The Association between Screen Time, Physical Activity and Sleep Problems among Primary School Children in Amsterdam during the COVID-19 period (2019-2022): A Cross-Sectional Study

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Abstract

Background: During COVID-19, there has been a decrease in physical activity and an increase in screen time among children. It is known that a high screen time and low physical activity lead to more sleep problems. This study's main aim was to investigate the association between physical activity, screen time and sleep problems among primary school children in Amsterdam during the COVID-19 period. It also aimed to investigate differences in sleep problems, screen time and physical activity throughout the school years (2019/2020, 2020/2021 and 2021/2022) and between sociodemographic factors.

Methods: This cross-sectional study included children of ages 5 and 10 years old who live in Amsterdam (n = 6304 and n = 4748). The validated questionnaire *'Jij en Je Gezondheid'* was filled in by parents to collect data. Chi-square tests were performed to test differences throughout the school years and between sociodemographic factors. Logistic regression analyses were performed to correct for sociodemographic factors: sex, ethnicity, socioeconomic status of the neighbourhood, education level of parents and family composition.

Results: This study found sleep problems in 9.1% of 5–year olds and 10.5% of 10–year olds. Over three school years, sleep problems remained stable for 5–year olds but improved in 2020/2021 among 10–year olds. Notably, there was an increase in screen time (≥2 hours per day), decrease in playing a sport (<0.5 hour per week) in 2020/2021 and an increase in playing outdoors (≥1 hour per day). Sociodemographic factors played an important role in sleep problems, screen time and physical activity for both age groups. Non-Western children, those living in a (very) low socioeconomic status neighbourhood, children with parents with a low/middle education level and those not living with both parents consistently had *un*favourable behaviours (screen time ≥ 2 hours per day; playing a sport <0.5 hour per week; playing outdoors <1 hour per day). When correcting for confounders, the study found that a screen time over two hours per day heightened the likelihood of having sleep problems, compared to a screen time less than 2 hours per day for both age groups (5 yr.: OR=1.83, 95% CI=1.31-2.55 and 10 yr.: OR=1.62, 95% CI=1.24-2.13). However, playing a sport less than half an hour per week (OR=1.49, 95% CI=1.05-2.11), playing outdoors less than an hour per day (OR=1.50, 95% CI=1.18-1.92) and *un*favourable behaviour (OR=3.00, 95% CI=1.55-5.81) only showed statistically significant associations with sleep problems among 10–year olds.

Conclusion: There were statistically significant differences observed for both age groups in sleep problems, screen time and physical activity, throughout the school years and between sociodemographic factors. Furthermore, a high screen time was positively associated with sleep problems among both 5– and 10–year olds; physical activity was only found to be positively associated with sleep problems for 10–year olds. Future research should explore causal relationships and the specific restrictive measures during the COVID-19 period on children's screen time and physical activity in relation to sleep.

Keywords: Screen time, Physical activity, Sleep problems, Children, COVID-19.

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1. Introduction

Sleep problems among children are a public health concern (Chattu et al., 2018; Belmon et al., 2021). Poor sleep can be characterised by insufficient sleep or, conversely, sleeping too long and/or a low sleep quality (Leone et al., 2018). The recommended sleep duration for children 3–5 years old and 6–13 years old is, respectively, 10–13 hours and 9–11 hours per night (Antczak et al., 2020). However, worldwide, children do not meet these guidelines (Antczak et al., 2020). A study by Roman-Viñas et al. (2016) reported that across the twelve studied countries, only 42% of the children met the sleep guidelines. In addition to decreasing sleep duration, problems such as low levels of sleep efficiency and quality are growing among children (Belmon et al., 2022).

This growing trend is concerning, because childhood is the most crucial phase for growth and development, and impacts health outcomes throughout life (Likhar et al., 2022). The presence of sleep problems affects different domains of development (physical, cognitive and socioemotional), which can lead to a higher risk of diverse problems later on in life, such as non-communicable diseases, cognitive problems and behavioural difficulties (Bothe et al., 2022; Schlieber & Han, 2021). Adequate sleep is especially important during early childhood, because this is the most vulnerable time, where healthy habits are acquired (Schlieber & Han, 2021). Additionally, health problems due to sleep problems lead to higher economic and social costs (Chattu et al., 2018; Leone et al., 2018).

Childhood sleep problems are complicated health issues, which are influenced by a wide range of factors that interact with each other (Komrij et al., 2020). Research has repeatedly shown how important lifestyle choices are in determining childhood health, and particularly sleep. Screen time and physical activity are factors that are known to play a vital role in sleep specifically (Fonseca et al., 2021; Komrij et al., 2020). Children aged 5 years and above are advised to limit screen time to a maximum of two hours per day (Nederlands Centrum Jeugdgezondheid, n.d). Additionally, they are encouraged to engage in at least one hour of moderate intensity physical activity per day (Nederlands Centrum Jeugdgezondheid, n.d). When these recommendations were not met, low physical activity levels were found to be negatively associated with children's health development (Chaput et al., 2020; Kerai et al., 2022).

Screen time can affect sleep negatively due to reduced melatonin production, which is a hormone produced to signal nighttime information throughout the body, promoting sleep (Hale et al., 2018; Wood et al., 2013). Melatonin production is normally increased before bedtime,

but the blue light emitted from screens suppresses this production, delaying bedtime (Gringras et al., 2015; Hale et al., 2018). As shown in a systematic review, the most consistently screen types associated with sleep are computer use, unspecified screen time, video games and mobile devices (Hale & Guan, 2015).

Studies have found that when children are more physically active, they have a longer sleep duration and better sleep efficiency (Afonso et al., 2022; Larrinaga-Undabarrena et al., 2023). Physical activity can be a protective factor for good sleep due to various reasons, such as a higher energy expenditure (Pano-Rodríguez et al., 2023). Furthermore, it ensures the production of melatonin, and the release of diverse neurotransmitters, such as endorphins, which all result in improved relaxation and reduced stress and anxiety (Alnawwar et al., 2023).

