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Smartphone use and smartphone addiction among young people in Switzerland

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Background and aims: Smartphone addiction, its association with smartphone use, and its predictors have not yet been studied in a European sample. This study investigated indicators of smartphone use, smartphone addiction, and their associations with demographic and health behaviour-related variables in young people. *Methods:* A convenience sample of 1,519 students from 127 Swiss vocational school classes participated in a survey assessing demographic and health-related characteristics as well as indicators of smartphone use and addiction. Smartphone addiction was assessed using a short version of the Smartphone Addiction Scale for Adolescents (SAS-SV). Logistic regression analyses were conducted to investigate demographic and health-related predictors of smartphone addiction. *Results:* Smartphone addiction occurred in 256 (16.9%) of the 1,519 students. Longer duration of smartphone use on a typical day, a shorter time period until first smartphone use in the morning, and reporting that social networking was the most personally relevant smartphone function were associated with smartphone addiction. Smartphone addiction was more prevalent in younger adolescents (15–16 years) compared with young adults (19 years and older), students with both parents born outside Switzerland, persons reporting lower physical activity, and those reporting higher stress. Alcohol and tobacco consumption were unrelated to smartphone addiction. *Discussion:* Different indicators of smartphone use are associated with smartphone addiction and subgroups of young people have a higher prevalence of smartphone addiction. *Conclusions:* The study provides the first insights into smartphone use, smartphone addiction, and predictors of smartphone addiction in young people from a European country, which should be extended in further studies.

Keywords: smartphone, mobile phone, addiction, predictors, students

INTRODUCTION

Smartphones are becoming increasingly indispensable in everyday life and offer a substantial variety of mobile applications for information, communication, education, and entertainment purposes. Smartphones typically have touch screens, mobile Internet access via Wi-Fi or cellular networks, capability for installation of smartphone applications, and other functions such as media players, digital cameras, and GPS-based navigation.

Similar to many other Western countries, in Switzerland, nearly all adolescents aged 12–19 years (98%) own a mobile phone, most of which (97%) are smartphones (Medienpädagogischer Forschungsverbund Südwest, 2014; Willemse et al., 2014). While mobile applications offer several promising ways to prevent and treat chronic diseases such as diabetes (Arsand, Muzny, Bradway, Muzik & Hartvigsen, 2015; Bain, Jones, O'Brian & Lipman, 2015) or alcoholism (Gustafson et al., 2014), there are also obvious adverse effects on physical and mental health caused by their overuse. Examples of adverse physical effects include neck pain symptoms (Lee, Kang & Shin, 2015) or accidents affecting pedestrians and drivers while the phone is used when the user is driving (Klauer et al., 2014; Shelton, Elliott, Lynn & Exner, 2009).

Regarding mental health, recent studies showed that increased smartphone use might be related to sleep disturbances and depression (Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann & Grob, 2015). Furthermore, increasing frequency and time spent on smartphones is closely related to the severity of smartphone addiction (Lee, Ahn, Choi & Choi, 2014; Lin et al., 2015).

According to Lin et al. (2014), smartphone addiction could be considered a form of technological addiction. Specifically, Griffiths (1996) operationally defined these addictions as non-chemical behavioural addictions that involve human–machine interaction. Other than 'gambling disorder', 'Internet gaming disorder' is currently the only non-substance-related disorder proposed for inclusion in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a substance-related and addictive disorder (American Psychiatric Association, 2013). Although a primary smartphone characteristic is the use of Internet-based applications, smartphone portability and capability for installing applications that are suited to

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individuals' needs and lifestyles make it a versatile, multipurpose object that many persons carry with them at all times. Therefore, smartphone addiction symptoms may differ from those of Internet addiction. Through exploratory factor analysis, Lin et al. (2014) demonstrated that smartphone addiction has several similar aspects to DSM-5 substance-related disorders including the following four main factors: compulsive behaviour, functional impairment, withdrawal, and tolerance. Based on clinical interviews to establish the sensitivity and specificity of these factors for classifying individuals with and without smartphone addiction, Lin et al. (2015) proposed several diagnostic criteria for smartphone addiction.

