

University of Groningen

## Physical activity, screen-based activities and their potential determinants

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### *Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*  
2018

[Link to publication in University of Groningen/UMCG research database](#)

### *Citation for published version (APA):*

Kopčáková, J. (2018). *Physical activity, screen-based activities and their potential determinants: Active living during adolescence*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.

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# 8

## General discussion





# General discussion

The aim of this thesis was to examine the relationships between adolescents' physical activity and screen-based activities and the associations of these behaviours with potential determinants (e.g. body image, motives to physical activity, school environment, degree of urbanization, perceived activity-friendly environment). Additionally, this thesis also explored the role of gender, age and socioeconomic differences in these associations.

This final chapter summarises (8.1) and discusses the main findings of the study (8.2). Next, the methodological considerations of the study (8.3) and the implications of the findings for practice, policy and future research (8.4) are addressed.

## 8.1 Main findings

The main findings are summarized per research question.

Research question 1:

*Do associations of body image and gender with physical activity exist? (Chapter 3)*

We found that adolescents with a negative body image less often engage in regular sufficient physical activity than others, and that boys are more likely to be sufficiently physically active. Poor body image among girls did not affect their physical activity, whereas poor body image among boys was associated with a lower likelihood of reaching the recommended level of moderate to vigorous physical activity.

Research question 2:

*Does an association exist between motives for physical activity and the level of physical activity among adolescent boys and girls? (Chapter 4)*

Our results indicate that associations between motives for physical activity (social motives, health motives, "good child" motives, achievement motives) and the level of physical activity partially differ by gender. We found that "good child" motives and achievement motives are associated with the level of PA among boys, and also among girls. Health motives were associated with sufficient PA only among boys, and social motives were associated with sufficient physical activity only among girls.

Research question 3:

*Are the motives for undertaking physical activity items from the HBSC questionnaire reliable among adolescents and does this reliability differ by gender, age group and country? (Chapter 5)*

The motives for undertaking physical activity items from the HBSC questionnaire showed a moderate agreement for most motives in the whole sample and also stratified by gender, age group and country. After dichotomisation we observed moderate test and retest correlation coefficients for almost all examined items such as “to have fun”; “to be good at sports”; “to win”; “to see my friends”; “to get in good shape”; “to look good”; “to please my parents”; “to be cool”; “to control weight” and “it is exciting”. The only exceptions were three motives with weak or trivial correlation.

Research question 4:

*Are the school environment and degree of urbanization supportive for being more physically active and engaging in less screen-based activities among adolescents? (Chapter 6)*

We found a significant association between schools having an area for skating or a tennis court and having active breaks and PA among adolescents. Furthermore, we found that adolescents in small and bigger towns were more likely to be engaged in SB activities than in villages. The association between the accessibility of sports facilities at school and active breaks with PA and SB activities was not modified by the degree of urbanization.

Research question 5:

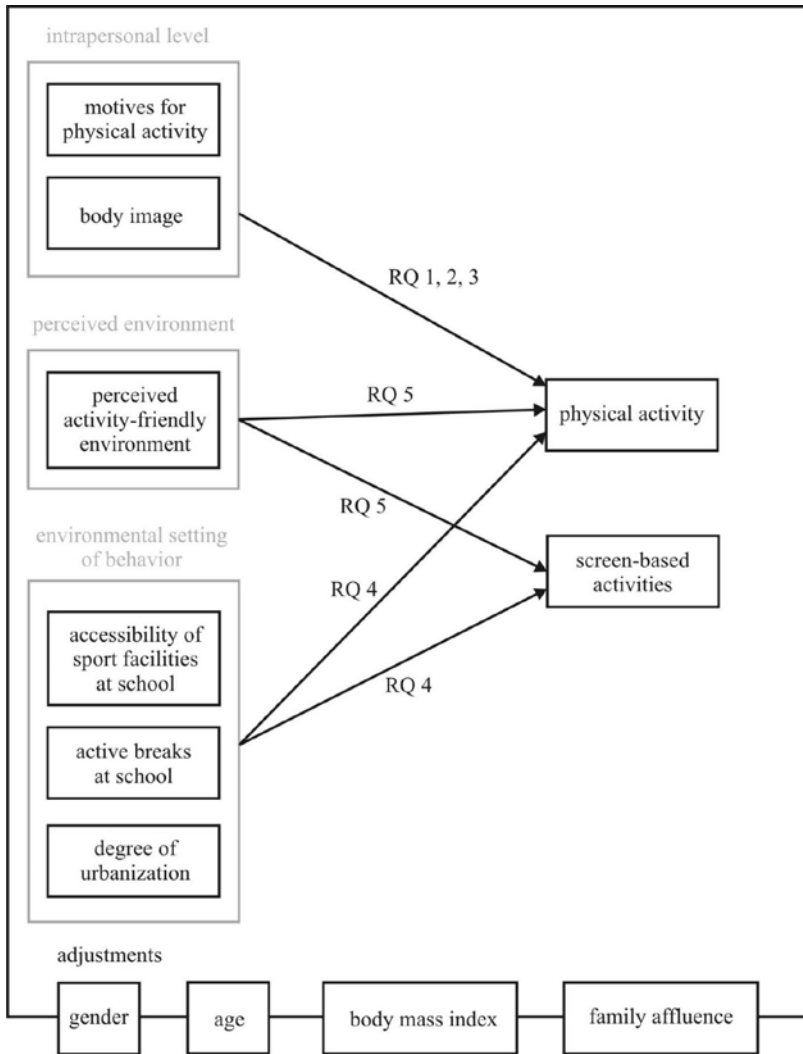
*Is a perceived activity-friendly environment associated with adolescent's behaviour in terms of physical activity and screen-based activities? (Chapter 7)*

We found that perception of the environment as more activity-friendly was significantly associated with a higher probability that adolescents meet the recommendations for physical activity among the four European countries studied: the Czech Republic, Slovakia, Poland and Germany. Furthermore, we found that perception of the environment as more activity-friendly was associated with a lower probability of adolescent's excessive screen-based activities in the four European countries studied. Moreover, younger adolescents, boys and adolescents from highly affluent families tended to meet physical activity recommendations more frequently, while older adolescents and boys tended to have more excessive screen-based activities in the four European countries.

## **8.2 Discussion of the main findings**

The main findings of this thesis will be discussed within the framework of the general aims, as outlined in Chapter 1, and repeated in Figure 8.1. We will focus on the relationships between adolescents' physical activity and screen-based activities and the associations of these behaviours with potential determinants. Finally, we will also discuss the role of country (Figure 8.1).

Figure 8.1 Model of the relationships examined in the thesis.



### **8.2.1 Physical activity, screen-based activities and their potential determinants**

Physical activity and screen-based activities have an important impact on youth development (Inchley et al., 2016). During the last years a discussion has been taking place about the connection between these two behaviours, and it might be inferred that more screen-time activities lead to less physical activity. However, screen-time activities and physical activity are recognised as independent constructs, and various studies have highlighted the relative independence of these two behaviours (Mansoubi et al., 2014; Pearson et al., 2014).

A relatively low level of physical activity and a high level of screen-based activities were highly prevalent among Slovak adolescents. In comparison to other European countries adolescents from Slovakia in all age groups and in both genders could be at the same time physically active and still sedentary. The same pattern can be found in other European countries, such as Bulgaria, Albania, Ukraine or Croatia. Both physical activity and screen-based activities of adolescents could be explained in terms of a socio-ecological approach, and the results of this thesis will be discussed in terms of this approach (Sallis et al., 2006). Ecological models refer to adolescent's interaction with their physical and socio-cultural surroundings. Therefore, for the purpose of this thesis we will discuss its results as the relationships between adolescents' physical activity and screen-based activities and the associations of these behaviours with intrapersonal level, perceived environment and the environmental setting of the behaviour.

#### *Intrapersonal level*

We found that body image is associated with physical activity among adolescents and also that some gender differences exist. Among adolescent girls poor body image did not affect their physical activity, whereas poor body image among boys was associated with a lower probability of reaching the recommended level of moderate to vigorous physical activity (WHO, 2010). This leads to boys, not girls, being prone to be physically inactive when they are dissatisfied with their body image. This gender difference regarding the association of body image seems to originate from different sociocultural expectations. Boys and girls also differ, e.g. in self-perception and motivation. Generally, boys are more engaged in organized and free-time activities (Badura et al., 2015) with the aim of being part of peer relationships, which is not connected directly with the way they perceive themselves. Therefore, it is also important to take a closer look at the motivation for physical activity and possible barriers to it among adolescents.