During the COVID-19 pandemic, the daily routines of children changed, which impacted lifestyle factors (Scapaticci et al., 2022). Examples are lower levels of physical activity, social activity and higher levels of screen time (Lucchini et al., 2022; Okely et al., 2021). Studies in the Netherlands showed that children did not meet the guidelines for physical activity (at least one hour of moderate intensity physical activity per day) during the lockdown and participated less in sport activities due to restrictions (Nederlands Jeugdinstituut, 2021). Before the lockdown, 64% of the children met the guideline, but this was only 20% during the lockdown (Nederlands Jeugdinstituut, 2021). The lockdown restrictions also resulted in more screen time among children due to homeschooling and less outdoor activities (Nederlands Jeugdinstituut, 2021). Over fifty percent of the children had increased screen time, which was partly due to parents being less strict (Nederlands Jeugdinstituut, 2021).

In addition, the COVID-19 pandemic had an impact on the sleep routines of children. A systematic review by Jahrami et al. (2021) presents a prevalence rate of 32.3% for sleep problems among the global general population during the pandemic. Among Dutch children (8-18 years), 5% reported more sleep problems in comparison to the situation before the first lockdown (before COVID-19: 6.1% and during the lockdown: 11.5%) (Luijten et al., 2021; Nederlands Jeugdinstituut, 2021). The most reported changes among children worldwide were increased sleep duration, delayed bed- and waking times, increased sleep latency and more sleepiness during the day (Camacho-Montaño et al., 2022).

Studies have repeatedly shown that as the COVID-19 pandemic spread and caused disruptions to daily routines, there was an increase in sleep problems and screen time and a decline in physical activity among children (Jahrami et al., 2021; Okely et al., 2021; Scapaticci et al., 2022). As previously mentioned, screen time and physical activity do have an association

with sleep, especially among children (Fonseca et al., 2021; Komrij et al., 2020). Nevertheless, a knowledge gap exists regarding the association between sleep and physical activity and screen time during the COVID-19 period. The pandemic has been a unique circumstance, that could have long-term impact on the health and development of young children. Consequently, it is important to investigate the association between screen time, physical activity and sleep problems among a study population of primary school children during the COVID-19 pandemic.

Additionally, studies found that sociodemographic factors have an association with lifestyle factors and health outcomes (Doane et al., 2018; Ke et al., 2022; Nagata et al., 2022). Sex, ethnicity, socioeconomic status (SES) and education level are examples of sociodemographic factors described in studies to be associated with sleep, screen time and physical activity. For example, boys were more likely to meet physical activity guidelines than girls (Ke et al., 2022). Furthermore, income, SES and education level of parents were also associated with more sleep problems among children, but also with fewer physical activity and higher levels of screen time among children (Doane et al., 2018; Ke et al., 2022; Nagata et al., 2022).

Therefore, the main aim of this cross-sectional study is to investigate the association between screen time and physical activity and sleep problems among primary school children aged 5 and 10 years old living in Amsterdam during COVID-19 over the period of 2019-2022.

The secondary aim was to investigate differences in sleep problems, screen time and physical activity throughout the three school years (2019/2020, 2020/2021 and 2021/2022) and between sociodemographic factors.

The research findings will contribute to the prevention research of The Public Health Service of Amsterdam (GGD Amsterdam), which aims to create a healthier population through prevention (GGD Amsterdam, 2021). This is done through Dahlgren and Whithead's 'Determinants of Health Model', which demonstrates how both internal and external factors can have an impact on complicated health issues such as sleep (Komrij et al., 2020). This study will contribute to knowledge to prevent disease, reduce additional healthcare costs and maintain health. Consequently, it will contribute to working towards sustainable health by investing in early childhood development, since this research targets primary school children (Likhar et al., 2022).

2. Methods

2.1 Study design, setting and study population

This cross-sectional study consists of data from school years 2019/2020, 2020/2021 and 2021/2022, each linked to a phase of the COVID-19 period. The first school year corresponds to the beginning of COVID-19, the second school year is the year in which COVID-19 was mostly present throughout the whole school year and the last school year is where restrictive measures vanished permanently. It included 3178, 3896 and 3978 children for the respective school years. Parents were asked to fill in a digital questionnaire about their child by GGD Amsterdam. This study included children of 5 years and 10 years old in Amsterdam.

GGD Amsterdam aims to present a representative population with their research (GGD Nederland & RIVM, 2009). Therefore, they make use of multiple weighting factors in their data. The data were weighted by sex, ethnicity and SES of the neighbourhood. This leads to less bias caused by non-response (GGD Nederland & RIVM, 2009).

The unweighted data were only used for the descriptive statistics. The weighted data were used for the descriptive statistics, chi-square tests and the logistic regression analyses.

2.2 Data collection

2.2.1 Instrument

Data were collected using the questionnaire '*Jij en Je Gezondheid*' in Dutch. GGD Amsterdam, developed this questionnaire as part of the preventive health examination (PGO), conducted by the Youth Health Care (JGZ). The questionnaire used for this study, targets primary school children at the age of 5 (PGO5) and 10 (PGO10) years old each year. The parents of the children were asked to fill in the questionnaire at home before the contact moment, where their children's height and weight were also measured.

Parents were informed about the purposes of the data, which were for scientific research and to provide advice to schools and the municipality. Data were pseudonymised. At the end of the questionnaire, the parents were asked for consent.

The questionnaire consists of multiple short, reliable and validated screening lists. It covers various topics regarding the health and development of children, based on the guidelines of the Youth Health Care *(Appendix A)*. The guidelines also determine the cut-off points (*Appendix B)*. Only the topics relevant to this study will be explained further.

