Problematic mobile phone use of Swiss adolescents: Is it linked with mental health or behaviour?

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Introduction

Nowadays mobile phones are omnipresent in everyday life and adolescents are among the heaviest mobile phone users. A recent representative survey in more than 1000 adolescents aged 12 to 19 years in Switzerland revealed that 98% of the adolescents own a mobile phone and 97% of these devices are smartphones (Willemse et al. 2014). Smartphones are multifunctional devices often used by adolescents for gaming, browsing the internet and exchanging text messages. For instance, 94% of the Swiss adolescents surveyed used their mobile phone daily or several times per week for exchanging text messages via internet-based applications, 87% for browsing the internet, 53% for gaming and 61% for checking their e-mails (Willemse et al. 2014). This frequent use may have a negative impact on daily life and thus may be problematic. However, to date it is not clear what aspects of mobile phone use, if any, are problematic and what this means for mental health and behaviour of adolescents.

On the basis of the lack of a theoretical framework for problematic mobile phone use, Billieux (2012) proposed an integrative model describing four pathways leading to problematic mobile phone use (Billieux 2012), an impulsive pathway, a relationship maintenance pathway, an extraversion pathway and a cyber-addiction pathway. The first three pathways describe a link of problematic mobile phone use and personality traits found in previous studies (Augner and Hacker 2012; Bianchi and Phillips 2005; Takao et al. 2009). The cyber addiction pathway is related to and inspired by research about problematic internet use, since nowadays most adolescents own a smartphone and therefore have internet access on their mobile phone. Along that line, Bianchi and Phillips (2005) have introduced a 27-item Mobile Phone Problem Use Scale to measure problematic use. The scale addresses different aspects of addiction such as tolerance, escape from other problems, withdrawal, craving and negative life consequences.

Strikingly, little research has quantified the impact of problematic mobile phone use on mental health and behaviour of adolescents. A cross-sectional survey in 196 young adults living in Austria observed increased chronic stress, increased extraversion, increased depression and decreased emotional stability to be related to problematic mobile phone use (Augner and Hacker 2012). In this study problematic mobile phone use was more common among women than men. In an Australian survey of 195 adults, prevalence of problematic mobile phone use was not different between men and women, but also related to increased extraversion and low self-esteem (Bianchi and Phillips 2005). In a cross-sectional study including more than 10,000 Taiwanese adolescents, depressive symptoms were related to problematic mobile phone use (Yen et al. 2009). Additionally, adolescents showing symptoms of problematic use showed impairment in daily life such as poor relationship with friends and family, problems in financial affairs or poor academic performance. Another study in the same adolescents observed that those adolescents with problematic use were more likely to be aggressive, be victims of aggression and to have low self-esteem (Yang et al. 2010). Furthermore, they found higher prevalence of problematic mobile phone use in girls and in older adolescents. A South Korean study dividing mostly male adolescents in an excessive user group and a comparison group found more depressive symptoms, more difficulty in expression of emotions, higher anxiety and lower self-esteem in the excessive mobile phone users (Ha et al. 2008).

To better understand the consequences of problematic mobile phone use for the life of adolescents, potential associations with physical well-being and behaviour need to be evaluated. However, this was not done so far, although impaired well-being (Byun et al. 2013a; Redmayne et al. 2013) and Attention Deficit Hyperactivity Disorder (ADHD) symptoms (Byun et al. 2013b) were linked to amount of mobile phone use in children and

adolescents. Thus, it remains unclear, if these adverse effects in adolescents may be attributed to problematic use of the mobile phone or amount of mobile phone use.

In this explorative study, we aim at obtaining a better understanding on how problematic mobile phone use is related to health related quality of life (HRQOL) including mental health and behavioural problems in adolescents while controlling for amount of mobile phone use. These findings are relevant to assess the impact of problematic mobile phone use for adolescents and to contribute to a better understanding of behavioural and emotional problems in adolescents.

Methods

Study population

The HERMES study (Health Effects Related to Mobile PhonE use in adolescentS) population consists of 7th, 8th and 9th grade students attending secondary schools in Central Switzerland. The baseline investigation took place from June 2012 until March 2013. Participating adolescents were recruited through initial phone contact with the head of the school and a subsequent informational visit in the respective class. Participation was voluntary and had to be preceded by informed consent of the adolescents and a parent. The investigation took place in school during school time and was led by two study managers. It consisted of filling in a paper and pencil questionnaire. An additional paper and pencil questionnaire for the parents was distributed, filled in at home and sent back to the study managers.

