Presidente autorizou a aluna para iniciar a apresentação de seu trabalho final intitulado: **"ESTUDO DA RELAÇÃO ENTRE A DEPENDÊNCIA DE JOGOS DE INTERNET E SINTOMAS INTERNALIZANTES DURANTE A PANDEMIA DE COVID-19"**. Seguiu-se à arguição pela comissão Examinadora, com a respectiva defesa da aluna. Logo após a Comissão reuniu-se sem a presença da candidata e do público para julgamento e expedição do resultado da avaliação do trabalho final da aluna e decidiu considerar a tese Aprovada. O resultado final foi comunicado publicamente à aluna pela Presidente da Comissão. Nada mais havendo a tratar, a Presidente encerrou a sessão e lavrou a presente ata que, após lida, será assinada eletronicamente por todos os membros da Comissão.

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Aos meus filhos, Saulo e Alice ♡

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“Eu tenho uma alma que é feita de sonhos.”

(CBJr.)

RESUMO

TAVARES, Hunayara Lorena Sousa. **Study of the relationship between Internet gaming addiction and internalizing symptoms during the COVID-19 pandemic.** Belo Horizonte, 2022. Tese (Doutorado em Saúde da Criança e do Adolescente) - Faculdade de Medicina, Universidade Federal de Minas Gerais, 2022.

A pandemia da doença de Coronavírus (COVID-19) representa um dos eventos mais estressantes dos últimos tempos. O vírus da família coronavírus 2 da síndrome respiratória aguda grave (SARS-CoV-2, anteriormente 2019-nCoV) é a causa da doença de coronavírus 2019. Na tentativa de conter a disseminação do vírus, medidas de distanciamento e isolamento social foram adotadas gerando consequências sociais e econômicas. As crianças e os adolescentes foram expostos a estressores biopsicossociais gerados pela pandemia. Essa transformação de estilo de vida e a ameaça de infecção aumentou o número de sintomas internalizantes. A consequente interrupção das atividades e fechamento das escolas também trouxe fatores de risco comportamentais, como o uso problemático de dispositivos eletrônicos pelas crianças e adolescentes. Nesta tese, investigamos a associação entre dependência de jogos de Internet, tempo de tela e sintomas internalizantes em três momentos da pandemia de COVID-19. Os resultados do primeiro trabalho demonstram que a alta dependência de jogos de Internet está associada com altos sintomas internalizantes. Porém, o tempo de tela reduzido pode atenuar a relação entre dependência de jogos de Internet e sintomas internalizantes se a dependência de jogos de Internet for baixa. Já no segundo artigo, a pergunta de pesquisa diz respeito sobre como tempo de tela, dependência de jogos de Internet e sonolência excessiva se associam com os sintomas internalizantes. Em todos os três momentos avaliados, o alto tempo de tela leva à alta dependência de jogos de Internet, levando à sonolência excessiva e, por fim, levando a maiores sintomas internalizantes. Portanto, nesta tese abordamos aspectos que nos ajudam a avançar no entendimento da associação entre dependência de jogos de Internet, tempo de tela e sintomas internalizantes em crianças e adolescentes durante três momentos da pandemia de COVID-19.

Palavras-chave: COVID-19; sintomas internalizantes; dependência de jogos; Internet; tela.

ABSTRACT

TAVARES, Hunayara Lorena Sousa. ***Study of the relationship between Internet gaming addiction and internalizing symptoms during the COVID-19 pandemic.*** [Estudo da relação entre a dependência de jogos de Internet e sintomas internalizantes durante a pandemia de COVID-19] Belo Horizonte, 2022. Tese (Doutorado em Saúde da Criança e do Adolescente) - Faculdade de Medicina, Universidade Federal de Minas Gerais, 2022.

The Coronavirus disease pandemic (COVID-19) represents one of the most stressful events in recent times. The severe acute respiratory syndrome coronavirus family virus 2 (SARS-CoV-2, formerly 2019-nCoV) is the cause of coronavirus disease 2019. To contain the spread of the virus, measures of social distancing and isolation were adopted generating social and economic consequences. Children and adolescents have been exposed to biopsychosocial stressors generated by the pandemic. This transformation in lifestyle and the threat of infection increased the number of internalizing symptoms. The consequent disruption of activities and school closures also brought about behavioral risk factors, such as problematic use of electronic devices by children and adolescents. In this thesis, we investigate the association between Internet gaming addiction, screen time, and internalizing symptoms at three times during the COVID-19 pandemic. The results of the first paper show that high Internet gaming addiction is associated with high internalizing symptoms. However, reduced screen time may attenuate the relationship between Internet game dependence and internalizing symptoms if Internet game dependence is low. In the second article, on the other hand, the research question concerns how screen time, Internet game dependence, and excessive sleepiness associate with internalizing symptoms. At all three time points evaluated, high screen time leads to high Internet game addiction, leading to excessive sleepiness, and ultimately leading to higher internalizing symptoms. Therefore, in this thesis we address aspects that help us advance our understanding of the association between Internet game addiction, screen time and internalizing symptoms in children and adolescents during three moments of the COVID-19 pandemic.

Keywords: COVID-19 pandemic; internalizing symptoms; addiction; gaming; internet; screen.

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LISTA DE ABREVIATURAS E SIGLAS

APA	*American Psychiatric Association*
CABI	*Child and Adolescent Behavior Inventory*
CCEB	Critérios de Classificação Económica Brasileira
CID	Classificação Internacional de Doenças
COEP	Comitê de Ética em Pesquisa
COVID-19	*Coronavirus Disease 2019*
DP	Desvio-Padrão
DSM	Manual Diagnóstico e Estatístico de Transtornos Mentais
GAS	*Game Addiction Scale*
IGD	*Internet Gaming Disorder*
OMS	Organização Mundial da Saúde
PSQI	*Pittsburgh Sleep Quality Index*
SDRA	Síndrome do Desconforto Respiratório Agudo
TCLE	Termo de Consetimento Livre e Esclarecido
TDAH	Transtorno do Déficit de Desatenção e Hiperativdade
UFMG	Universidade Federal de Minas Gerais

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1 INTRODUÇÃO

A pandemia da doença de Coronavírus (COVID-19) representa um dos eventos mais estressantes dos últimos tempos. O vírus da família coronavírus 2 da síndrome respiratória aguda grave (SARS-CoV-2, anteriormente 2019-nCoV) é a causa da doença de coronavírus 2019. O primeiro caso registrado da doença ocorreu na Província de Wuhan, na China. No dia 11 de março de 2020, o Diretor Geral da Organização Mundial da Saúde (OMS), Tedros Adhanom, declarou o surto de COVID-19 como uma "pandemia" devido ao aumento da taxa de infecção em vários países de diferentes continentes (WHO, 2020).

Os sintomas da COVID-19 incluem febre, tosse seca, dispneia, mialgias, fadiga e diarreia, bem como alterações em exames sorológicos e de imagem. Durante sua progressão para casos graves, a COVID-19 pode se apresentar como pneumonia, Síndrome do Desconforto Respiratório Agudo (SDRA) e evoluir para choque séptico (Huang C. et al., 2020; Murthy, Gomersall, & Fowler, 2020). O coronavírus 2 é transmitido de pessoa para pessoa por meio de contato próximo e/ou aerossóis de gotículas respiratórias. Medidas de isolamento físico e social foram amplamente utilizadas. É recomendado o distanciamento físico de pelo menos 1 m, pois está associado a uma grande redução na infecção, e distâncias de 2 m podem ser mais eficazes. O uso de máscaras protege as pessoas da infecção do coronavírus. A proteção dos olhos confere benefícios adicionais. No entanto, nenhuma dessas intervenções oferece proteção completa contra infecção (Chu, et al., 2020).

Na tentativa de conter a disseminação do vírus, medidas de distanciamento e isolamento social foram adotadas gerando consequências sociais e econômicas. Mudanças bruscas no estilo de vida acarretaram um grande impacto na saúde física, psíquica e social do ser humano. Entre as medidas mais drásticas, seguidas especialmente nos estágios iniciais, o *'lockdown*' foi adotado pela maioria dos países e contemplava o fechamento de todas as atividades produtivas e comerciais, escolas, universidades e todos os demais pontos de encontro social. Apesar da importância dessas medidas para a redução da disseminação da doença, a saúde mental da população foi afetada (Fazio, et al., 2022; Burhamah, et al., 2020). Muitos fatores contribuíram para as complicações de saúde mental, tais como as incertezas sobre doença nova e desconhecida, dificuldades econômicas, notícias falsas, desestrutura da rede social, além dos fatores individuais.

Qualquer grande surto epidêmico terá efeitos negativos sobre os indivíduos e a sociedade. As reações psicológicas da população desempenham um papel crítico na formação tanto da disseminação da doença quanto da ocorrência de sofrimento emocional e desordem social durante e após o surto (Taylor, 2022). Durante o estágio inicial do surto de COVID-19 na Arábia Saudita, uma pesquisa foi realizada com 1.160 pessoas com o objetivo de avaliar o grau de impacto psicológico durante a pandemia. Os resultados mostraram que quase um quarto da população geral da amostra experimentou um impacto psicológico moderado a grave (A.Alkhamees, A.Alrashed, A.Alzunaydi, S.Almohimeed, & S.Aljohani, 2020). Na mesma direção, um estudo conduzido na Argélia com 678 pessoas encontrou resultados semelhantes, 50,3% dos entrevistados relataram vivenciar situações de ansiedade durante as três primeiras semanas de confinamento, 48,2% se sentiram estressados, 46,6% afirmaram episódios de mau humor e 47,4% tiveram pensamentos recorrentes ao longo do dia sobre a pandemia e como se proteger (Madani, Boutebal, & Bryant, 2020). Dados de um estudo conduzido com 45.161 brasileiros mostraram que durante a pandemia, 40,4% das pessoas frequentemente se sentiam tristes ou deprimidos; 52,6% frequentemente se sentiam ansiosos ou nervosos; 43,5% relataram o início de problemas de sono e 48,0% tiveram um problema de sono prévio que se agravou. A tristeza e o nervosismo frequentes, bem como a mudança nos padrões de sono foram maiores em jovens e naqueles com histórico de depressão (Barros, et al., 2020).

Em comparação com os adultos, há evidências crescentes na literatura que as crianças e os adolescentes também tiveram prejuízos significativos na saúde mental durante a pandemia de COVID-19 e desenvolveram sintomas semelhantes, como ansiedade, depressão, distúrbios do sono, medo, estresse, solidão, irritabilidade, entre outros (Shah, Mohammad, Qureshi, Abbas, & Aleem, 2021; Bai, et al., 2022; Hards, et al., 2022; Varma, Junge, Meaklim, & Jackson, 2021; Meade, 2021). As mudanças inéditas trazidas pelo COVID-19, como isolamento social, fechamento das escolas, recreação limitada e estresse familiar reduziram as interações sociais das crianças e adolescentes (Ma, et al., 2021).

Antes da pandemia de COVID-19, a prevalência mundial de transtornos mentais em crianças e adolescentes era de 13,4%. A prevalência de qualquer transtorno de ansiedade era de 6,5%, qualquer transtorno depressivo 2,6%, Transtorno de Déficit de Atenção e Hiperatividade (TDAH) 3,4% e qualquer transtorno disruptivo 5,7% (Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015). Já na pandemia, uma revisão

sistemática e metanálise com 57.927 crianças e adolescentes da China e Turquia encontrou altos índices de transtorno mental na população pesquisada. A metanálise dos resultados de 23 estudos mostrou que a prevalência combinada de depressão foi de 29%, ansiedade 26%, distúrbios do sono 44% e sintomas de estresse pós-traumático 48% (Ma, et al., 2021). Na mesma direção, uma pesquisa com 1.784 alunos do 2° ao 6° ano da Provincia de Hubei que estavam em isolamento domiciliar por uma média (DP) de 33,7 (2,1) dias quando completaram a pesquisa, teve como resultado que 22,6% das crianças e adolescentes relataram sintomas ansiosos e 18,9% sintomas depressivos (Xie, et al., 2020).

As crianças e os adolescentes foram expostos a estressores biopsicossociais gerados pela pandemia. Essa transformação de estilo de vida e a ameaça de infecção aumentou o número de sintomas internalizantes (Shah, Mohammad, Qureshi, Abbas, & Aleem, 2021; Bai, et al., 2022; Ma, et al., 2021; Xie, et al., 2020). Em 2020, um estudo avaliou 1.036 crianças e adolescentes em quarentena na China em uma faixa etária de 6 a 15 anos, dos quais 112, 196 e 68 apresentavam depressão, ansiedade e ambos, respectivamente (Chen, et al., 2020). Além disso, também foi relatado na Índia que crianças e adolescentes de 9 a 18 anos experimentaram desamparo (66,11%), preocupação (68,59%) e medo (61,98%) (Ranjan, 2020).

