

REVIEW ARTICLE

The impact of problematic smartphone use on children's and adolescents' quality of life: A systematic review

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Abstract

Aim: To provide a systematic review on studies examining problematic smartphone (PSU) use in children and adolescents, and its impact on quality of life, life satisfaction, and well-being.

Methods: An extensive literature search was conducted in Google Scholar, Scopus and Pubmed.

Results: The search yielded $k = 9$ articles for which inclusion criteria were met. Five studies examined health-related or overall quality of life, two assessed life satisfaction, and two evaluated well-being in relation to PSU. Negative associations between PSU and the outcome variables were reported almost consistently, with one study yielding only a trend for a negative correlation of PSU with life satisfaction, and one study finding no significant correlation regarding quality of life. Comparability between studies was impeded by the scarcity of studies which met inclusion criteria and by the use of different measures.

Conclusion: More research is needed regarding PSU and the outcome variables in children and adolescents. Also, a distinct and consistent theoretical conceptualisation of PSU is required to replicate findings, and to enhance comparability between studies. Based on the trend reported here, the development of customised, early on interventions for children and adolescents at risk of PSU is warranted.

KEYWORDS

adolescents, children, life satisfaction, quality of life, problematic smartphone use

1 | INTRODUCTION

While prevalence rates of problematic smartphone use (PSU) in children and adolescents vary widely from 5%¹ to about 50%,² the overall number of smartphone owners has continuously increased worldwide.³ Furthermore, the vulnerability in children and adolescents for PSU is assumed to be higher than in adults,^{4,5} a fact that highlights the

high relevance of the topic particularly in minors. Although research regarding risk factors for problematic smartphone use in children and adolescents remains somewhat inconclusive to date, a recent systematic review⁶ has found female gender, strict parenting, low self-esteem as well as gaming and social networking to serve as crucial predictors of PSU. Good friendships as well as academic motivation and success, in turn, may constitute protective factors.

Abbreviations: HRQOL, Health related quality of life; MPAS, Mobile Phone Addiction Scale; MPPUS-10, Mobile Phone Problem Use Scale; QoL, Quality of life; PSU, Problematic smartphone use; SAPS, Smartphone Addiction Proneness Scale; SAS - SV, Smartphone Addiction Scale-Short Version; WHO, World Health Organization.

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In addition to risk factors, a growing body of reviews finds PSU (e.g. constantly checking for notifications or excessive usage^{7,8}) to be associated with negative consequences,^{7,9,10} such as decreased sleep quality (in various age samples^{10,11}; in children/adolescents¹² and mental disorders like anxiety or depression^{7,10,11}). Mental disorders can also be linked to related constructs like problematic social networking site use.^{13,14} In children and adolescents, excessive screen time in general also seems to be related to physical health effects (e.g. decreased sleep quality^{15,16}) and psychological health effects (e.g. depressive symptoms or ADHD^{15,16}).

Despite this wide array of findings, less studies or literature reviews can be found for the link between PSU and quality of life (QoL), health-related quality of life (HRQOL), life satisfaction or well-being in children and adolescents. Generally, data show that adolescents' overall well-being has started to decrease at the time smartphones became ubiquitous.¹⁷ In line with this, PSU has been found to be negatively associated with psychological well-being among university students¹⁸; and greater life satisfaction in children and adolescents has—in turn—been linked to a combination of low screen time and high physical activity.¹⁹

The theoretical concepts of QoL, HRQOL, life satisfaction and subjective well-being are connected. QoL is defined by the World Health Organization (WHO) "as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns"²⁰, p. 1. HRQOL, in turn, includes the elements of overall quality of life that are particularly related to physical or mental health.²¹ While one component of subjective well-being covers positive and negative affect,²² the second component, life satisfaction, is construed as a cognitive process in which a person globally evaluates his or her life.²³ Furthermore, psychological well-being may be defined as the absence of symptoms of mental illness.²⁴

Despite the considerable body of literature on PSU, the underlying concept is defined quite broadly and at times—depending on the theoretical background of those proposing it—contradictorily.^{7,9} To date, there is still no consensus on the question if excessive usage constitutes an addiction or if it should better be termed problematic usage (not meeting clinical criteria). On the one hand, symptoms commonly associated with addiction (e.g. overuse, withdrawal, daily-life disturbance) have been observed in relation to problematic smartphone use,²⁵ leading some research groups to compare PSU to behavioural addictions like Internet gaming disorder.^{4,8,26} On the other hand, some researchers conclude that evidence is not sufficient to assume the existence of smartphone addiction,⁹ and hence, the term PSU is preferred over addiction.²⁷ In sum, according research is partly impeded by the use of inconclusive terminology as well as by different operationalisations of the concept and, thus, different measures.⁶