Ethical approval for the conduct of the study was received from the ethical committee of Lucerne, Switzerland on May 9, 2012.

Questionnaire

The adolescents' questionnaire included questions about mobile phone use, age, sex, nationality, school level, the German adaptation of the self-report version of the standardized Strengths and Difficulties Questionnaire (SDQ) (Goodman 1997) (referred to as *Adolescents SDQ*) measuring behavioural and affective problems of adolescents and the KIDSCREEN-52 (Ravens-Sieberer et al. 2008; The KIDSCREEN Group Europe 2006) measuring HRQOL. The parents' questionnaire included a question about the educational level of the parents and the German adaptation of the informant-rated version of the SDQ (referred to as *Parents SDQ*) measuring adolescents' behavioural and affective problems.

Problematic mobile phone use measured by the MPPUS-10

We used a shortened 10-item version (MPPUS-10 (Foerster et al. 2015); Table S1 in Electronic Supplementary Material) of the *Mobile Phone Problem Use Scale* (MPPUS), which addresses different issues of problematic mobile phone use by means of a 27-item questionnaire (Bianchi and Phillips 2005). The five factors covered by the MPPUS-10 are loss of control, withdrawal, negative life consequences, craving and peer dependence. The first four factors are strongly related to addiction theory, the fifth factor *peer dependence* was considered important especially in adolescents (Foerster et al. 2015). The items have to be answered on a 10-point Likert scale ranging from 1 ("not true at all") to 10 ("extremely true"). Internal consistency of the MPPUS-10 measured by Cronbach's alpha was 0.84 in our study sample.

Amount of mobile phone use

To capture various aspects of mobile phone use, we collected different usage measures which were either self-reported or recorded by the mobile phone operators. Adolescents' self-reported mobile phone use included frequency of outgoing and incoming calls, frequency of outgoing text messages (text messages sent by mobile phone network (SMS) as well as text

messages sent by internet-based applications) and duration of data traffic on the mobile phone. Objective mobile phone use data was provided from the three mobile phone operators in Switzerland for the participants who gave informed consent together with their parents to collect these data. These operator data included frequency of outgoing and incoming calls and outgoing SMS and the volume of data traffic for up to six months prior to the investigation.

Behaviour measured by the SDQ

The *Adolescents SDQ* in the questionnaire of the adolescents and the *Parents SDQ* in the parents' questionnaire investigate self-reported and parent-rated behavioural and affective problems of adolescents, respectively. They consist of five scales assessing *Emotional Symptoms, Conduct Problems, Hyperactivity, Peer Problems* and *Prosocial Behaviour* on five items answered on a 3-point Likert scale, respectively. A *Total Difficulties Score* can be calculated by summing up the scores for *Emotional Symptoms, Conduct Problems, Hyperactivity* and *Peer Problems*. Internal consistency of the five scales measured by Cronbach's alpha ranged from 0.51 to 0.74 in our study sample and was comparable to a nationwide British study sample of children and adolescents (0.41 to 0.77) (Goodman 2001). Furthermore, the scales of the SDQ were associated with relevant diagnoses (Goodman 2001). An overview from Klasen et al. (2003) concluded that the German SDQ is just as useful and valid as the English original scale in terms of similar factorial structure, reliability and validation of the scales (Klasen et al. 2003).

HRQOL measured by the KIDSCREEN

The KIDSCREEN-52 (Ravens-Sieberer et al. 2008; The KIDSCREEN Group Europe 2006) is a standardized questionnaire measuring health related quality of adolescents' life on ten dimensions named *Physical Well-being* (5 items), *Psychological Well-being* (6 items), *Moods and Emotions* (7 items), *Self-Perception* (5 items), *Autonomy* (5 items), *Parent Relations and Home Life* (6 items), *Social Support and Peers* (6 items), *School Environment* (6 items),

Social Acceptance (3 items) and *Financial Resources* (3 items) answered on a 5-point Likert scale. Internal consistency of the ten dimensions ranged from 0.77 to 0.88 in our study sample and was comparable to a representative sample of children and adolescents from 13 European countries (0.77 to 0.89) (Ravens-Sieberer et al. 2008).