A consequente interrupção das atividades e fechamento das escolas também trouxe fatores de risco comportamentais, como o uso problemático de dispositivos eletrônicos pelas crianças e adolescentes. As experiências negativas do distanciamento social foram substituídas pelo uso de Internet (Cauberghe, Wesenbeeck, Jans, Hudders, & Ponet, 2021). Por meio de uma pesquisa sistemática da literatura e metanálise, 30 estudos publicados até setembro de 2021 foram analisados em relação a saúde mental e uso de mídia social por adolescentes durante a pandemia de COVID-19. Os resultados mostraram que a maioria dos estudos relataram uma associação positiva entre o mal-estar e o uso de mídias sociais ($r = 0{,}171$, $p = 0{,}011$) e mal-estar e vício em mídia ($r = 0{,}434$, $p = 0{,}024$) (Marciano, Ostroumova, Schulz, & Camerini, 2022).

Dados obtidos do estudo transnacional *Health Behavior in School-aged Children* traçaram um panorama das tendências temporais na visualização de TV e uso de computador entre adolescentes de 30 países. Entre 2002 e 2010, a visualização de TV diminuiu ligeiramente na maioria dos 30 países entre meninos e meninas. Esta diminuição foi mais do que compensada por um aumento acentuado no uso de computadores, que foi consistente em todos os países (Bucksch, et al., 2016). O uso de dispositivos digitais

tornou-se parte integrante da vida diária das crianças e adolescentes. A literatura sugere que crianças e adolescentes passam grande parte do tempo de lazer consumindo conteúdos digitais (K, 2018; Marshall, Gorely, & Biddle, 2006; Silva, Lopes, Dumith, Garcia, & Nahas, 2013).

Durante a pandemia da doença de Coronavírus 2019, as medidas de bloqueio instituídas causaram restrições das atividades escolares presenciais. As instituições educacionais adotaram o modelo de ensino remoto para as crianças e adolescentes darem continuidade aos estudos. O uso de telas por crianças e adolescentes já estava em ascensão e foi adaptativo estar na frente das telas em tempos de poucas atividades e opções. O relatório de 2019 da *Common Sense Media* traz um alerta em relação ao tempo de uso de dispositivos eletrônicos por crianças e adolescentes. A quantidade de horas que crianças de 8 a 12 anos nos Estados Unidos da América utilizavam telas para entretenimento era de quase 5 horas por dia, já adolescentes de 13 a 18 anos, eram mais de 7 horas por dia (Rideou & Robb, 2019).

Não obstante, com o surto epidêmico de COVID-19, o tempo de tela tornou-se maior durante os períodos de fechamento de escolas, bloqueios e distanciamento social (Wang, Zhang, Zhao, Zhang, & Jiang, 2020). Uma pesquisa realizada na Turquia durante a pandemia de COVID-19 revelou que o tempo de tela de 71,7% das famílias entrevistadas (n=1.115) com crianças entre 6 e 13 anos teve um aumento considerável, totalizando 6,42 ± 3,07 h/dia (Eyimaya & Irmak, 2021). A duração, o conteúdo, a finalidade, o uso após o anoitecer, o tipo de mídia e o número de dispositivos são variáveis que determinam os efeitos do tempo de tela na vida das crianças e adolescentes (Lissak, 2018).

Os efeitos do tempo de tela na saúde física das crianças e adolescentes relatados em pesquisas conduzidas durante a pandemia de COVID-19 destacam a piora da qualidade do sono, o risco para doenças cardiovasculares, o aumento da obesidade, a visão prejudicada e o estresse - alta excitação simpática e desregulação do cortisol (Schmidt, et al., 2020; Nagata, Magid, & Gabriel, 2020; Wong, et al., 2021; Velde, et al., 2021). Já os efeitos psicológicos mais relatados são: ansiedade, depressão, desatenção, oscilações de humor, sintomas externalizantes e comportamentos de desejo que se assemelha ao comportamento de dependência de substâncias (Qin, et al., 2020; Groep, Zanolie, Green, Sweijen, & Crone, 2020; Tandon, Zhou, Johnson, Gonzalez, & Kroshus, 2021; Caffo, Asta, & Scandroglio, 2021; Sutomo, Ramadhani, & Hanifa, 2022).

O aumento no número de horas online em atividades recreativas, a falta de

supervisão dos pais e o isolamento social foram fatores que contribuíram para a dependência de jogos de Internet durante a pandemia. Uma revisão sistemática do impacto do COVID-19 no transtorno de jogos de Internet em crianças e adolescentes mostrou que houve um aumento de 2,3 a 29,4% no tempo de uso de jogos virtuais durante a pandemia de COVID-19, além de maiores pontuações em escalas de vício de jogos digitais (Han, Cho, Sung, & Park, 2022). A *American Psychiatric Association (APA)* incluiu o Transtorno de Jogo pela Internet *(Internet gaming disorder – IGD, em inglês)* na 5ª edição do Manual Diagnóstico e Estatístico de Transtornos Mentais (DSM) como tema de investigação empírica adicional, e a Organização Mundial de Saúde descreveu o Transtorno de Jogo pela Internet na 11ª revisão da Classificação Internacional de Doenças (CID). (American Psychiatric Association, 2013; Organization World Health, 2019).

Entender os efeitos do confinamento na saúde mental das crianças e adolescentes e a associação entre sintomas internalizantes, tempo de tela e dependência de jogos de Internet é importante para futuros estudos de intervenção e recomendações baseadas em evidências para promover o uso saudável dos dispositivos digitais. Nesta tese, abordamos quando e como ocorre essa associação e possíveis desfechos, em dois trabalhos. No primeiro trabalho, investigamos a associação entre dependência de jogos de Internet, tempo de tela e sintomas internalizantes em três momentos da pandemia de COVID-19. Nossos resultados demonstram que a alta dependência de jogos de Internet está associada com altos sintomas internalizantes. Porém, o tempo de tela reduzido pode atenuar a relação entre dependência de jogos de Internet e sintomas internalizantes se a dependência de jogos de Internet for baixa.

Finalmente, se o primeiro artigo respondeu quando o transtorno de jogos de Internet, tempo de tela e sintomas internalizantes estavam associados, no segundo artigo a pergunta de pesquisa diz respeito sobre como tempo de tela, dependência de jogos de Internet e sonolência excessiva se associam com os sintomas internalizantes. Em todos os três momentos avaliados, o alto tempo de tela leva à alta dependência de jogos de Internet, levando à sonolência excessiva e, por fim, levando a maiores sintomas internalizantes. Portanto, nesta tese abordamos aspectos que nos ajudam a avançar no entendimento da associação entre transtono de jogos de Internet, tempo de tela e sintomas internalizantes em crianças e adolescentes durante três momentos da pandemia de COVID-19. Em resumo é importante reconhecer que os jogos online, embora benéficos com moderação, podem gerar ou promover consequeências na saúde mental das crianças

e adolescentes. Abordagens equilibradas e eficazes aos jogos durante a pandemia são necessárias para apoiar o bem estar físico e psicológico das crianças e adolescentes.

2 OBJETIVOS

Objetivo Geral

- Investigar a associação entre dependência de jogos de Internet, tempo de tela e sintomas internalizantes em três momentos da pandemia de COVID-19.

Objetivos Específicos

- Investigar QUANDO ocorre a associação entre dependência de jogos de Internet, tempo de tela e sintomas internalizantes.
- Investigar COMO ocorre a associação entre dependência de jogos de Internet, tempo de tela, sintomas internalizantes e sonolência excessiva.

3 MÉTODOS

Esta tese foi estruturada em torno de dois artigos científicos que compõem a sessão resultados. Optou- se por essa estrutura, pois parte do material que compõe a tese já se encontra publicado em periódicos científicos e as metodologias empregadas são específicas de cada estudo.

- Sousa Tavares HL, Souza Costa D, Soares AA, Kestelman I, da Silva AG, Malloy-Diniz LF, de Paula JJ, de Miranda DM. Gaming addiction and screen time in a context of increase of internalizing symptons: Moderation evaluation. Clin Child Psychol Psychiatry. 2022 Sep 3.

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As crianças e os adolescentes sofreram impactos psicossociais advindos da pandemia de COVID-19. Durante este período, houve um aumento dos sintomas internalizantes, do tempo de tela e do Transtorno de jogos de Internet. No entanto, a interação destas variáveis não é totalmente compreendida. Aqui, temos um estudo transversal repetido com o objetivo de investigar a associação entre sintomas internalizantes, tempo de tela e dependência virtual durante a pandemia de COVID-19. Os dados foram coletados em três momentos, com seis meses de intervalo entre si, de um total de 1.211 participantes. Encontramos um aumento no tempo de tela, dependência de jogos e sintomas internalizantes. Independentemente do tempo em frente a tela, níveis mais elevados de dependência de jogos foram associados a níveis mais elevados de sintomas internalizantes em crianças e adolescentes. Mesmo que os participantes demonstrassem pouco tempo de tela, se estivessem virtualmente dependentes tinham tendência a apresentar níveis mais elevados de sintomas internalizantes. O mesmo resultado foi encontrado em todas as três amostras. Há necessidade de investigar a natureza da relação entre o trasntorno de jogos de Internet, os sintomas internalizantes e os efeitos de longos períodos em frente às telas.

- Sousa Tavares HL, Souza Costa D, Soares AA, Malloy-Diniz LF, de Paula JJ, de Miranda DM. Study of relationship between the Internet gaming addiction and internalizing symptoms during three timepoints in stressful timing.

O uso exacerbado de jogos pela Internet por crianças e adolescentes é uma preocupação crescente. O Transtorno de Jogos de Internet, em inglês Internet Gaming Disorder - IGD) está descrito na 5ª edição do Manual de Diagnóstico e Estatística das Doenças Mentais e na 11ª revisão da Classificação Internacional de Doenças (CID). O vício de jogos da Internet refere-se a uma série de comportamentos excessivos e compulsivos relacionados com a tecnologia, que resultam numa deficiência na vida do sujeito. A pandemia de COVID-19 teve impacto na utilização de jogos de Internet por crianças e adolescentes e aumentou a prevalência e gravidade do vício. Existem associações entre a dependência de jogos de Internet, sintomas internalizantes e sonolência excessiva. Aqui, avaliamos em três momentos, as frequências da dependência de jogos de Internet para verificar os mecanismos de associação entre o tempo de tela e sintomas internalizantes através da dependência de jogos de Internet e sonolência excessiva. Os resultados indicaram que a relação entre o tempo de tela e sintomas internalizantes foi moderada/forçada por onda, enquanto a associação indireta através de dependência de jogos de Internet e sonolência excessiva permaneceu semelhante através de diferentes ondas. Também se pode concluir que níveis mais elevados de tempo de tela estão associados a pontuações mais elevadas de sintomas internalizantes, independentemente dos níveis de vício virtual e sonolência excessiva. É importante notar que a associação se tornou mais forte nas ondas 2 e 3.

3.1 Procedimentos

A presente pesquisa foi aprovada pelo Comitê de Ética e Pesquisa (COEP) da Universidade Federal de Minas Gerais (UFMG) e está de acordo com a Declaração de Helsínquia. Os participantes do estudo foram convidados através da internet a preencher o Termo de Consentimento Livre e Esclarecido (TCLE), em seguida responderam algumas escalas psicológicas e um questionário sociodemográfico. O inquérito online foi disponibilizado na plataforma SoSci Survey (https://www.soscisurvey.de), escolhida devido aos seus elevados padrões de segurança. Os resultados foram comunicados de acordo com a lista de verificação CHERRIES, que tem como objetivo melhorar a qualidade dos inquéritos na Web (Gunther, 2004). Aos pais de crianças dos 6 aos 17 anos foi solicitado que preenchessem um questionário online sobre apenas um dos seus filhos. O inquérito foi realizado em três momentos: Julho de 2020 (onda 1), Dezembro de 2020 (onda 2), e Julho de 2021 (onda 3). Trata-se de um estudo transversal repetido, ou seja, é possível descrever padrões de mudança ao longo do tempo nas populações alvo (Lebo & Weber, 2014).

3.2 Participantes

Foram convidados para participar da pesquisa pais maiores de 18 anos, com crianças entre os 6 e os 17 anos, que possuem acesso à Internet. Os participantes que preencheram os formulários incompletamente e/ou não viveram com os seus filhos durante o período de isolamento social da COVID-19 foram excluídos. Na primeira onda 528 pais responderam ao questionário, na segunda onda 330, e na terceira onda houve 353 participações válidas. O total foi de 1.211 participantes.

3.4 Instrumentos de Avaliação

Características sociodemográficas

As características sociodemográficas dos participantes foram coletadas através do inquérito online que continha perguntas que investigavam a idade, sexo, etnia, tipo de escola (pública ou particular) e grau escolar dos pais. Para a classificação econômica, utilizou-se os Critérios de Classificação Económica Brasileira (CCEB). O CCEB é um

sistema de classificação de preços para o público brasileiro. Pretende ser uma forma única de avaliar o poder de compra dos grupos de consumidores. Não tem a pretensão de classificar a população em termos de "classes sociais" e sim, dividir o mercado exclusivamente em classes económicas. Esta classificação é baseada na posse de bens e não no rendimento familiar. Para cada bem possuído existe uma pontuação e cada classe é definida pela soma destas pontuações. A pontuação no CCEB pode variar de 0 a 100. As classes definidas pelo CCEB são A (rendimento médio de U$ 4621,04), B1 (rendimento médio de U$ 2039,63), B2 (rendimento médio de U$ 1020,19), C1 (rendimento médio de U$ 557,95), C2 (rendimento médio de U$ 316,20), e DE (rendimento médio de U$ 135,59) (ABEP, 2019).