We found that motives for physical activity were associated with the level of physical activity, and that this association was partially gender dependent. "Good child" motives and achievement motives were associated with the level of physical activity among boys, and also among girls. Health motives were associated with sufficient physical activity only among boys, and social motives were associated with sufficient physical activity only among girls. It was already known that motivation is a personal characteristic that may be one of the key factors for understanding why some people are physically active in their leisure time (Aaltonen et al., 2014). Moreover, the amount of physical activity and the motives for physical activity differ highly by gender (Aaltonen et al., 2014; Iannotti et al., 2013; Caglar et al., 2009; Verkooijen et al., 2009; Kalman et al., 2015b) and by age (Verkooijen et al., 2009; Kalman et al., 2015b). Our findings are mostly in line with previous studies (e.g. Iannotti et al., 2013; Wold&Kannas, 1993; Litt et al., 2011) and also with the self-determination theory (Ryan&Deci, 2000). Motives for physical activity thus vary by gender, and this aligns with differences in physical activity.

In addition, we found that the HBSC questionnaire on motives for physical activity is an acceptable instrument to measure motives for physical activity among adolescents. The continuous-level responses on this questionnaire could better be used than the dichotomised ones, as these continuous-level responses were more stable over time. Motives thus not only align with actual levels of physical activity but can also be measured pretty reliably.

#### *Perceived environment*

We found that a perception of the environment as more activity-friendly was significantly associated with higher odds that adolescents meet the recommendations for physical activity in the four European countries studied. Our study confirms the findings of previous studies (Ding et al., 2011; Haug et al., 2008; Haug et al., 2010; Millstein et al., 2011) showing that promoting adolescents' physical activity through a perceived activity-friendly environment is associated with better achievement of the daily recommended physical activity levels. In contrast, Bringolf-Isler et al. (2015) found that perceived environment was not associated with the physical activity of adolescents. An explanation for this may be that adolescents' perceptions of environments are not similar to more objective aspects of environments. Both perception and actual environment are likely to be important influences (Sallis et al., 2006). Our findings, based on data from young European adolescents, may then be interpreted as that in Central Europe adolescent perception may play at least some role in their actual behaviour.

Moreover, this study showed that perception of the environment as more activity-friendly was significantly associated with less excessive



screen-based activities among adolescents. This is in line with previous research, which suggests that the built environment may be a key in promoting a non-sedentary, more active lifestyle among adolescents (Davison, Lawson, 2006). Our findings are in line with previous studies among Australian children and youth (Veitch et al. 2011; Christian et al., 2015). Veitch et al. (2011) showed that parental satisfaction with the quality of their local parks was associated with less computer time, and that greater public open spaces were associated with less TV viewing among children. Another study showed that spending a lot of time outside is one of the most consistent predictors of reduced screen-based activities in youth (Leblanc et al., 2015). Research on the association between adolescents' perception of an activity-friendly environment and screen-based activities within the European context is scarce, and comparison with previously mentioned studies might be problematic based on the different cultural backgrounds. These findings may then be interpreted as that in Central Europe adolescent perception may play at least some role in their actual experiences with screen-based activities.

*The environmental setting of behaviour*

We found that sufficient physical activity was not associated with the degree of urbanization among adolescents. Moreover, we found that adolescents in small towns, towns and cities were more likely to be engaged in screen-based activities than those in villages. Research on the association between adolescents' screen-based activities and degree of urbanization in a European context is scarce. One exception is a study of young Swiss children, which showed that the levels of screen-based activities were not explained by the built environment (Bringolf-Isler et al., 2015). In addition, some studies in the review of Pate et al. (2011) investigated the associations between measures of sedentary behaviour and the degree of urbanization among sampled children and adolescents, but this yielded heterogeneous studies, i.e. studies of Davey (2008) conducted in China and of Kourlaba et al. (2009) conducted in Greece found that living in urban areas was related to higher levels of screen-time activities. On the other hand, studies of Loucaides et al. (2004) conducted in Cyprus and of Gordon-Larsen et al. (2000) in the US did not find any association between the studied variables. This could guide the choice of parents regarding a place for living, but this is rather unlikely, as other factors determine this. However, our findings indicate that it is really important to support parents and adolescents in small towns, towns and cities in being less sedentary and in creating an environment supporting their active living.

