about causality. Our findings, therefore, need to be confirmed in longitudinal studies. Moreover, in our study we did not include the use of smartphones, which are a highly portable electronic device that can also be combined with physical activities and outdoor/indoor use. In contrast, typical/classic screen-based activities tend to naturally disrupt physical activities and are limited to indoor use (Iannotti et al., 2009a). Therefore, the effect of smartphone use on physical activity deserves further study.

Conclusions

More and more school-aged children spend excessive time on screen-based activities, and the number of these children increases every year, mainly among older peers. It seems that there are several factors which could have an important impact on screen time. The availability of specific electronic devices in their own bedrooms, for example, or the fact that parents or even family-shared activities might play key role in reducing excessive time spent in front of screens. Based on our results, parents and applying rules about watching TV or playing computer games have only a moderate effect. The home environment and parents may still partly influence the behaviour of their children, including how they spend their leisure time. They could keep in mind that they have an opportunity to change the “unhealthy” lifestyle of their children and encourage them to do alternative activities which could be more beneficial to them.
This thesis focuses on active participation among school-aged children and its association with health. Moreover, it contributes to the understanding of perceived barriers to this participation, especially in adolescents with health conditions. This final chapter summarises and discusses the main findings of the study. Then the methodological considerations of the study and implications for practice and future research are addressed.

8.1 Main findings

Research question 1: *Do adolescents with long-term illness, asthma and learning disabilities differ in screen-based activities?*

We found that adolescents with long-term illness are highly involved in screen-based activities and mostly do not differ from their peers without long-term illness in this regard. However, adolescents with asthma are more likely to play computer games than their peers without any chronic conditions. We also found that adolescents with a learning disability are at greater risk of excessive Internet use.

Research question 2: *Is the association of screen-based behaviour and selected health complaints moderated by physical activity?*

We found that adolescents with more intensive screen-based behaviours have more health complaints and that these associations are not moderated by physical activity. Moreover, excessive working with a computer is related to more health problems than is watching TV.

Research question 3: *Is Internet and computer screen time associated with school difficulties and what is the role of sleep quality and unhealthy eating habits?*

Time spent with a computer was found to be associated with school difficulties directly and also indirectly via high consumption of soft and energy drinks and lower sleep quality and quantity. However, the direct association of time spent on a computer with school difficulties was relatively weak in comparison with the indirect association via unhealthy eating habits and sleeping difficulties.
Research question 4: Do adolescents with diabetes mellitus type-1 perceive barriers to active participation? The more parental worries adolescents perceive, the more likely they are to report diabetes mellitus-related limitations in social relationships, activities at school and leisure-time activities. Adolescents’ personal worries are associated only with limitations in exercising and in social relationships.

Research question 5: Are family-related factors associated with excessive time spent on screen-based activities by adolescents? We found that parental rules that restrict the time spent on screen-based activities are associated with a lower probability of excessively spending time on screen-based activities. However, parental rules restricting the content of TV programmes or computer work are not. Moreover, adolescents who watched TV jointly with their parents every day were more likely to report excessive TV watching.

8.2 Discussion of the main findings
The main findings will be discussed within the framework of the general aims, as outlined in Chapter 1. We will focus on active participation and understanding of perceived barriers to active participation of school-aged children, especially children with health conditions. Moreover, we will discuss the role of screen-based behaviour as a possible barrier to active participation in daily activities. Finally, we will also discuss the influence of these barriers on health. The relations between the five research questions are summarised in Figure 8.1.