Child and Adolescent Behavior Inventory (CABI)

O *Child and Adolescent Behavior Inventory* é uma escala de rastreio dimensional para trasntornos mentais e comportamentos problemáticos em crianças e adolescentes. Tem 75 itens que cobrem várias áreas da psicopatologia e do comportamento das crianças. Os sintomas mais representativos relatados nos critérios de diagnóstico DSM-IV-TR e DSM-5 foram escolhidos e agrupados em três principais subescalas do CABI: Sintomas Internalizantes (ou seja, ansiedade e transtornos depressivos), Sintomas Externalizantes (comportamentos opositores e desafiadores), e Transtorno do Déficit de Atenção e Hiperatividade (TDAH) (Cianchetti 2013). O questionário é preenchido pelos pais que responderam a cada pergunta numa escala com três opções: 2- muito verdadeira, 1- um pouco ou às vezes verdadeira, ou 0 - não verdadeira. Pontuações mais elevadas são indicativas de problemas emocionais e/ou comportamentais. Nos dois estudos, utilizamos apenas a subescala de sintomas internalizantes. O CABI demonstrou uma elevada consistência interna e uma aplicação clínica válida (Cianchetti 2013, 2017). Os primeiros itens (1 a 4) dizem respeito a quatro tipos de sintomas que podem ser isolados, mas que são mais frequentemente incluídos em ansiedade ou perturbações depressivas. Os 10 itens que exploram sintomas depressivos perguntam sobre humor (19-22), falta de interesse (23), autoestima (24), abulia (25), culpa (26), e pensamentos e tentativas suicidas (27 e 28). Subgrupos mais amplos podem ser delineados: a) "transtornos internalizantes", equivalente aos sintomas de ansiedade e depressão, poderiam incluir os itens 5-10 e 19-28; contudo, num sentido mais amplo, essa categoria poderia incluir todos os itens do 1 ao 28; b) "transtornos externalizantes" inclui os itens 33-42 e possivelmente os itens 29-

32, enquanto os itens 43-51 são específicos para TDAH, um transtorno do neurodesenvolvimento com características peculiares (Cianchetti, et al., 2013). A versão brasileira adaptada foi recentemente desenvolvida e está em processo de revisão numa revista especializada. As estimativas de confiabilidade sugerem uma elevada consistência interna para as suas escalas principais (alfas e/ou ómegas variando entre 0,87 e 0,91) e a sua validade (testada por análise de fatores e correlações) sugere adequação para o uso proposto.

Tempo de Tela

A variável Tempo de Tela foi medida através do questionário online a partir da seguinte pergunta: "Durante quanto tempo o seu filho ou adolescente usa tela (usa computadores, vê vídeos em redes sociais, vê televisão, joga jogos eletrônicos, etc.) durante o dia?" O cuidador poderia marcar uma das seguintes alternativas: a) Até 2 horas b) De 2 a 4 horas c) De 4 a 8 horas d) Mais de 8 horas. O período considerado corresponde a um dia (24 horas).

Game Addiction Scale (GAS)

A *Game Addiction Scale* foi desenvolvida para avaliar o Transtorno de Jogos de Internet. A GAS consiste em 21 itens que estão divididos em sete fatores: saliência, tolerância, mudanças de humor, recaída, retirada, conflito e problemas. Utiliza os critérios clínicos do DSM-5 para o jogo patológico (Lins Lemos, Cardoso, & Botelho, 2016). A versão adaptada e traduzida para o português brasileiro teve uma boa consistência interna (o alfa-Cronbach varia de 0,55 a 0,92 para cada critério e 0,92 para a pontuação total) (Lemmens & Peter, 2009). Nos dois estudos que compõe a tese, utilizamos uma versão do GAS orientada para as crianças, que está atualmente em desenvolvimento pelo nosso laboratório. Envolve basicamente a adaptação de perguntas e instruções direcionadas aos pais, uma vez que a escala original é uma medida de autorrelato, mantendo o conteúdo de cada item e as dimensões dos sintomas. Para avaliação, foi utilizada a pontuação total. Assim, as pontuações altas são indicativas de dependência do jogo. Embora não sejam publicados dados psicométricos para esta versão de GAS no momento, a versão brasileira em português para adolescentes apresenta uma boa consistência interna (alfa varia de 0,55 a 0,92 para cada critério e 0,92 para a pontuação total) (Lemmens & Peter, 2009).

Pittsburgh Sleep Quality Index (PSQI)

O Pittsburgh Sleep Quality Index é um instrumento de autorrelato composto por 19 itens que medem sete componentes do sono: qualidade subjetiva do sono, latência, duração, eficiência, distúrbios, uso de medicação para dormir e disfunção diurna. As respostas para cada item variam de 0 (nunca) a 3 (todo o tempo), com pontuações mais altas indicando sono ruim/pior sono ou problemas/dificuldades de sono. A pontuação global do PSQI varia de 0 a 21, sendo que uma pontuação total >5 é indicativo de qualidade de sono ruim ou prejudicada, e quanto maior a pontuação, pior a qualidade do sono (Buysse, Reynolds, Monge, Berman, & Kupfer, 1989). Os estudos de confiabilidade e validade da versão brasileira apresentaram bons resultados. O questionário obteve elevada consistência interna e confiabilidade moderada. O α de Cronbach foi de 0,71 e coeficiente de correlação intraclasse de 0,65 (IC95% 0,21-0,85) (Passos, et al., 2017). Este instrumento foi utilizado nas análises do segundo artigo apresentado.

4 RESULTADOS

4.1 ARTIGO 1

Sousa Tavares HL, Souza Costa D, Soares AA, Kestelman I, da Silva AG, Malloy-Diniz LF, de Paula JJ, de Miranda DM. **Gaming addiction and screen time in a context of increase of internalizing symptons: Moderation evaluation.** Clin Child Psychol Psychiatry. 2022 Sep 3.

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Gaming addiction and screen time in a context of increase of internalizing symptoms: Moderation evaluation

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Hunayara Lorena Sousa Tavares, Daniellede Souza Costa, Antônio Alvim Soares, Iane Kestelman, Antônio Geraldo da Silva, Leandro Fernandes Malloy-Diniz, Jonas Jardim de Paula and Débora Marques de Miranda
Department of Pediatrics, Federal University of Minas Gerais, Belo Horizonte, Brazil

Abstract
Children and adolescents were largely affected by the psychosocial impact of the 2019-2022 pandemic. During this time, there was an increase in internalizing symptoms, screen and internet use, and internet addiction. However, the interaction of these variables are not fully understood in a stressful time. Here, we have a repeated cross-sectional study aiming to model internalizing symptoms' prediction depending on screen time and game addiction during the COVID-19 pandemic. Parent-reported online data were collected at three timepoints, 6 months apart from each other, from a total of 1211 participants. We found an increase in screen time, game addiction, and internalizing symptoms. Regardless of the time spent in front of screens, higher levels of game addiction were associated with higher levels of internalizing symptoms in children and adolescents. Even if participants demonstrated low screen time, if they were virtually dependent they tended to exhibit higher levels of internalizing symptoms. The same result was found in all three samples. There is a need to investigate the nature of the relationship between internet addiction and internalizing symptoms and the long lasting effects of long hours on the screen.

Keywords
Internalizing symptoms, internet, gaming, screen, addiction, COVID-19 pandemic

Introduction

The Coronavirus disease (COVID-19) brought a drastic and sudden change in the way we organize ourselves. Besides children and adolescents having lower morbimortality related to COVID-19,

Corresponding author:
Hunayara Lorena Sousa Tavares, Department of Pediatrics, Federal University of Minas Gerais, 190 Professor Alfredo Balena Ave, Belo Horizonte 30130-100, Brazil.
Email: hunayarat@gmail.com

they are largely affected by the psychosocial impact of the 2019-2021 pandemic (Ghosh et al., 2020). The use of quarantine and social isolation to contain the spread of the virus and the burden on health care systems were measures adopted by most countries; however, the impact of the social isolation on children and adolescents exacerbated pre-existing difficulties and problems (Samantha K Brooks, 2020).

Before the pandemic, the prevalence of mental illness in children and adolescents across all mental disorders was estimated at 13.4%, with 6.5% related to anxiety and 2.6% to depression (Polanczyk et al., 2015). In Finland, a sample of 111,171 adolescents aged 14–18 years observed rates of anxiety of 11.6% (Kati et al., 2019). Regarding depression, a survey that gathered health data from 95,856 adolescents aged 12 to 17 who participated in the National Survey on Drug Use and Health (NSDUH) from 2011 to 2016 found the prevalence of depression to be 12.9% (Lu, 2019). Current research suggests also a significant increase in internalizing symptoms during the pandemic causing considerable impact on well-being (Racine et al., 2021) (Jiao, et al., 2020) (Xinyan Xie, et al., 2020).

Social withdrawal caused disruption in daily routine and changes in schools' activities. For children and adolescents with mental disorders, school closures often meant lack of access to health resources and worsening of symptoms (Lee, 2020). A meta-analysis conducted with 29 studies including 80,879 children and adolescents worldwide estimated that the prevalence of depression and anxiety in this population had a clinically significant increase to 25.2% and 20.5%, respectively (Lee, 2020). Estimates obtained in the first year of the pandemic suggest that 1 in 4 young people worldwide are experiencing clinically elevated symptoms of depression, while 1 in 5 young people are experiencing clinically elevated symptoms of anxiety (Racine et al., 2021). These combined estimates, which have increased over time, are double the pre-pandemic estimates (Racine et al., 2021).

In addition to the significant increase in internalizing symptoms, research also shows an increased use of digital devices by children and adolescents stemming during the COVID-19 pandemic (Meitei et al., 2021; Wong, et al., 2021; Dong et al., 2020; Duan, et al., 2020; Deslandes & Coutinho, 2020). In order to avoid the complete interruption of social and school interactions, data transmission by digital means (Internet) has become an important element. The impact of hours of use of screens have been evaluated in a recent meta-analysis evaluating the impact of screen time in internalizing and externalizing symptoms. For that, 159 425 individuals were included. Screen time had a small but significant correlation with more externalizing problems (90 samples; r, 0.11; 95% CI, 0.10–0.12) and internalizing problems (43 samples; r, 0.07; 95% CI, 0.05–0.08) in children. Before the COVID-19 pandemic the issue of screen time and Internet related disorders among children and adolescents has been raised, social isolation contributed to consolidate and expand the Internet use with its good and bad implications (Christakis, 2010; Oliveira et al. 2021).

The American Psychiatric Association (APA) included Internet gaming disorder (IGD) in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders as the subject of further empirical investigation, and the World Health Organization (WHO) described gaming disorder in the 11th revision of the International Classification of Diseases (ICD) (American Psychiatric Association, 2013; Organization World Health, 2019). The proposed classification for Internet Gaming Disorder (IGD) contains nine criteria: (A) preoccupation with Internet gaming; (B) withdrawal symptoms when Internet gaming is withdrawn; (C) tolerance, the need to spend more and more time engaged in Internet gaming; (D) unsuccessful attempts to control participation in Internet gaming; (E) loss of interest in hobbies and entertainment as a result of, and with the exception of, Internet gaming; (F) continued excessive use of Internet gaming despite knowledge of psychosocial problems; (G) deception of family members, therapists, or others regarding the amount

of Internet gaming; (H) use of Internet gaming to escape or relieve a negative mood; and (I) loss of a significant relationship, job, or educational or career opportunity due to participation in Internet gaming (American Psychiatric Association, 2013). Currently, there is an increase in prevalence worldwide, making addiction a potentially problematic condition usually associated with other existing psychiatric disorders such as anxiety and depression (Christakis, 2010). During the pandemic, there is an increase of the frequency and duration of recreational Internet use among children and adolescents (Dong et al., 2020). In Turkey, a cross-sectional study of 1572 adolescents investigated the prevalence of Internet addiction and psychosocial problems during the COVID-19 pandemic (Ozturk & Ayaz-Alkaya, 2021). The prevalence of psychosocial problems was 20.7%. Some of the adolescents (4.8%) had symptoms of Internet addiction. There was a positive correlation between Internet addiction and mean scores of psychosocial problems ($p < .05$). The psychosocial problems reported in the study were post-traumatic stress, sleep disturbance, depression, anxiety, loneliness, social isolation, suicidal behavior, substance use, and domestic violence. Most adolescents were Internet users and one in five adolescents was at risk for psychosocial problems (Ozturk & Ayaz-Alkaya, 2021). In China with 2050 adolescents, excessive Internet use during the COVID-19 outbreak was observed. Internet addiction was observed in 2.68% of the participants, while 33.37% were classified with problematic Internet users from data collected on Young's Internet Addiction Test (IAT) and Depression, Anxiety and Stress Scale (DASS-21) (Dong et al., 2020).

In this regard, the present exploratory study aims to better understand the problems existing during the pandemic related to screen use by children and adolescents and the increase of internalizing symptoms in this population. To investigate the influence of screen time on the relationship between game addiction and internalizing symptoms. Also, to understand how the variables internet addiction, screen time, and the time of data gathering (wave) during the COVID-19 pandemic interact in a model to predict internalizing symptoms. The research has the potential to assess the direct and indirect effects of screen time, Internet addiction, and internalizing symptoms in children and adolescents.

