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Which personal and social resources help adolescents to recover from negative affect in daily life? An experience sampling study

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Background: **Reducing anxiety and depression in adolescents is a global health priority. Personal and social resources (e.g., hobbies and socialising) may reduce distress. Yet, there is insufficient understanding of how adolescents use such resources to reduce distress.**
Objective: **To identify resources that reduced distress in the everyday lives of adolescents and whether resource use differed according to symptoms of anxiety and depression.**
Methods: **The experience sampling method was used, a longitudinal method requiring participants to report on context and mood at randomly selected moments across a week. A total of 5 558 reports were contributed by 151 adolescents, including 90 with symptoms of anxiety and/or depression. The study was conducted in the poorest neighbourhoods of Bogotá, Buenos Aires, and Lima.**
Results: **Multi-level modelling indicated that using resources was significantly associated with less nervousness and sadness. Adolescents with symptoms of anxiety and/or depression were less likely to use some resources (e.g., sport). Cross-level interactions showed the efficacy of resources differed according to the severity of symptomatology. For adolescents with symptoms of anxiety and depression, some resources (e.g., peer support) improved mood, while others (e.g., music listening) did not.**
Discussion: **Personal and social resources are important for reducing distress in the everyday life of adolescents, giving insight into potential interventions to help mitigate symptoms of anxiety and depression before escalation. Further research could assess the quality of experiences (e.g., appraisal) to deepen understanding of how engagement promotes resilience.**
Conclusions: **Care must be taken when recommending resource use, since some forms (e.g., music listening) may be unhelpful to adolescents with symptoms of anxiety and depression.**

Keywords: adolescents, anxiety, depression, everyday resources, mood, resilience

Background

Globally, approximately 14% of adolescents experience mental health conditions, most commonly anxiety and depression, accounting for 13% of the global burden of disease in this age group (Biswas et al., 2020; World Health Organization [WHO], 2021), a prevalence that has risen in recent years (Mojtabai et al., 2015; Shorey et al., 2022). Symptoms of anxiety and depression increase from early to mid-adolescence (Henker et al., 2002; Kessler et al., 2005). Longitudinal data suggest a peak between the ages of 14 and 18 (Hankin et al., 2015), with a recurrence rate in young adulthood of 25%–47% (Benjet et al., 2020). Both depression and anxiety are associated with future morbidity and educational and social impairments (Deady et al., 2022; van Ameringen et al., 2003). Furthermore, over half of all adolescent suicides are attributable to depression (Thompson et al., 2019), making it the leading cause of mortality for this age group (Horn et al., 2014). Consequently, the WHO (2017) has identified reducing adolescent depression and anxiety as a key priority.

Depression, anxiety, and suicidal ideation during adolescence are a concern within low- and middle-income countries (LMICs) (Ferrari et al., 2013; Renaud et al., 2022; Sánchez-Castro et al., 2024; Uddin et al., 2019; WHO, 2017). This includes Latin America, the setting for the current study, where the prevalence of depression and/or anxiety for adolescents has been estimated to be 14%–16% (Biswas et al., 2020; UNICEF, 2021), with specific estimates of 17% in Colombia (Murcia et al., 2009) and 26% in Argentina (Méndez et al., 2002). Urban regions, predominantly large cities, account for approximately 80% of the population in Latin America (United Nations [UN], 2012). Adolescents who live in big cities have more frequent exposure to risk factors for developing anxiety and depression, including conflict, poverty, social isolation, poor education, low employment rates, gang warfare, victimisation, violence, and substance misuse (Morgan et al., 2014; Thapar et al., 2012; Varese et al., 2012; Zammit et al., 2010). Therefore, identifying protective factors that could modify the future risk of mental health problems in this context is important.

Although mental health problems in adulthood often originate in adolescence (Steel et al., 2014), 75% of all mental health conditions developing before the age of 18 (Caspi et al., 1996), it has been estimated that 50%–60% of adolescents experience symptomatic recovery, often despite accumulated and ongoing adversity and a lack of formal mental healthcare (March et al., 2004; Roach et al., 2023; Stapinski et al., 2013). However, it is not known which resources are mobilised by adolescents to help prevent and overcome anxiety and depression and build mental health resilience.

Resilience is defined as overcoming adversity and rebounding from illness (Anderson & Priebe, 2021). This covers both the process of avoiding depression and/or anxiety in the face of risk factors and the process of recovering from them if they developed. Adolescence can be a time when opportunities for resilience open, a neurodevelopmental period when self-regulation is developing, and social and cultural exposure to new events can arise, such as going to college, joining clubs, and falling in love (Masten & Barnes, 2018). Resilience involves both personal and social resources, including a wide range of assets. Although these categories are not mutually exclusive, personal resources include behavioural strategies (e.g., participating in a hobby) and internalised resources (e.g., self-efficacy) (Gross & John, 2003), and social resources are group-based, operating at a community or societal level (e.g., support from friends) (Kim, 2010; Masten & Barnes, 2018; Pargas et al., 2010).

Qualitative research with adolescents in Latin America described the perceived importance of such resources for managing distress (Toyama et al., 2022). Reported resources included: spirituality/religion (e.g., meditation); social support (e.g., spending time with family); social media (e.g., connecting with others online); community resources (e.g., visiting libraries); arts activities (e.g., writing poetry); leisure activities (e.g., listening to music); and sports activities (Toyama et al., 2022). However, despite resilience being crucial to help adolescents deal with emerging challenges, little is known about 'resilience as a process' and how resources are used to reduce distress in everyday life (Lennarz et al., 2019; Taylor & Carr, 2021). To address this, the current study examined the immediate impact of resources on mood in the everyday life of adolescents, using the experience sampling method (ESM), a longitudinal diary technique for collecting quantitative data at randomly selected moments in everyday life (please refer to the Materials and Methods section for more detail).

Previous ESM research suggests that adolescents report improved mood in particular contexts. A high prevalence of negative affect (e.g., stress) has been reported in school (Moeller et al., 2020), while adolescents report feeling happier during leisure time (Bassi & Delle Fave, 2004; Mesurado & Richaud de Minzi, 2014), especially during structured activities, such as sports (Mazereel et al., 2021), versus passive activities ('doing nothing') (Delle Fave et al., 2011). Adolescents have also reported experiencing less negative affect when they are with friends and family compared to when they are alone (Henker et al., 2002; Offer, 2013; Schneiders et al., 2007; van Roekel et al., 2015). However, research has not identified how specific resources, such as those reported by Toyama and colleagues (2022), relate to the management of distress in daily life.