2.2.2 Outcome measures

Sleep problems were asked according to the '*Kind Slaap Diagnose Lijst (KSDL)*'. This screening list consists of nine different topics, based on the questions regarding 'sleep'. The topics were (1) falling asleep and/or sleeping through, (2) waking up in the morning, (3) concentration and/or memory, (4) mood and/or temper, (5) sleepiness and/or fatigue, (6) snoring or other breathing problems, (7) nightmares or night terrors with severe reactions such as sweating, (8) sleepwalking and (9) phenomena such as teeth grinding, head bobbing, head rolling, rocking, etc.

All these topics were asked given five possible categorical answers; 'Never'=0 (points), 'Rarely='0, 'Sometimes'=0, 'Usually'=1 and 'Always'=2. A maximum of eighteen points could be scored in total. Parents were asked to think about the past four weeks when answering the questions. These variables were clustered together to form one dichotomous variable. Children were categorised as having sleep problems, when they scored two points or higher in total for the nine topics.

2.2.3 Determinants

The determinants were 'screen time' (hours per day) and physical activity, which consisted of two determinants: 'playing a sport' (hours per week') and 'playing outside' (hours per day). All three determinants were asked given five categorical answers; '(Almost) never'=0, 'Less than half an hour a day/week'=1, 'Half an hour to 1 hour a day/week'=2, '1 to 2 hours a day/week'=3 and '2 hours a day/week or more'=4. Parents were asked to think about the past week when answering these questions.

All three determinants were dichotomised and renamed into groups ('No' and 'Yes'). For each determinant a maximum of four points total could be scored. Screen time was presented as 'Screen time of maximum two hours per day' ('No'=4 and 'Yes'=0–3). Playing a sport was presented as 'Playing a sport for a minimum of half an hour per week' ('No'=0–1 and 'Yes'=2–4) and playing outside as 'Playing outside for a minimum of an hour per day' ('No'=0–2 and 'Yes'=3–4). The cut-off points were based on the guidelines of the Youth Health Care *(Appendix B).*

Additionally, screen time, playing a sport and playing outdoors were combined for the logistic regression analyses. It was 'favourable behaviour' when all three determinants were categorised as 'Yes' (screen time <2 hours per day, playing a sport ≥0.5 hour per week and playing outdoors ≥1 hour per day). And it was 'unfavourable behaviour' when all three

determinants were categorised as 'No' (screen time ≥2 hours per day, playing a sport <0.5 hour per week and playing outdoors <1 hour per day).

2.2.4 Covariates

The logistic regression analyses included the sociodemographic factors of the study population as confounders. Literature showed that sociodemographic factors have an association with sleep problems, screen time and physical activity (Doane et al., 2018; Ke et al., 2022; Nagata et al., 2022). This study included the following confounders; sex, ethnicity, SES of the neighbourhood, educational level of parents and family composition.

2.3 Data analyses

Data were analysed separately for 5– and 10–year olds, because statistically significant differences between the age groups were observed across multiple sociodemographic factors; ethnicity, education level of parents and the family composition (p<0.001 for all three) (see Appendix C: Table A). Statistically significant differences were only observed for the education level of the parents among the school years (5 years (yr.): p=0.02, 10 yr.: p=0.03) (see Appendix C: Table B and C). Consequently, data were not analysed individually per school year.

Descriptive statistics were applied to provide an overview of the study population. This was presented using frequencies (n), percentages, means and standard deviations (SD), depending on the variable.

Chi-square tests were performed to test the differences between school years and sociodemographic factors. This was done for sleep problems, screen time, playing a sport and playing outdoors based on the sociodemographic factors (sex, ethnicity, SES of the neighbourhood, educational level of parents and family composition) of the study.

The assumptions of logistic regression were checked before the analyses were performed. Multiple logistic regression analyses were conducted to examine the association between sleep problems and the determinants; screen time, playing a sport and playing outdoors, adjusted for confounders.

Data were analysed using IBM SPSS Version 26. A p-value of < 0.05 was considered statistically significant, which is presented in bold in the tables in the next section.

3. Results

3.1 Characteristics of the study population

The characteristics of the study population can be found in Table 1 before and after weighting, divided by 5– and 10–year olds. Before weighing, the total population of 5–year olds was 6304 and for 10–year olds, 4748. In 2019/2020, the total population for the 5–year olds was 1774 (28.1%) and for the 10–year olds, 1404 (29.6%). The number of 5– and 10–year olds was larger in school years 2020/2021 (5 year (yr.): n = 2249, 35.7%, 10 yr.: n = 1647, 34.7%) and 2021/2022 (5 yr.: n = 2281, 36.2%, 10 yr.: n = 1697, 35.7%). In both age groups, the majority was Dutch (5 yr.: 54.1%, 10 yr.: 57.0%), parents had a high education level (5 yr.: 85.0%, 10 yr.: 82.7%), and children mostly lived with both parents (5 yr.: 90.3%, 10 yr.: 85.5%). The minority lived in neighbourhoods with a very low or low SES (5 yr.: 14.7% and 11.8%, 10 yr.: 12.5% and 12.3%).

After weighting, the total population of 5–year olds was 24,092 and for 10–year olds, 24,019 (see Table 1). The proportion of Dutch children became smaller (5 yr.: 40.0%, 10 yr.: 37.4%) and the proportion of non-Western children became larger within the study population (5 yr.: 42.3%, 10 yr.: 47.4%). The majority were still parents with a high education level (5 yr.: 78.1%, 10 yr.: 73.3%), but the group with a low/middle level of education increased after weighing. SES of the neighbourhood became more evenly distributed across (very) low, middle and (very) high SES.

Table 1. Characteristics of the study population shown for 5– and 10–year olds separately, before and after weighing by sex, ethnicity and socioeconomic status (SES) of the neighbourhood.