Methods

Procedures

The present research was approved by the ethical board of the **Federal University of Minas Gerais, Belo Horizonte, Brazil** and it follows the Declaration of Helsinki. Each included individual consented to participate after an information provided in the first page of the online survey.

We performed a cross-sectional design study using an online survey at the SoSci Survey platform (https://www.soscisurvey.de), chosen because of its high-security standards. Results were reported following the CHERRIES checklist, which is directed to improve the quality of Web Surveys (Gunther, 2004). In the repeated cross-sectional design, it is possible to describe patterns of change over time in the target populations (Lebo & Weber, 2014). Parents of children from 6 to 17 years were asked to complete an online questionnaire about only one of their children. A non-probability sample from the general population was self-selected via an open survey link shared by social media recruiting, starting from the researchers and colleagues' personal accounts. The survey was conducted at three timepoints: July 2020 (wave 1), December 2020 (wave 2), and July 2021 (wave 3).

Participants

Parents over the age of 18 years, with children between the ages of 6–17 years, who have access to the internet were invited to participate in this study. Participants who filled out the forms incompletely and/or did not live with their children during the COVID-19 social isolation period were excluded. In the first wave 528 parents responded to the questionnaire, in the second wave 330, and in the third wave there were 353 valid participations. The total was 1211 participants.

Assessment

Sociodemographic characteristics. The online survey had questions investigating participants' age, gender, ethnics, child school type, and parental school degree. For economic classification we used the Brazilian Economic Classification Criteria *(CCEB)*. The CCEB is a price classification system for the Brazilian public. It aims to be a unique way to evaluate the purchasing power of consumer groups. It sets aside the pretension of classifying the population in terms of "social classes" and divides the market exclusively into economic classes. This classification is based on the possession of goods and not on family income. For each asset owned there is a score and each class is defined by the sum of these scores. A subject score on the CCEB can vary from 0 to 100. The classes defined by CCEB are A (average income of U$ 4621.04), B1 (average income of U$ 2039.63), B2 (average income of U$ 1020.19), C1 (average income of U$ 557.95), C2 (average income of U$ 316.20), and DE (average income of U$ 135.59) (ABEP, 2019).

Child and Adolescent Behavior Inventory (CABI). The Child and Adolescent Behavior Inventory (CABI) is a dimensional screening questionnaire for mental disorders and problematic behaviors in children and adolescents. It has 75 items covering several areas of children's psychopathology and behavior. The most representative symptoms reported in the DSM-IV-TR and DSM-5 diagnostic criteria were chosen and grouped into three main CABI subscales: Internalizing Disorders (i.e., anxiety and depressive disorders), Externalizing Disorders (i.e., oppositional-defiant and conduct disorders), and ADHD (Cianchetti et al., 2013). Parents answered each question on a scale with three options: 2- very true, 1- somewhat or sometimes true, or 0 - not true. Higher scores are indicative of more emotional and/or behavior problems. In this study, we only used the Internalizing subscale. The CABI has shown high internal consistency and valid clinical application (Cianchetti et al., 2013, 2017).

The first items (nos.1–4) concern four types of symptoms which may be isolated but which are more frequently included in anxiety or depressive disorders. The 10 items exploring depressive symptoms ask about mood (items nos.19–22), lack of interest (no.23), self-esteem (no.24), aboulia (no.25), guilt (no.26), and suicidal thoughts and attempts (nos.27 and 28). Broader groups can be delineated: a) "internalizing disorders", if viewed as anxiety and depression symptoms, could include items nos.5–10 and 19–28; however, in a broader sense, that category could include all the items from no.1 to no.28; b) "externalizing disorders" includes items nos. 33–42 and possibly nos. 29–32, while nos.43–51 are specific for ADHD, an externalizing disorder with peculiar characteristics (Cianchetti, et al., 2013). The adapted Brazilian version is in development. The adapted Brazilian version was recently developed and it is under review in a specialized journal. Reliability estimates suggest high internal consistency for its main scales (alphas and/or omegas ranging from 0.87 to 0.91) and its validity (tested by factor analysis and correlations) suggests adequacy for the proposed constructs.

Screen time. The variable Screen Time was measured through the online questionnaire from the following question: "How long does your child or teen use screen (uses computers, watches videos on social networks, watches TV, plays electronic games, etc.) during the day?" The caregiver could mark one of the following alternatives: a) Up to 2 hours b) From 2 to 4 hours c) From 4 to 8 hours d) More than 8 hours. The period considered corresponded to 1 day (24 hours).

Game Addiction Scale (GAS). The Game Addiction Scale (GAS) was developed to assess this type of addiction. The GAS consists of 21 items that are divided into the following seven factors: salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems. It uses the DSM-5 clinical criteria for pathological gambling (Lins Lemos et al., 2016). The adapted and translated version to Brazilian Portuguese for adolescents had good internal consistency (alpha-Cronbach ranges from 0.55 to 0.92 for each criterion and 0.92 for the total score) (Lemmens & Peter, 2009). In the current study we used a child-oriented version of the GAS, which is currently in development by our lab. It involves basically the adaptation of questions and instructions to parent-reporting, since the original scale is a self-report measure, maintaining each item content and the symptoms dimensions.For evaluation, the total score was used. Thus, high scores are indicative of game addiction. Although no psychometric data for this version of GAS is published at the moment the Brazilian Portuguese version for adolescents had good internal consistency (alpha ranges from 0.55 to 0.92 for each criterion and 0.92 for the total score) (Lemmens & Peter, 2009).

Data analysis

All analyses were conducted using the Statistical Package for the Social Sciences (SPSS, IBM, Armonk, NY). Descriptive analyses were performed using absolute and relative frequencies for categorical variables and means and 95% confidence intervals (generated by the Bootstrapping procedure) for continuous variables. One-way analysis of variance (ANOVA) was used with the Bootstrapping procedure with 1000 resamples and bias-corrected and accelerated (BCa) method to check for differences in continuous variables between the three assessment times. Posteriori comparisons were performed in ANOVA using Hochberg's GT2 test. The association between categorical variables and waves were tested using the chi-square test in addition to verifying the standardized residuals between observed and expected.

Moderation analysis was tested in the PROCESS macro for SPSS using a multiple linear regression model with simultaneous input to predict internalizing symptom values from virtual dependence, screen time, and the time of assessment. The model was adjusted for the covariates of age, ethnicity, gender, school type, parent educational level, parent history of anxiety and depressive disorders, and the daily amount of time parents spend on playing with their kids. Values of $p < .05$ were considered statistically significant in all analyses.

Results

Table 1 demonstrates the descriptive data of the sample. Statistically significant differences were found for the virtual dependence scores ($p = .001$). The posteriori comparisons indicated that subjects assessed at the third time point of assessment had lower virtual dependence than subjects assessed at time point 01 ($p = .009$) and time point 02 ($p = .002$). No differences were found in the scores of the internalizing symptoms variable and the age of the subjects between the three assessment moments. The chi-square test demonstrated that less public students than expected were observed within wave 3 ($z = -3.34$), whereas less parents than expected were observed with a high

Table 1. Sample Descriptive Data.

	Evaluation timepoint during the COVID-19 pandemic			*p*
	Wave 01 (Jul/20)	**Wave 02 (Dec/20)**	**Wave 03 (Jul/21)**	
	***n* = 528**	***n* = 330**	***n* = 353**	
		Mean (95% CI)		
Internalizing symptoms	9.67 (9.12; 10.18)	9.63 (8.93; 10.30)	9.27 (8.58; 9.92)	0.638
Virtual dependence	15.51 (14.87; 16.16)	15.91 (15.17; 16.69)	14.11 (13.51; 14.71)	0.001[a]
Age	9.89 (9.58; 10.24)	9.74 (9.37; 10.09)	9.62 (9.21; 9.99)	0.538
		n (%)		
Screen time				
Up to 2 hours	63 (11.9)	37 (11.2)	55 (15.6)	-
From 2 to 4 hours	188 (35.6)	111 (33.6)	107 (30.3)	
From 4 to 8 hours	202 (38.3)	131 (39.7)	141 (39.9)	
More than 8 hours	75 (14.2)	51 (15.5)	50 (14.2)	
Gender				
Male	51 (9.7)	24 (7.3)	30 (8.5)	-
Female	477 (90.3)	306 (92.7)	323 (91.5)	
Ethnics				
White	372 (70.5)	243 (73.6)	266 (75.4)	-
Non-white	156 (29.5)	87 (26.4)	87 (24.6)	
School type				
Public	135 (25.6)	92 (27.9)	51 (14.4)	-
Private	393 (74.4)	238 (72.1)	302 (85.6)	
Parental school degree				
High school/Incomplete graduate	92 (17.4)	51 (15.5)	29 (8.2)	-
Fully graduated	371 (70.3)	222 (67.3)	244 (69.1)	
Master	46 (8.7)	48 (14.5)	51 (14.4)	
PHD	19 (3.6)	9 (2.7)	29 (8.2)	
Anxiety disorder				
Yes	420 (79.5)	260 (78.8)	276 (78.2)	-
No	108 (20.5)	70 (21.2)	77 (21.8)	
Depression				
Yes	391 (74.1)	251 (76.1)	263 (74.5)	-
No	137 (25.9)	79 (23.9)	90 (25.5)	
Declared parental time with kids				
Less than 1 hour	358 (67.8)	205 (62.1)	257 (72.8)	-
2 hours	134 (25.4)	96 (29.1)	72 (20.4)	
3 hours	24 (4.5)	21 (6.4)	18 (5.1)	
More than 4 hours	12 (2.3)	8 (2.4)	6 (1.7)	

Note: Data expressed as means and 95% confidence intervals (95% CI) for continuous variables and absolute (n) and relative (%) frequencies for categorical variables; Differences between waves for continuous variables verified by one-way analysis of variance (ANOVA), considering a *p* value of <0.05, with posteriori comparisons performed by Hochberg's GT2 test.
[a]Post-hoc comparisons by Hochberg's GT2 test: Wave 01 versus Wave 02: p=0.793; Wave 02 versus Wave 03: p=0.002; Wave 01 versus Wave 03: p=0.009.

Table 2. Moderation analysis of the relationship between virtual addiction and internalizing symptoms.

		β	SE	*t*	*p*	95% CI
Constant	β_0	12.281	3.203	3.834	<0.001	5.996 18.566
Virtual dependence	β_1	−0.046	0.205	−0.222	0.824	−0.449 0.357
Screen time	β_2	−2.100	1.122	−1.870	0.062	−4.302 0.130
Interaction 01 (Virtual dependence *screen time)	β_3	0.113	0.070	1.618	0.106	−0.024 0.250
Wave	β_4	−3.740	1.424	−2.627	0.009	−6.533–0.947
Interaction 02 (Virtual dependence * study wave)	β_5	0.187	0.103	1.811	0.070	−0.016 0.389
Interaction 03 (screen time * study wave)	β_6	1.501	0.531	2.827	0.005	0.459 2.543
Interaction 04 (Virtual dependence * screen time * wave)	β_7	−0.070	0.035	−2.015	0.044	−0.139–0.002
Age	β_8	0.102	0.045	2.260	0.024	0.013 0.190
Ethnia	β_9	0.533	0.385	1.385	0.166	−0.222 1.288
Gender	β_{10}	1.638	0.591	2.772	0.006	0.478 2.797
School type	β_{11}	−0.549	0.425	−1.292	0.196	−1.383 0.285
Parental school degree	β_{12}	−1.039	0.265	−3.925	<0.001	−1.558–0.520
Anxiety disorder	β_{13}	1.354	0.418	3.238	0.001	0.534 2.175
Depression	β_{14}	1.748	0.393	4.454	<0.001	0.978 2.519
Parental time with the individual	β_{15}	−0.058	0.247	−0.234	0.815	−0.542 0.426
		r^2 = 0.181; r^2_{change} = 0.003; f^2 = 0.221				
		F (15, 1195) = 17.624; p < 0.001				

school/incomplete graduate level of education within wave 3 (z = −2.99); less parents than expected were observed with a masters degree within wave 1 (z = −2.17); and more parents than expected were observed with a PhD degree within wave 3 (z = 3.04).

Table 2 demonstrates the multiple linear regression model constructed with internalizing symptoms as the dependent variable. It can be seen that interaction term #04 between virtual addiction, screen time, and the assessment wave is statistically different from zero (β7 = −0.070; t(1195) = −2.015; p = .044), indicating that there is evidence that the influence of screen time on the relationship between virtual addiction (GAS) and internalizing symptoms (CABI) is linearly dependent on the assessment wave, even though this interaction accounts for only 0.3% (r2change = 0.003) of the variance of internalizing symptoms.

To gain a better perspective on how the variables virtual addiction (GAS), screen time, and wave interact in the model to predict internalizing symptoms (CABI), internalizing symptom values were estimated from the multiple regression equation using the β coefficients from Table 2 and different values of the predictor variables (see the notes in Figure 1 for more information). Figure 1 demonstrates these estimated values.

At the first moment of evaluation, the estimated values showed that regardless of screen time levels, those individuals with less virtual dependence (GAS) had lower levels of internalizing symptoms (CABI), while those individuals with more virtual dependence (GAS) had higher levels of internalizing symptoms (CABI).