Clinical research using ESM has focused on the moods of at-risk youth, in particular, depressive symptoms in daily life (van Beveren et al., 2017). At-risk adolescents have reported higher levels of negative affect, lower positive affect, mood lability, and mood reactivity (Dietvorst et al., 2021; Schneiders et al., 2007; Silk et al., 2003). Research has also reported differences in time use, for example, at-risk adolescents spending less time in recreational activities and more time alone (Achterhof et al., 2022; Henker et al., 2002). However, it is not known whether at-risk adolescents differ in their use of personal and social resources, as most research has focused on broad contexts (e.g., being at home) or risk factors (e.g., exposure to violence) (Dietvorst et al., 2021; Russell & Gajos, 2020).

Risk level has been reported to moderate affective experience when with others, for example, high-risk youth have reported higher levels of depression when with family than low-risk adolescents, and higher anxiety with others outside friends or family (Schneiders et al., 2007). This research suggests a sensitivity to social context in high-risk adolescents, but these complexities have not been extended to personal resources, a gap that was addressed in the current study.

Objective

We aimed to improve understanding of the everyday resources involved in reducing distress in adolescents and inform the development of locally relevant interventions to help mitigate symptoms of anxiety and depression before escalation (Shorey et al., 2022). We used ESM to examine the use of resources in a sample of adolescents, with and without symptoms of anxiety and depression, from the poorest neighbourhoods in the cities of Buenos Aires (Argentina), Bogotá (Colombia), and Lima (Peru). We aimed to identify how successful specific personal and social resources (e.g., creative hobbies, sport activities, and spending time with friends) were at improving mood (sadness and nervousness) 'in the moment'; thereby building on the work of Toyama and colleagues (2022). Additional objectives were to improve our understanding of the complexities of resource use for adolescents with symptoms of generalised anxiety disorder and depression, specifically, whether they used resources less often in everyday life, and whether they had the same affective response while engaging with resources as low-risk adolescents.

We hypothesised that: (1) engaging with personal and social resources would be associated with improved mood (reduced nervousness and increased happiness); (2) using personal and social resources less frequently would be associated with higher levels of anxiety and depression; and (3) symptoms of anxiety and depression would moderate the association between resource use and mood (nervousness and happiness).

Materials and methods

Participants
Participants (*n* = 151) were recruited from a large cohort study (Priebe et al., 2021). Fifty participants were from Buenos Aires, 51 from Bogotá, and 50 from Lima. There were 76 adolescents aged 15–16 years (mean = 15.34 years, SD = 0.51 years) and 75 aged 20–24 years (mean = 21.83 years, SD = 1.40 years). Sixty-two identified as male; 86 as female; and three as other. Fifty-nine adolescents reported symptoms of generalised anxiety disorder and 80 reported symptoms of depression (61 participants met the criteria for neither).

Through collaborations with community organisations in each country (e.g., schools and youth organisations), adolescents were recruited from defined geographical areas: those within the poorest 50% of neighbourhoods (defined using the Human Development Index (United Nations, 2023) in Bogotá and Lima and the Unsatisfied Basic Needs Index (Socioeconomic Data and Applications Center, n.d.) in Buenos Aires). Recruitment included two groups of adolescents, focusing on critical developmental periods. One group consisted of adolescents aged 15–16 years, since disorders commonly develop before the age of 18 (Caspi et al., 1996; Hankin et al., 2015). The second group included older adolescents aged 20–24 years. This age range represents a time when the critical developmental phase is over, but when adolescents are still exposed to similar environments and stressors (Sawyer et al., 2018). This period is crucial regarding the potential recurrence of disorders in young adulthood (Benjet et al., 2020). All participants had the capacity to provide informed consent or assent, with parental informed consent being obtained when necessary. Exclusion criteria were any severe mental illness (psychosis, bipolar disorder, and schizophrenia), cognitive impairment, illiteracy, and use of Huawei phones (following problems identified during the pilot phase).

Remuneration strategies were developed according to the cultural context of each country. In Peru, each participant received a gift (equivalent to S/50.00) and costs for data plans. In Colombia, each participant received an Éxito supermarket voucher for 140 000 pesos. In Argentina, participants received $1 000 pesos (including data plans).

Sample sizes were based on recommendations for cross-level interactions with multiple predictors in two-level models to achieve 80% power (requiring 125 participants and 3 125 sampled moments) (Arend & Schäfer, 2018).

Design
ESM is a structured, quantitative diary technique for the collection of longitudinal data, with participants completing short questionnaires about their immediate experience as they go about their daily lives, providing multiple snapshots of contextualised experience (Conner et al., 2009). Reports are usually triggered at random moments over a set period of time, with participants typically receiving notifications on their mobile devices (van Berkel et al., 2017). ESM has multiple benefits, including ecological validity (since reports are made in response to real events in 'natural settings') and minimising recall bias, since reports are made immediately (Ben-Zeev et al., 2009).

The ESM design had two levels, with 5 558 reports at the experiential level (level 1) and 151 participants at the person level (level 2). Variables at level 1 (repeated measures) included mood (happiness and nervousness) and resource use (engaging with a resource in the moment). Variables at level 2 included scores on measures of generalised anxiety disorder and depression, age group, gender, and country.

Materials
eMoodie (https://emoodie.com) is an experience sampling application designed for adolescents in terms of interface and accessibility (Domoff et al., 2021). Using the application, the participants completed the Experience Sampling Questionnaire (ESQ), the General Anziety disorder 7-Item Scale (GAD-7: Spitzer et al., 2006), and the Patient Health Questionnaire (PHQ-8: Kroenke& Spitzer, 2002).

Experience Sampling Questionnaire
The ESQ consisted of six items enquiring about participants' thoughts, feelings, behaviours, and environment. Items included: "Where are you?" (with predefined response categories: "at home", "at work", "at the home of a friend, partner or family member", "at a shop or restaurant", "at school or University", "other"); "What are you doing now?" (open-text response); "How long have you been doing this activity?" (5-item response scale, ranging from "up to 10 minutes" to "more than three hours"); "Who are you doing this activity with?" (Response options: mother, father, sibling, partner, friends, teacher, co-workers, classmates, child(ren), other, nobody); "How happy or sad do you feel right now?" ("Qué tan feliz o triste te sientes ahora?") (7-point scale from 1 = very sad, to 7 = very happy); and "How nervous or calm are you right now?" ("Qué tan nervioso(a) o tranquilo(a) estás ahora?") (7-point scale from 1 = very nervous, to 7 = very relaxed and calm).