	5–year olds		10–year olds	
	Unweighted	Weighted	Unweighted	Weighted
Total population, n	6304	24092	4748	24019
School year, n (%)				
2019/2020	1774 (28.1)	8212 (34.1)	1404 (29.6)	8081 (33.6)
2020/2021	2249 (35.7)	8028 (33.3)	1647 (34.7)	8160 (34.0)
2021/2022	2281 (36.2)	7852 (32.6)	1697 (35.7)	7778 (32.4)
Age in years, mean (SD)	5.1 (0.4)	5.1 (0.4)	10.1 (0.4)	10.1 (0.4)
Sex, n (%)				
Boy	3186 (50.5)	12364 (51.3)	2384 (50.2)	12308 (51.2)
Girl	3118 (49.5)	11728 (48.7)	2364 (49.8)	11711 (48.8)
Ethnicity, n (%)				

Dutch	3410 (54.1)	9646 (40.0)	2704 (57.0)	8993 (37.4)
Western	1384 (22.0)	4266 (17.7)	857 (18.0)	3641 (15.2)
Non-Western	1510 (24.0)	10180 (42.3)	1187 (25.0)	11385 (47.4)
Socioeconomic status of the neighbourhood, n (%)				
Very low	929 (14.7)	5037 (20.9)	593 (12.5)	4927 (20.5)
Low	741 (11.8)	4632 (19.2)	585 (12.3)	4740 (19.7)
Middle	1258 (20.0)	4774 (19.8)	969 (20.4)	4639 (19.3)
High	1706 (27.1)	4868 (20.2)	1378 (29.0)	4941 (20.6)
Very high	1670 (26.5)	4781 (19.8)	1223 (25.8)	4772 (19.9)
Education level of parents, n (%)				
Low/Middle	918 (15.0)	5098 (21.9)	804 (17.3)	6191 (26.7)
High	5203 (85.0)	18198 (78.1)	3831 (82.7)	17021 (73.3)
Family composition, n (%)				
Lives with both parents	5691 (90.3)	21212 (88.0)	4057 (85.5)	19767 (82.3)
Does not live with both parents	613 (9.7)	2880 (12.0)	688 (14.5)	4244 (17.7)

3.2 Chi-square tests: Differences in sleep problems, screen time and physical activity between school years

Tables 2A and 2B present the prevalence of sleep problems, screen time, playing a sport and playing outdoors by school years (2019/2020, 2020/2021 and 2021/2022) of the 5– and 10–year olds.

Across all three school years, 9.1% of 5–year olds had sleep problems (Table 2A). Among these children, 8.6% had a screen time over two hours per day, which increased throughout the years. Screen time over two hours per day in 2020/2021 (10.4%) was the highest compared to the other years (p=0.003). The amount of 5–year olds playing a sport less than half an hour per week was 23.5%. In 2020/2021, this increased to 28.7% (2019/2020: 21.5%), but decreased the school year after to 20.9% (p<0.001). In total 38.6% played outdoors for less than an hour per day. This decreased in 2020/2021 from 44.8% to 32.7%, but slightly increased in 2021/2022 to 37.7% (p<0.001).

Table 2A. Prevalence and the chi-square tests of sleep problems, screen time, playing a sport and playing outdoors by the school years of the 5–year olds.

	Sleep problems[1]	Screen time (≥2 hours per day)	Playing a sport (<0.5 hour per week)	Playing outdoors (<1 hour per day)
5–year olds				
Total, n (%)	2118 (9.1)	2011 (8.6)	5490 (23.5)	9009 (38.6)
School year, sig.	0.850	**0.003**	**<0.001**	**<0.001**
2019/2020, %	9.2	6.7	21.5	44.8
2020/2021, %	8.7	10.4	28.7	32.7
2021/2022, %	9.3	9.0	20.9	37.7

[1]*The values present the respondents who were categorised into 'yes' for sleep problems (score of two points or higher for the nine topics regarding sleep).*

Among the 10–year olds, 10.5% had sleep problems (Table 2B). Sleep problems decreased in the second school year from 12.1% to 8.3%, but rose back to 11.0% in 2021/2022 (p=0.017). In total, 25.4% had a screen time over two hours per day. This increased from 21.2% in 2019/2020, to 27.8% in 2021/2022 (p<0.001). Among these children, 13.2% played a sport less than half an hour per week. Almost half of the 10–year olds (46.2%) played outdoors less than an hour per day. Throughout the years this group decreased, with the lowest prevalence in 2020/2021 (39.7%, p<0.001).

Table 2B. Prevalence and the chi-square tests of sleep problems, screen time, playing a sport and playing outdoors by the school years of the 10–year olds.

	Sleep problems[1]	Screen time (≥2 hours per day)	Playing a sport (<0.5 hour per week)	Playing outdoors (<1 hour per day)
10–year olds				
Total, n (%)	2430 (10.5)	5932 (25.4)	3088 (13.2)	10773 (46.2)
School year, sig.	**0.017**	**<0.001**	0.172	**<0.001**
2019/2020, %	12.1	21.2	11.6	53.6
2020/2021, %	8.3	27.6	14.5	39.7
2021/2022, %	11.0	27.8	13.8	44.7

[1]*The values present the respondents who were categorised into 'yes' for sleep problems (score of two points or higher for the nine topics regarding sleep).*

3.3 Chi-square tests: Differences in sleep problems, screen time and physical activity between sociodemographic factors

The prevalence of the outcome variable, sleep problems, and determinants, screen time, playing a sport and playing outdoors, by the sociodemographic factors are presented in Table 3A (5–year olds) and 3B (10–year olds).

Among the 5–year olds, statistically significant differences in sleep problems were found between ethnicity, education level of parents and family composition (respectively, p=0.006, p<0.001 and p=0.001, Table 3A). There was no difference observed among boys and girls (both 9.1%). More sleep problems were observed among children with parents with a low/middle education level compared to children with parents with a high education level (respectively, 12.6% and 7.9%).