At the third point of assessment, the estimated values continued to show that higher levels of virtual dependence (GAS) were associated with higher levels of internalizing symptoms (CABI), regardless of the level of screen time. In other words, even if the individual had low or high screen time, if they were virtually dependent, they would have higher levels of internalizing symptoms. On the other hand, the values estimated at the third time point of assessment showed that individuals

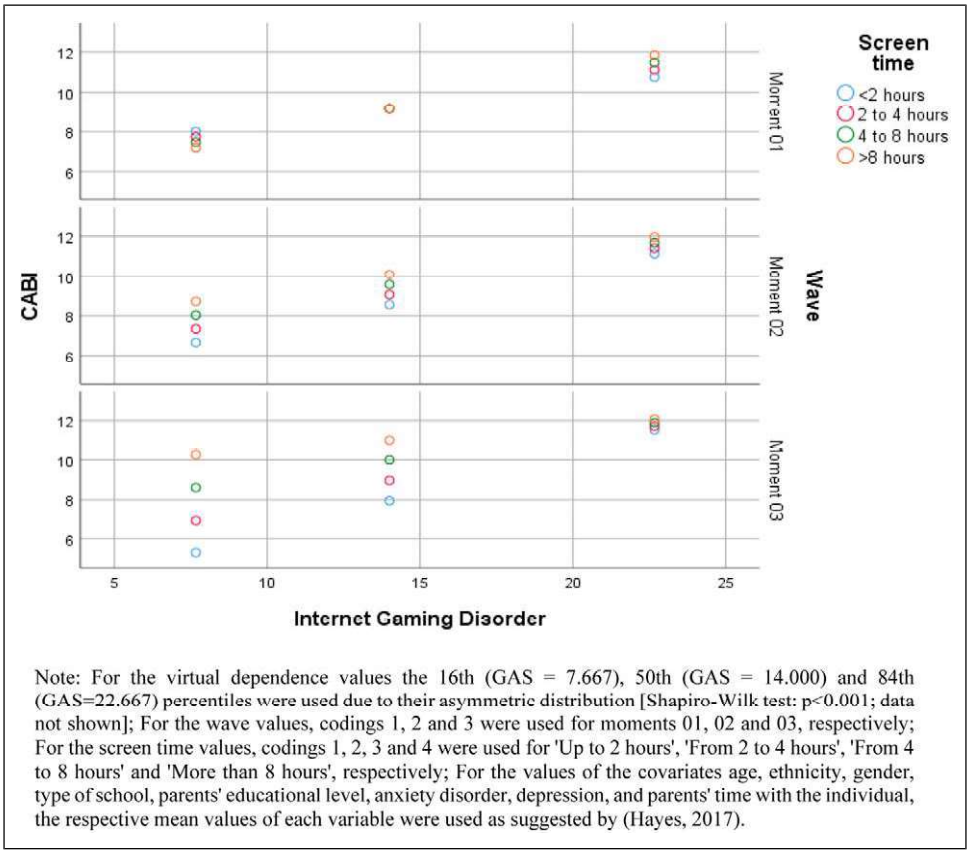

Figure 1. Estimated values of Virtual Dependence, Internalizing Symptoms and Screen Time at waves 1, 2 and 3. *Note*: For the virtual dependence values the 16th (GAS = 7.667), 50th (GAS = 14.000) and 84th (GAS = 22.667) percentiles were used due to their asymmetric distribution [Shapiro-Wilk test: $p < .001$; data not shown]; For the wave values, codings 1, 2 and 3 were used for moments 01, 02 and 03, respectively; For the screen time values, codings 1, 2, 3 and 4 were used for 'Up to 2 hours', 'From 2 to 4 hours', 'From 4 to 8 hours' and 'More than 8 hours', respectively; For the values of the covariates age, ethnicity, gender, type of school, parents' educational level, anxiety disorder, depression, and parents' time with the individual, the respective mean values of each variable were used as suggested by (Hayes, 2017).

with low virtual dependence (GAS) and high screen time had higher levels of internalizing symptoms (CABI) than those with low screen time.

Table 2 also shows that the difference in the means and females is 1.638 points on the internalizing symptoms scale, considering the values adjusted for other variables included in the model. As for the level of education, for each unit of increase in the educational level of those responsible, internalizing symptoms decrease by an average of 1.039, adjusted for the other variables.

Discussion

The research findings raise important points about game addiction, screen time, and the increase in internalizing symptoms in children and adolescents during the COVID-19 pandemic. The present

study demonstrates that, regardless of time spent in front of screens, higher levels of virtual addiction (GAS) are associated with higher levels of internalizing symptoms (CABI) in children and adolescents. That is, even if participants demonstrated low screen time, if they were virtually dependent they tended to exhibit higher levels of internalizing symptoms. Furthermore, these results were observed at both the first assessment time point throughout the third time point.

After 6 months from the initial time point of assessment, the results suggest that those individuals who had low virtual dependence (GAS) and were in front of screens for longer periods during the day demonstrated higher levels of internalizing symptoms than individuals who also had low virtual dependence but who had low screen time. This trend was also observed in median virtual dependence values at both time point 02 and time point 03 of assessment.

In this regard, a study conducted in Canada with 2482 students in grades 7 to 12 examined how sedentary screen-based activities may relate to symptoms of depression and anxiety in youth. The results indicated that the duration of sedentary screen time was associated with more severe symptoms of depression and anxiety in a large sample of Canadian adolescents. This suggests that screen time may represent a risk factor or marker of anxiety and depression disorders among youth (Maras et al., 2015).

In the same direction, a survey conducted in South Korea evaluated 452 adolescents regarding virtual addiction and depression. The study revealed a significant association between internet addiction and depressive symptoms in adolescents. The data suggest the need for assessment of the potential for underlying depression in the treatment of adolescent Internet addicts (Ha et al., 2007).

Sedentary behavior and physical inactivity favours development of chronic diseases during adulthood (diabetes, hypertension, cardiovascular disease, among others). A review published by Biddle & Asare (2011) reinforces the role of physical activity as a protective factor for mental health. Small, but consistent associations between sedentary screen time and poor mental health is observed. A survey conducted in Germany of 1711 4- to 17-year-olds before and during quarantine measures found that sports activity decreased, while recreational screen time increased (Schimit et al. 2020). Finally, a cross-sectional study of American children found that more physical activity and less screen time were associated with better mental health. The questionnaire assessed internalizing and externalizing symptoms, and screen time was correlated with greater total difficulties (Tandon et al., 2021). High levels of internalizing symptoms can lead to the development of other conditions in the future. In Australia, a study conducted in 2021 identified a 104% increase in children with anorexia nervosa requiring hospital admission for nutritional rehabilitation compared to 3 years prior (Haripersad et al., 2021).

It can be concluded from the research results that virtual addiction is associated with higher levels of internalizing symptoms, regardless of screen time. On the other hand, high screen time seems to influence internalizing symptoms more strongly even in children and adolescents who have low virtual addiction. This trend was observed both at the initial moment of the pandemic and in the moments afterwards.

It is also important to note that the children and adolescents who participated in remote learning often spent hours in front of screens just to attend classes in a mandatory manner, even though they had preferences not to be in front of screens (they were not virtual dependent, but had high screen time). All this time spent in front of screens might influence the level of internalizing symptoms. The follow up data will inform future public health campaigns to adopt measures aimed at promoting the mental health of children and adolescents during pandemics, similar situations and in the aftermatch.

Strengths and limitations

Some limitations should be addressed in future studies. First, the sample within the present study is predominantly female (>90%), most parents have been to university, and the levels of anxiety and depression (>70%) are relatively high. Therefore, caution should be exerted when interpreting the present finding to be representative of the general population. Secondly, despite recognition by APA and WHO that excessive gaming use can cause harm, literature reviews on Internet gaming disorder emphasize the need for further study and caution in interpreting symptoms (King & Delfabbro, 2013) (Sim et al., 2012) (King et al., 2013). The set of criteria is intended to provide greater clarity to the clinical formulation regarding the recognition and diagnosis of disorders associated with Internet gaming. However, the diagnostic category may cause confusion by stating that seven of the nine criteria refer specifically to "Internet gaming," while the other criteria refer to Internet use more generally. Blaszczynski (2006) adds that one should turn to science and look for clear empirical evidence of neuroadaptive changes, in addition to psychological dependence for clear and coherent criteria. A functional impact also should be evaluated since during the pandemic the adaptability could be even worse without the gaming and the screens to handle with isolation and loneliness. The changes and the findings of impact in other scenarios might shed light on the functional impact of screens and internet gaming.

Therefore, it would also be important to identify with the child or adolescent what the purpose of Internet use is and to classify according to their primary motivation or gratification of specific needs (Blaszczynski, 2006). It should be a central question, to identify whether a pattern of problematic behaviors related to video game use over a prolonged period of time may constitute a psychological disorder.

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ORCID iD

Hunayara Lorena Sousa Tavares https://orcid.org/0000-0003-4792-8220

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2 ARTIGO II

Sousa Tavares HL, Souza Costa D, Soares AA, Malloy-Diniz LF, de Paula JJ, de Miranda DM. **Study of relationship between the Internet gaming addiction and internalizing symptoms during three timepoints in stressful timing.**

Study of relationship between the Internet gaming addiction and internalizing symptoms during three timepoints in stressful timing

Abstract

Problematic internet use by children and adolescents is a growing concern, the Internet gaming disorder (IGD) is now in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders and a gaming disorder is in the 11th revision of the International Classification of Diseases (ICD). Internet addiction refers to a series of excessive and compulsive technology-related behaviors resulting in impairment in the subject's life, during the COVID-19 pandemic has also impacted Internet use and increased the prevalence and severity of addiction. There are association between internet addiction and internalizing symptoms and excessive sleepiness. Here, we evaluated in three timepoints, the frequencies of internet addiction to verify the mechanisms of association between screen time and internalizing symptoms via virtual addiction and excessive sleepiness. The results indicated that the relationship between screen time and CABI were moderated/strengthened by wave, whereas the indirect association through GAS and Excessive somnolence remained similar across different waves. It can also be concluded that higher levels of screen time are associated with higher internalizing symptom scores, regardless of levels of virtual addiction and excessive sleepiness. Importantly, the association became stronger at waves 2 and 3.

Introduction

The Coronavirus Disease Pandemic (COVID-19) brought about a drastic and sudden change in the way we organize ourselves. In an attempt to contain the spread of the virus, measures of social distancing and isolation have been adopted. Although children and adolescents are less likely to develop severe symptoms of SARS-CoV-2 disease, they are not immune to the direct and indirect psychological and social effects that affect mental health (Holmes EA, 2020; Li S, 2020; Panda PK, 2021).

The prolonged closure of schools has caused institutions to adopt the online teaching and learning model for students. As schools migrated to remote learning and extracurricular activities were cancelled, children and adolescents had more time for screens (Nagata, et al., 2021; Moitra & Madan, 2022). Research reports that when children are out of school, they are

physically less active, have difficulty maintaining sleep patterns, consume more caloric foods, and spend more time on electronic devices (Wang, Zhang, Zhao, Zhang, & Jiang, 2020; Brooks, et al., 2020).

A cross-sectional descriptive study conducted at a university hospital in Turkey in 2020 with 253 children aged 3 to 10 years compared screen time and digital gaming habits before and during the COVID-19 pandemic. It was found that the proportion of children with screen time greater than or equal to 1 hour during the pandemic was significantly higher than before the pandemic ($p<0.001$) (Oflu, Bükülmez, Elmas, Tahta, & Çeleğen, 2021). In the same direction, a study conducted in Germany with 1,711 children and adolescents aged 4 to 17 years compared physical activity and recreational screen time before and during the first block of COVID-19. It was found that sports activity decreased, while recreational screen time increased (SCE, et al., 2020). A survey conducted in Chile with the aim of examining the sociodemographic predictors associated with change in physical activity behaviors, screen time, and sleep in children during the early stages of the coronavirus pandemic in 2019 also found similar results. Older children, those whose caregivers were between 35 and 45 years old and had higher education, and those who lived in an apartment showed greater changes, mainly decreased total physical activity and increased screen time (Aguilar-Farias, et al., 2021).

Regarding adequate screen time for children and adolescents, the American Academy of Pediatrics (AAP) makes some recommendations. The technical report Children and Adolescents and Digital Media, which reviews the latest media research studies and updates pediatricians and parents suggests that infants up to 24 months do not use screens; 2 to 5 years old use should be limited to one hour per day of quality and appropriate programming; above 6 years old it is up to parents to determine the amount of time based on the general recommendations, but always with monitoring of the content to which the child has access. (Hill, et al., 2016; Chassiakos, et al., 2016).

A systematic review investigating the prevalence of "Problematic Internet Use" (PIU) in adolescents in the United States of America (USA) suggests that 93% of adolescents aged 12-29 go online and 50% report feeling "addicted" to their phones (LJ & MB, 2016). When it comes to children, the data is also alarming (Kabali, et al., 2015). A total of 96.6% of young children in a low-income community in the US had near-universal exposure to mobile devices, with 75% having their own device by age 4 (Kabali, et al., 2015).