To date, few studies have examined smartphone addiction. Existing studies have been conducted in Taiwan (Lin et al., 2014; Lin et al., 2015), Korea (Cho & Lee, 2015; Kwon, Kim, Cho & Yang, 2013; Kwon et al., 2013), India (Davey & Davey, 2014), and the US (Roberts, Yaya & Manolis, 2014; Smetaniuk, 2014). The majority of these studies have focused on the development and validation of the instruments designed to assess smartphone addiction (Cho & Lee, 2015; Kwon, Kim et al., 2013; Kwon, Lee et al., 2013; Lee et al., 2014; Lin et al., 2014; Lin et al., 2015). However, little is known about indicators and predictors of excessive or addictive smartphone use. In one study of 164 US college undergraduates, Roberts et al. (2014) indicated that females reported spending significantly more time on their phones per day than males, and that texting, sending e-mails, and using social media sites were the most time-consuming activities. Although addictive activities varied by gender, time spent on social networking sites, number of phone calls made, and number of texts sent were predictors of mobile phone addiction within the sample. Another US study of 362 employed adults (Smetaniuk, 2014) tested the association between age, self-esteem, extraversion, emotional stability, depression, and impulse control in relation to different measures of addictive and problematic mobile phone use. Subsequently, this study revealed that lower age, depression, and extraversion predicted higher scores on measures of problematic mobile phone use. Additionally, a Korean study of 79 young adults (Lin et al., 2015) demonstrated that smartphone addiction was more strongly associated with use frequency than use duration. Furthermore, in this study, a comparison of self-reported and application recorded smartphone use time revealed that participants typically underestimated use time, with a greater underestimation in participants who used their smartphones more frequently. Moreover, in another Korean study of 197 adults (Kwon, Lee et al., 2013), it was reported that persons with lower education levels were more likely to have smartphone addiction.

The present study focused on smartphone addiction and its associations with different indicators of smartphone use, demographics, and health behaviour-related variables. This is the first European study on this topic as well as the first to use a relatively large sample of over 1,000 participants. The major objectives of this study were to accomplish the following: (1) test indicators of the reliability and validity of the German version of the Smartphone Addiction Scale for Adolescents (SAS-SV) (Kwon, Kim et al., 2013); (2) describe smartphone use, smartphone addiction, and the associations between the two; and (3) test demographic and health behaviour-related predictors of smartphone use and smartphone addiction.

METHODS

Participants and procedure

In Switzerland, vocational schools are typically post-secondary public schools and are analogous to American community colleges. Specifically, they are part of the dual educational system that combines business-related apprenticeships and school-related vocational training. Vocational schools provide general education and specific skills related to each profession.

Directors of and contact teachers for addiction prevention from Swiss vocational schools in the cantons of Aargau, Basel, Berne, and Zurich were invited to have some of their classes participate in a study testing the efficacy of a text messaging-based smoking cessation program. Research assistants invited all students in participating vocational school classes to participate in an anonymous online health survey during a regular school lesson reserved for health education. Participation was voluntary. The online survey included data collection of information about demographics, perceived stress, physical activity, body weight, alcohol consumption, smoking status, mobile phone ownership, and mobile phone type (smartphone or other). As part of this survey, students that smoked cigarettes daily or occasionally and owned a mobile phone were invited to participate in a 3-month text message-based program that provided information about smoking tobacco. Details of the program are presented in Haug et al. (2014).

Smartphone use and smartphone addiction were assessed in students who indicated that they owned a smartphone and were either not eligible for participation in the text message-based program for smoking cessation because they did not smoke or did not agree to participate in the program.

Assessments of smartphone use and smartphone addiction were conducted within 127 school classes between 2015 February and 2015 June. At the time of the assessment, 2101 students attended the school classes and a total of 2093 (99.6%) participated in the online health survey. Of these students, 457 (21.8%) participated in the text message-based smoking-cessation program and 35 did not complete the online health survey items related to mobile phone ownership. Of the 1601 vocational school students who did not participate in the text message-based program and answered the questions about mobile phone ownership, 1600 (99.9%) indicated that they owned a mobile phone, of which 1561 (97.6%) owned a smartphone. Of smartphone owners, 1519 (97.3%) answered all questions concerning smartphone use and smartphone addiction. Thus, a total of 1519 participants were used for data analyses in the present study. The mean age of the study participants was 18.2 years (SD = 3.6) with a similar percentage of male (48.2%) and female (51.8%) participants and the majority (82.2%) having a secondary school degree (see also Table 1).