Health conditions and active participation
This study shows that long-term illness and other health conditions are associated with the life of adolescents and their family, but that these adolescents do not differ from their healthy counterparts regarding screen-based activities. It has to be pointed out that both groups reported a high involvement in screen-based behaviour (Chapter 3). Findings from the Health Behaviour in School-aged Children study showed that 54% of adolescent girls and 59% adolescent boys from Slovakia exceeded recommended 2 hours per day of watching TV in both gender what rank Slovakia among the ten countries with the highest level of excessive watching TV out of the 41 countries on which data were available (Inchley et al. 2016). Overall, this percentage ranged from 30% (Switzerland) to 69% (Israel). Previous findings on physical activity were very similar: Canadian and Finnish school-aged children reporting long-term illness or disability did not differ from their healthy peers in moderate-to-vigorous intensity physical activity. They were also equally physically inactive. Instead of the recommended 7 days per week they reported physical activity on average 3.3 to 4.7 days a week (Rintala et al., 2011). Our results add that the presence of a health condition as such is not necessarily associated with inactivity among adolescents in Central Europe.
Despite the finding of similar levels of screen-based behaviour among healthy adolescents and those who have a health condition, we found that adolescents with asthma reported a higher involvement in computer games playing, and adolescents with learning disabilities reported a greater risk of excessive Internet use (Chapter 3). The explanation may lie in the motivation of these adolescents. Computer gaming is often classified as a mood-management activity that increases one’s own feelings of competence (Reinecke, 2009; Reinecke et al., 2012) and that may be popular among asthmatic children as a substitution for physical activity and a coping strategy. In addition to motivation, multiple other factors, like poor motor skills and executive function deficits in children with learning disabilities, may contribute to the low levels of physical activity and subsequently to the high levels of sedentary behaviour (Cook et al., 2011). Some studies focused on screen-based activities among children with a chronic condition have also suggested that excessive time spent in front of screens is associated with negative health outcomes. Increased sedentary behaviour in children with asthma was related, e.g. to obesity (Lang et al., 2004; Kim et al., 2011). Due to a lack of physical activities, asthmatic children may have lower self-esteem and self-efficacy and greater mood difficulties (Seigel et al., 1990; Vila et al., 2000). Children with some types of health conditions thus seem to be at higher risk of excessive screen-based activities, especially when combined with other personal factors.

Moreover, we found that high involvement in screen-based activities, particularly working with a computer, was associated with health complaints among healthy adolescents and that these associations were not moderated by physical activity (Chapter 4). Previous research has shown that excessive time spent watching TV or playing computer games is associated with physical and psychological health complaints (Torsheim et al., 2010; Costigan, et al. 2013). These previous findings may reflect the important role of body postures during these activities. Incorrect sitting postures when spending time with a PC and watching TV may negatively affect different parts of the body, mostly the back or neck. Incorrect postural angles, as an element of sitting, seem to be a risk factor for upper quadrant musculoskeletal pain, as Brink & Louw (2013) found. In addition, other studies show that excessive playing of PC or video games negatively affects sleeping habits (Punamäki et al., 2007) or sleep latency (Higuchi et al., 2005) and is associated with elevated levels of anxiety and depression and even with poorer well-being and life satisfaction (Mentzoni et al., 2011; Chanfreau et al., 2008). Adolescents prefer screen-based activities, regardless of the presence of a health condition, at the expense of participation in, e.g. exercise, school activities or social relationships. This choice may influence their health negatively.

Personal factors related to active participation
We found that screen-based activities are indirectly associated with lower active participation in school through several personal factors in healthy children as well as in those with a health condition. Specifically, time spent with a computer was associated with school difficulties, particularly when combined with higher consumption of soft and energy drinks resulting in worse quality of sleep (Chapters 5). This association may be causal, i.e. the time spent with a computer causing the other problems, as is partially supported by other studies, which show that the use of computers late into the night and subsequently consuming of beverages containing caffeine or sugar are related to the adolescent’s ability to stay alert and fully functional. As a consequence, during the next day adolescents try to stay alert by consuming soft drinks, with caffeine, taurine, guarana and other stimulating ingredients as the main components. Such drinks have a stimulation effect (Babu et al., 2008), and they might disrupt sleep as well (Temple, 2009). Moreover, high caffeine consumption during the previous evening is associated with adolescents’ daytime sleepiness the next day (Kristjansson et al., 2011), which may simply be due to sleep deprivation, too. Problems with sleeping in terms of short sleep duration, daytime sleepiness or poor sleeping quality are frequent among adolescents (Gradisar et al., 2011), but sleep quality and quantity seem to be crucial for them, especially in the school context (Curcio et al., 2006). Thus, our finding that higher levels of screen-based behaviour on the previous evening together with other factors limit adolescents’ participation in school activities the next day may be causal indeed.

However, an opposite causality is also possible. Hume et al. (2011) indicated that symptoms of depression predict a higher level of TV watching, which suggests that screen-based activities and some health complaints do not have to be in a one-way association. Moreover, according to the mood modification hypothesis of media use, media entertainment is often used as a tool for regulating stressful and otherwise unpleasant feelings (Reinecke et al., 2012). Adolescents may thus turn especially to media entertainment to regulate their school problems. This may lead to a vicious circle: the higher time on the Internet may then cause less sleep and further worsen school problems.