Moreover, findings on how PSU affects QoL, well-being or satisfaction with life in children and adolescents are still scarce. While there is some literature regarding the link between PSU and QoL/HRQOL or life satisfaction and well-being, no review exists to date integrating studies explicitly examining PSU and these constructs in

Key Notes

- Given the increasing smartphone use in children and adolescents, this systematic review aimed to provide an overview over the impact of problematic smartphone use (PSU) on quality of life, life satisfaction and well-being.
- Nine studies met inclusion criteria, and most report a negative association between PSU and the outcome variables.
- A consistent definition of PSU and well-designed studies are needed for the development of early interventions.

children and adolescents, particularly. This, however, would be of great practical relevance for the development of customised, early on interventions for afflicted minors. Thus, this systematic review aims to provide an overview over studies on the association between PSU and QoL, HRQOL, life satisfaction and well-being in children and adolescents.

2 | METHODS

2.1 | Search strategy

The time frame of studies was set to begin after 2007, to increase the likelihood of studies examining smartphones instead of other mobile phones (i.e. without Internet access), as has been done by Elhai et al.⁷ An extensive literature search was conducted in PubMed, Scopus and Google scholar regarding papers published between January 2008 and April 2020. Search parameters were PROBLEMATIC/MALADAPTIVE/EXCESSIVE/PATHOLOGICAL/DYSFUNCTIONAL in combination with SMARTPHONE/SMARTPHONE/PHONE/CELLPHONE/CELL PHONE/MOBILE PHONE and ADDICTION/USE and ADOLESCENTS/CHILDREN/YOUTH as well as QUALITY OF LIFE/HEALTH RELATED QUALITY OF LIFE/LIFE SATISFACTION/WELL BEING. To ensure the inclusion of accepted articles and articles in preprint, Google Scholar alerts were enabled. Additionally, a reference search strategy was used to identify other relevant articles.

2.2 | Study selection process

The authors independently examined the title, abstract and main text of each study, and at each stage of the process, studies were excluded (see Figure 1). Inclusion criteria covered original studies, which were published not earlier than 2008 in peer-reviewed journals, which are written in English or German and focus on children and adolescents (1–20 years). The lower age limit was chosen to ensure inclusion of studies with very young children as there is a need to learn more about the impact of smartphone use particularly on