Table 1. Demographic and health-related characteristics of the study sample (n = 1,519). Values are represented in numbers unless stated otherwise.

Female gender	787 (51.8%)
Age, *Md (Q1; Q3)*	17 (17; 19)
15–16 years	365 (24.0%)
17–18 years	759 (50.0%)
19–20 years	248 (16.3%)
21 years or older	147 (9.7%)
Highest educational degree	
None	16 (1.1%)
Secondary school	1248 (82.2%)
Vocational qualification	232 (15.3%)
Technical or high school	23 (1.5%)
Immigrant background	
No immigrant background	986 (64.9%)
One parent born outside Switzerland	222 (14.6%)
Both parents born outside Switzerland	311 (20.5%)
Hours of extracurricular moderate to vigorous physical activity per week, *Md (Q1; Q3)*	3 (2; 5)
Body weight in kilograms, *Md (Q1; Q3)*	65 (57; 74)
Perceived stress	
Low	618 (40.7%)
High	901 (59.3%)
Tobacco smoking	
Non-smoking	1180 (77.7%)
Currently smoking daily or occasionally	339 (22.3%)
Number of standard drinks in a typical week, *Md (Q1; Q3)*	3 (0; 7)
Maximum number of drinks on an occasion in the past 30 days, *Md (Q1; Q3)*	3 (0; 6)

Measures

Smartphone use was assessed by 4 questions concerning the following: (1) duration of smartphone use on a typical day, to which they could respond by choosing 'less than 10 minutes', '11–60 minutes', '1–2 hours', '3–4 hours', '5–6 hours', or 'more than 6 hours'; (2) frequency of smartphone use on a typical day, as measured using an open number field; (3) duration of time until first smartphone use in the morning upon waking (other than using alarm function), to which they could respond by choosing 'within 5 minutes', 'within 6–30 minutes', 'within 31–60 minutes', and 'after more than 60 minutes'; and (4) the smartphone function with the most personal relevance, to which they could respond by choosing 'social networking', 'phoning', 'gaming', 'text messaging', 'e-mailing', 'watching videos', 'listening to music', and 'reading news'.

Smartphone addiction was assessed using the SAS-SV (Kwon, Kim et al., 2013; Kwon, Lee et al., 2013). This 10-item self-report instrument was developed and validated in a sample of 343 boys and 197 girls from Korea. The measure's items were selected from the original Smartphone Addiction Scale (SAS) based on their validity, as established through review by 7 experts (Kwon, Lee et al., 2013). The SAS-SV addresses the following 5 content areas: (1) 'daily-life disturbance', (2) 'withdrawal', (3) 'cyberspace-oriented relationship', (4) 'overuse', and (5) 'tolerance'. Analysis of receiver operating characteristics (ROC) was conducted with a sample of 90 boys and 60 girls who underwent consultation with clinical psychologists. The results of the SAS-SV analysis indicated a Cronbach's alpha of 0.911. Among boys, the area under the curve (AUC) value was 0.963 (0.888–1.000), the cut-off value was 31, the sensitivity value was 0.867, and the specificity value was 0.893. Among girls, the AUC value was 0.947 (0.887–1.000), the cut-off value was 33, the sensitivity value was 0.875, and the specificity value was 0.886. Based on the cut-off values, this SAS-SV was considered an appropriate tool for assessing smartphone addiction. Based on the results of the ROC analysis conducted by Kwon, Kim et al. (2013), we used cut-off values of 31 and 33 for male and female participants, respectively.

The German version of the SAS-SV was translated based on the available English and Korean versions of the SAS-SV (Kwon, Kim et al., 2013; Kwon, Lee et al., 2013) by a native English and German speaking student and a native Korean and German speaking student.

We assessed the following demographic variables: gender, age, school education, immigrant background, and vocational field. Common Swiss levels of educational attainment were assessed with the options (a) none, (b) secondary school, (c) vocational qualification, and (d) technical or high school. To identify possible immigrant status, we assessed the birth country of both of each student's parents. For analyses, we collapsed (a) persons with neither parent born outside Switzerland, (b) persons with one parent born outside Switzerland, and (c) persons with both parents born outside Switzerland.