General Anxiety Disorder

The GAD-7 (Spitzer et al., 2006) is a 7-item screening measure for generalised anxiety disorder (GAD), enquiring about the frequency of symptoms (such as being unable to control worrying) in the past two weeks, with a 4-item response scale ranging from 0 = not at all, to 3 = every day. The scale has demonstrated adequate internal consistency, convergent, discriminant, and construct validity (Johnson et al., 2019; Kroenke et al., 2007). Scores above nine were used to identify cases of GAD (Spitzer et al., 2006). In the present sample, the reliability coefficient for the GAD-7 was 0.866.

Patient Health Questionnaire

The PHQ-8 (Kroenke & Spitzer, 2002) is an 8-item screening measure for depression, enquiring about the frequency of symptoms (such as feeling down, depressed, or hopeless) in the past two weeks, with a 4-item response scale ranging from 0 = not at all, to 3 = every day. The scale has good psychometric properties (Kroenke et al., 2008; Shin et al., 2019). Scores above nine were used to identify cases of depression (Kroenke et al., 2009). In the present sample, the reliability coefficient for the PHQ-8 was 0.857.

Procedure

Participants completed baseline measures (including measures of GAD and depression) as part of the cohort study. Following screening for the ESM study, participants were invited to participate, and informed consent/assent was obtained. Participants attended a briefing session with researchers, who introduced them to the study, explained how to install and use eMoodie, and how to complete ESQs. Participants could practice using eMoodie, and each item on the ESQ was explained. To increase compliance, researchers aimed to generate enthusiasm and build a rapport with participants. After the briefing, participants could contact researchers with any questions about the study. Researchers conducted a midweek phone call at an agreed time with each participant to discuss any concerns they might have and to motivate participants to complete as many ESQs as possible.

The sampling schedule involved participants receiving notifications over a 7-day period (at a random time within hour-long intervals). Participants aged 15–16 years received notifications five times per day on school days (not sampling during school hours to avoid disturbing lessons) and eight times per day on weekends. Participants aged 20–24 years received notifications eight times per day over a 7-day period.

Upon receiving a notification from eMoodie, participants were asked to stop their current activity and complete the ESQ, which took no longer than 2 minutes. If this first notification was missed, participants received a reminder after 7 minutes and a second reminder 7 minutes later. If the reminders were not responded to within 20 minutes after the first notification, the assessment point was recorded as missed. To maximise compliance, participants were allowed additional self-initiated responses: one ESQ following a missed notification (if completed prior to the next notification); one at the start of the day (up to 1-hour before the sampling schedule began); and one at the end of the day (up to 1-hour after the end of the sampling schedule). After the sampling period, researchers contacted participants to complete a short debriefing questionnaire and discuss their experience of participating.

The study received ethical approval from the Ethics Committee in Biomedical Research, Faculty of Medicine, University of Buenos Aries; and local approvals from the Institutional Review Boards at the Ethics Committee of the Pontificia Universidad Javeriana, Bogotá; Institutional Ethics Committee of Research of the Universidad of the Universidad Peruana Cayetano Heredia; and Ethics of Research Committee, Queen Mary, University of London.

Data cleaning and scoring

The resident research teams coded open-text responses to "What are you doing?" in Spanish, agreeing upon codes and categories across countries before final coding of the data. Responses were organised into codes (377 simple descriptions of activities, e.g., "brushing teeth"). Codes were clustered into 15 categories and subcategories, including work activities, eating and drinking, chores, transportation, and educational activities, in addition to the resource categories detailed in Table 1. Participants reported using resources on 3 436 occasions.

Table 1. Average levels of happiness according to reported activity in the moment

Main categories	Subcategories	n	Mean at 0	Mean at 1	Estimate	SE	t	p	Lower bound 95% interval	Upper bound 95% interval
Spiritual and religious activities		15	6.17	6.78	−0.094	0.0648	−1.456	0.145	−0.222	0.033
Artistic activities		76	6.25	6.69	−0.069	0.0310	−2.220	0.026*	−0.129	−0.008
Sport and exercise		91	6.22	6.72	−0.077	0.0283	−2.731	0.006*	−0.133	−0.022
Spending time with pets		53	6.10	6.85	−0.116	0.0404	−2.876	0.004*	−0.195	−0.037
Spending time with people		467	6.23	6.71	−0.073	0.0132	−5.568	< 0.001*	−0.099	−0.048
	Mother	801	5.06	5.05	0.002	0.0123	0.168	0.867	−0.022	0.026
	Father	289	5.12	5.00	0.022	0.0164	1.347	0.178	−0.010	0.054
	Siblings	818	5.02	5.09	−0.014	0.0122	−1.136	0.256	−0.038	0.010
	Partner	550	4.92	5.21	−0.058	0.0146	−3.932	< 0.001*	−0.086	−0.029
	Friends	469	4.91	5.22	−0.061	0.0140	−4.346	< 0.001*	−0.088	−0.033
Recreational activities		2091	6.31	6.62	−0.049	0.0076	−6.381	< 0.001*	−0.064	−0.034
	Outdoor activities	66	6.13	6.62	−0.077	0.0338	−2.271	0.023*	−0.143	−0.010
	Playing games	271	6.06	6.70	−0.101	0.0168	−6.015	< 0.001*	−0.134	−0.068
	Shopping	53	6.06	6.69	−0.099	0.0360	−2.740	0.006*	−0.169	−0.028
	Social media and internet	232	6.52	6.23	0.045	0.0183	2.477	0.013*	0.009	0.081
	Reading	97	6.22	6.52	−0.047	0.0296	−1.600	0.110	−0.105	0.011
	Watching sport	41	6.14	6.61	−0.073	0.0406	−1.797	0.072	−0.153	0.007
	Watching TV/movies	998	6.28	6.46	−0.028	0.0095	−2.968	0.003*	−0.047	−0.010
	Listening to music	319	6.22	6.53	−0.048	0.0160	−3.021	0.003*	−0.080	−0.017

Note. $*p < 0.05$. "Mean at 0" indicates mean happiness score when not engaging with a resource, while "Mean at 1" indicates mean happiness score when engaging with a resource. *n* indicates the number of sampled experiences.