Statistical analyses

The associations of problematic mobile phone use (MPPUS-10) with behaviour (Adolescents SDQ, Parents SDQ) and HRQOL (KIDSCREEN) of the adolescents were investigated by multivariable linear regression models. Nonparametric bootstrapping was used to estimate the coefficients to account for non-normal data distribution. MPPUS-10 was included either as continuous score or as categorical variable since no cut-off point dividing mobile phone use into non-problematic and problematic is proposed. The four categories of MPPUS-10 were defined a priori using the 30th, the 60th and the 90th percentile of the distribution of the MPPUS-10 as cut-off points. All models were adjusted for age, sex, nationality (Swiss, mixed or foreign), school level (college preparatory high school or high school), educational level of the parents (six categories: no education, mandatory school, training school, college preparatory high school, college of higher education, university) and self-reported frequency of outgoing text messages as a proxy for amount of mobile phone use. Sensitivity analyses were conducted with operator-recorded frequency of outgoing text messages instead of self-reported frequency of text messages as well as without any adjustment for amount of mobile phone use. Missing items in the MPPUS-10 were imputed using a linear regression imputation taking into account the available items of the MPPUS-10 (13 participants with four or less missing values in the MPPUS-10 items). Missing values in the confounder variables were imputed using imputation of the most common category "training school" for education of the parents (71 missing values) and mean of the available answers for self-reported frequency of outgoing text messages (1 missing value).

Statistical analyses were carried out using STATA version 12.1 (StataCorp, College Station, TX, USA). Figures were made with the software R using version R for Windows 3.0.1.

Results

HERMES study

In total, 439 adolescents participated in the HERMES study. Participation rate was 36.8% and 89.5% of the parents returned the questionnaire. 27 (6.2%) of the adolescents reported not to own a mobile phone and were therefore excluded for this analysis. Out of the remaining 412 participants, 319 (77.4%) indicated to own a smartphone. Participants had a mean age of 14.0 years (ranging from 12.1 to 17.0 years) and 253 (61.4%) of the participants were female (Table 1). The majority of the adolescents (66.8%) were 8th grade students.

The average MPPUS-10 score was 28.2 (SD = 15.6). Score was higher in smartphone users than in non-smartphone users (mean of 30.6 (SD = 16.1) vs. 20.0 (SD = 10.0)). The 30th, 60th and 90th percentile of the MPPUS-10 corresponded to MPPUS-10 scores of 17, 29 and 51 units, respectively. All participants in the highest MPPUS-10 category reported to own a smartphone.

According to multivariable regression modelling, problematic mobile phone use score was 4.7 (95% CI: (1.8, 7.6)) units higher in girls than in boys and increased significantly with age (2.1 units increase per one year ageing, $p = 0.031$) (Table 1). Problematic mobile phone use score was significantly decreased with increasing educational level of the parents ($p = 0.004$). Problematic mobile phone use score tended to be higher in adolescents with mixed nationality compared to Swiss nationality ($p = 0.107$) and tended to be lower for participants attending college preparatory high school compared to participants from high schools ($p = 0.222$).

Table 1 about here

Amount of mobile phone use

Self-reported mobile phone use data was available for all 412 participating mobile phone users (1 missing value each for frequency of outgoing text messages and duration of data traffic), operator recorded data was available for a subsample of 233 (56.6%) participants. Spearman correlation coefficients of self-reported and operator recorded mobile phone use were 0.48 ($p < 0.001$) for frequency of calls, 0.56 ($p < 0.001$) for frequency of outgoing text messages and 0.50 ($p < 0.001$) for data traffic on the mobile phone.

There was a clear trend of increasing mobile phone use across the four MPPUS-10 categories (Table S2 and Figure S1 in Electronic Supplementary Material). The participants in the highest MPPUS-10 category reported to use their mobile phone on average for 2.7 calls, sending 44.8 text messages (SMS and text messages sent by internet-based applications) and for 84.3 min of data traffic per day. According to objectively recorded operator data they used their mobile phone for 1.8 calls, sending 6.8 SMS (only SMS were recorded but not text messages sent by internet-based applications) and their mobile phone transmitted 13.9 MB data traffic volume per day.