For adolescents with a health condition, their worries due to their condition are reported as a direct barrier to active participation in different areas of their lives, especially in physical activities and social relationships (Chapter 6). In general, our findings indicate that children with a health condition have fewer friends and lower levels of social behaviour. This, in turn, leads to their isolation and increases the odds of becoming a victim of bullying in school (Georgiadi et al., 2012; Lindsay & McPherson, 2011). Moreover, some of the personal characteristics, like lack of motivation or poor health, might be consequently associated with...
a lower level of leisure-time physical activities and last into adulthood, as well (Cerin et al., 2010). Finally, screen-based activities themselves might act as barrier to active participation because they not only occupy time that could be used for other activities, but they also absorb the capacity for other activities. However, adolescents need to participate in social activities in order to develop their skills and competencies, which have impact on their health. Our findings add that the health condition and the associated worries indeed limit adolescents’ participation, probably via a number of routes.

Environmental factors related to active participation

We found that environmental factors, including family-related factors, restrict active participation of adolescents, too. Parents stimulate more screen-based behaviour through not applying restrictive rules about time spent with computer or TV as well as on frequent joint TV watching (Chapter 7). Previous research shows that parents are effective modulators of the amount of time spent with computer or television, especially through restrictions and joint activities (Nikken & Jansz, 2006; Brooks et al., 2016). Mascheroni & Cuman (2014) show that rules regarding time are an important tool to regulate adolescents’ media consumption, but due to the diversification of devices and programmes and the variation between age groups it is quite complicated for parents to find the right level of rule-setting. Some parents set a general limit for all screen media, while others try to limit time for each single device. Limits seem to be set rather intuitively and individually without considering the characteristics and affordances of the particular media (Mascheroni & Cuman, 2014). Moreover, watching TV together with parents does not give adolescents another model of how to spend their leisure time; it does not promote adequate structuring of their leisure time and thus seems to lead to more screen time. Thus, the home environment, especially parents, has the opportunity and means to influence the sedentary behaviour of children, including how they spend their leisure time.

Parental worries as perceived by children with a health condition were reported as being a direct barrier to active participation, mainly in social relationships, activities at school and leisure time activities (Chapter 6). According to a review study (Shields, 2012), there is a wide range of barriers to physical activities, including a lack of knowledge and skills, the child’s preferences, fear, parental behaviour, negative attitudes to disability, inadequate facilities, lack of transport, lack of programs and staff capacity, and cost. In relation to these findings, the qualitative study of Shields & Synnot (2016) indicates that social barriers to participation, such as the attitudes of parents, staff and peers, are more influential than the other ones. This might be associated with the fact that parents are aware of all the strict rules required for self-management of the chronic condition and are concerned about the child’s adherence, which is often translated into stressed interactions between themselves and their children. Moreover, parents have considerable anxiety about their children’s future well-being (Carroll et al., 2006). In addition, parents of children with a health condition report that their over-protectiveness limits their child’s independence (Heah et al., 2006), and that this is really associated with decreased participation in active participation (Majnemer et al., 2008). These findings can be interpreted as meaning that the family is an important factor in influencing active participation among adolescents. On one hand, parental worries are viewed as a barrier to participation in various activities. On the other hand, implementing restrictive parental rules provides a time slot for active participation.

Regarding environmental factors, school seems to be an important determinant of active participation of healthy adolescents as well as of adolescents with a health condition.

The physical environmental characteristics of schools (i.e. facilities for physical activity) relate to students’ daily physical activity at school (Haug et al., 2008; Haug et al., 2010), but evidence on the connection of school facilities with screen-based activities and activity is lacking. A study in Slovak adolescents (Kopcakova et al., accepted) showed that not the school environment but the degree of urbanisation was associated with lower screen-based activities. In addition, a study in young Swiss children showed that rates screen-based activities were not associated with the nature of the built environment (Bringolf-Isler et al. 2015). Moreover, having a higher accessibility to sport facilities at school was associated with higher rates of sufficient physical activity of adolescents (Kopcakova et al., accepted).

As for active participation of adolescents with a chronic condition, it seems that management and treatment of such condition might affect their participation within the school context. Those adolescents have to face with many restrictions, such as treatment regimens or special educational needs, what might lead to school absence, resulting in social isolation or lower academic achievement (Jackson 2013, Michaud et al. 2005). Therefore, inclusive education is a necessity for providing quality education for these children. Dyssegaard and Larsen (2013) conclude that successful inclusion requires instruction or in-service training of teachers in intervention initiatives that target children with special needs. This training’s focus should be access to resource persons (e.g. school nurse, assistant) who can supervise and offer direct support during teaching; and furthermore increasing the knowledge of evidence-based teaching methods and intervention initiatives that target special needs of these children.