Screen time was statistically significantly different across all the presented sociodemographic factors (ranging from p<0.001 to p=0.006). Non-Western children had over twice as much screen time over two hours per day compared to Dutch and Western children (respectively, 13.9%, 4.7% and 5.5%, p<0.001). Furthermore, screen time was significantly higher among children with parents with a low/middle education level compared to the ones with parents with a high education level (respectively, 16.8% and 6.2%).

Children living in a (very) low SES neighbourhood were the largest group that did play a sport less than half an hour per week (very low: 30.1% and low: 31.8% versus middle: 22.6%, high: 18.1% and very high: 16.3%). This was also observed among children with parents with a low/middle education level compared to those with parents with a high education level (respectively, 39.6% and 18.6%, p <0.001).

Playing outdoors was also statistically significantly different across all sociodemographic factors. Girls played outdoors less than an hour per day more often than boys (40.5% versus 36.9%, p=0.012). Furthermore, more non-Western children did not play outdoors for at least one hour per day compared to Dutch and Western children (respectively, 49.0%, 31.8% and 30.4%, p<0.001). Children who did not live with both parents more often played outside for less than an hour per day than children who lived with both parents (44.3% versus 37.9%).

Table 3A. Prevalence and the chi-square tests of sleep problems, screen time, playing a sport and playing outdoors by the sociodemographic factors of the study population of the 5–year olds.

	Sleep problems[1]	Screen time (≥2 hours per day)	Playing a sport (<0.5 hour per week)	Playing outdoors (<1 hour per day)
5–year olds				
Total, n (%)	2118 (9.1)	2011 (8.6)	5490 (23.5)	9009 (38.6)
Sex, sig.	0.996	**0.006**	0.453	**0.012**
Boy, %	9.1	9.8	24.0	36.9
Girl, %	9.1	7.4	23.1	40.5
Ethnicity, sig.	**0.006**	**<0.001**	**<0.001**	**<0.001**
Dutch, %	7.9	4.7	17.6	31.8
Western, %	8.5	5.5	19.5	30.4
Non-Western, %	10.6	13.9	31.2	49.0
Socioeconomic status of the neighbourhood, sig.	0.251	**<0.001**	**<0.001**	**<0.001**
Very low, %	10.8	11.5	30.1	44.2
Low, %	8.4	13.9	31.8	49.7
Middle, %	9.7	7.4	22.6	35.1
High, %	8.3	4.7	18.1	31.8
Very high, %	8.3	6.3	16.3	33.9
Education level of parents, sig.	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Low/Middle, %	12.6	16.8	39.6	52.8
High, %	7.9	6.2	18.6	34.6
Family composition, sig.	**0.001**	**0.002**	**0.010**	**0.007**
Lives with both parents, %	8.5	8.1	22.9	37.9
Does not live with both parents, %	13.3	12.5	28.3	44.3

[1]*The values present the respondents who were categorised into 'yes' for sleep problems (score of two points or higher for the nine topics regarding sleep).*

Among the 10–year olds, sleep problems were statistically different for ethnicity, SES of the neighbourhood, education level of parents and family composition (Table 3B). Non-Western children had almost twice as many sleep problems as Dutch children (13.6% versus 7.4%, p<0.001). Sleep problems were more than twice as prevalent among children with parents who have a low/middle education level compared to those with parents with a high education level (16.5% versus 8.1%, p<0.001).

Screen time showed statistically significant differences across all sociodemographic factors (p<0.001 – p=0.022). Boys had more often screen time of at least 2 hours per day compared to girls (27.2% versus 23.6%). When children did not live with both their parents, the prevalence of screen time over two hours per day was higher (32.8% versus 23.8%).

For the determinant 'playing a sport', the non-Western children were the largest group that did not meet the half an hour sports per week, compared to Dutch and Western children (respectively, 18.9%, 7.6% and 10.0%). Children who lived in a (very) low SES neighbourhood were also the largest group who did not play a sport for half an hour per week, compared to children from a middle to very high SES neighbourhood (very low: 20.8%, low: 17.4% versus middle: 12.6%, high: 8.7% and very high: 7.6%). Furthermore, a pronounced difference can be seen between education level of parents (low/middle: 24.0% versus high: 9.0%, p<0.001).

Lastly, the prevalence of playing outdoors differed statistically significantly between all the sociodemographic factors, except for family composition (p=0.252). Girls played outdoors less than an hour per day more often than boys (respectively, 53.3% and 39.4%, p<0.001). Furthermore, 42.7% of Dutch children played outdoors less than an hour per day, whereas for non-Western children this was almost fifty percent (p=0.001).

Table 3B. Prevalence and the chi-square tests of sleep problems, screen time, playing a sport and playing outdoors by the sociodemographic factors of the study population of the 10–year olds.

	Sleep problems[1]	Screen time (≥2 hours per day)	Playing a sport (<0.5 hour per week)	Playing outdoors (<1 hour per day)
10–year olds				
Total, n (%)	2430 (10.5)	5932 (25.4)	3088 (13.2)	10773 (46.2)
Sex, sig.	0.605	**0.022**	**0.006**	**<0.001**
Boy, %	10.8	27.2	11.5	39.4
Girl, %	10.2	23.6	15.0	53.3
Ethnicity, sig.	**<0.001**	**<0.001**	**<0.001**	**0.001**
Dutch, %	7.4	19.1	7.6	42.7
Western, %	8.9	22.6	10.0	45.4
Non-Western, %	13.6	31.6	18.9	49.3
Socioeconomic status of the neighbourhood, sig.	**<0.001**	**<0.001**	**<0.001**	**0.005**
Very low, %	15.0	26.9	20.8	50.2
Low, %	11.6	36.4	17.4	49.5
Middle, %	9.3	22.4	12.6	47.2
High, %	9.0	19.6	8.7	42.7
Very high, %	7.8	23.0	7.6	42.1
Education level of parents, sig.	**<0.001**	**<0.001**	**<0.001**	**0.019**
Low/Middle, %	16.5	36.6	24.0	49.8
High, %	8.1	21.0	9.0	44.6
Family composition, sig.	**<0.001**	**<0.001**	**<0.001**	0.252
Lives with both parents, %	9.4	23.8	11.9	45.7
Does not live with both parents, %	15.7	32.8	19.3	48.5

[1]The values present the respondents who were categorised into 'yes' for sleep problems (score of two points or higher for the nine topics regarding sleep).