The strongest Spearman correlation of problematic mobile phone use score with amount of mobile phone use was observed for self-reported frequency of outgoing text messages with rho = 0.59 ($p < 0.001$). Other types of use were only fairly to moderately correlated (self-reported frequency of calls: 0.32 ($p < 0.001$), self-reported duration of data traffic: 0.42 ($p < 0.001$), objectively recorded frequency of calls: 0.35 ($p < 0.001$), objectively recorded frequency of outgoing SMS: 0.41 ($p < 0.001$), objectively recorded volume of data traffic: 0.39 ($p < 0.001$)).

Behaviour

Problematic mobile phone use was significantly positively associated with overall behavioural problems (adjusted coefficient: 0.96 (95% CI: 0.58, 1.35) units increase in the *Total Difficulties Score* per 10 units increase in the MPPUS-10 score) (Table 2). Among the specific behavioural problems, most pronounced association was observed for *Hyperactivity* (0.42 (0.26, 0.57)), followed by *Conduct Problems* (0.30 (0.19, 0.41)) and *Emotional Symptoms* (0.17 (0.02, 0.32)). *Prosocial Behaviour* was significantly negatively associated with problematic mobile phone use (-0.14 (-0.25, -0.04)), whereas *Peer Problems* were not related to problematic mobile phone use. Results were similar for continuous and categorical analysis. Behavioural problems rated by the parents based on 344 questionnaires showed a similar pattern although coefficients were lower and associations with *Emotional Symptoms* and *Prosocial Behaviour* did not reach statistical significance (Table S3 in Electronic Supplementary Material).

Furthermore, estimated coefficients and the corresponding 95% confidence intervals did not much change if adjustment for self-reported or operator recorded frequency of outgoing text messages was dropped (Tables S4 and S5 in Electronic Supplementary Material).

HRQOL

Seven out of the ten HRQOL dimensions were significantly decreased (*Psychological Well-being, Moods and Emotions, Self-Perception, Autonomy, Parent Relations and Home Life, Financial Resources* and *School Environment*) for increasing problematic mobile phone use score (Table 2). Not related to problematic mobile phone use were the dimensions *Social Support and Peers* and *Social Acceptance*. *Physical Well-being* was significantly decreased in the 10% of adolescents in the highest MPPUS-10 category, but the association was not significant according to the test for trend and the continuous analysis. Again, results were

similar for continuous and categorical analysis. Adjustment for self-reported or operator recorded frequency of outgoing text messages as a proxy for amount of mobile phone use had little impact on the results (Tables S4 and S5 in Electronic Supplementary Material).

Table 3 about here

Discussion

Overall, problematic mobile phone use, expressed by a higher MPPUS-10 score, was associated with increased amount of mobile phone use, impaired psychological well-being, decreased mood and more behavioural problems whereas no association with social relationships with peers was observed. Our categorical analysis indicates that there is no common threshold above which mobile phone use becomes problematic for mental health, instead we observed a fairly linear relation between the problematic mobile phone use score and various mental health outcomes.

Problematic mobile phone use and amount of mobile phone use

Problematic mobile phone use score was associated with amount of calls, text messages and data traffic. Nevertheless, Spearman correlations were modest indicating that problematic mobile phone use as measured by the MPPUS-10 does not only reflect amount of mobile phone use but also other aspects such as loss of control, withdrawal symptoms, craving and peer dependence which are problematic. As a consequence even extensive amount of mobile phone use did not result in a high problematic mobile phone use score in some study participants and vice versa high problematic mobile phone use score occurred in participants with low to modest amount of mobile phone use. Strikingly, the coefficients of all models with mental health outcomes did not change noticeably if models were not adjusted for amount of mobile phone use. This indicates that the observed associations are independently

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related to problematic aspects of use and not to the amount of mobile phone use itself. Thus, amount and problematic aspects of mobile phone use should be considered separately in future studies in adolescents.