According to the European Agency for Special Needs and Inclusive Education, segregation of pupils with special needs has been increasing since 2008 and there are huge differences between European countries.
For instance, Italy has almost 0% segregation, whereas the Czech Republic or Belgium have percentages ranging from 3.9% to 4.7%. In Slovakia, over 6% of pupils with special needs are educated in segregated settings. These percentages rank Slovakia among the countries with the highest level of segregation among European countries. Despite we do not know what kind of special need prevails among children who are segregated, it might indicate considerable barriers of inclusive education in Slovakia which might face any children with special need (European Agency for Development in Special Needs Education, 2008, 2012). The educational approach and appropriate school environment of all students at schools, including students with chronic conditions may contribute to the provision of a good quality education for all students (Muntaner et al., 2014).

**Clustering of health-compromising behaviour**

Excessive screen-based behaviour, duration of sleeping, consumption of soft and energy drinks might coincide simply because they are parts of one behavioural cluster. The theoretical and empirical evidence supports the existence of organized patterns in adolescent health-compromising behaviour (Petraitis et al., 1995; Jessor, 1991; van Nieuwenhuijzen et al., 2009). For example, duration of sleep clustered in a sample of 12- to 15-year-old Dutch adolescents with substance use related behaviour (e.g. alcohol consumption, smoking, drug use) switched into a norm-breaking cluster (e.g. delinquency, aggression, drug abuse, smoking) in late adolescence (16-18 years), but fit into a health-promoting behaviour cluster in adulthood (19-40 years) comprising nutrition and exercise-related behaviour (van Nieuwenhuijzen et al., 2009).

Applying evolutionary theory, adolescents with educational aspirations are more likely to be involved in health-promoting behaviour than those without these aspirations, because investment in health is highly valuable for them. Educational expectations were positively associated with health-protective behaviours (e.g. daily fruit and vegetable consumption, regular exercise, tooth brushing) and negatively associated with health-compromising behaviour (daily crisps consumption, daily coke/sugary drinks, alcohol consumption, smoking, fighting, having sexual intercourse) in 15-year-old Scottish adolescents (Whitehead et al., 2015). Children with educational aspiration might be more motivated to control time spent with a computer, avoid drinking soft and energy drinks to suppress tiredness and keep sufficient time of sleeping to assure capacity for successful participation in school activities.

### 8.3 Strengths and Limitations

#### 8.3.1 Quality of the sample

A major strength of this thesis is that it is based on two nationally representative samples of adolescents aged 11 to 15 years, with data that are comparable with other international data from the HBSC study. Moreover, the response rates of both samples were high. Thus, selection bias is unlikely and representativeness is high. The sample of adolescents with diabetes mellitus type 1 from outpatient clinics was small. However, we reached a high response rate in a chronically diseased adolescent population which is not so numerous in Slovakia. Moreover, given the specialised nature of diabetes care for adolescents, these clinics are likely to serve most of the patients concerned in their catchment area. Therefore, we do not expect that we had any major selection bias.

#### 8.3.2 Quality of information

Regarding the quality of the information that we obtained, we used validated internationally recognized instruments that have been used in various studies and documented in a variety of international and national reports and publications (Inchley et al., 2016; Currie et al., 2014; Roberts et al., 2009).

However, a limitation might be the fact that we used only self-reported data, which can be inaccurate and biased by social desirability. While self-reported data on psychological complaints are a rather preferred source of information, the reliability of self-reported physical activity or sedentary behaviours has been heavily discussed in the literature (Bobakova et al., 2015; Biddle et al., 2012; Corder et al., 2009; Slootmaker et al., 2009; Baquet et al., 2007; Nilsson et al., 2002). Self-reported measures of activity participation (e.g. physical activity, screen-based activity, organized leisure-time activities) have been reported to have acceptable test-retest reliability, despite the fact that these tools do not fully estimate time spent on an activity accurately, they do rank accurately (Bobakova et al., 2015; Bosakova et al., 2016; Corder et al., 2009).

We further used a question on long-term illness which is very general and might comprise a group of health problems that is very heterogeneous with regard to type as well as severity, and consequently also with regard to their impact on daily activities (e.g. participation in school activities, leisure-time activities). Alternatively, one might start from a patient population of a specific service, as we did for diabetes. This alternative may have the risk, however, that only severe case are included, except if most patients require that type of service, such as in diabetes. Another limitation might be that parental rules-setting on time and content restrictions for watching TV as well as computer work were measured based
Screen-based activities have become a preferred way of spending leisure time among adolescents. This is connected with negative health outcomes. The excess in screen-based activities at the expense of physical activity associated with undesirable health consequences implies that time spent with a computer especially needs to be restricted in children to prevent health complaints. One way might be to promote a healthier and active lifestyle, for instance by promoting alternative organised leisure-time activities which might be more beneficial for adolescents (Knifsend & Grahan, 2012; Badura et al., 2016). Moreover, screen-based behaviour should not be at the expense of active participation in other daily activities, like social relationships, organised leisure-time activities, physical activity or school activities. Children’s capacity for participation might be directly or indirectly decreased via deteriorating their sleep quality due excessive screen-based behaviour. Therefore, sufficient quality of sleep needs to be promoted by restricting soft and energy drinks and devoting sufficient time for sleep.