Perceived stress was assessed using the question, 'How much stress have you felt within the past 30 days', and participants responded on a 6-point Likert scale ranging from 'not at all' to 'very much'. We dichotomized values from 1 to 3 into "low perceived stress" and values from 4 to 6 into "high perceived stress". Self-reported moderate to vigorous physical activity was measured by a question derived from Suppli et al. (2013), 'Outside school: How many hours a week do you exercise or participate in sports that make you sweat or become out of breath?'. Body weight was assessed in kilograms.

Indicators of alcohol consumption were evaluated using (1) the maximum number of drinks on an occasion in the past 30 days, and (2) quantity of alcohol consumption. The latter indicator was assessed using a 7-day drinking calendar similar to the Daily Drinking Questionnaire (DDQ) (Collins, Parks & Marlatt, 1985), whereby students were asked to think about a typical week in the past month and, for each day, record the number of standard drinks they typically consumed each day.

Tobacco smoking was assessed using the question, 'Are you currently smoking cigarettes or did you smoke in the past?' and participants responded by choosing one of the following options: (a) I smoke cigarettes daily; (b) I smoke cigarettes occasionally, but not daily; (c) I smoked cigarettes in the past, but I do not smoke anymore; and (d) I have never smoked cigarettes or have smoked less than 100 cigarettes in my life. Current daily and occasional smokers (categories a and b) were classified as smokers.

Statistical analysis

To begin, baseline characteristics of the study sample were presented. As a result of skewed distributions of most metric variables, we reported the medians and 25th and 75th

percentiles as measures of central tendency. In order to test the internal consistency of the German version of the SAS-SV (Kwon, Kim et al., 2013), Cronbach's alpha correlation coefficients were calculated. To examine associations between smartphone use and smartphone addiction, which was operationalized according to Kwon Kim/Lee et al.'s (2013) recommended SAS-SV cut-off points, we initially performed separate logistic regression analyses (subsequently referred to as 'univariate analyses') to evaluate the ability of each smartphone use indicator to predict smartphone addiction. After examining the univariate predictors, multivariate prediction models were developed. As suggested by Hosmer, Lemeshow and Sturdivant (2013, pages 89–94), variable selection consisted of the following steps: (1) significant predictors ($p < .20$) from the univariate analyses were entered into the preliminary multivariate model; (2) variables that were non-significant at $p > .05$ were removed one at a time and those with the highest p-values were removed first (backward selection); and (3) to account for suppressor effects, the resulting model was verified by tentatively adding the aforementioned excluded variables separately to the regression model. Only variables significant at $p < .05$ were retained in the final model (forward selection). In order to examine associations between demographic and health-related variables and smartphone addiction, we chose a similar procedure involving univariate analyses followed by multivariate analyses using stepwise backward and forward selection.

Given the clustered nature of the data (students within school classes), we computed robust variance estimators for all logistic regression models. All analyses were performed using STATA version 10. An alpha level of .05 (2-tailed) was utilized for statistical tests.

Ethics

Data for this study were collected as part of the 'Efficacy of an Internet and SMS-based integrated smoking cessation and alcohol intervention for smoking cessation in young people' randomised controlled trial (Trial registration: Current Controlled Trials ISRCTN02427446). The study was approved by the Ethics Committee of the Philosophy Faculty of the University of Zurich, Switzerland (date of approval: 13 August 2014). The study procedures were carried out in accordance with the Declaration of Helsinki. All subjects were informed about the study and provided informed consent prior to participation.

RESULTS

Sample characteristics

The study sample's demographic and health-related characteristics are presented in Table 1.

Table 2. Items and reliability of the German version of the short version of the Smartphone Addiction Scale for Adolescents (SAS-SV) (n = 1,519). English translation displayed in square brackets