Personal and social factors related to problematic mobile phone use

Significant increases of problematic mobile phone use score were found for being female, age and low educational level of the parents. These findings are in line with other studies (Augner and Hacker 2012; Bianchi and Phillips 2005; Byun et al. 2013a; Sanchez-Martinez and Otero 2009; Yang et al. 2010) although, to the best of our knowledge, parents' education was not reported to be associated with problematic mobile phone use before. It is conceivable that parents with higher educational background are more aware of problematic aspects of their children's mobile phone use and thus consider these aspects in their education. Furthermore, the school environment also plays an important role, as indicated by our results on the corresponding KIDSCREEN dimensions (*Parent Relations and Home Life* and *School Environment*). These findings also support the relevance of the social background for developing addictive behaviours. Particularly, good family functioning and good communication between parents and adolescents may help prevent problematic mobile phone use in adolescents as it was observed for pathological internet use (Wartberg et al. 2015). A possible explanation could be that rules for media use controlled by parents prevent problematic use. Education of media use in school in combination with adolescents feeling comfortable in school may play a similar role.

HRQOL and problematic mobile phone use

Our results indicate decreased mood and psychological well-being to be associated with problematic mobile phone use. Similar findings come from recent studies linking symptoms of mental ill health, depression and anxiety to problematic mobile phone use (Augner and

Hacker 2012; Ha et al. 2008; Yen et al. 2009), to problematic internet use (Kaess et al. 2014; Ko et al. 2012) and to amount of mobile phone use which is expected to partly reflect problematic use (Ikeda and Nakamura 2014; Thomée et al. 2011). Similar to these studies, our cross-sectional study cannot clarify the direction of these associations. Either problematic mobile phone use could be the consequence of decreased mood, psychological well-being and negative self-perception or the other way around. For both pathways there are plausible arguments. Negative self-perception is linked to depression (Lewinsohn et al. 1980) and individuals with negative self-perception may use the mobile phone to elevate their self-perception by spending time on social networks (Steinfield et al. 2008). Mobile phones might thus be used to escape from negative feelings, which in the long run may act as an amplifier of such feelings because the underlying problems are not approached. Or mobile phones may be used to seek for social support in times of depressed feeling. In line of the latter hypothesis, decreased depressive symptoms have been observed for increased instant messenger and social network use (Morgan and Cotten 2003). On the other hand decreased mood and psychological well-being may be a consequence of problematic mobile phone use thinking of the overwhelming possibilities the mobile phone and the internet provide nowadays and the accompanying stress of being accessible all the time. This hypothesis is in agreement with the finding of Thomée et al. (2011) of high mobile phone use being a risk factor for reporting symptoms for depression one year later with the risk being greatest among those participants who reported to perceive stress because of the high accessibility via mobile phone (Thomée et al. 2011). Another possibility is that there is not a pathway pointing in one direction but a reinforcing spiral leading to the associations between problematic mobile phone use and health and behavioural factors as it is proposed for media effects in general (Slater 2007).

Behaviour and problematic mobile phone use

We found a strong association between *Hyperactivity* and problematic mobile phone use, which, to the best of our knowledge, has not been examined so far. Previous studies found hyperactivity and ADHD associated with problematic internet use (Kaess et al. 2014; Ko et al. 2012; Kormas et al. 2011; Ozturk et al. 2013) and using the mobile phone for entertainment (playing games, internet) (Byun et al. 2013b; Zheng et al. 2014). Hyperactive adolescents are easily distracted, show problems in sustaining attention and are less capable of impulse control (Douglas 1972). Thus, hyperactive adolescents may be prone to develop problematic mobile phone use through the countless possibilities of a mobile phone to drift away, find excitement and escape from boredom. At the same time we found *Conduct Problems* to be associated with problematic mobile phone use, which is in line with the finding of Kaess et al. (2014) of problematic internet use being related to conduct problems in adolescents. Adolescents with conduct problems are often impulsive and pathological internet use is considered to be an impulse-control disorder.

Strengths and limitations

A particular strength of this study is that we could rely on both self-reported and objectively recorded mobile phone use data from mobile phone operators. It is well established that adolescents tend to overestimate their mobile phone use (Aydin et al. 2011; Inyang et al. 2009). This especially holds for duration of mobile phone calls and less pronounced for frequency of calls. However, since results were similar for self-reported and operator recorded amount of mobile phone use, recall or reporting bias is not expected to affect our study results. We adjusted our analyses for self-reported and operator recorded frequency of outgoing text messages. We think that daily frequency of outgoing text messages is a valuable proxy for all types of activity on the mobile phone. Note that analyses with adjustment for data traffic or call frequency yielded similar results.