Problematic internet use by children and adolescents is a growing concern. The American Psychiatric Association (APA) included Internet gaming disorder (IGD) in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders as the subject of further

empirical investigation, and the World Health Organization (WHO) described gaming disorder in the 11th revision of the International Classification of Diseases (ICD) (American Psychiatric Association, 2013; World Health Organization, 2019). Internet addiction refers to a series of excessive and compulsive technology-related behaviors resulting in impairment in the subject's life (Pan, Chiu, & Lin, 2020). The COVID-19 pandemic has also impacted Internet use and increased the prevalence and severity of addiction (Li, et al., 2021). A 2020 study in China with 20,472 participants found 36.7% Internet addiction in the general population during the pandemic, severe addiction was 2.8% (Li, et al., 2021). In the same direction, a survey of 1,060 high school students in Taiwan during the pandemic found an internet dependence prevalence of 24.4% between March 2 and 27, 2020 (Lin, 2020).

Global prevalence estimates of gaming disorders extracted from 53 studies conducted between 2009 and 2019 with 226,274 participants from 17 different countries and compiled in a systematic review and meta-analysis was 1.96%. Thus, the values presented in the studies conducted during the pandemic, suggest an alarming growth (Li, et al., 2021; Lin, 2020; Miranda, Athanasio, Oliveira, & Silva, 2020).

Regarding harms, it is known that excessive use of electronic devices entails adverse physical and psychological consequences. The effects on physical health are mainly associated with poor sleep, sedentary lifestyle, impaired vision, among others (Lissak, 2018). Problematic Internet use by children and adolescents during the COVID-19 pandemic appears to influence sleep quality (Moraleda-Cibrián, Albares-Tendero, & Pin-Arboledas, 2022; Vézina-Im, et al., 2022; A.Jahramia, et al, 2022; Wehbe, et al., 2022; Dondi, et al., 2021), in internalizing symptoms (Qin, et al., 2021; Gadermann, et al., 2022; Ellis, Dumas, & Forbes, 2020) and attention (Santos, Mendes, Miranda, & Romano-Silva., 2022).

During the isolation of the coronavirus pandemic, a survey of 265 Spanish adolescents with a mean age of 13.6 years residing in urban areas investigated Internet use and sleep patterns. Adolescents who used electronic devices > 4 h/d compared to those who used < 4 h/d reported longer sleep latency (93% vs. 7%, $p = 0.007$), low sun exposure (77% vs. 23% , $p = 0.031$), less physical activity (86% vs. 15%, $p = 0.011$), and weight gain (78% vs. 22%, $p = 0.049$) (Moraleda-Cibrián, Albares-Tendero, & Pin-Arboledas., 2022). In the same direction, 1720 school-aged adolescents from private and public schools in the United Arab Emirates participated in a survey aimed at identifying the association between sleep quality and screen time during the COVID-19 outbreak. The results confirm the correlation between sleep and screen time in adolescents, with the average screen time being 420min on weekdays and 300min

on weekends. Smartphone-related screen time on weekends ($p = 0.003$) and increased screen time in bed ($p < 0.001$) were significantly associated with poor sleep (Bani-Issa, et al., 2022).

Psychological consequences related to excessive Internet use by children and adolescents, on the other hand, are primarily associated with increased internalizing symptoms, i.e., anxiety and depression (Lissak, 2018; Roberston, Twenge, Joiner, & Cummins., 2022; Maras, et al., 2015). A survey conducted with 1,199,320 students in Guangdog Province, China, between March 8 and March 30, 2020 suggests that the prevalence of self-reported psychological distress among students during the COVID-19 pandemic was relatively high. A total of 126,355 students (10.5%) self-reported psychological distress. Compared to elementary school students, high school students had an increased risk of psychological distress (OR, 1.19 [95% CI, 1.15-1.23]) (Qin, et al., 2021). A survey conducted in Canada investigated the psychological and social impacts of the COVID-19 pandemic from the perspective of 1,755 students aged 12-14 years. The adolescents reported significantly lower optimism, lower life satisfaction, and higher sadness compared to the previous year (Gadermann, et al., 2022). In the same country, Canada, 1316 high school students filled out an online survey with questions about stress around the COVID-19 crisis. The results showed that adolescents are very concerned about the COVID-19 crisis and are particularly worried about schooling and peer relationships. COVID-19 stress was related to more loneliness and more depression, especially for adolescents who spend more time on social media. In addition to COVID-19 stress, more time connecting with friends virtually during the pandemic was related to greater depression (Ellis, Dumas, & Forbes, 2020).

Methods

Procedures

The present research was approved by the Ethics and Research Council (COEP) of the Federal University of Minas Gerais (UFMG) and is in accordance with the Declaration of Helsinki. The study participants were invited via the internet to fill out the Informed Consent Form (ICF), then answered some psychological scales and a sociodemographic questionnaire. The online survey was made available on the SoSci Survey platform (https://www.soscisurvey.de), chosen for its high security standards. Results were reported according to the CHERRIES checklist, which aims to improve the quality of web-based surveys (Gunther, 2004). Parents of children aged 6 to 17 were asked to complete an online

questionnaire about only one of their children. A non-probability sample from the general population was self-selected via an open survey link shared by social media recruiting, starting from the researchers and colleagues' personal accounts. The survey was conducted at three points in time: July 2020 (wave 1), December 2020 (wave 2), and July 2021 (wave 3). This is a repeated cross-sectional study, meaning that it is possible to describe patterns of change over time in the target populations (Lebo & Weber, 2014).

Participants

Parents over the age of 18 with children between the ages of 6 and 17 who have access to the Internet were invited to participate in the survey. Participants who filled out the forms incompletely and/or did not live with their children during the COVID-19 social isolation period were excluded. In the first wave 528 parents responded to the questionnaire, in the second wave 330, and in the third wave there were 353 valid participations. The total was 1,211 participants.

Assessment

Sociodemographic characteristics

The sociodemographic characteristics of the participants were collected through the online survey that contained questions investigating age, gender, ethnicity, type of school (public or private), and parents' educational level. For economic classification, the Brazilian Economic Classification Criteria (CCEB) was used. The CCEB is a price classification system for the Brazilian public. It aims to be a unique way to evaluate the purchasing power of consumer groups. It is not intended to classify the population in terms of "social classes", but rather to divide the market exclusively into economic classes. This classification is based on the possession of goods and not on family income. For each asset owned there is a score and each class is defined by the sum of these scores. The CCEB score can range from 0 to 100. The classes defined by the CCEB are A (average income of U$ 4621.04), B1 (average income of U$ 2039.63), B2 (average income of U$ 1020.19), C1 (average income of U$ 557.95), C2 (average income of U$ 316.20), and DE (average income of U$ 135.59) (ABEP, 2019).

Child and Adolescent Behavior Inventory (CABI)

The Child and Adolescent Behavior Inventory (CABI) is a dimensional screening questionnaire for mental disorders and problematic behaviors in children and adolescents. It has 75 items covering several areas of children's psychopathology and behavior. The most representative symptoms reported in the DSM-IV-TR and DSM-5 diagnostic criteria were chosen and grouped into three main CABI subscales: Internalizing Disorders (i.e., anxiety and depressive disorders), Externalizing Disorders (i.e., oppositional-defiant and conduct disorders), and ADHD (Cianchetti 2013). Parents answered each question on a scale with three options: 2- very true, 1- somewhat or sometimes true, or 0 - not true. Higher scores are indicative of more emotional and/or behavior problems. In this study, we only used the Internalizing subscale. The CABI has shown high internal consistency and valid clinical application (Cianchetti 2013, 2017).

The first items (nos.1 to 4) concern four types of symptoms which may be isolated but which are more frequently included in anxiety or depressive disorders. The 10 items exploring depressive symptoms ask about mood (items nos.19-22), lack of interest (no.23), self-esteem (no.24), aboulia (no.25), guilt (no.26), and suicidal thoughts and attempts (nos.27 and 28). Broader groups can be delineated: a) “internalizing disorders”, if viewed as anxiety and depression symptoms, could include items nos.5-10 and 19-28; however, in a broader sense, that category could include all the items from no.1 to no.28; b) “externalizing disorders” includes items nos. 33-42 and possibly nos. 29-32, while nos.43-51 are specific for ADHD, an externalizing disorder with peculiar characteristics (Cianchetti, et al., 2013). The adapted Brazilian version is in development. The adapted Brazilian version was recently developed and it is under review in a specialized journal. Reliability estimates suggest high internal consistency for its main scales (alphas and/or omegas ranging from 0.87 to 0.91) and its validity (tested by factor analysis and correlations) suggests adequacy for the proposed constructs.

Screen time

The variable Screen Time was measured through the online questionnaire from the following question: "How long does your child or teen use screen (uses computers, watches videos on social networks, watches TV, plays electronic games, etc.) during the day?" The caregiver could mark one of the following alternatives: a) Up to 2 hours b) From 2 to 4 hours c) From 4 to 8 hours d) More than 8 hours. The period considered corresponded to one day (24 hours).

Game Addiction Scale (GAS)

The Game Addiction Scale (GAS) was developed to assess this type of addiction. The GAS consists of 21 items that are divided into the following seven factors: salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems. It uses the DSM-5 clinical criteria for pathological gambling (Lins Lemos, Cardoso, & Botelho, 2016). The adapted and translated version to Brazilian Portuguese for adolescents had good internal consistency (alpha-Cronbach ranges from 0.55 to 0.92 for each criterion and 0.92 for the total score) (Lemmens & Peter, 2009). In the current study we used a child-oriented version of the GAS, which is currently in development by our lab. It involves basically the adaptation of questions and instructions to parent-reporting, since the original scale is a self-report measure, maintaining each item content and the symptoms dimensions.For evaluation, the total score was used. Thus, high scores are indicative of game addiction. Although no psychometric data for this version of GAS is published at the moment the Brazilian Portuguese version for adolescents had good internal consistency (alpha ranges from 0.55 to 0.92 for each criterion and 0.92 for the total score) (Lemmens & Peter, 2009).

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a 19-item self-report instrument that measures seven sleep components: subjective sleep quality, latency, duration, efficiency, disturbances, sleep medication use, and daytime dysfunction. Responses for each item range from 0 (never) to 3 (all the time), with higher scores indicating poor/worse sleep or sleep problems/difficulties. The overall PSQI score ranges from 0 to 21, with a total score >5 being indicative of poor or impaired sleep quality, and the higher the score, the worse the sleep quality (Buysse, Reynolds, Monge, Berman, & Kupfer, 1989). Reliability and validity studies of the Brazilian version showed good results. The questionnaire obtained high internal consistency and moderate reliability. Cronbach's α was 0.71 and intraclass correlation coefficient of 0.65 (95%CI 0.21-0.85) (Passos, et al., 2017)

Statistical analysis

The Statistical Package for the Social Sciences (SPSS, version 23.0 IBM, Armonk, NY) software was used for all statistical analyses. A descriptively analysis described the whole sample and the sample at each wave using means and standard deviations for continuous data

and absolute and relative frequencies for categorical data. Ordinary least squares path analyses were implemented to construct a conditional process model using the PROCESS macro for SPSS (version 4.1), as described by Hayes (HAYES, 2022). A conditional process model is a model that combines mediation and moderation within the same model. The PROCESS model number 92 investigated the direct associations between Screen time and CABI and the indirect association through GAS and Excessive somnolence in serial. All paths involving screen time, GAS, Excessive somnolence, and CABI within this model were allowed to be moderated by wave (0, 6, and 12 months). Consequently, the direct and indirect associations became conditional relative direct and indirect associations. If the interaction terms exhibited a regression coefficient (β coefficient) statistically different from zero, an omnibus and subsequent pairwise comparison approach of equality of estimated conditional means was applied to probe the interaction. This was used because screen time was treated as a categorical variable with three groups. Indicator coding system was applied to screen time. The PROCESS macro used percentile bootstrapping methods based on a resampling procedure of 5,000 bootstrap samples to estimate 95% confidence intervals for the β coefficients. An alpha value of 0.05 was considered in all analyses.