	Item	Item *M*	Item *SD*	Corrected item/total correlation	Alpha if item deleted
1	Wegen des Gebrauchs meines Smartphones fällt es mir schwer, geplante Aufgaben zu erledigen. [Missing planned work due to smartphone use]	2.57	1.40	0.52	0.84
2	Wegen des Gebrauchs meines Smartphones fällt es mir schwer, mich auf den Unterricht in der Schule oder auf meine Arbeit zu konzentrieren. [Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use]	1.85	1.13	0.51	0.84
3	Ich spüre Schmerzen im Nacken oder im Handgelenk aufgrund des Gebrauchs meines Smartphones. [Feeling pain in the wrists or at the back of the neck while using a smartphone]	1.40	0.89	0.40	0.85
4	Ich könnte es nicht ertragen, kein Smartphone zu besitzen. [Won't be able to stand not having a smartphone]	3.62	1.63	0.55	0.84
5	Wenn ich mein Smartphone nicht zur Hand habe, bin ich unruhig und gereizt. [Feeling impatient and fretful when I am not holding my smartphone]	2.16	1.29	0.63	0.83
6	Ich muss ständig an mein Smartphone denken, sogar dann wenn ich es nicht benutze. [Having my smartphone in my mind even when I am not using it]	1.61	0.95	0.62	0.83
7	Auch wenn durch den Gebrauch des Smartphones im Alltag Probleme auftreten sollten, kann ich nicht darauf verzichten. [I will never give up using my smartphone even when my daily life is already greatly affected by it]	2.47	1.38	0.60	0.83
8	Um keine Neuigkeiten zu verpassen, muss ich ständig mein Smartphone kontrollieren. [Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook]	2.80	1.39	0.63	0.83
9	Wenn ich einmal damit angefangen habe, beschäftige ich mich länger mit meinem Smartphone als beabsichtigt. [Using my smartphone longer than I had intended]	3.23	1.43	0.60	0.83
10	Die Menschen in meinem Umfeld machen sich Sorgen, weil ich zu viel Zeit an meinem Smartphone verbringe. [The people around me tell me that I use my smartphone too much]	1.75	1.11	0.50	0.84

Notes: Overall Cronbach's alpha = .85; Scale M = 23.45, SD = 8.34.

Reliability of the German SAS-SV

Internal consistency, as measured using Cronbach's alpha, was .85 for the 10 items in the German version of the SAS-SV. The mean scores and standard deviations of each item are shown in Table 2. The corrected item total correlation coefficients ranged from .40 to .63. The deletion of any individual item would have decreased the internal consistency of the scale.

Smartphone use, smartphone addiction, and their associations

As suggested by Kwon, Kim et al. (2013), we used smartphone addiction cut-off values of ≥31 and ≥33 for male and female participants, respectively. Results indicated that smartphone addiction was present in 256 (16.9%) of the 1,519 participants. Table 3 presents univariate associations; Table 4 presents multivariate associations of indicators of smartphone use with smartphone addiction according to the German version of the SAS-SV. In the final multivariate model (R^2 = .15) the following variables were significant predictors of smartphone addiction: longer duration of smartphone use on a typical day (reference category: less than 60 minutes per day; 1–2 hours: OR = 2.32, p = .03; 3–4 hours: OR = 5.79, p < .01; 5–6 hours: OR = 10.78, p < .01; more than 6 hours: OR = 10.98, p < .01); a shorter time period until first smartphone use in the morning (reference category: within 5 minutes; within 6–30 minutes: OR = 0.49, p < .01; within 31–60 minutes: OR = 0.25, p < .01; after more than 60 minutes: OR = 0.39, p = .04); and indicating social networking as the most personally relevant smartphone function (reference category: social networking; listening to music: OR = 0.49, p = .01).

Demographics, health behaviours, and their associations with smartphone addiction

Table 5 presents univariate associations; Table 6 presents multivariate associations between demographics and health behaviours with smartphone addiction according to the German version of the SAS-SV. Within the final multivariate model (R^2 = .05), the following variables were significant predictors of smartphone addiction: belonging to the

Table 3. Univariate associations of smartphone use and smartphone addiction. Values are represented in numbers unless stated otherwise