We were able to investigate a variety of external as well as internal factors found in literature and possibly related to problematic mobile phone use in one study sample at the same time. An inherent limitation of our study is that problematic mobile phone use, HRQOL and behaviour are self-reported. However, we had additionally parent-rated behaviour available and SDQ and KIDSCREEN are widely used and validated scales.

Conclusion

Our study indicates that problematic mobile phone use in adolescents is associated with external factors such as worse home and school environment, and internal factors such as impaired HRQOL and behavioural problems. Future longitudinal studies should clarify whether problematic mobile phone use is the consequence of unfavourable conditions or whether and to what extent problematic mobile phone use reinforces behavioural problems as well as decreased mood and psychological well-being. In the meantime, problematic mobile phone use in adolescents should be addressed, in particular when dealing with adolescents showing behavioural or emotional problems.

The authors declare that they have no conflict of interest.

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Table 1: Personal and social factors of the HERMES study participants and change in the Mobile Phone Problem Use Scale-10 score per unit increase in factors, the corresponding 95% confidence intervals and p-values, HERMES study, Switzerland, 2012

Personal and social factors			MPPUS-10 score		
			Coefficient	95% CI	p-value
Age (in years)	14.0 (12.1 - 17.0)	per year	2.09	(0.19, 4.00)	0.031
Sex: female	253 (61.4%)	compared to male	4.71	(1.78, 7.64)	0.002
Nationality:					
Swiss	328 (79.6%)				
mixed	56 (13.6%)	compared to Swiss	4.10	(-0.89, 9.10)	0.107
foreign	28 (6.8%)	compared to Swiss	-0.76	(-6.98, 5.47)	0.811
School level: college preparatory high school	95 (23.1%)	compared to high school	-2.12	(-5.52, 1.28)	0.222
Highest education parents:		per category	-1.80	(-3.05, -0.56)	0.004
no education	3 (0.7%)				
mandatory school	12 (2.9%)				
training school	212 (51.5%)				
college preparatory high school	30 (7.3%)				
college of higher education	122 (29.6%)				
university	33 (8.0%)				

Table 2: Change in the Adolescents Strengths and Difficulties Questionnaire scores and KIDSCREEN dimensions per 10 unit increase in the Mobile Phone Problem Use Scale-10 score and per Mobile Phone Problem Use Scale-10 category and the corresponding 95% confidence intervals and p-values for the test for trend in the Mobile Phone Problem Use Scale-10 categories, HERMES study, Switzerland, 2012