Secondly, our results showed that adolescents with a health condition perceived worries in their parents, which affected their own participation in daily activities. The importance of these worries implies that we should pay much more attention to these worries. Our focus should therefore also be on the education of parents in management regimes of chronic diseases. Moreover, appropriate interventions could help parents to acquire effective strategies of coping with the chronic condition of their children, as evidence suggest that the majority of them needs to adapt to management of such condition in the longer term (Lowes & Lyne, 2000).

Considering existing barriers in the physical environment, parents of children with a health condition are often stressed about limitations due to the conditions of their children and view their children as being less able to handle environmental barriers. That might affect the involvement of the child in e.g. physical activity (Riner & Sellhorst, 2013). Thus, environmental barriers besides personal and familial factors are perceived as significant contributors to insufficient engagement in physical activities (Shields et al., 2016). This implies that making supportive and safe physical conditions for active participation of children with health disadvantage is crucial, as well.

Finally, we found that in the home environment parents play an especially important role in encouraging children in their active participation through restriction of time spent with screen-based activities. The findings of EU Kids Online show that most children go online at home, which indicates that their parents are the best positioned to mediate their children’s Internet usage. Four forms of parental mediation were found to be most useful: active mediation, restrictive mediation, monitoring and active mediation of the child’s safety (Livingstone et al., 2011). Research suggests that the effectiveness of these strategies is complex and that using only one strategy does not have long-term effects. However, using at least one strategy is better than no strategy (Blinka & Sevcikova, 2014). Therefore, interventions should be focused on improving parental mediation skills and their implementation at home.

Our study also implies several suggestions for future research. One of our study samples comprised a group of adolescents with diabetes mellitus type 1. We reached a high response rate in the catchment area of two hospitals, but the sample size was still quite small due to the low prevalence of active participation in other daily activities, like social relationships, organised leisure-time activities, physical activity or school activities. Children’s capacity for participation might be directly or indirectly decreased via deteriorating their sleep quality due excessive screen-based behaviour. Therefore, sufficient quality of sleep needs to be promoted by restricting soft and energy drinks and devoting sufficient time for sleep.

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of DM-1 in the Slovak adolescent population. Recruiting more outpatient clinics with a larger catchment area regarding adolescents with DM-1 is an option to increase the sample size. Moreover, data from health professionals and parents might provide additional information on active participation and health among adolescents.

As for the quality of information, in our study we used only self-reported data on perceived limitations in participation in different areas of adolescents’ lives. However, adding information about health indicators assessed by professionals (e.g. severity of the disease, treatment regime, objective assessment of limitations, compliance) might provide us with some specifics connected to the impact of a particular health condition and its treatment on the daily activities of adolescents.

In this thesis we focused on active participation as well as screen-based activities of adolescents. Using a better measurement of active participation and mapping a wider range of activities that adolescents undertake might provide more details about such behaviour and its associations with health. Furthermore, the available evidence suggests that different factors (e.g. child’s preferences, fear, parental behaviour, negative attitudes to disability) might act as barriers to active participation (Shields et al., 2012). At the same time, adolescents and their parents identified several facilitators (e.g. the child’s desire to be active, involvement of peers, family support), but further research is needed to examine possible barriers as well as facilitators in particular clinical groups of adolescents.

Finally, the cross-sectional design of our study implies another way for future research. Longitudinal research focused on leisure-time activities of adolescents and its organisation by parents should confirm our results.

8.5 Conclusion

A considerable number of adolescents exceeded the recommended duration of involvement in screen-based activities and at the same time they were not sufficiently physically active, which was associated with negative outcomes (e.g. physical and psychological health complaints). Similarly, adolescents with long-term illness or chronic conditions reported higher levels of screen-based behaviour, but they did not differ from their peers, with exception of adolescents with asthma and learning disabilities. Such children perceived barriers to active participation, including parental and personal worries, which might be associated with frequent engagement in screen-based activities. Moreover, parental restrictions as well as family joint activities were found to be important determinants of the amount of time spent with screen-based activities. Active participation should be promoted, particularly in adolescents with chronic conditions, as they might face more barriers than their healthy counterparts.

Intervention strategies should target their social context, including family and school, as well as the creation or increasing of a physical activity-enhancing environment.
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