Results

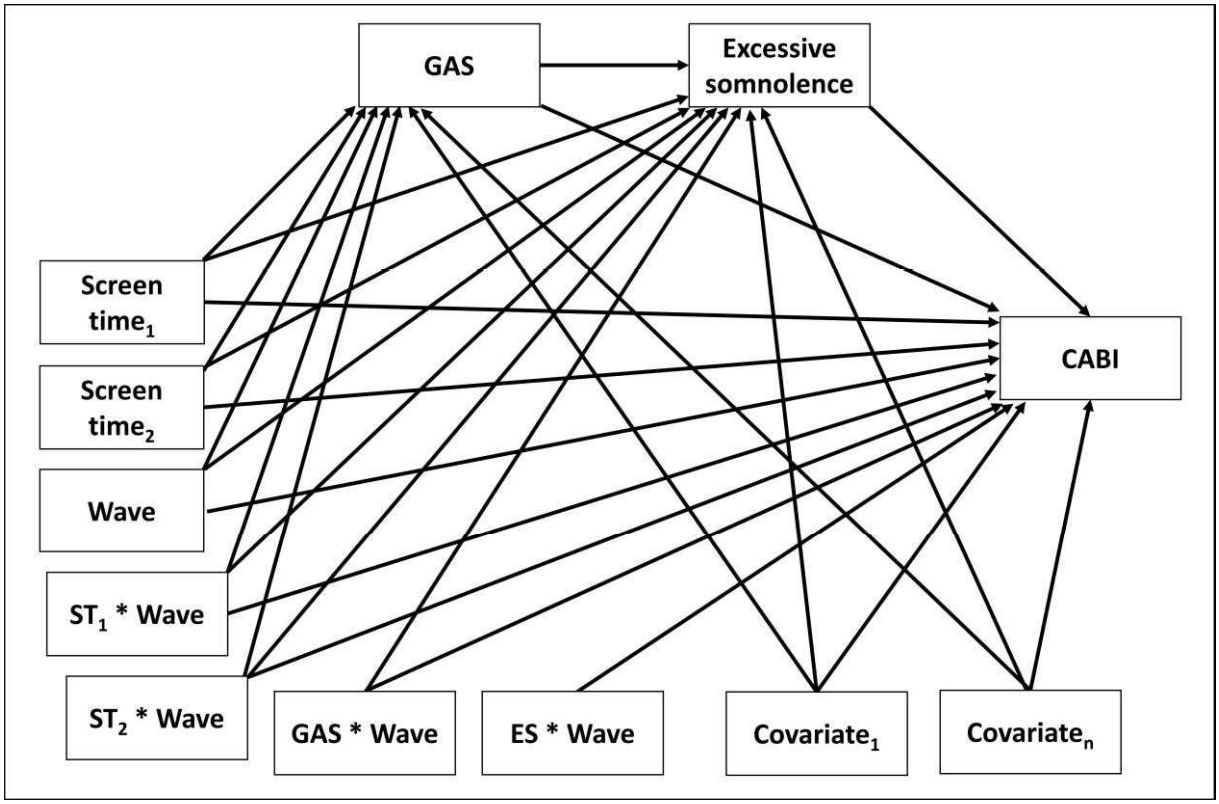
Table 1 descriptively describes the whole sample and within waves using means and standard deviations for continuous data and absolute and relative frequencies for categorical data.

Table 1. Sample characteristics.

	Wave 01 (0 months)	Wave 02 (6 months)	Wave 03 (12 months)	Total
	n = 505	n = 302	n = 336	n = 1,143
		Mean (SD)		
GAS	15.55 (6.90)	15.89 (7.12)	14.30 (6.73)	15.27 (6.93)
Excessive somnolence	8.66 (3.90)	8.36 (3.88)	8.40 (3.64)	8.50 (3.82)
CABI	9.83 (6.29)	9.69 (6.61)	9.18 (6.27)	9.60 (6.37)
Age	10.32 (4.69)	10.03 (4.18)	9.88 (3.94)	10.11 (4.35)
Socioeconomic status	3.99 (0.64)	4.02 (0.61)	4.23 (0.71)	4.07 (0.66)
		n (%)		
Screen time				
Less than 4 hours	243 (48.1)	137 (45.4)	155 (46.1)	535 (46.8)
4 to 8 hours	193 (38.2)	118 (39.1)	133 (39.6)	444 (38.8)
More than 8 hours	69 (13.7)	47 (15.6)	48 (14.3)	164 (14.3)
Sex				
Males	46 (9.1)	21 (7.0)	28 (8.3)	95 (8.3)
Females	459 (90.9)	281 (93.0)	308 (91.7)	1048 (91.7)
Ethnicity				
White	358 (70.9)	218 (72.2)	252 (75.0)	828 (72.4)
Non-white	147 (29.1)	84 (27.8)	84 (25.0)	315 (27.6)
Anxiety				
No	404 (80.0)	239 (79.1)	260 (77.4)	903 (79.0)
Yes	101 (20.0)	63 (20.9)	76 (22.6)	240 (21.0)
Depress				
No	373 (73.9)	228 (75.5)	251 (74.7)	852 (74.5)
Yes	132 (26.1)	74 (24.5)	85 (25.3)	291 (25.5)

Note: Data express as means and standard deviations for continuous data and absolute (n) and relative frequencies (%) for categorical data; GAS: Game Addiction Scale; CABI: Child and Adolescent Behavior Inventory.

The conditional process model built for the present study can be seen within figure 1. Note that not all covariate arrows are presented to improve the visual clarity of the figure, but they statistically control the associations on GAS, Excessive somnolence, and CABI paths within the model. Also, each arrow has its own specific β coefficient.



Note: ST: Screen time; ES: Excessive somnolence; GAS: Game Addiction Scale; CABI: Child and Adolescent Behavior Inventory.

Figure 1. Statistical diagram of the conditional process model for the relationship between multicategorical antecedent screen time and CABI mediated by GAS and Excessive somnolence and moderated by waves.

The above statistical diagram demonstrated in Figure 1 is represented by three regression equations, which allows the path coefficients to depend linearly on the wave of evaluation:

Equation 1

$$GAS = Intercept + a_1 * Screen\ time_1 + a_2 * Screen\ time_2 + a_3 * Wave + a_4 * (Screen\ time_1 * Wave) + a_5 * (Screen\ time_2 * Wave) + \beta_1 * Covariate_1 + \beta_n * Covariate_n + \varepsilon_{GAS}$$

Equation 2

$$Excessive\ somnolence = Intercept + a_6 * Screen\ time_1 + a_7 * Screen\ time_2 + a_8 * Wave + a_9 * (Screen\ time_1 * Wave) + a_{10} * (Screen\ time_2 * Wave) + d_1 * GAS + d_2 * (GAS * Wave) + \beta_1 * Covariate_1 + \beta_n * Covariate_n + \varepsilon_{Excessive\ somnolence}$$

Equation 3

$$CABI = Intercept + c'_1 * Screen\ time_1 + c'_2 * Screen\ time_2 + c'_3 * Wave + c'_4 * (Screen\ time_1 * Wave) + c'_5 * (Screen\ time_2 * Wave) + b_1 * GAS + b_2 * (GAS * Wave) + b_3 * Excessive\ somnolence + b_4 * (Excessive\ somnolence * Wave) + \beta_1 * Covariate_1 + \beta_n * Covariate_n + \varepsilon_{CABI}$$

Where a_n, d_n, b_n, and c'_n coefficients within the equations are all β coefficients written in a different form only to be highlighted and easily mentioned within the next sections; and where ε is residual error between the estimated and real values. Collectively, these three equations allow for moderation of wave on the paths within the conditional process model between screen time and CABI. Note that the indicator coding system, as known as *dummy* coding, applied to Screen time$_1$ captures the difference association of '4 to 8 hours' versus 'Less than 4 hours' group, whereas the indicator coding system applied to Screen time$_2$ captures the difference association of 'More than 8 hours' versus 'Less than 4 hours' group. Values for the β coefficients of Screen time, GAS, Excessive somnolence, and interaction terms within the model in Figure 1 are presented in Table 2 (information on intercept' and covariates' β coefficients can be seen in the Supplementary Table 1).

Table 2. Model coefficients for the conditional process model in figure 1.

Antecedent variables		Consequent variables: GAS				Excessive sonolence				CABI		
		β (95% CI)	**SE**	***p***		**β (95% CI)**	**SE**	***p***		**β (95% CI)**	**SE**	***p***
Screen time	*a*	4.423 (3.270; 5.607)	0.596	<0.001	a_6	0.087 (-0.544; 0.704)	0.321	0.794	c'_1	-0.163 (-1.136; 0.815)	0.496	0.753
Screen time	*a*	7.312 (5.503; 9.102)	0.915	<0.001	a_7	1.733 (0.578; 2.924)	0.598	<0.001	c'_2	0.006 (-1.569; 1.664)	0.820	0.993
Wave	*a*	-0.071 (-0.162; 0.018)	0.046	0.194	a_8	-0.023 (-0.122; 0.076)	0.051	0.641	c'_3	-0.078 (-0.256; 0.108)	0.092	0.403
Screen time * Wave	*a*	-0.014 (-0.172; 0.145)	0.081	0.867	a_9	0.065 (-0.023; 0.154)	0.045	0.153	c'_4	-0.002 (-0.137; 0.128)	0.068	0.976
Screen time * Wave	*a*	-0.179 (-0.429; 0.066)	0.126	0.117	a_{10}	-0.067 (-0.209; 0.083)	0.074	0.297	c'_5	0.202 (-0.012; 0.416)	0.107	0.046
GAS	-	-	-	-	d_1	0.103 (0.046; 0.156)	0.027	<0.001	b_1	0.193 0.119; 0.262)	0.037	<0.001
GAS * Wave	-	-	-	-	d_2	0.001 (-0.007; 0.008)	0.004	0.901	b_2	0.001 (-0.010; 0.011)	0.005	0.966
Excessive somnolence	-	-	-	-	-	-	-	-	b_3	0.610 (0.475; 0.746)	0.068	<0.001
Excessive somnolence * Wave	-	-	-	-	-	-	-	-	b_4	0.005 (-0.014; 0.024)	0.010	0.560
		$R^2_{adjusted}$ = 0.142 F (11; 1131) = 19.383; p < 0.001				$R^2_{adjusted}$ = 0.189 F (13; 1129) = 22.860; p < 0.001				$R^2_{adjusted}$ = 0.290 F (15; 1127) = 33.670; p < 0.001		

Note: Standard errors (SE) and 95% confidence intervals (CI) obtained by the percentile bootstrap method with 5,000 samples; GAS: Game Addiction Scale; CABI: Child and Adolescent Behavior Inventory.

The present conditional process model contains two to three stages, depending on the path linking screen time to CABI (Figure 1). For example, the first stage of the mechanism linking screen time and CABI through GAS only is the association of screen time and GAS, and the second stage is the association of GAS and CABI. On the other hand, the mechanism linking screen time and CABI through both GAS and Excessive somnolence has three stages. Since screen time is a multicategorical variable with three groups, it requires two *dummy* variables to represent its associations on consequent variables: Screen $time_1$ and Screen $time_2$, as depicted in equations 1 to 3 and table 2. The β coefficients for these two variables for a specific consequent variable can be visualized within the first two rows of table 2. The interaction terms included within equations 1 to 3 allow the path from Screen $time_1$ and Screen $time_2$ to consequent variable to be moderated by wave. The results demonstrate that the associations between screen time and GAS (a_1 and a_2) do not vary across wave, because the interaction terms between Screen $time_n$ and Wave (a_4 and a_5) do not present β coefficients statistically different from zero (p values > 0.05). The same is observed for the associations of screen time and Excessive somnolence, GAS and Excessive somnolence, GAS and CABI, and Excessive somnolence and CABI: the associations do not vary across wave because the interaction terms within these paths do not have β coefficients statistically different from zero (p values > 0.05). However, the β coefficient for the interaction term between Screen $time_2$ and wave is statistically different from zero ($p = 0.046$) within the path also known as the relative conditional direct association of Screen time and CABI, indicating that this association is moderated by Wave.

Since screen time is a multicategorical variable with three groups, the interpretation of the relative conditional direct association focus on the gap between the three lines of Figure 2 and how this gap varies as a function of wave at each wave (0, 6, and 12 months). An omnibus approach of equality of CABI estimates to probing the interaction leads to the inference that there are statistically significant differences in CABI scores at second and third wave: 6 months ($F [2, 1127] = 3.945$; $p = 0.020$); 12 months ($F [2, 1127] = 5.338$; $p = 0.005$). No differences were observed for the first wave ($F [2, 1127] = 0.061$; $p = 0.941$).

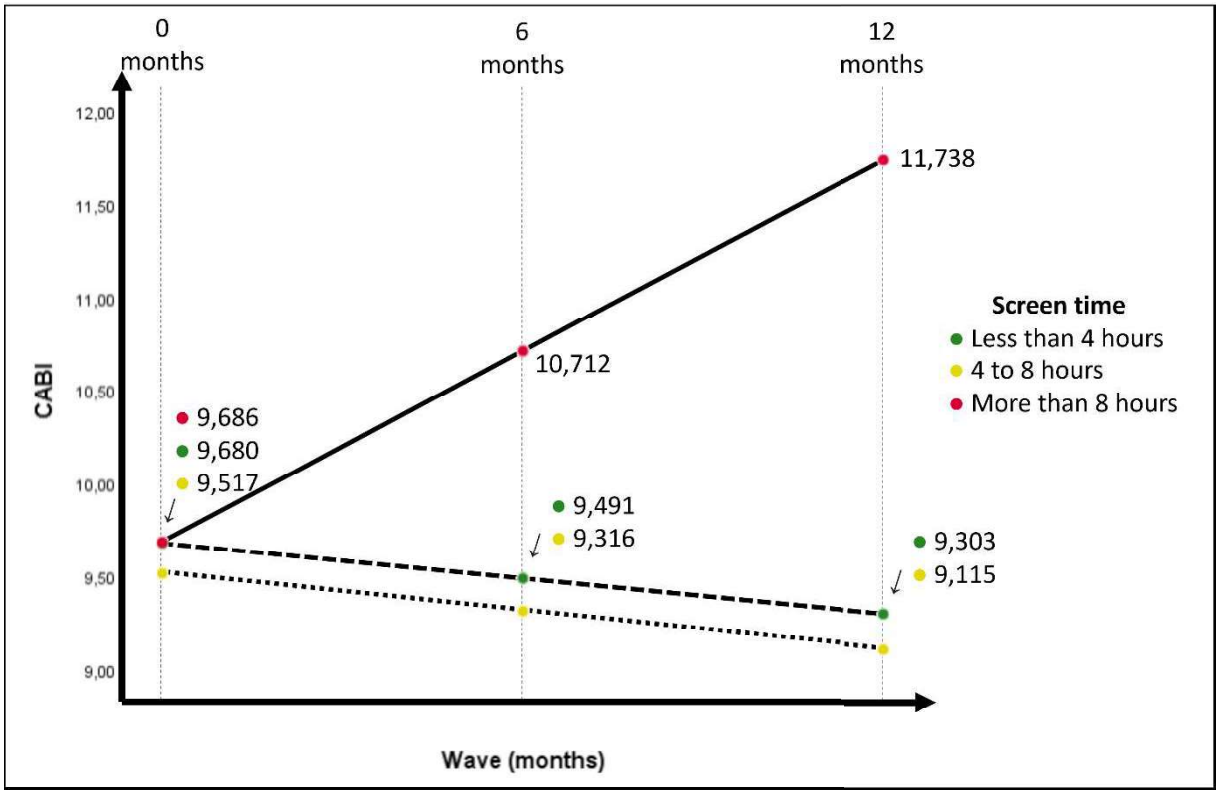


Figure 2. Visual representation of estimated conditional means being compared and the moderation '*effect*' of Wave in the association of Screen time and CABI.