| | | MPPUS-10 score | | | | MPPUS-10 categories ** | | | | | | | | | Test for trend *** |
| | | crude | | adjusted * | | < 30th (n = 125) | | 30th - 60th (n = 120) | | 60th - 90th (n = 125) | | ≥ 90th (n = 42) | | |
Adolescents SDQ	n	Coefficient	95% CI	Coefficient	95% CI			Coefficient	95% CI	Coefficient	95% CI	Coefficient	95% CI	p-value
Total Difficulties Score	412	0.80	(0.48, 1.12)	0.96	(0.58, 1.35)	0	(reference)	1.17	(0.07, 2.27)	2.36	(1.22, 3.49)	4.99	(2.94, 7.03)	< 0.001
Emotional Symptoms	412	0.20	(0.07, 0.34)	0.17	(0.02, 0.32)	0	(reference)	0.04	(-0.46, 0.53)	0.26	(-0.24, 0.76)	0.73	(-0.12, 1.57)	0.075
Conduct Problems	412	0.26	(0.17, 0.35)	0.30	(0.19, 0.41)	0	(reference)	0.52	(0.17, 0.86)	0.88	(0.5, 1.25)	1.52	(0.89, 2.14)	< 0.001
Hyperactivity	412	0.38	(0.24, 0.51)	0.42	(0.26, 0.57)	0	(reference)	0.55	(0.04, 1.05)	1.13	(0.63, 1.63)	2.33	(1.52, 3.15)	< 0.001
Peer Problems	412	-0.05	(-0.15, 0.05)	0.08	(-0.05, 0.21)	0	(reference)	0.07	(-0.39, 0.53)	0.09	(-0.38, 0.56)	0.41	(-0.34, 1.16)	0.371
Prosocial Behaviour	412	-0.05	(-0.15, 0.05)	-0.14	(-0.25, -0.04)	0	(reference)	-0.38	(-0.81, 0.05)	-0.25	(-0.69, 0.2)	-0.88	(-1.48, -0.28)	0.039
KIDSCREEN														
Physical Well-being	411	-0.44	(-1.02, 0.14)	-0.66	(-1.53, 0.21)	0	(reference)	-0.02	(-2.28, 2.23)	-1.24	(-3.91, 1.44)	-5.07	(-9.02, -1.13)	0.036
Psychological Well-being	412	-0.74	(-1.33, -0.16)	-0.62	(-1.39, 0.14)	0	(reference)	-0.90	(-3.22, 1.41)	-0.80	(-3.22, 1.62)	-5.00	(-9.23, -0.78)	0.063
Moods and Emotions	412	-2.00	(-2.70, -1.30)	-1.73	(-2.64, -0.82)	0	(reference)	-2.25	(-4.98, 0.48)	-5.87	(-8.59, -3.14)	-8.65	(-12.94, -4.36)	< 0.001
Self-Perception	412	-1.12	(-1.68, -0.57)	-0.90	(-1.66, -0.15)	0	(reference)	-1.41	(-3.8, 0.98)	-4.23	(-6.61, -1.84)	-3.90	(-7.46, -0.33)	0.001
Autonomy	409	-0.62	(-1.12, -0.12)	-0.67	(-1.28, -0.06)	0	(reference)	-2.05	(-4.17, 0.07)	-1.62	(-3.94, 0.7)	-4.61	(-7.87, -1.34)	0.026
Parent Relations and Home Life	408	-1.39	(-1.87, -0.90)	-1.50	(-2.09, -0.91)	0	(reference)	-2.58	(-4.92, -0.23)	-5.15	(-7.52, -2.77)	-5.82	(-9.36, -2.28)	< 0.001
Financial Resources	405	-1.15	(-1.63, -0.68)	-1.51	(-2.03, -0.99)	0	(reference)	-1.85	(-3.78, 0.08)	-4.47	(-6.46, -2.47)	-6.15	(-9.1, -3.21)	< 0.001
Social Support and Peers	412	0.46	(-0.03, 0.94)	-0.11	(-0.72, 0.50)	0	(reference)	-1.95	(-4.09, 0.2)	-0.38	(-2.84, 2.09)	-2.08	(-5.34, 1.17)	0.551
School Environment	407	-1.08	(-1.51, -0.65)	-0.97	(-1.54, -0.41)	0	(reference)	-2.62	(-4.66, -0.59)	-3.51	(-5.58, -1.44)	-5.34	(-8.1, -2.58)	< 0.001
Social Acceptance	409	-0.04	(-0.66, 0.57)	-0.60	(-1.36, 0.16)	0	(reference)	-0.09	(-2.72, 2.53)	-1.07	(-3.87, 1.73)	-2.19	(-6.38, 2.00)	0.266

* models adjusted for age, sex, nationality, school level, education of the parents and self-reported frequency of outgoing text messages

** MPPUS-10 categories correspond to MPPUS-10 scores of 10-17 ($< 30^{th}$ percentile), 18-28 ($30th - 60^{th}$ percentile), 29-50 ($60^{th} - 90^{th}$ percentile) and 51-100 ($\geq 90^{th}$ percentile), respectively

*** p-value of the ordinal variable of the four MPPUS-10 categories $< 30^{th}$ percentile, $30^{th} - 60^{th}$ percentile, $60^{th} - 90^{th}$ percentile and $\geq 90^{th}$ percentile ranging from 1 to 4 in adjusted regression models

Electronic Supplementary Material: German version of the MPPUS-10, amount of mobile phone use, additional analyses for behaviour measured by the Parents SDQ and sensitivity analysis regarding adjustment for amount of mobile phone use for the whole sample and the operator sample