3.4 Logistic regression analyses

The logistic regression analyses for the 5–year olds are presented in Table 4A and for the 10–year olds in Table 4B.

Among the 5–year olds, when they had screen time over two hours per day compared to when they had screen time less than two hours per day, sleep problems were more prevalent (15.4% versus 8.5%, Table 4A). 11.2% of the children who had sleep problems, played a sport less than half an hour per week. Among the group who had sleep problems, 10.4% played outdoors less than an hour per day. 17.0% of the children with sleep problems had all three *un*favourable behaviours combined and 7.3% had all favourable behaviours combined.

The crude analysis for the 5–year olds showed statistically significant associations between sleep problems and screen time, playing a sport and playing outdoors. Children with a screen time over two hours per day were almost twice more as likely to have sleep problems, compared to children with a screen time under two hours per day (OR=1.95, 95% CI=1.43-2.66). The 5–year olds who did not play a sport for at least half an hour per week, had a 1.38 times higher odds of sleep problems, compared to those who did meet this half an hour or more per week (95% CI=1.09-1.74). Playing outdoors (<1 hour per day) also showed a statistically significant association: children who played less than an hour outdoors per day had 1.28 times higher odds of sleep problems than the 5–year olds who did play outdoors over an hour per day (95% CI=1.04-1.58). Having all *un*favourable behaviours combined, led to 2.59 times higher odds of sleep problems compared to children who had all favourable behaviours combined (95% CI=1.44-4.68).

After adjustment, the association between screen time and sleep problems remained statistically significant with slightly lower odds (OR=1.83, 95% CI=1.31-2.55). The associations between playing a sport, playing outdoors, *un*favourable behaviours combined and sleep problems were not statistically significant, with also lower odds than before correcting for the confounders (respectively, OR=1.27, 95% CI=0.99-1.62, OR=1.18, 95% CI=0.95-1.47 and OR=1.96, 95% CI=0.97-3.93).

Table 4A. Logistic regression analyses of the crude and adjusted model, showing the association between screen time, playing a sport, playing outdoors and sleep problems, for 5–year olds.

	Sleep problems[1]	Crude		Adjusted*	
	%	OR	95% CI	OR	95% CI
Screen time <2 hours per day	8.5	1	-	1	-
Screen time ≥2 hours per day	15.4	**1.95**	**1.43-2.66**	**1.83**	**1.31-2.55**
Playing a sport ≥0.5 hour per week	8.4	1	-	1	-
Playing a sport <0.5 hour per week	11.2	**1.38**	**1.09-1.74**	1.27	0.99-1.62
Playing outdoors ≥1 hour per day	8.3	1	-	1	-
Playing outdoors <1 hour per day	10.4	**1.28**	**1.04-1.58**	1.18	0.95-1.47
Favourable behaviour[2]	7.3	1	-	1	-
Unfavourable behaviour[3]	17.0	**2.59**	**1.44-4.68**	1.96	0.97-3.93

Adjusted for sex, ethnicity, education level of parents, SES of the neighbourhood and family composition.

[1]*The values present the respondents who were categorised into 'yes' for sleep problems (score of two points or higher for the nine topics regarding sleep).*
[2]*Screen time (<2 hours per day), playing a sport (≥0.5 hour per week) and playing outdoors (≥1 hour per day) combined, where all three were categorised as 'yes'.*
[3]*Screen time (≥2 hours per day), playing a sport (<0.5 hour per week) and playing outdoors (<1 hour per day) combined, where all three were categorised as 'no'.*

Among the 10–year olds who had sleep problems, 15.8% had a screen time over two hours per day, which was almost two times bigger than when they had screen time less than two hours per day (8.7%. Table 4B). 16.9% of the children who had sleep problems, played a sport less than half an hour per week, whereas 9.5% played a sport over half an hour per day. The group of 10–year olds who had sleep problems, was also bigger when they played outdoors less than an hour per day (12.8%). And when they had all *un*favourable behaviours combined, the group with sleep problems was almost three times bigger than when they had all favourable behaviours combined (18.0% versus 6.5%).

The crude analysis for the 10–year olds showed statistically significant associations. The association between screen time and sleep problems was similar to the 5–year olds, with a 1.97 times higher odds of sleep problems in comparison to children with a screen time under two hours per day (95% CI=1.53-2.54). The 10–year olds who played a sport less than half an hour per week were also almost twice more likely to have sleep problems compared to the children who played sport over half an hour per week (OR=1.93, 95% CI=1.40-2.67). Playing outdoors for less than an hour per day, showed a 1.57 (95%CI=1.24-1.99) times higher odds

of sleep problems than when children played outdoors at least an hour per day. This association was stronger compared to the 5–year olds. The 10–year olds, who had all *un*favourable behaviours combined, were three times more likely to have sleep problems in comparison with children that had all favourable behaviours combined (OR=3.14, 95% CI=1.67-5.92).