Following the study protocol (Priebe et al., 2021): (1) only participants with a compliance rate (% of notifications responded to) of 40% or above were included in the data set; and (2) after cleaning the data, only participants with at least 20% of notifications remaining were included in the data set (Mehl & Conner, 2012). All participants met these criteria. Data were screened for invalid observations (Mehl & Conner, 2012), removing duplications and ESQs with more than 50% of items completed in under 1 second, indicative of 'skipping through'. After cleaning, the mean compliance rate was 76% (range = 34% to 100%).

Data analysis

Because the data are nested, multi-level modelling was used to account for the lack of independence of data at the experiential level (Goldstein, 1995). Multi-level modelling also allows for missing data, which occurs in ESM studies since some notifications are missed (Hox & Roberts, 2011). Following standard recommendations, 'level 1' predictor variables were centred around individual mean scores, while 'level 2' variables were centred around grand mean scores (Algina & Swaminathan, 2011). The residuals for happiness were significantly positively skewed. A Gamma model (which allowed the normality assumption to be violated) with log transformation was conducted, being the model with the best fit (using Akaike's Information Criteria, a measure of model quality: Heck et al., 2013). For nervousness, residuals were skewed and Akaike's Information Criteria showed best fit for a model that assumed a normal distribution but with log transformed data. Age group, gender, and country were included as predictors in the models. In level 1 models, notification number (time) was included to control for autocorrelation (where chronologically close notifications cannot be assumed to be independent: Bolger & Laurenceau, 2013).

Results

Sample characteristics

Overall, 90 participants met the criteria for either GAD or depression (59 meeting the criteria for GAD and 80 for depression). Several participants (*n* = 49) met the criteria for both. The characteristics of these groups are described in Table 2, showing similar compliance rates, age composition, and resource use. Participants with symptoms of both anxiety and depression reported more sadness and nervousness during the sampling week. Average GAD-7 and PHQ-8 scores for participants with symptoms were at moderate levels of severity, transitioning to moderately severe in the case of PHQ-8 scores.

The impact of personal and social resources on immediate mood

We predicted that engaging with everyday resources would be associated with improved mood, feeling happier, and calmer than at other sampled moments. To test this, multi-level models (with a random intercept) were conducted to predict happiness and nervousness, with resource use as predictors (controlling for age group, country, gender, and autocorrelation, as described earlier). One model was conducted for main resource categories (detailed in Table 1). Separate models were conducted for the subcategories of 'recreational activities' and 'who time was spent with'. Parameters and statistical outcomes for these models are provided in Tables 1 (happiness) and 3 (nervousness).

All personal and social resources predicted higher levels of happiness in the moment except spiritual activities. Adolescents felt significantly happier while engaging in art activities, participating in sport and exercise, participating in recreational activities, spending time with others, and interacting with pets. When examining which recreational activities contributed to higher levels of happiness, various activities were significant predictors including outdoor activities, playing games, shopping, watching television and movies, and listening to music. However, spending time on social media and the internet was significantly associated with reduced happiness. When further exploring who time was spent with, happiness was only significantly greater than usual when spending time with partners and friends, rather than with family members (parents and siblings).

Table 2. Sample characteristics for participants with and without symptoms of anxiety and depression

	Participants with symptoms of GAD	Participants with symptoms of depression	Participants with symptoms	Participants without symptoms	Entire sample
n	59	80	90	61	151
Age (mean (SD)) 15–16 group	15.27 (0.45)	15.34 (0.53)	15.31 (0.51)	15.39 (0.50)	15.34 (0.51)
Age (mean (SD)) 20–24 group	22.21 (1.32)	21.85 (1.42)	21.91 (1.40)	21.70 (1.42)	21.83 (1.40)
Gender (% female)	62.71	60.00	60.00	52.50	56.95
Country (% from AR, CO, PE)	27.1, 42,4, 30.5	33.8, 33.8, 32.5	34.4, 32.8, 32.8	34.4,32.8, 32.8	33.1, 33.8, 33.1
GAD-7 (mean (SD))	13.00 (2.97)	11.03 (4.52)	11.11 (4.36)	4.02 (2.74)	8.23 (5.14)
PHQ-8 (mean (SD))	14.25 (4.50)	14.40 (3.55)	13.75 (3.93)	3.95 (2.56)	9.77 (5.92)
Happiness (mean (SD))	4.70 (0.96)	4.75 (1.02)	4.82 (1.01)	5.23 (0.89)	4.98 (0.99)
Nervousness (mean (SD))	4.81 (1.05)	4.88 (1.15)	4.89 (1.12)	5.35 (0.96)	5.07 (1.08)
Resource use (% time) (mean (SD))	62.80 (21.54)	61.41 (22.56)	61.74 (22.17)	64.69 (20.37)	62.92 (21.44)
Compliance rate (%) (mean (SD))	76.46 (16.51)	74.44 (16.11)	74.41 (16.34)	77.43 (16.48)	75.63 (16.41)

Note. 'With symptoms' indicates meeting the threshold for either generalised anxiety disorder (GAD) or depression based on GAD-7 and PHQ-8 scores. AR = Argentina; CO = Colombia; PE = Peru; PHQ-8 = 8-item Patient Health Questionnaire Scale. 'Resource use' indicates the % time spent engaging with an activity identified as a personal or social resource. 'Compliance rate' is the % of notifications responded to. Nervousness is reverse scored, so high scores indicate more calmness.

For nervousness, adolescents reported feeling significantly calmer during sport and exercise, during recreational activities, and when spending time with others. Further analysis by type of recreational activity showed that nervousness was significantly reduced when playing games, watching television or movies, and listening to music. Analysis of who adolescents were with showed that nervousness significantly reduced when with partners, siblings, and friends.

Use of personal and social resources according to levels of depression and anxiety
We predicted that adolescents who used everyday resources less frequently would have higher levels of anxiety and depression. To examine this, a level 2 model was conducted (controlling for age, gender, and country), predicting anxiety and depression scores with the proportion of time spent engaging with a resource across the sampling week. Depression scores were significantly lower for participants who spent more time than average engaging with arts activities ($\gamma = -2.042$, t (138) = -3.129, $p = 0.002$, $CI_{95} = -3.331, -0.752$), and anxiety scores were significantly lower for participants who spent more time engaging in sport ($\gamma = -1.855$, t (138) = -2.175, $p = 0.031$, $CI_{95} = -3.541, -0.168$), and with spiritual/religious activities ($\gamma = -6.440$, t (138) = -2.324, $p = 0.022$, $CI_{95} = -11.919, -0.962$). Regarding social resources, only spending more time with siblings was significantly associated with lower levels of anxiety ($\gamma = -0.385$, t (138) = -2.244, $p = 0.026$, $CI_{95} = -0.724, -0.046$). Please refer to Tables A.1 and A.2 in the appendices for further details.