This study showed that screen-based activities and physical activity were not associated with the accessibility of sports facilities, the exception being the availability of an area for skating or a tennis court in association

with physical activity. An explanation of our results might be that those children who are attending schools with higher standards, such as those with accessibility of an area for skating or a tennis court, are better off and are also prone to be more physically active. Previous studies have demonstrated that some physical environmental characteristics in the school setting can influence students' activity level (Haug et al., 2008; Haug et al., 2010; Czerwinski et al., 2015; Sallis et al., 2001; Davison et al., 2006). After the school day has ended, adolescents are more likely to do screen-based activities and less likely to engage in positive behaviours, such as physical activity (Mahoney, 2011). Consequently, it is useful for adolescents to have at least access to use these sport facilities after the end of school day. Our findings indicate that it is also important to support adolescents with active use of sports facilities in schools and outside schools, because access to sports facilities alone does not guarantee their use. Our findings from young adolescents may then be interpreted as meaning that accessibility of sport facilities may play at least some role in their physical activity and screen-based activities.

Last but not least, we found that screen-based activities were not associated with active breaks at school, and physical activity was negatively associated with active breaks at school among adolescents. Previous studies (Haug et al., 2008; Verstraete et al., 2006) have shown that promoting adolescents' physical activity through active breaks can contribute to achieving the daily recommended physical activity levels. However, our finding contradicts the findings of previous studies, as we found physical activity to be lower in the case of active recess. It is probably not only an exceptional case, because similar findings were found among adolescents from the Czech Republic (Sigmundova, oral communication), in a country where physical activity has a better tradition. A possible explanation of our findings could be that young people with access to environmental resources, such as physical activity during breaks at school, may not necessarily use them (Haug et al., 2008). During breaks, students are free to do what they want. Another explanation could be that the information on active breaks as given by the school management might differ from the students' own 'experience of activity', thus explaining the negative association with physical activity. Finally, active breaks may be a response to low physical activity levels and then are not fully able to counteract these low physical activity levels. Based on our cross-sectional data, we cannot discriminate between these three explanations. Further research is needed to fully understand which of these mechanisms may explain this rather unexpected finding.

### **8.2.2 Physical activity, screen-based activities and country aspect**

The studies reported in Chapters 4 and 5 were conducted in Slovakia and the Czech Republic, and we found no statistical differences in the characteristics and findings between these two countries. An explanation might be that both countries were together as Czechoslovakia until 1993, when they separated, and that they still share a very similar cultural and linguistic background. In general, the Czech Republic and Slovakia do not differ that much (Veselska et al., 2011). We expanded our research sample in Chapter 7; the data for that chapter had been collected in four middle European countries (Slovakia, the Czech Republic, Poland and Germany). Three of these countries (Slovakia, the Czech Republic and Poland) share similar cultural, historical and geopolitical background as Visegrad-4 countries. Moreover, in the past they were the part of the Eastern Bloc (Comecon and the Warsaw Pact), with a communist regime during most of the second half of the 20th century. Comparable characteristics may be found partly in Germany, as this country was divided in Eastern and Western parts during this time period as well. The Eastern part was part of the Eastern Bloc as well, which is likely to have led to similar experiences. Given the large similarities in findings regarding these four countries, it might be expected that findings regarding physical activity and screen-based activities from this thesis apply to other Central European countries, too.

## **8.3 Methodological considerations**

### **8.3.1 Quality of samples**

The present study used large and representative samples of adolescents aged 11 to 15 years old, which represents a major strength of the study. Moreover, the response rates in all study samples used in this thesis were very high. Finally, we included a number of countries. A limitation of the present study might be that a small number of adolescents do not attend school and are educated by home schooling. Our study thus missed this group, but that will hardly affect its findings due to the small size of this group. Some data were based on information given only from one informant in the school management, and this may be quite different from students' experiences. Moreover, per school this regarded just one informant. Therefore, in future research we need to triangulate this data, using multiple types of informants and a large number of respondents per school at managerial level.