	Total sample (n = 1,519)	Smartphone addiction according to the SAS-SV		Smartphone Addiction No vs. Yes	
		No (n = 1,263)	Yes (n = 256)	*OR (95% CI)*	*p*
Duration of smartphone use on a typical day[a]					
Less than 10 minutes	25 (1.6%)				
11–60 minutes	218 (14.4%)	235 (18.6%)	8 (3.1%)	Ref.	
1–2 hours	501 (33.0%)	459 (36.3%)	42 (16.4%)	2.69 (1.23–5.89)	.01
3–4 hours	472 (31.1%)	375 (29.7%)	97 (37.9%)	7.60 (3.76–15.34)	<.01
5–6 hours	178 (11.7%)	116 (9.2%)	62 (24.2%)	15.70 (7.26–33.94)	<.01
More than 6 hours	125 (8.2%)	78 (6.2%)	47 (18.4%)	17.70 (8.01–39.11)	<.01
Frequency of smartphone use on a typical day[b], *Md (Q1; Q3)*	25 (10; 50)	20 (10; 50)	40 (20; 100)		
Less than 5 times/day	204 (13.5%)	182 (14.4%)	22 (8.7%)	Ref.	
6–10 times/day	226 (14.9%)	196 (15.6%)	30 (11.8%)	1.27 (0.75–2.15)	.38
11–20 times/day	310 (20.5%)	275 (21.8%)	35 (13.8%)	1.05 (0.55–2.01)	.88
21–50 times/day	434 (28.7%)	359 (28.5)	75 (29.5%)	1.73 (1.05–2.85)	.03
51–100 times/day	227 (15.0%)	168 (13.3%)	59 (23.2%)	2.91 (1.74–4.86)	<.01
More than 100 times/day	113 (7.5%)	80 (6.3%)	33 (13.0%)	3.41 (1.83–6.37)	<.01
Time until first smartphone use in the morning					
Within 5 minutes	600 (39.5%)	434 (34.4%)	166 (64.8%)	Ref.	
Within 6–30 minutes	558 (36.7%)	491 (38.9%)	67 (26.2%)	0.36 (0.26–0.49)	<.01
Within 31–60 minutes	249 (16.4%)	233 (18.4%)	16 (6.3%)	0.18 (0.10–0.32)	<.01
After more than 60 minutes	112 (7.4%)	105 (8.3%)	7 (2.7%)	0.17 (0.07–0.41)	<.01
Most personally relevant smartphone function					
Social networking	1022 (67.3%)	814 (64.4%)	208 (81.3%)	Ref.	
Phone calls	97 (6.4%)	92 (7.3%)	5 (2.0%)	0.21 (0.08–0.53)	<.01
Gaming	10 (0.7%)	8 (0.6%)	2 (0.8%)	0.98 (0.23–4.08)	.98
Text messaging	47 (3.1%)	41 (3.2%)	6 (2.3%)	0.57 (0.25–1.29)	.18
E-mailing	7 (0.5%)	5 (0.4%)	2 (0.8%)	1.56 (0.29–8.31)	.60
Watching videos	27 (1.8%)	22 (1.7%)	5 (2.0%)	0.89 (0.39–2.03)	.78
Listening to music	271 (17.8%)	247 (19.6%)	24 (9.4%)	0.38 (0.24–0.61)	<.01
Reading news	20 (1.3%)	18 (1.4%)	2 (0.8%)	0.43 (0.11–1.76)	.24
Other	18 (1.2%)	16 (1.3%)	2 (0.8%)	0.49 (0.11–2.24)	.35

Notes: Separate binary logistic regression model for each variable. SAS-SV = short version of the Smartphone Addiction Scale for Adolescents. [a]The categories 'less than 10 minutes' and '11–60 minutes' were collapsed for comparing persons with and without smartphone addiction to avoid small cell counts. [b]n = 5 missing due to implausible values.

Table 4. Multivariate associations of smartphone use and smartphone addiction (n = 1,519)

	Smartphone addiction according to the SAS-SV	
	OR (95% CI)	*p*
Duration of smartphone use on a typical day		
Less than 60 minutes	Ref.	
1–2 hours	2.32 (1.07–5.04)	.03
3–4 hours	5.79 (2.90–11.57)	<.01
5–6 hours	10.78 (5.01–23.19)	<.01
More than 6 hours	10.98 (5.04–23.95)	<.01
Time until first smartphone use in the morning		
Within 5 minutes	Ref.	
Within 6–30 minutes	0.49 (0.35–0.68)	<.01
Within 31–60 minutes	0.25 (0.14–0.46)	<.01
After more than 60 minutes	0.39 (0.16–0.95)	.04
Most personally relevant smartphone function		
Social networking	Ref.	
Phone calls	0.44 (0.16–1.24)	.12
Gaming	1.40 (0.36–5.51)	.63
Text messaging	0.72 (0.33–1.56)	.40
E-mailing	4.85 (0.68–34.79)	.12
Watching videos	1.08 (0.46–2.57)	.85
Listening to music	0.49 (0.30–0.80)	.01
Reading news	0.76 (0.17–3.45)	.72
Other	0.92 (0.18–4.85)	.92