Table 3. Average levels of nervousness (reverse coded) according to reported activity in the moment

Main categories	Subcategories	n	Mean at 0	Mean at 1	Estimate	SE	t	p	Lower bound 95% interval	Upper bound 95% interval
Spiritual and religious activities		15	6.00	6.36	−0.059	0.0558	−1.052	0.293	−0.168	0.051
Artistic activities		76	6.04	6.32	−0.046	0.0270	−1.700	0.089	−0.099	0.007
Sport and exercise		91	5.92	6.44	−0.084	0.0250	−3.350	< 0.001*	−0.133	−0.035
Spending time with pets		53	6.00	6.36	−0.057	0.0378	−1.505	0.132	−0.131	0.017
Spending time with people		467	6.03	6.33	−0.047	0.0123	−3.871	< 0.001*	−0.071	−0.023
	Mother	801	5.11	5.09	0.005	0.0113	0.479	0.632	−0.017	0.028
	Father	289	5.08	5.13	−0.010	0.0147	−0.679	0.497	−0.039	0.019
	Siblings	818	5.03	5.17	−0.027	0.0113	−2.371	0.018*	−0.049	−0.005
	Partner	550	4.98	5.23	−0.049	0.0132	−3.673	< 0.001*	−0.075	−0.023
	Friends	469	5.02	5.18	−0.031	0.0129	−2.448	0.014*	−0.057	−0.006
Recreational activities		2091	6.04	6.31	−0.043	0.0072	−5.966	< 0.001*	−0.057	−0.029
	Outdoor activities	66	5.97	6.12	−0.026	0.0322	−0.814	0.416	−0.089	0.037
	Playing games	271	5.88	6.22	−0.057	0.0153	−3.700	< 0.001*	−0.087	−0.027
	Shopping	53	5.93	6.16	−0.039	0.0331	−1.190	0.234	−0.104	0.026
	Social media and internet	232	6.01	6.08	−0.010	0.0177	−0.565	0.572	−0.045	0.025
	Reading	97	6.01	6.07	−0.010	0.0265	−0.378	0.705	−0.062	0.042
	Watching sport	41	5.89	6.21	−0.053	0.0361	−1.458	0.145	−0.123	0.018
	Watching TV/movies	998	5.93	6.16	−0.038	0.0091	−4.162	< 0.001*	−0.055	−0.020
	Listening to music	319	5.91	6.18	−0.045	0.0154	−2.909	0.004*	−0.075	−0.015

Note. $*p < 0.05$. "Mean at 0" indicates mean happiness score when not engaging with a resource, while "Mean at 1" indicates mean happiness score when engaging with a resource. N indicates the number of sampled experiences.

Impact of personal and social resources on mood according to levels of depression and anxiety

The final analyses examined whether the extent to which mood changed while engaging with a resource depended upon symptoms of depression and anxiety. Cross-level interactions were added to the level 1 models previously reported to test whether symptoms moderated the mood associated with resource use. To reduce the number of models run, each screening tool was used to assess changes in the specific mood it targets. One model predicted nervousness with resource use, GAD symptoms, and the interaction between the two. A second model predicted happiness with resource use, depressive symptoms, and the interaction between the two. Models allowed for random intercepts and a random slope (allowing slopes for resource use to vary) and controlled for age group, gender, country, and autocorrelation.

Depressive symptoms significantly predicted reporting more sadness across the sampling week ($\beta = -0.014$, t (5548) = -5.190, $p < 0.001$, $CI_{95} = -0.019$, -0.008). GAD predicted more experiences of nervousness ($\beta = -0.013$, t (5548) = -3.601, $p < 0.001$, $CI_{95} = -0.020$, -0.006).

Two interaction patterns with resource and mood were observed in the significant cross-level interactions. Some resources were associated with a steeper increase in mood (from a lower starting point) when adolescents with symptomatology engaged with them, as illustrated in Figures 1a to 1d. This was the case for nervousness, which decreased more steeply for adolescents with symptoms of anxiety when: spending time with others ($\beta = -0.005$, t (5548) = -1.928, $p = 0.05$, $CI_{95} = -0.010$, -0.00008), spending time with friends ($\beta = -0.005$, t (5548) = -2.037, $p = 0.042$, $CI_{95} = -0.011$, 0.000), playing games ($\beta = -0.006$, SE = 0.003, t (5548) = -2.067, $p = 0.039$, $CI_{95} = -0.012$, -0.000), and watching sport ($\beta = -0.014$, t (5548) = -2.193, $p = 0.028$, $CI_{95} = -0.026$, -0.001). Happiness increased more steeply for adolescents with depressive symptoms when spending time with friends ($\beta = -0.007$, t (5548) = -2.853, $p = 0.004$, $CI_{95} = -0.012$, -0.002) and interacting with pets ($\beta = -0.020$, t (5548) = -2.526, $p = 0.012$, $CI_{95} = -0.036$, -0.005).

A different pattern (Figures 1e and 1f) was observed for arts activities and listening to music, where mood improvement increased more steeply for adolescents without symptoms when engaging with these resources (artistic activities and happiness: $\beta = 0.011$, t (5548) = 2.313, $p = 0.021$, $CI_{95} = 0.002$, 0.021; listening to music and nervousness: $\beta = 0.008$, t (5548) = 2.683, $p = 0.007$, $CI_{95} = 0.002$, 0.014). Full outcomes can be found in Tables A.3 and A.4 in the appendices.

Discussion

We investigated how adolescents living in the poorest urban areas in Latin America used personal and social resources in everyday life to improve understanding of the factors that help adolescents avoid and/or recover from distress in everyday life. Engaging with resources was associated with reduced sadness and nervousness in the moment. Adolescents with symptoms of depression and GAD engaged less frequently with some resources (artistic activities, sports, and spiritual/religious activities). Further, resource use differentially impacted mood for adolescents with symptoms of depression and anxiety, either increasing mood to a greater degree (spending time with friends, playing games, and watching sports) or being less efficacious (artistic activities and listening to music). The study suggests that resource use plays an important role in improving mood in the daily life of adolescents, but that care needs to be taken when promoting their use, given that some resources may be more useful than others for improving the mood of adolescents with anxiety or depression symptomatology.