### 8.3.2 Quality of information

A further strength of this study is the use of validated measures that have been used in various studies and documented in a variety of reports and publications on both national and cross-national levels. A limitation of the present study might be that the data were based on adolescent self-reports, which can be inaccurate and biased by social desirability. The probability of under- or over-reporting was decreased by guaranteeing confidentiality, anonymity and privacy during self-administration of questionnaires in the absence of teachers. In addition, previous research has shown the high validity of the measures used by the present study (Brener et al., 2003; Currie et al., 2014). While self-reported data on psychological complaints are a rather preferred source of information, the validity and reliability of self-reported as well as measured physical activity or sedentary behaviour indicators are discussed heavily in the literature (Bobakova et al., 2015; Biddle et al., 2011; Corder et al., 2009; Sliotmaker et al., 2009). For example, objectively measured physical activity and indicators of sedentary behaviour demand the compliance of respondents, and use of them during research might be difficult for several adolescents. On the other hand, the use of subjective measurement methods makes it possible to obtain more information about the domain and context in which an adolescent's physical activity and sedentary behaviour took place (De Meester et al., 2011). Moreover, regarding school policies, we fully relied on managers, which may have led to some bias in the information. Other sources of information may partially solve this problem, e.g. assessing the activities of schools related to these policies.

### 8.3.3 Causality and confounding

One of the strengths and at the same time a limitation of the study is the cross-sectional design of all the samples. Though our research samples provide information on a range of ages for the same period, the cross-sectional design limits the potential for making causal inferences. Taking into account the robustness of the associations and the fact that adjustment for potential confounders (age, gender, body mass index and family affluence) did not affect the associations that were found to a significant degree provides at least support for the robustness of these associations. However, this does not guarantee that the associations that we found were indeed causal. In particular, they might also be due to common causes, or to reverse causality. However, it should be noted that such common causes might even lead to longitudinal associations, implying that probably the best design to establish causality would be longitudinal or experimental, as a more final foundation of interventions.

## 8.4 Implications

Our study has several important implications for public health practice and policy, as well as for further research.

### 8.4.1 Implications for practice and policy

Our findings suggest that a relatively low level of physical activity and a high level of screen-based activities are very common among adolescents and that these levels are associated with potential determinants on several levels, as represented in the socio-ecological model. The findings of this thesis suggest that interventions based on the socio-ecological approach may be a good option to achieve change in adolescent lives. Following the theoretical framework of the socio-ecological approach (Sallis et al., 2006), preventive strategies should be targeted at each level of influence (intrapersonal level, perceived environment and environmental setting of behaviour).

#### *Intrapersonal level*

Firstly, we found that body image among girls was not associated with physical activity, whereas poor body image among boys was associated with less physical activity. Based on our findings, it seems that for health-promotion programmes to be successful they should consider gender-specific strategies aiming at girls and boys separately. Adolescent boys with a negative body image are less physically active than other boys, and therefore it could be effective to pay attention to this. This implies that at the intrapersonal level it is also important to take a closer look at the motivation for physical activity and possible barriers for it among adolescents, allowing for variation by gender.

Our study showed that the motives for physical activity were associated with the level of physical activity, and this association was again partially gender dependent. “Good child” motives and achievement motives were associated with a higher level of physical activity among boys and also among girls. Focusing on “good child” motives and achievement motives in planned programmes for the promotion of physical activity will probably fit the needs of both girls and boys and might increase their engagement in physical activity. At the same time, stressing social motives might be effective only among girls, while stressing health motives might be effective only among boys, as associations of these motives with physical activity differ by gender according to our results. This implies that to increase the efficiency and successful implementation of programmes for the promotion of physical activity of adolescents, adolescents’ motives should be accounted for and that gender specific motives should be considered in the development and delivery of such interventions.

### *The perceived environment*

We found that perceiving the environment as more activity-friendly was significantly associated with physical activity and screen-based activities among adolescents in four European countries. As adolescents spend approximately half of their days in school, the school day could also be organized in such a way that there are time and facilities available to enable everybody to be active for at least an hour each day. One suggestion could be to build school yards or other facilities nearby homes that are so intriguing that children cannot stay passive near them (Rintala et al., 2011). Even a small change in day-to-day routines at school, e.g. desks that can be lifted into standing positions, incorporating standing or even an activity as a part of the lesson might have a beneficial effect.

### *The environmental setting of behaviour*

This study showed that the place where adolescents live was not associated with their physical activity, but that it was associated with their screen-based activities. Adolescents from small towns, towns and cities were at more risk for being more sedentary in comparison with adolescents from villages. This could guide the choice of parents regarding a place to live. Our findings imply that is really important to support parents and adolescents in small towns, towns and cities in being less sedentary and in creating an environment supporting their active living.