Notes: Multivariate binary logistic regression model. SAS-SV = short version of the Smartphone Addiction Scale for Adolescents.

lowest age group (reference category: 15–16 years; 19–20 years: $OR = 0.59$, $p = .03$; 21 years and older: $OR = 0.50$, $p = .02$), immigrant background with both parents born outside Switzerland (reference category: no immigrant background; both parents born outside Switzerland: $OR = 2.21$, $p < .01$); lower physical activity ($OR = 0.95$, $p = .02$); and high perceived stress ($OR = 2.14$, $p < .01$).

DISCUSSION

This study examined indicators of smartphone use and smartphone addiction within a relatively large convenience sample of adolescents and young adults in Switzerland. The study revealed four main findings: (1) the German version of the SAS-SV might provide an appropriate instrument for assessing smartphone addiction in young people; (2) a longer duration of smartphone use, shorter time period until first smartphone use in the morning, and indicating that social networking is the most personally relevant smartphone function were positively associated with smartphone addiction; (3) smartphone addiction was more prevalent in young adolescents (15–16 years) compared with young adults (19 years and older), students with both parents born outside Switzerland, persons reporting lower physical activity, and those reporting higher stress; and (4) alcohol and tobacco consumption were unrelated to smartphone addiction.

The first analyses of the reliability and validity of the German version of the SAS-SV showed good psychometric properties, with an internal consistency of .85 and item total correlation coefficients within an acceptable range. Although further validation is required, the results of the SAS-SV concerning the content validity of the scale were also promising in regard to the association of specific indicators of smartphone use (frequency, duration, time until first use, preferred smartphone function) and smartphone addiction.

Regarding smartphone use, our multivariate analyses demonstrated that duration of use and time until first use in the morning provided better indicators for smartphone addiction than use frequency. This is in contrast to previous results showing smartphone addiction to be more strongly associated with use frequency than duration (Lee et al., 2014; Lin et al., 2015). However, in the present study, both use time and frequency were assessed using self-report and may be biased as the result of recall-bias and time distortion. The higher prevalence of smartphone addiction in persons indicating social networking as the most personally relevant function is in line with previous studies that showed that texting and use of messengers and social media sites were predictors of mobile phone or smartphone addiction (Kwon, Kim et al., 2013; Roberts et al., 2014).

The higher prevalence of smartphone addiction in younger adolescents and those with both parents born outside Switzerland indicates that targeted preventive measures should be considered, especially for these groups of young people. Based on the results of Kwon, Lee et al. (2013) and the increasing tendency for smartphone addiction in persons without an educational degree found in the present study, selective prevention efforts should also focus on groups with lower educational levels. Although the mutual influences of excessive smartphone use, stress, and physical activity needs further examination, the results of the present and existing studies showing associations between electronic media use at night and depression and sleep disturbances (Lemola et al., 2015) indicate that excessive smartphone use might have adverse effects on several indicators of mental and physical health. However, no association between excessive smartphone use and tobacco or alcohol use were obtained in either the present study or an existing study conducted in Korea (Kwon, Kim et al., 2013). This is of particular interest, as studies on Internet addiction and alcohol problems revealed an association between the two domains (Hwang et al., 2014; Ko et al., 2008; Yen, Ko, Yen, Chen & Chen, 2009). For instance, one of these studies reported that fun-seeking was the shared characteristic of these two problem behaviours and might contribute to this relationship (Yen et al., 2009). Future studies on smartphone addiction, substance use, and associated personality characteristics might provide important insights into the shared characteristics of different addictive disorders and reveal differences in the aetiology of Internet and smartphone addiction.