Adolescents were significantly happier and/or calmer when using resources in daily life. This concurs with previous literature using ESM, where adolescents reported feeling happier during structured leisure activities versus passive activities (doing nothing) (Delle Fave et al., 2011; Mazereel et al., 2021) and when with friends and family (Henker et al., 2002). However, the current study extended this by focusing on specific resources identified by adolescents as being useful to help regulate mood during focus groups in a prior study (Toyama et al., 2022). We corroborated the use of personal resources (e.g., artistic activities, sport, and recreational activities) as improving

Figure 1. The relationship between resource use and affect according to the presence of symptomatology
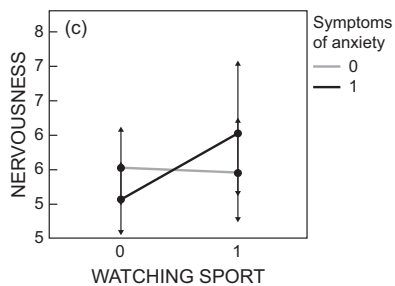
Figure 1a. The relationship between watching sport and nervousness according to the presence of symptoms of anxiety
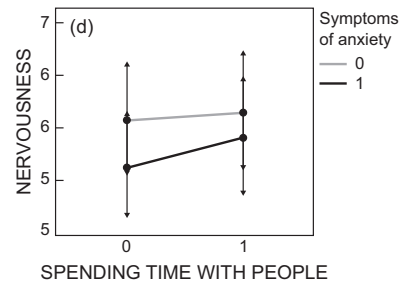
Figure 1b. The relationship between spending time with people and nervousness according to the presence of symptoms of anxiety
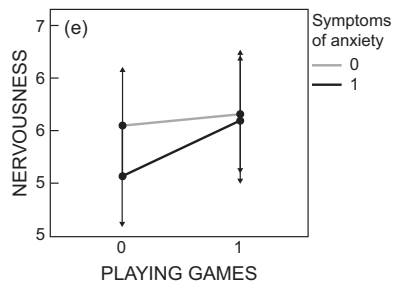
Figure 1c. The relationship between playing games and nervousness according to the presence of symptoms of anxiety
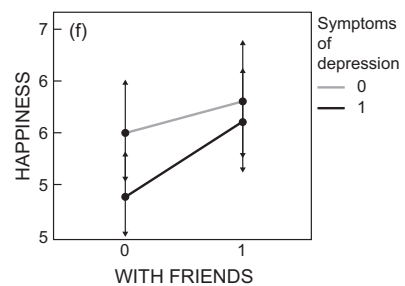
Figure 1d. The relationship between being with friends and happiness according to the presence of symptoms of depression
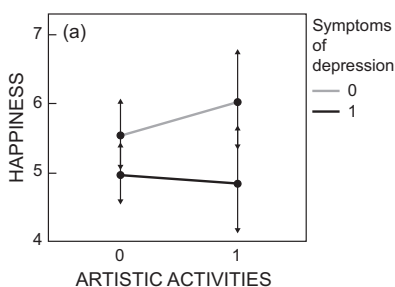
Figure 1e. The relationship between artistic activities and happiness according to the presence of symptoms of depression
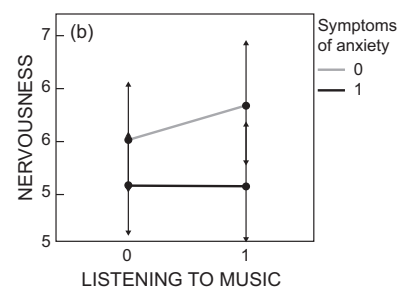
Figure 1f. The relationship between listening to music and nervousness according to the presence of symptoms of anxiety

mood and found that time spent with peers (partners, siblings, and friends) was particularly important for reducing anxiety and sadness (Mitic et al., 2021). The only personal resource with conflicting findings was for social media and internet use, which was significantly associated with higher levels of sadness, perhaps reflecting the complexity and personalised nature of its impact on well-being (Beyens et al., 2020). This complexity was commented on by Toyama and colleagues (2022) whose participants noted that while social media helped to maintain contact with friends, it could have negative aspects such as promoting unrealistic appearance standards or cyberbullying.

Time spent using resources differed according to the presence of symptoms of anxiety or depression. Adolescents with symptoms of depression engaged with artistic activities less often, supporting research on the benefit of the arts for mental health (Zarobe & Bungay, 2017). Adolescents with symptoms of anxiety were less likely to spend time playing sport, engage in spiritual activities, or spend time with siblings. These findings are supported by correlational studies, where, for adolescents in Brazil, well-being was associated with spending time with relatives and friends, playing games and sports, and individual activities (hobbies, reading, and being outdoors) (Holder et al., 2009; Sarriera et al., 2007). However, in the current study, behaviours were tracked in real time (rather than being based on memory) and differences were found for specific resources only (e.g., sport), suggesting that engaging with these resources may be an important area of focus when considering possible interventions for mental health resilience.

While use of resources generally predicted improved mood, differences in mood response were found according to symptomatology. When engaging with some resources, adolescents with high GAD and depression scores reported a greater improvement in mood than adolescents without symptoms (e.g., those with symptoms of depression experienced a greater increase in happiness when spending time with friends, bringing their happiness levels close to those without symptoms). While previous research noted mood reactivity following negative events in at-risk adolescents (greater increases in negative affect following negative events) (Schneiders et al., 2007), our findings suggest that the converse may occur—a greater increase in positive affect following resource use. Engaging with personal and social resources may be particularly important for adolescents with experiences of anxiety and depression (e.g., time spent with pets, friends, playing games). The current study did not replicate previous work where high-risk youth reported higher levels of negative affect when with others (Schneiders et al., 2007) or responded with a negative affect profile to all events (Dietvorst et al., 2021). Rather, our findings supported the importance of time spent with friends for happiness and well-being and suggested that interventions for at-risk adolescents target friendships (Markovic & Bowker, 2017; Schwartz-Mette et al., 2020).