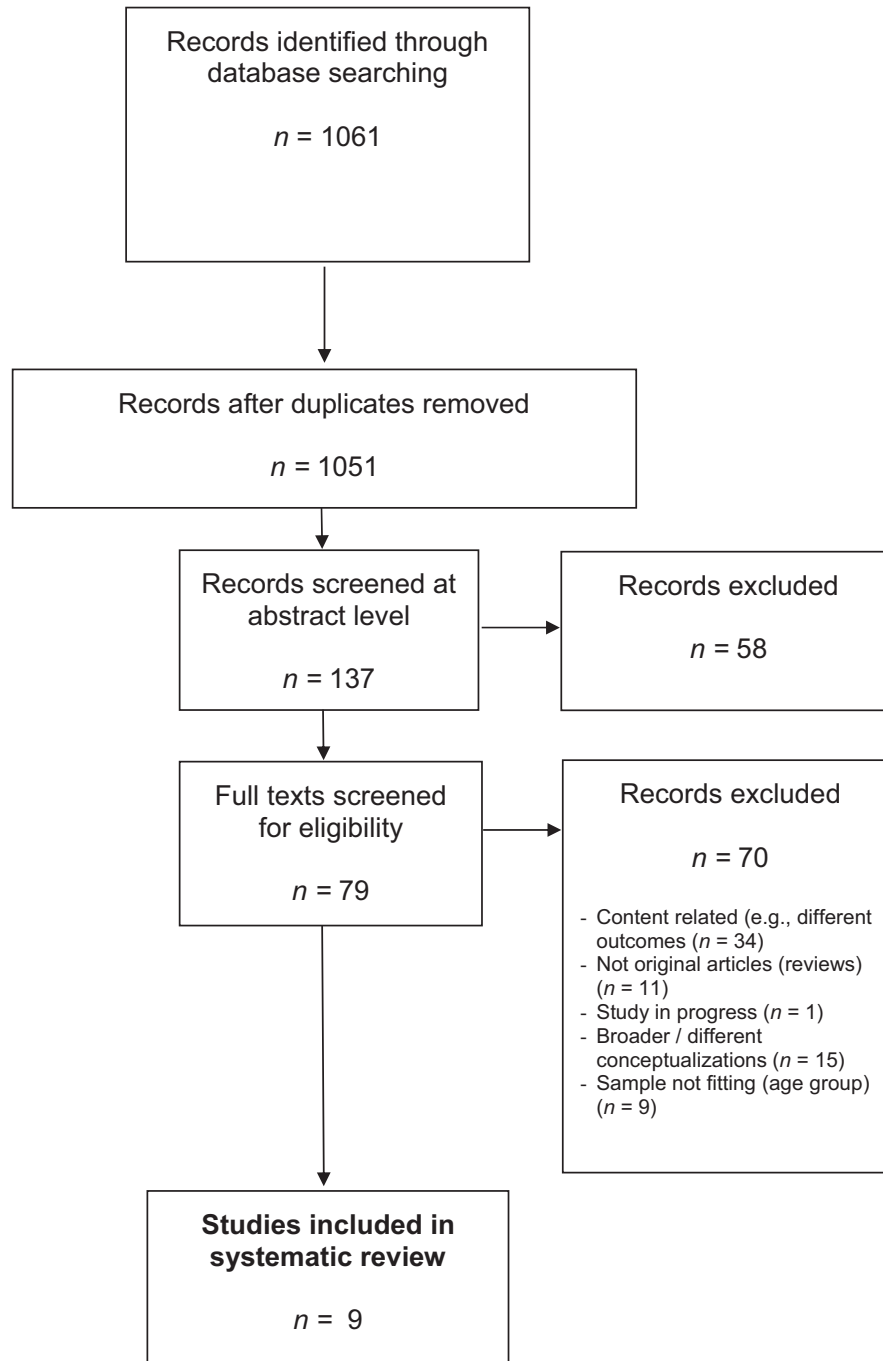


FIGURE 1 PRISMA flow diagram

young children.⁶ The upper age limit corresponds to the observed circumstance that many studies on this subject include mixed age samples ranging from early puberty to late adolescence.

Papers on university students were included if the sample's age fell into the mentioned age range. To increase comparability, articles not specifically referring to smartphones but instead to media/ technology use or screen time in general, as well as papers on the constructs of nomophobia (e.g. Ref. [28]), problematic Internet use, and problematic social networking services use were all excluded. Before reviewing full-text articles, titles and abstracts were screened by all authors.

3 | RESULTS

3.1 | Sample of included studies

Overall, 1017 articles were found in the initial search process, and 44 were identified through reference search strategy. Of these, ten duplicates had to be removed. Subsequently, 1042 articles were excluded since they were not written in English or German, or did not constitute original articles, were not published in peer-reviewed journals, or did not (exclusively) focus on children/adolescents. Also,

articles, which focused on problematic Internet use, media / screen use in general, or problematic networking services use were excluded. Additionally, articles were only considered if the targeted outcome variables were explicitly assessed. Figure 1 provides a detailed description of the exclusion process.

The final sample amounted to $k = 9$ articles with overall $n = 5928$ participants. Of these, two (22.2%) were carried out in Italy and two (22.2%) in South Korea. The Philippines, Turkey, Indonesia, China and Switzerland were represented with one paper each in the review.

To measure PSU, 55.6% ($k = 5$) of the included studies used the *Smartphone Addiction Scale-Short Version (SAS-SV)*,²⁵ while the *Smartphone Addiction Proneness Scale (SAPS)*²⁹ was applied in 22.2% ($k = 2$) of the studies. Finally, one study used the 10-item version of the *Mobile Phone Problem Use Scale (MPPUS-10)*,³⁰ and another used the *Mobile Phone Addiction Scale (MPAS)*.³¹

In most of the included studies ($k = 7$, 77.8%), distribution of male and female participants was almost equal ($50\% \pm 15\%$). One study, which compared two groups, had a higher amount of female participants (73.7%) in one of the groups,³² while in another study the amount of male participants was 78.2%.³³ For an overview over the characteristics of included studies, see Table 1.