However, the omnibus approach offers vague information about differences between groups of screen time. A pairwise approach was also applied to probe the interactions by looking at: (I) the difference between '4 to 8 hours' and 'Less than 4 hours' groups, represented by Screen time$_1$ *dummy* variable; and (II) the difference between 'More than 8 hours' and 'Less than 4 hours' groups, represented by Screen time$_2$ *dummy* variable. The β coefficients presented within Table 3 also represent the part of the association of Screen time and CABI that does not operate through the mediator variables within the conditional process model built (Figure 1). Clearly, the association between Screen time and CABI was strengthened in the second and third wave for those spending more than 8 hours in comparison to those spending less than 4 hours in front of screen-based devices, indicating that the higher the number of hours of screen time, the higher the punctuation on the CABI scale.

Table 3. Relative conditional direct association of screen time and CABI, independently of GAS and Excessive somnolence.

	β (95% CI)	**SE**	***p***
1st Wave (0 months)			
Screen time$_1$	-0.163 (-1.177; 0.852) *	0.517	0.753
Screen time$_2$	0.006 (-1.468; 1.480) **	0.751	0.993
2nd Wave (6 months)			
Screen time$_1$	-1.175 (-0.924; 0.573) *	0.381	0.646
Screen time$_2$	1.221 (0.168; 2.273) **	0.536	0.023
3rd Wave (12 months)			
Screen time$_1$	-0.188 (-1.415; 1.039) *	0.625	0.764
Screen time$_2$	2.435 (0.735; 4.135) **	0.866	0.005

Note: SE: Standard errors; 95% CI: 95% confidence intervals; *β coefficients obtained by algebraically rearranging the β coefficient of Screen time$_1$ on equation 3 to linearly depend on wave: $c'_1 + c'_4$ * Wave = -0.163 – 0.002 * Wave; ** β coefficients obtained by algebraically rearranging the β coefficient of Screen time$_2$ on equation 3 to linearly depend on wave: $c'_2 + c'_5$ * Wave = 0.006 + 0.202 * Wave.

Lastly, the relative conditional indirect associations of screen time and CABI operating through the mediator(s) variable(s) are quantified as the product between β coefficients of the aforementioned two or three stages (see table 2 for β coefficients). Since all stages within the conditional process model built allow for the coefficients to vary across the variable wave (Figure 1; Equations 1 to 3), the indirect paths also allow it even if the interaction terms do not present a β coefficient statistically different from zero (HAYES, 2015). Table 4 shows the conditional indirect effects of Screen time and CABI. The interest here is within the mechanism linking Screen time and CABI through both GAS and Excessive somnolence. Positive and statistically significant conditional indirect association coefficients are observed for this mechanism within the three waves, indicating that higher screen time seems to associate with higher GAS, which in turn associated with higher Excessive somnolence, which in turn associated with higher CABI punctuation.

Table 4. Relative conditional indirect association of screen time and CABI through the mediator(s) variable(s).

	Relative conditional indirect association*	
	β (95% CI)	**SE**
Screen time → GAS → CABI		
1st Wave (0 months)		
Screen time$_1$	0.853 (0.484; 1.283)	0.204
Screen time$_2$	1.410 (0.844; 2.050)	0.313
2nd Wave (6 months)		
Screen time$_1$	0.843 (0.567; 1.147)	0.147
Screen time$_2$	1.211 (0.824; 1.647)	0.212
3rd Wave (12 months)		
Screen time$_1$	0.832 (0.411; 1.332)	0.237
Screen time$_2$	1.010 (0.465; 1.657)	0.306
Screen time → Excessive somnolence → CABI		
1st Wave (0 months)		
Screen time$_1$	0.053 (-0.352; 0.421)	0.197
Screen time$_2$	1.058 (0.349; 1.797)	0.374
2nd Wave (6 months)		
Screen time$_1$	0.305 (0.001; 0.610)	0.154
Screen time$_2$	0.855 (0.368; 1.363)	0.253
3rd Wave (12 months)		
Screen time$_1$	0.581 (0.058; 1.158)	0.282
Screen time$_2$	0.627 (-0.135; 1.463)	0.399
Screen time → GAS → Excessive somnolence → CABI		
1st Wave (0 months)		
Screen time$_1$	0.277 (0.117; 0.473)	0.091
Screen time$_2$	0.459 (0.192; 0.797)	0.156
2nd Wave (6 months)		
Screen time$_1$	0.293 (0.175; 0.427)	0.064
Screen time$_2$	0.420 (0.250; 0.625)	0.096
3rd Wave (12 months)		
Screen time$_1$	0.308 (0.115; 0.551)	0.111
Screen time$_2$	0.373 (0.136; 0.684)	0.143

Note: Standard errors (SE) and 95% confidence intervals (CI) obtained by the percentile bootstrap method with 5,000 samples; *Relative conditional indirect association coefficients obtained by the product of β coefficients algebraically rearranged to linearly depend on wave[1] within the two or three stages of Screen time and CABI through GAS only, Excessive somnolence only, or GAS and Excessive somnolence in serial; GAS: Game Addiction Scale; CABI: Child and Adolescent Behavior Inventory.

Discussion

The purpose of the present study was to test if the mechanisms linking screen time and CABI, both directly and indirectly, were strengthened or attenuated by wave of evaluation. The results indicated that the relationship between screen time and CABI were moderated/strengthened by wave, whereas the indirect association through GAS and Excessive somnolence remained similar across different waves.

Even though the paths linking the antecedent and consequent variables linearly depend on Wave, the conditional relative indirect associations present polynomial relationships because they are a product of two or three linear relationships.

Previously, the study "Gaming addiction and screen time in a context of increase of internalizing symptoms: Moderation evaluation" had already found an increase in screen time, gaming addiction and internalizing symptoms. Regardless of the time spent in front of screens, higher levels of gaming addiction were associated with higher levels of internalizing symptoms in children and adolescents. Even if participants demonstrated little screen time, if they were virtually addicted, they tended to exhibit higher levels of internalizing symptoms. The same result was found in all three samples (Tavares, et al., 2022).

Thus, the mediation analysis allowed us to see how screen time associates with internalizing symptoms and when this association occurs. In addition to enabling a theoretical relationship between the variables and their influences: Screen Time - Virtual Dependence - Excessive Sleepiness - Internalizing Symptoms.

The indirect relationship of the proposed model assumes that higher levels of screen time are associated with higher levels of virtual dependence and excessive sleepiness, as well as higher levels of virtual dependence and excessive sleepiness are associated with higher levels of internalizing symptoms. It can also be concluded that higher levels of screen time are associated with higher internalizing symptom scores, regardless of levels of virtual addiction and excessive sleepiness. Importantly, the association became stronger at waves 2 and 3. That is, the child or adolescent who spent eight or more hours of screen time had higher levels of internalizing symptoms compared to the child who spent four hours or less at waves 2 and 3 compared to wave 1 (fig, 2).

In this regard, a study conducted in the United States of 11,780 9- and 10-year-old children found similar results. Participants reported the number of hours per day they spent connected and responded to a semi-structured clinical interview measuring current and past symptoms of internalizing disorders using DSM-5 criteria. Children who spend more time using screens, especially digital media, are more likely to fit DSM-5 criteria for internalizing disorders (L, JW, TE, & K, 2022).

In the same direction, a systematic review and meta-analysis with 87 studies evaluated the association between duration of screen time and externalizing and internalizing behavior problems in children aged 12 years and younger. The review found correlations between screen time and externalizing (90 samples; r, 0.11; 95% CI, 0.10-0.12) and internalizing (43 samples; r, 0.07; 95% CI, 0.05-0.08) symptoms (Eirich R, 2022).

However, these relationships do not get stronger or less strong with the pandemic. The point is that what seems to influence even higher levels of internalizing symptoms is high exposure in front of screens, even though virtual addiction and excessive sleepiness have their respective contributions to a higher level of internalizing symptoms.

Strengths and Limitations

Some limitations should be addressed in future research. This is a cross-sectional study using retrospective screen time reports, which limits our ability to determine causality and accuracy of reporting. It suggests that other randomized studies could test these associations.

The sample in the present study is predominantly female (> 90%), most parents attended university, and levels of anxiety and depression (> 70%) are relatively high. Therefore, caution should be exercised in interpreting the present finding as representative of the general population.

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5 CONSIDERAÇÕES FINAIS

Há um consenso crescente de que as consequências para a saúde mental da pandemia de COVID-19 em crianças e adolescentes são uma grande prioridade de saúde pública e que estudos de boa qualidade são importantes para expandir e melhorar as evidências sobre os efeitos da pandemia na saúde mental (Shah, Mohammad, Qureshi, Abbas, & Aleem, 2021; Bai, et al., 2022; Hards, et al., 2022; Varma, Junge, Meaklim, & Jackson, 2021; Meade, 2021). Através de dois artigos, investigamos como e quando ocorre a associação entre dependência de jogos de Internet, tempo de tela e sintomas internalizantes em três momentos da pandemia de COVID-19.

Para obter uma melhor perspectiva de como as variáveis dependência de jogos de Internet, tempo de tela e onda interagem no modelo para predizer os sintomas internalizantes, foram estimados valores de sintomas internalizantes a partir da equação de regressão múltipla. No primeiro momento de avaliação, os valores estimados demonstraram que independente dos níveis de tempo tela, aqueles indivíduos com menor dependência de jogos de Internet tiveram menores níveis de sintomas internalizantes, enquanto aqueles indivíduos com maior dependência de jogos de Internet tiveram maiores níveis de sintomas internalizantes. Já no terceiro momento de avaliação, os valores estimados continuaram demonstrando que os maiores níveis de dependência de jogos de Internet estavam associados com maiores níveis de sintomas internalizantes, independentemente do nível de tempo de tela. Em outras palavras, mesmo tendo um baixo ou elevado tempo de tela, se fosse dependente de jogos virtuais, o indivíduo teria maiores níveis de sintomas internalizantes. Por outro lado, os valores estimados no terceiro momento de avaliação demonstraram que indivíduos com baixa dependência de jogos de Internet e elevado tempo de tela possuíam maiores níveis de sintomas internalizantes do que aqueles com baixo tempo de tela. Há evidência de que a influência do tempo de tela na relação entre dependência de jogos de Internet e sintomas internalizantes depende linearmente do momento de avaliação, ainda que essa interação seja responsável por apenas 0,3% (r2mudança = 0,003) da variância de sintomas internalizantes.

No geral, os resultados deste estudo foram consistentes com as alegações acadêmicas anteriores, sugerindo que a pandemia de COVID-19 potencialmente levaria crianças e adolescentes a se envolverem mais com jogos virtuais (Pasquale, Chiappedi, Sciacca, Martinelli, & Hichy, 2021; L, et al., 2021; Giuseppe, Tavormina, & Tavormina, 2021; Musa, Elyamani, & Dergaa, 2022), piora na qualidade do sono (A.Jahramia, et al.,

2022; Abbas, et al., 2022; Cellini, Giorgio, Mioni, & Riso, 2021) e desenvolverem sintomas internalizantes (Shah, Mohammad, Qureshi, Abbas, & Aleem, 2021; Bai, et al., 2022; Ma, et al., 2021; Xie, et al., 2020; Teng, Pontes, Nie, Griffths, & Guo, 2021) e

Porém, alguns pontos devem ser considerados na generalização dos resultados da pesquisa. Este estudo compreendeu crianças e adolescentes com idades entre 06 e 18 anos e, portanto, os achados podem não ser generalizados para outros grupos. Além disso, as reações e políticas do governo para controlar a infecção por Covid-19 no Brasil podem ser muito diferentes de outros países e, portanto, podem ser necessárias replicação para entender de maneira mais abrangente como as variáveis usadas no presente estudo se relacionam com os países. Nesse sentido, mais pesquisas são necessárias para confirmar esses dados e desenvolver estratégias baseadas em evidências para reduzir os impactos psicológicos adversos e sintomas psiquiátricos em crianças e adolescentes durante a pandemia.

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