However, for engagement with arts activities, there was little mood improvement for adolescents with depression symptomatology (mood improvement was associated with a lack of symptoms). The way in which the arts are used is important, for example, the arts can be used to distract from negative moods or can amplify negative moods and rumination, especially for individuals experiencing depression (Stewart et al., 2019). While these findings were exploratory, and hence must be interpreted with caution, they suggest that there may be optimal ways to engage with personal resources for at-risk youth, e.g., avoiding music that amplifies feelings of sadness or writing about feelings in a way that increases their intensity (Giovanetti et al., 2019).

Implications for practice

The finding that engaging with specific resources reduced distress is supported by research showing that behavioural activation (increasing engagement with meaningful activities) can help reduce feelings of depression among adolescents, thereby increasing feelings of happiness and accomplishment (Malik et al., 2021). This suggests a role for interventions, customised to individual needs, that increase engagement with meaningful activities (e.g., through activity scheduling or social prescribing) (Bertotti et al., 2022; Malik et al., 2021).

Importantly, our findings suggest that care needs to be taken when scheduling well-being activities for at-risk adolescents (e.g., music listening), since the way in which these activities are engaged

in may either increase or decrease distress (Giovanetti et al., 2019). It is recommended that interventions are carefully constructed to consider active ingredients and scaffold well-being, e.g., through specific use of intentional music listening or supported arts for health activities (Dingle et al., 2021; Holt, 2018; Warran et al., 2022).

Strengths, limitations, and future recommendations

The current study was unique in its focus on the affective impact, in real time, of personal and social resources on the lived experience of adolescents, working with a large sample of adolescents living in urban areas in LMICs. A further strength was developing codes for resource use based on reported experiences in that context, rather than using predetermined categories based on existing ESM coding schemes. Most previous research on time use and behavioural activation has occurred in high-income countries (Malik et al., 2021). Given that participants in the current study were from the poorest neighbourhoods in LMICs, this emphasises the importance of resource use in these contexts. However, this raises additional issues, regarding equitable access to resources and how to provide these in practice, in settings with numerous barriers to access and implementation of interventions (Leonard et al., 2020).

The use of the ESM to explore resource use was fruitful, enabling temporal and contextual patterns to be explored, which, while associational, suggest that engaging with particular resources (e.g., spending time with peers) is important for reducing distress in the daily life of adolescents. The cross-sectional analyses provided useful insights into the differential impacts of resources for adolescents with anxiety and depressive symptomatology, strengthening the role of particular resources in reducing distress.

Despite this, the limitations of the study must be considered when interpreting results. While resource use was assessed, there was no assessment of the quality of experiences (e.g., appraisal factors, such as the quality of a social interaction) which may interact with activities to affect mood (e.g., competence or self-esteem). ESM research with adolescents playing sports suggests that self-esteem and enjoyment interact in the moment, illustrating the complexity and individualised nature of the impact of sports on well-being (Mazereel et al., 2021). It must also be noted that for some activities (e.g., spiritual activities), there were small sample sizes, meaning that these analyses had weaker statistical power. For less frequent activities (such as attending church), sampling over a longer period may be useful. Finally, although the compliance rates in the current study were good, issues with receiving notifications for some participants may have reduced compliance rates (due to no/poor internet connection during the download of eMoodie, glitches with eMoodie for some smartphone brands, or having no/low battery).

Conclusion

The current study suggests that personal and social resources are important for reducing nervousness and sadness in the everyday life of adolescents in urban areas of Latin America, giving insight into interventions that might be useful to reduce distress (e.g., interventions promoting engagement with friends, sports, and playing games). However, the complexity observed in the cross-level interactions suggests that interventions need to be developed carefully for adolescents with symptoms of anxiety and depression to ensure 'active ingredients' are included, e.g., arts interventions that foster well-being (self-esteem, flow, happiness, and stress reduction) (Holt, 2023), rather than amplifying negative affect or rumination (Giovanetti et al., 2019; Stewart et al., 2019).

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Conflict of interest

The authors have no conflicts of interest to declare.

Ethical approval

The study received ethical approval from: Ethics Committee in Biomedical Research, Faculty of Medicine, University of Buenos Aires; Faculty of Medicine-Research and Ethics Committee of the Pontificia Universidad Javeriana, Bogotá; Institutional Ethics Committee of Research of the Universidad Peruana Cayetano Heredia; and Ethics of Research Committee, Queen Mary, University of London.

Authorship statement

N.J.H.: writing—original draft, formal analysis, methodology, and conceptualisation. Á.F.-V.: investigation, data curation, and writing—review and editing. C.G.-R.: conceptualisation, funding acquisition, and writing—review and editing. N.G.-C.: investigation, data curation, and writing—review and editing. M.T.: investigation, data curation, and writing—review and editing. L.H.-P.: investigation, data curation, and writing—review and editing. F.D.-C.: investigation, data curation, and writing—review and editing. L.I.B.: investigation, data curation, and writing—review and editing. N.O.: investigation, data curation, and writing—review and editing. S.L.: investigation, data curation, and writing—review and editing. D.S.S.: writing—review and editing. C.F. project administration, data curation, and writing—review and editing. S.P.: conceptualisation, funding acquisition, and supervision.

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Table A.1. Relationship between the proportion of time spent engaging with resources across the sampling week and GAD-7 scores

Main categories	Subcategories	Estimate	SE	df	t	p	Lower bound 95% interval	Upper bound 95% interval
Spiritual and religious activities		−6.440	2.771	138.013	−2.324	0.022*	−11.919	−0.962
Artistic activities		−0.807	0.653	138.012	−1.236	0.219	−2.098	0.484
Sport and exercise		−1.855	0.853	138.012	−2.175	0.031*	−3.541	−0.168
Spending time with pets		1.304	1.376	138.011	0.947	0.345	−1.418	4.026
Spending time with people		0.004	0.303	138.012	0.013	0.990	−0.595	0.602
	Mother	−0243	0.202	138.012	−1.202	0.231	−0.643	0.157
	Father	0.080	0.376	138.012	0.214	0.831	−0.664	0.825
	Siblings	−0.385	0.172	138.013	−2.244	0.026*	−0.724	−0.046
	Partner	0.238	0.172	138.011	1.378	0.170	−0.103	0.579
	Friends	0.004	0.273	138.012	0.014	0.989	−0.535	0.543
Recreational activities		0.208	0.152	138.011	1.364	0.175	−0.093	0.509
	Outdoor activities	−0.966	1.098	138.012	−0.880	0.380	−3.137	1.205
	Playing games	−0.048	0.426	138.012	−0.114	0.910	−0890	0.794
	Shopping	−0.844	1.226	138.011	−0.688	0.493	−3.269	1.581
	Social media and internet	0.349	0.515	138.012	0.677	0.499	−0.670	1.368
	Reading	−0.699	0.812	138.011	−0.861	0.391	−2.305	0.907
	Watching sport	0.482	1.328	138.012	0.363	0.717	−2.144	3.109
	Watching TV/ movies	0.378	0.215	138.011	1.762	0.080	−0.046	0.803
	Listening to music	0.243	0.341	138.012	0.712	0.478	−0.432	0.918

Note. *p < 0.05.