We found that physical activity and screen-based activities were not associated with the accessibility of sports facilities at school. One exception was a significant association between schools having an area for skating or a tennis court and physical activity among adolescents. Our results might be due to the fact that those children who are attending schools with higher standards, such as those with accessibility of an area for skating or a tennis court, are more well off and also more prone to be physically active. Our findings suggest that not only accessibility of sport facilities but also the perception of these facilities as activity-friendly may contribute to their active use. Moreover, availability and accessibility of sport facilities support active living of adolescents and should be regulated within the school environment and the family. This leaves the responsibility on families and children themselves to be active during weekdays and over the weekends, together as a family or by themselves (Rintala et al., 2011). We recommend that schools ensure at least the availability of and access to recreation facilities for after-school and youth-development programmes.

In conclusion, our findings on physical activity and screen-based activities and their potential determinants indicate that the ecological model of active living (Sallis et al., 2006) provides an appropriate and useful theoretical framework for creating implications for practice and policy. Understanding why adolescents are active or inactive in their

life could significantly contribute to the design and delivery of health-promoting interventions.

#### **8.4.2 Implications for future research**

Our findings suggest that Slovak adolescents could at the same time be physically active and still sedentary. The same pattern can be found in other European countries, such as Bulgaria, Albania, Ukraine or Croatia. Based on existing differences in physical activity and screen-based activities, it seems that such activities among adolescents should take into account different approaches for investment into the active living of adolescents.

The study samples used in this thesis provide information on a range of ages for the same period, but some data were based on information given only from the principal or vice-principal of the Slovak schools, and this may be quite different from students' experiences. Moreover, this involved just one informant per school, and how school management perceived e.g. active breaks at school might deviate from the perception of adolescents. Therefore, in future research we need to triangulate such data, using multiple types of informants and involving at managerial level a larger number of respondents per school.

Another implication for future research is connected to the measurement of physical activity and screen-based activities. Measurements of these variables are most commonly made by self-reported questionnaires and by objective measures. It seems that it is not easy to measure these variables among adolescents, because it may be problematic to sensibly sort out the strictly optimal amount of these activities. It has already been mentioned that adolescents can be active and still sedentary. The solution for this problem might be a change in the orientation of researchers, with more focus on measurable outcomes instead of on measures of the process itself. Next, the reliability and validity of physical activity and screen-based activities instruments are more and more questionable and should be explored further. Physical activity and screen-based activities among adolescents might be better measurable by instruments developed for measuring fitness, fatness, obesity and overweight.

We found cross-sectional associations between the studied adolescents' physical activity and screen-based activities and their potential determinants. Given the cross-sectional design of the present study, we could not make strong causal inferences. To disentangle causality, future longitudinal studies on these relations are needed. A time trend analysis could be used to explore the occurrence of physical activity and screen-time activities over time. In addition, some qualitative research and experimental research may also confirm the concepts. However, more research on this topic needs to be undertaken with the aim

of understanding how various other variables may influence adolescents' physical activity and screen-time activities.

In conclusion, our findings indicate that the ecological model of active living (Sallis et al., 2006) is a useful theoretical framework for creating implications for future research in the field of potential determinants of physical activity and screen-based activities. For example, even a small change in day-to-day routines at school, such as desks that can be lifted into standing positions, incorporating standing or even an activity as a part of the lesson might have a beneficial effect.

## **8.5 Conclusion**

Adolescents reported relatively little physical activity and rather many screen-based activities. These behaviours were associated with potential determinants on several levels based on the socio-ecological model, starting with the intrapersonal level (gender-specific role of body image and motives for physical activity), the perceived environment (positive influence of perception of the environment as activity-friendly) and the environmental setting of behaviour (degree of urbanization, some accessibility to sports facilities and active breaks). A better understanding of the potential determinants associated with physical activity and screen-based activities in adolescents are therefore essential in the field of prevention and health promotion. Preventive strategies should involve multiple levels, such as intrapersonal characteristics, perceived environment, behaviour setting (especially the school setting) and policy, and they should also target a wide range of active living across adolescents. Much can be gained also in regard to these relatively new challenges and approaches for adolescent public health.