3.2 | Outcomes

3.2.1 | Overall QoL, HRQOL and well-being

Three out of the total nine studies examined overall QoL,³³⁻³⁵ two focused on HRQOL,^{36,37} and two evaluated well-being^{32,38} in children and adolescents with PSU. Significant negative correlations were reported between PSU and QoL,^{34,35} as well as between PSU and total HRQOL.³⁶ Overall lower QoL was also found to predict higher levels of PSU.³⁴

In addition to the overall constructs of QoL and HRQOL, PSU has also been found to be significantly negatively associated with several sub-domains such as psychosocial health (i.e. emotional, social and school functioning)/QoL/well-being,³⁴⁻³⁷ physical health/QoL/well-being,³⁴⁻³⁶ social QoL (i.e. personal relationships, social support),³⁵ environmental QoL (i.e. freedom, physical safety, home environment)³⁵ and school environment (i.e. feelings about school),^{36,37} moods and emotions (i.e. stress, depressive mood),³⁷ self-perception (i.e. satisfaction with bodily appearance),³⁷ autonomy (i.e. the ability to organise their free time),³⁷ parent relations and home life (i.e. atmosphere at home, relationship with their parents),³⁷ as well as financial resources.³⁷

In the context of well-being, PSU also seems to be associated with less perceived social support and with a decreased ability to understand and to resolve a problematic social situation.³² Moreover, another study³⁸ found a significant moderation effect of PSU on the link between self-regulation and well-being, from which the authors conclude that a high level of smartphone addiction may weaken the effect of self-regulation on well-being.³⁸

No significant associations could be found regarding PSU and the HRQOL subscale peers and social support^{36,37} (relationship with other adolescents),³⁹ and social acceptance³⁷ (e.g. bullying).³⁹ Somewhat contrary to the findings mentioned above, one study³³ yielded no significant correlation between PSU and overall QoL. In the study by Roser et al.,³⁷ the association between PSU and physical well-being was not significant in a more detailed analysis, whereas the study by Buctot et al.³⁶ found no significant correlation between PSU and autonomy and relationship with parents, thus yielding slightly different results from Roser et al.³⁷

3.2.2 | Life satisfaction

Two^{4,40} of the nine included studies examined life satisfaction in children and adolescents in the context of PSU, yielding slightly inconsistent results.

One of these studies⁴⁰ found a strong negative correlation between life satisfaction and the *Smartphone Addiction Proneness Scale (SAPS)*²⁹ in college students aged 18 to 20 years.⁴⁰ In contrast, the other study⁴ which also used the SAPS in adolescents aged 15 years on average found no significant difference between the smartphone addiction risk group and the normal user group regarding life satisfaction. Yet, the authors reported a trend: the number of adolescents who indicated to be satisfied with their life was higher in the normal user group than in the risk group.

4 | DISCUSSION

The aim of this systematic review was to assemble findings on the impact of PSU on QoL, HRQOL, life satisfaction, and well-being in children and adolescents. Only few studies were found which explicitly examine these constructs in children and adolescents in the context of PSU: nine studies were included in this review, of which five examined overall QoL and/or HRQOL, two evaluated life satisfaction, and two assessed well-being.

Despite the small number of included studies and despite the fact that different measures were applied, results tentatively suggest that PSU and the mentioned outcome variables are negatively associated. Hence, PSU seems to be accompanied by a lower QoL (both overall and health related) and by lower levels of life satisfaction. Also, PSU seems to influence well-being, although this relationship does not seem to be a direct one. In both studies, which evaluated this link,^{32,38} PSU acted as a moderating variable between self-regulation and well-being, and between social support and well-being. These findings are in line with a study examining adults, which found PSU to be negatively related to psychological well-being.¹⁸

However, among the studies included in this review, two also yielded contradictory results regarding the main constructs. Roh et al.³³ did not find a significant correlation regarding QoL and PSU, and Cha and Seo⁴ reported null findings concerning PSU and life