In the adjusted model, all the associations remained statistically significant. The association between screen time and sleep problems showed lower odds after adjustment (OR=1.62, 95% CI=1.24-2.13). The 10–year olds who played a sport less than half an hour per week had a 1.49 times higher odds of sleep problems, compared to those who played it over half an hour per week (95% CI=1.05-2.11). The odds of having sleep problems when children played outdoors less than an hour per day was almost similar as in the crude model (OR=1.50, 95% CI=1.18-1.92). The association between *un*favourable behaviour and sleep problems slightly weakened, but in the adjusted model children with all *un*favourable behaviours combined were still three times more likely to have sleep problems compared to children with all favourable behaviours combined (OR=3.00, 95% CI=1.55-5.81).

Table 4B. Logistic regression analyses of the crude and adjusted model, showing the association between screen time, playing a sport, playing outdoors and sleep problems, for 10–year olds.

10–year olds					
	Sleep problems[1]	*Crude*		*Adjusted**	
	%	OR	95% CI	OR	95% CI
Screen time <2 hours per day	8.7	1	**-**	1	**-**
Screen time ≥2 hours per day	15.8	**1.97**	**1.53-2.54**	**1.62**	**1.24-2.13**
Playing a sport ≥0.5 hour per week	9.5	1	-	1	-
Playing a sport <0.5 hour per week	16.9	**1.93**	**1.40-2.67**	**1.49**	**1.05-2.11**
Playing outdoors ≥1 hour per day	8.5	1	-	1	-
Playing outdoors <1 hour per day	12.8	**1.57**	**1.24-1.99**	**1.50**	**1.18-1.92**
Favourable behaviour[2]	6.5	1	-	1	-
Unfavourable behaviour[3]	18.0	**3.14**	**1.67-5.92**	**3.00**	**1.55-5.81**

*Adjusted for sex, ethnicity, education level of parents, SES of the neighbourhood and family composition.

[1]*The values present the respondents who were categorised into 'yes' for sleep problems (score of two points or higher for the nine topics regarding sleep).*
[2]*Screen time (<2 hours per day), playing a sport (≥0.5 hour per week) and playing outdoors (≥1 hour per day) combined, where all three were categorised as 'yes'.*
[3]*Screen time (≥2 hours per day), playing a sport (<0.5 hour per week) and playing outdoors (<1 hour per day) combined, where all three were categorised as 'no'.*

4. Discussion

The main aim of this study was to investigate whether screen time and physical activity was associated with sleep problems among children of 5 years and 10 years old in Amsterdam during COVID-19 over the period of 2019-2022. Our secondary aim was to examine differences in sleep problems, screen time and physical activity across the school years and between sociodemographic factors.

The crude results showed that a high screen time (≥2 hours per day), playing less sports (<0.5 hours per week), playing less outdoors (<1 hours per day) and *un*favourable behaviours (high screen time, playing less sports and playing less outdoors) were associated with sleep problems for both the 5– and 10–year olds. However, after adjusting for confounders, the associations weakened and only the association between screen time and sleep problems remained statistically significant for 5–year olds. Among the 10–year olds, the association between screen time, playing a sport, playing outdoors, all *un*favourable behaviours and sleep problems remained statistically significant after adjustment.

We observed statistically significant differences in sleep problems, screen time and physical activity between school years (2019/2020, 2020/2021 and 2021/2022) and between sociodemographic factors for both age groups, which will be explained further in 4.1 and 4.2.

4.1 Differences throughout the school years: 2019-2022

4.1.1 Sleep problems

Throughout the three school years, 9.1% of the 5–year olds and 10.5% of the 10-year olds had sleep problems. Sleep problems differed significantly for 10-year olds, where sleep problems were the lowest in 2020/2021 compared to 2019/2020 and 2021/2022. This is contradicting to what was found in previous studies, where sleep problems among children were increased during the first lockdown compared to the situation before the lockdown (Luijten et al. 2021; Nederlands Jeugdinstituut, 2021). However, the COVID-19 period did seem to lead to an increase in the prevalence of screen time over two hours per day. Playing a sport less than half an hour per week increased in 2020/2021, but children played outdoors at least an hour per day more often in that year.

4.1.2 Screen time

Screen time increased from 2020/2021 on, and remained high even after lockdown restrictions were lifted in 2021/2022. This is in line with previously reported changes in screen time. Screen time increased during lockdown, but remained at high level among children after

2020/2021 (Hedderson et al. 2021; Velde et al., 2021). On the other hand, sleep problems seemed to decline in 2020/2021, which suggests that other factors influenced sleep positively. In this case, it could be playing outdoors (≥1 hour per day), since this increased in the same year. This could be a plausible explanation since children tend to have a better sleep when they are physically active (Afonso et al. 2022; Larrinaga-Undabarrena et al., 2023). Sleep is a complicated health issue and influenced by a wide range of interacting factors (Komrij et al., 2020), which is reflected in our study as well.

4.1.3 Physical activity

Playing a sport (≥0.5 hour per week) declined in 2020/2021, compared to 2019/2020 and 2021/2022. This is in line with literature, which showed less participation in sport activities due to the lockdown (Nederlands Jeugdinstituut, 2021). This can also explain the decrease in playing outdoors less than an hour per day, which was possibly a substitution for playing a sport that year. On the contrary, Velde et al. (2021) observed a decrease in Dutch children meeting physical activity guidelines, even after the lockdown restrictions were lifted. In our study, we observed that the time spent on physical activity improved in the year after 2020/2021, in which the restrictive measures were most present (Rijksinstituut voor Volksgezondheid en Milieu, n.d.).

4.2 Differences between sociodemographic factors

4.2.1 Sleep problems

Our study found that sleep problems were more prevalent among non-Western children, children living in a (very) low SES neighbourhood, children with parents with a low/middle education level and children that did not live with both their parents. Doane et al. (2018) support these findings, in whose study SES and home environment were associated with childhood sleep. The environment where higher SES families live in, promoted sleep, whereas children of lower SES were more likely to be in a disruptive environment for sleep, such as shared bedrooms and noisy neighbourhood (Cameron et al., 2022; Doane et al., 2018). Differences within ethnicity can be explained through the cultural differences in, for example the lack awareness of sleep practices among ethnic minority groups (Smith et al., 2019).