Table A.2. Relationship between the proportion of time spent engaging with resources across the sampling week and PHQ-8 scores

Main categories	Subcategories	Estimate	SE	df	t	p	Lower bound 95% interval	Upper bound 95% interval
Spiritual and religious activities		−2.506	2.893	139.009	−0.866	0.388	−8.226	3.215
Artistic activities		−2.042	0.652	139.008	−3.129	0.002*	−3.331	−0.752
Sport and exercise		−0.716	0.894	139.009	−0.801	0.425	−2.484	1.052
Spending time with pets		−0.834	1.404	139.009	−0.594	0.554	−3.609	1.942
Spending time with people		0.144	0.311	139.008	0.462	0.645	−0.471	0.759
	Mother	−0.142	0.208	139.009	−0.680	0.497	−0.553	0.270
	Father	−0.138	0.385	139.009	−0.359	0.720	−0.900	0.623
	Siblings	−0.279	0.177	139.009	−1.570	0.119	−0.629	0.072
	Partner	0.261	0.175	139.009	1.493	0.138	−0.085	0.608
	Friends	0.259	0.279	139.008	0.928	0.355	−0.293	0.811
Recreational activities		0.238	0.155	139.009	1.539	0.126	−0.068	0.545
	Outdoor activities	−0.455	1.142	139.009	−0.399	0.691	−2.713	1.802
	Playing games	0.008	0.432	139.009	0.019	0.985	−0.846	0.863
	Shopping	−0.130	1.259	139.009	−0.103	0.918	−2.619	2.359
	Social media and internet	0.114	0.529	139.009	0.216	0.829	−0.932	1.161
	Reading	−0.600	0.817	139.009	−0.734	0.464	−2.215	1.016
	Watching sport	−1.448	1.363	139.008	−1.062	0.290	−4.144	1.247
	Watching TV/ movies	0.374	0.221	139.009	1.695	0.092	−0.062	0.810
	Listening to music	0.436	0.348	139.009	1.253	0.212	−0.252	1.125

Note. *$p < 0.05$. PHQ-8 = 8-item Patient Health Questionnaire Scale.

Table A.3. Cross-level interactions between resource use and happiness according to symptoms of depression

Main categories	Subcategories	Estimate	SE	*t*	*n*	Lower bound 95% interval	Upper bound 95% interval
Spiritual and religious activities		0.008	0.0175	0.475	0.635	−0.026	0.043
Artistic activities		0.011	0.0048	2.313	0.021*	0.002	0.021
Sport and exercise		−0.001	0.0062	−0.090	0.928	−0.013	0.012
Spending time with pets		−0.020	0.0080	−2.526	0.012*	−0.036	−0.005
Spending time with people		−0.005	0.0028	−1.731	0.083	−0.010	0.001
	Mother	−0.003	0.0020	−1.662	0.097	−0.007	0.001
	Father	−0.002	0.0025	−0.803	0.422	−0.007	0.003
	Siblings	−0.004	0.0021	−1.804	0.071	−0.008	0.000
	Partner	−0.002	0.0044	−0.380	0.704	−0.010	0.007
	Friends	−0.007	0.0025	−2.853	0.004*	−0.012	−0.002
Recreational activities		0.003	0.0017	1.491	0.136	−0.001	0.006
	Outdoor activities	0.006	0.0077	0.731	0.465	−0.009	0.021
	Playing games	0.000	0.0027	0.037	0.970	−0.005	0.005
	Shopping	−0.011	0.0078	−1.432	0.152	−0.026	0.004
	Social media and internet	0.005	0.0035	1.350	0.177	−0.002	0.012
	Reading	0.001	0.0053	0.095	0.924	−0.010	0.011
	Watching sport	0.005	0.0086	0.640	0.522	−0.011	0.022
	Watching TV/ movies	0.003	0.0017	1.813	0.070	0.000	0.006
	Listening to music	0.002	0.0026	0.819	0.413	−0.003	0.007

Note. **p* < 0.05.

Table A.4. Cross-level interactions between resource use and nervousness according to symptoms of anxiety

Main categories	Subcategories	Estimate	SE	t	p	Lower bound 95% interval	Upper bound 95% interval
Spiritual and religious activities		0.014	0.0166	0.818	0.41	−0.019	0.046
Artistic activities		0.000	0.0081	−0.061	0.95	−0.016	0.015
Sport and exercise		−0.003	0.0061	−0.413	0.68	−0.015	0.009
Spending time with pets		−0.060	0.0398	−1.513	0.13	−0.138	0.018
Spending time with people		−0.005	0.0025	−1.928	0.05*	−0.010	0.00007
	Mother	−0.002	0.0021	−0.886	0.38	−0.006	0.002
	Father	0.001	0.0030	0.294	0.77	−0.005	0.007
	Siblings	−0.004	0.0023	−1.819	0.07	−0.009	0.000
	Partner	−0.002	0.0047	−0.445	0.66	−0.011	0.007
	Friends	−0.005	0.0027	−2.037	0.04*	−0.011	0.000
Recreational activities		0.000	0.0016	−0.286	0.78	−0.004	0.003
	Outdoor activities	−0.005	0.0083	−0.606	0.55	−0.021	0.011
	Playing games	−0.006	0.0030	−2.067	0.04*	−0.012	0.000
	Shopping	0.003	0.0078	0.394	0.69	−0.012	0.018
	Social media and internet	−0.001	0.0034	−0.320	0.75	−0.008	0.006
	Reading	−0.001	0.0045	−0.201	0.84	−0.010	0.008
	Watching sport	−0.014	0.0063	−2.193	0.03*	−0.026	−0.001
	Watching TV/ movies	−0.001	0.0019	−0.350	0.73	−0.004	0.003
	Listening to music	0.008	0.0030	2.683	0.007*	0.002	0.014

Note. *$p < 0.05$.