TABLE 1 Characteristics and main results of included studies

Study	Sample size	Age	Gender	Country	Measure PSU	Measure Outcome variable	Main results
Buctot et al., 2020	N = 1447	M = 15.22 SD = 1.61; 13–18 years	f = 59.9% m = 40.1%	The Philippines	SAS-SV	KIDSCREEN-27	- negative significant associations between PSU and several components of HRQOL and total HRQOL
Cha & Seo, 2018	N = 1824	M = 15.6 SD = 0.78	f = 49.0% m = 51.0%	South Korea	SAPS	life satisfaction measured with one item	- a higher percentage of satisfied adolescents in normal user group, but no significant difference concerning life satisfaction between addiction risk group and normal users
Kumcagiz, 2019	N = 352	M = 16.26 SD = 2.00; 14–19 years	f = 56.5% m = 43.5%	Turkey	SAS-SV	PedsQL	- negative correlation of smartphone addiction with overall QoL and physical and psychosocial health
Kusuma et al., 2019	N = 251	18–20 years	f = 51.0% m = 49.0%	Indonesia	SAPS	Scale of life satisfaction adopted from SWLS	- negative correlation between smartphone addiction and life satisfaction
Lu et al., 2018	1. N = 606 (Anhui province) 2. N = 705 (Qinghai province)	1. M = 14.2 SD = 1.7 2. M = 15.9 SD = 1.7	1. f = 43.7% m = 56.3% 2. f = 48.2% m = 51.8%	China	MPAS	WHOQOL-BREF	- significant negative correlations between mobile phone addiction scores and physical, psychological, social, and environmental QoL domains in the whole sample
Mascia et al., 2020	N = 215	M = 12.7 SD = 0.90; 10–15 years	f = 49.3% m = 50.7%	Italy	SAS-SV	My Life as a Student—questionnaire	- the level of smartphone addiction negatively moderates the relationship between self-regulation and well-being
Roh et al., 2018	N = 78	M = 12.75 SD = 2.50; 7–17 years	f = 21.8% m = 78.2%	South Korea	SAS-SV	PedsQL 4.0	- Implicit Association Test and SAS-SV significantly correlated - no significant correlation between Implicit Association Test and QoL
Roser et al., 2016	N = 412	M = 14.0; 12–17 years	f = 61.4% m = 38.6%	Switzerland	MPPUS-10	KIDSCREEN-52	- negative significant associations between PSU and several components of HRQOL (Psychological Well-being, Moods and Emotions, Self-Perception, Autonomy, Parent Relations and Home Life, Financial Resources and School Environment)
Sarti et al., 2019	1. N = 19 (diagnosis of SLD group) 2. N = 19 (CNT group)	1. M = 15.16 SD = 0.36 2. M = 15.42 SD = 0.77	1. f = 73.7% m = 26.3% 2. f = 52.6% m = 47.4%	Italy	SAS-SV	CIT	- similar results regarding well-being between the two groups - no significant differences regarding smartphone use between the two groups - in typically developing adolescents increasing smartphone use is related to decreased perceived support by others - smartphone use is negatively related to cognitive-functional variables such as perceived support and a decreased ability to understand and resolve problematic social situations

Note: N, sample size; M, mean; SD, standard deviation; f, female; m, male; CIT: Comprehensive Inventory of Thriving⁵⁴; CNT group: group of typically developing adolescents; KIDSCREEN-27: Quality of Life Measure for Children and Adolescents⁵⁵; KIDSCREEN-52: Quality of Life Measure for Children and Adolescents⁵⁹; MPAS: Mobile Phone Addiction Scale³¹; MPPUS-10: Mobile Phone Problem Use Scale—Short version³⁰; My Life as a Student—questionnaire⁵⁶; PedsQL: Pediatric Quality of Life Inventory^{57,58}; PSU = Problematic Smartphone Use; QoL, quality of life; SLD group: group of adolescents with specific learning disability; SWLS: The Satisfaction With Life Scale²²; WHOQOL-BREF: World Health Organization QOL—Brief Version⁵⁹.

satisfaction, although a trend towards a negative association was implied. The reason for these contradictory results may lie in methodological and sampling differences between the studies: In contrast with all other studies, which applied multiple-item questionnaires, Cha and Seo⁴ only used one item to measure life satisfaction. Whereas the participants of the other eight studies were acquired in schools or college, the study by Roh et al.³³ was conducted with children and adolescents visiting a hospital; also, it is the only one to include children under the age of 10 which might explain the contradictory results.

Taking a broader view on the examined constructs, the findings of the studies included in this review undoubtedly add to research in this field. Yet, further research is needed. More studies seem to define psychological well-being as the absence of mental illnesses,²⁴ and therefore, measures of well-being are replaced by measures of different constructs like attention and learning problems (e.g. Ref. [41]), depression, and loneliness (e.g. Ref. [42]), constructs, which certainly have an influence on subjective well-being. However, one can assume that there is more to well-being, life satisfaction, and QoL than the absence of physical or mental illnesses.