The present study has several limitations including (1) using a convenience sample of vocational school students inhibits generalization of the prevalence of smartphone addiction to the broader population of young people in Switzerland; (2) the cut-off scores used for the German

Table 5. Univariate associations of demographic and health behaviours with smartphone addiction (n = 1,519). Values are numbers unless stated otherwise

	Smartphone addiction according to the SAS-SV			
	No (n = 1,263)	Yes (n = 256)	*OR (95% CI)*	*p*
Gender				
Male	629 (85.9%)	103 (14.1%)	Ref.	
Female	634 (80.6%)	153 (19.4%)	1.47 (1.07–2.03)	.02
Age				
15–16 years	299 (81.9%)	66 (18.1%)	Ref.	
17–18 years	623 (82.1%)	136 (17.9%)	0.99 (0.75–1.30)	.94
19–20 years	213 (85.9%)	35 (14.1%)	0.74 (0.48–1.16)	.19
21 years or older	128 (87.1%)	19 (12.9%)	0.67 (0.39–1.17)	.16
Highest educational degree				
None	11 (68.8%)	5 (31.3%)	Ref.	
Secondary school	1045 (83.7%)	203 (16.3%)	0.43 (0.18–1.01)	.05
Vocational qualification	187 (80.6%)	45 (19.4%)	0.53 (0.20–1.40)	.20
Technical or high school	20 (87.0%)	3 (13.0%)	0.33 (0.08–1.43)	.14
Immigrant background				
No immigrant background	850 (86.2%)	136 (13.8%)	Ref.	
One parent born outside Switzerland	186 (83.8%)	36 (16.2%)	1.21 (0.80–1.82)	.36
Both parents born outside Switzerland	227 (73.0%)	84 (27.0%)	2.31 (1.63–3.28)	<.01
Hours of extracurricular moderate to vigorous physical activity per week, *Md (Q1; Q3)*	3 (2; 6)	3 (1; 5)	0.95 (0.90–0.99)	.02
Body weight in kilograms, *Md (Q1; Q3)*	65 (58; 75)	62 (55; 70)	0.99 (0.97–1.00)	.08
Perceived stress				
Low	551 (89.2%)	67 (10.8%)	Ref.	<.01
High	712 (79.0%)	189 (21.0%)	2.18 (1.68–2.84)	
Tobacco smoking				
Non-smoking	987 (83.6%)	193 (16.4%)	Ref.	
Current smoking daily or occasionally	276 (81.4%)	63 (18.6%)	1.17 (0.86–1.59)	.32
Number of standard drinks in a typical week, *Md (Q1; Q3)*	3 (0; 7)	3 (0; 8)	1.00 (0.98–1.01)	.59
Maximum number of drinks on an occasion in the past 30 days, *Md (Q1; Q3)*	3 (0; 6)	4 (0; 7)	1.01 (0.98–1.04)	.46

Notes: Separate binary logistic regression model for each variable. SAS-SV = short version of the Smartphone Addiction Scale for Adolescents.

Table 6. Multivariate associations of demographic and health behaviours with smartphone addiction (n = 1,519)

	Smartphone addiction according to the SAS-SV	
	OR (95% CI)	*p*
Age		
15–16 years	Ref.	
17–18 years	0.86 (0.64–1.15)	.31
19–20 years	0.59 (0.37–0.94)	.03
21 years or older	0.50 (0.29–0.87)	.02
Immigrant background		
No immigrant background	Ref.	
One parent born outside Switzerland	1.13 (0.75–1.71)	.56
Both parents born outside Switzerland	2.21 (1.55–3.15)	<.01
Hours of moderate to vigorous physical activity per week	0.95 (0.91–0.99)	.02
Perceived stress		
Low	Ref.	
High	2.14 (1.62–2.83)	<.01

Notes: Multivariate binary logistic regression model. SAS-SV = short version of the Smartphone Addiction Scale for Adolescents.

version of the SAS-SV were based on the Korean version of the scale, and the respective ROC analysis was conducted in a sample of adolescents from Korea; (3) only a limited number of health- and substance use-related characteristics were assessed; and (4) smartphone use indicators were assessed via self-report rather than objectively recorded data.

Consequently, future studies should (1) focus on the assessment of smartphone use and indicators of smartphone addiction in a representative sample of young people; (2) include clinical interviews and subsequent analyses of the diagnostic ability of the German version of the SAS-SV to correctly detect smartphone addiction symptoms; (3) assess a comprehensive set of personality, health- and substance use-related characteristics; and (4) include objectively recorded data on smartphone use (e.g. obtained via a smartphone application).

CONCLUSIONS

In conclusion, the present study provides the first insights into smartphone use, smartphone addiction, and predictors of smartphone addiction in young people from a European country. Future studies should extend this knowledge in order to draw clearer conclusions regarding the disease burden and aetiology of this ever-increasing behaviour.

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