Besides the lack of studies, a few aspects have to be considered when interpreting the present results: first, the constructs of PSU measured in the included studies are not the same. Four different measures were applied across the nine studies, with the majority (8 studies) focusing on the construct of smartphone addiction. Only one construed excessive smartphone use as problematic usage. As has been pointed out above, it is still discussed among researchers, if the problematic use of smartphones can be considered as an addiction or not (e.g. Ref. [9]), and the different conceptualisations of the construct found in this review reflect the still missing consensus among researchers. However, comparability between studies and progress in this field of research would be greatly enhanced if a clear definition of the phenomenon was available.

Second, as none of the included studies applied a longitudinal study design, no assumptions about causality can be made. One of the included studies³⁴ describes QoL as a predictor of higher PSU scores. A study concerning PSU and depressive symptoms found a bidirectional association between the two constructs.⁴³ On the other hand, most research seems to hypothesise that PSU is the predecessor to negative consequences. Clearly, more longitudinal studies are needed to shed more light on the direction of effects.

Third, although this review set out to summarise findings on PSU in children and adolescents, only one study covered children aged 7 years onwards.³³ All other studies focused exclusively on adolescents. Thus, almost no research on children below the age of 10 years is available. Although adolescents can be assumed to have greater access to smartphones, in recent years also children of the age of 6–10 show increasing smartphone usage rates.⁴⁴ Accordingly, younger samples should be included in future research. This would also be of relevance to start according interventions early on.

Of similar relevance would be a cultural comparison of the outcome variables in the context of PSU, which is not possible at this

point in time due to the small number of according studies. Our findings show a surplus of studies from the Asiatic region. Only three of nine studies originate from countries with western-oriented culture. Not only do the amount of smartphone users differ across different countries,⁴⁵ studies also suggest that the use of technology and its acceptance are influenced by cultural factors such as individualism vs. collectivism.⁴⁶ Cultural differences may also be assumed regarding the concept of QoL⁴⁷ and the other outcome variables, depending on which values are considered relevant to high QoL and life satisfaction in different cultures, like, for example, individualism, high achievement goals, or the social environment or family. In line with this reasoning, a study comparing adults from China and Germany found problematic Internet use to be negatively associated with life satisfaction in both samples, whereas a negative association between PSU and life satisfaction was only found in the Chinese sample.⁴⁸

Lastly, our review only focused on the global concept of PSU. However, research suggests that not the smartphone *per se*, but the usage of specific smartphone applications (i.e. social networking, games) is related to problematic usage patterns. For instance, some studies found evidence of social networking services use to be particularly responsible for problematic behaviours in adolescents.^{5,49–51} Similarly, entertainment seeking^{50,52} and gaming^{50–52} have also been linked to PSU. Hence, it would be of interest to evaluate which aspects of PSU are especially relevant when looking at negative effects on QoL, life satisfaction and well-being. Research regarding this particular issue is still scarce, although a study by Foerster and Röösl⁵³ on different types of media use found that high social media use was associated with the lowest scores in several aspects of HRQOL in adolescents.

All in all, results hint at a high relevance of future research regarding the topic of PSU in relation to QoL, life satisfaction and well-being, especially in children and adolescents, because, as has been pointed out before, these are especially vulnerable with regard to PSU,⁵ and early on interventions would be important. Next to longitudinal studies examining the direction of the association of PSU with QoL and life satisfaction, studies taking a closer look at which aspects of PSU are primarily related to QoL and life satisfaction would be of special interest.

4.1 | Limitations and Conclusion

This systematic review provides an initial overview over the existing literature on the association between PSU and QoL, HRQOL, life satisfaction and well-being in adolescents, and thus, contributes to a better understanding of these intricate relationships. However, the current work also has several limitations: one limitation is the small number of studies included in this review. Thus, nine studies cover four related, yet conceptually different outcome variables. Clearly, more research is needed, particularly with regard to the question of which aspects of PSU are related to which negative outcome.

Despite the limited number of studies, this review may tentatively state that PSU seems to be related to decreased health-related and overall quality of life as well as life satisfaction, and subjective well-being in adolescents. These findings highlight the relevance of future studies, especially with longitudinal research designs, to help parents, teachers, as well as adolescents to react quickly to an emerging PSU and to help health care professionals to develop effective interventions to increase QoL, satisfaction with life and well-being in those afflicted by PSU.

CONFLICT OF INTEREST

None of the authors have any potential conflict of interest.

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