4.2.2 Screen time

We found that screen time is significantly different between sociodemographic factors. These differences in socioeconomic background and education level of parents were also found in a study by Nagata et al. (2022). The role of the neighbourhood environment the children live in was given as possible explanation. For example, a lower SES neighbourhood offers less

opportunity for physical activity outdoors and therefore, more for screen time indoors (Nagata et al., 2022). Furthermore, parents with a higher education level have better understanding of the importance of limiting screen time and can provide alternative options, compared to parents with a lower education level (Määttä et al., 2017).

Similar to our study, Nagata et al. (2022) also reported a higher screen time among boys than girls (9-10 years old). This was due to more time spend on playing video games and watching videos, whereas girls spent their screen time social networking (Auhuber et al., 2019; Nagata et al., 2022). It can be a possible explanation for the higher screen time among boys that was observed in our study.

4.2.3 Physical activity

Our study also showed that playing a sport and playing outdoors statistically differed between sociodemographic factors. The results showed lower physical activity levels among non-Western children, children living in a low SES neighbourhood and children with parents with a low/middle education level. This is consistent with the finding from a previous study that a higher SES of the family was positively associated with higher physical activity levels (Ke et al., 2022). Parents play an important role in promoting physical activity. For example, parents with a higher education level were found to be more aware of the benefits of healthy lifestyles, leading to more physical activity during leisure time. On the other hand, parents with a lower education level preferred to spend leisure time using screens, influencing children's behaviour negatively (Ke et al., 2022; Lampinen et al., 2017). However, it is a combination of cultural and environmental factors that lowers opportunities for physical activity for minorities in Western countries (Trigwell et al., 2015). Factors, such as finances and as previously mentioned, the environmental structure, can determine whether there is opportunity to be physically active outdoors or to play sports at a club (Nagata et al., 2022; Trigwell et al., 2015).

In our study, boys played a sport (≥0.5 hour per week, only 10–year olds) and played outdoors (≥1 hour per day, both age groups) more often than girls. Other studies also found that boys are more physically active than girls (Ke et al., 2022; Kretschmer et al., 2023; Lampinen et al., 2017). This difference can be explained by the fact that boys are more likely to think of themselves as physically competent and enjoy engaging in intensity physical activity more than girls (Kretschmer et al., 2023). Furthermore, the role of parents can be a possible explanation as well. A study by Heinze et al. (2014) suggests that when parents have a more traditional gender role belief, in which they view sports as masculine, it could result into more support for boys to participate in sports than girls.

4.3 Screen time and sleep problems

Our study found that after adjusting for confounders, children with a higher screen time had a higher likelihood of sleep problems. The association among the 10–year olds (OR=1.62, 95% CI=1.24-2.13) was not as strong as for the 5–year olds (OR=1.83, 95%CI=1.31-2.55). However, 10–year olds with a high screen time (≥2 hours per day) did have a higher prevalence of sleep problems compared to 5–year olds. This suggests that screen time does not affect the sleep of 10–year olds as much as the younger children, highlighting developmental differences. Furthermore, our finding that screen time and sleep problems are negatively associated is also supported by a systematic literature review that found a negative association between screen time and sleep in 90% of the reviewed studies (Hale & Guan, 2015).

4.4 Physical activity and sleep problems

Our findings show that physical activity had a stronger positive association with sleep problems among 10–year olds than 5–year olds, which also remained statistically significant after adjusting for confounders. This suggests that the association between physical activity and sleep problems among the 5–year olds was due to the confounding factors. Studies from Afonso et al. (2022) and Larringa-Undabarrena et al. (2023) are in line with the finding that physical activity is associated with sleep. However, these studies made no distinguishing in the ages of the children as we did.

Differences among the associations between the 5–year and 10–year olds can be explained by differences in their movement patterns during the day. A study from Gao et al. (2015) shows differences in physical activity levels during recess among first and second-graders. Their study showed that second-graders were less physically active compared to the first-graders. Another study also reported a decline in physical activity level as age increases, transitioning from elementary school to high school (Pate et al., 2022). Although, these studies did not include the exact same ages as the current study, they do show evidence that physical activity levels can be explained by age. This suggests why playing a sport and playing outdoors remain statistically significant for the 10–year olds, even after adjusting for confounders. It seems like younger children do not rely on playing a sport or playing outside to be physically active as much as older children.

4.5 Strengths and limitations

This study has several strengths. Data was collected through a validated sleep questionnaire, enhancing the validity of the study. The study made use of weighted data, which makes the study population more representative to reflect the general population more and decrease

selection and non-response bias. In addition to that, it has a large sample size, which increases the generalisability of the findings. Furthermore, the collected data is over a period of three years, which makes it possible for the study to observe and analyse changes over the years. Also, to our knowledge, there are no previous studies that compare two different age groups like our study, investigating the association between screen time, physical activity and sleep problems.

However, there are some limitations to this study. Firstly, the cross-sectional design of the study does not allow establishing a causal relationship. The measurement was based on self-reports from the parents, which makes it more subject to different biases. Self-report can lead to response bias, because parents are more likely to give socially desirable answers. This could have led to an underestimation of sleep problems and *un*favourable behaviours among our study population. Additionally, parents were asked to think about the last four weeks (sleep problems) or week (screen time, playing a sport and playing outdoors) when answering the questions, heightening the chance of recall bias. Furthermore, there is also a possibility that the prevalence of screen time is underestimated, since the use of screens for school tasks were excluded in the question. However, with the lockdown restrictions, children were taking classes from home using screen devices. A Dutch study reported that school-related screen time increased during the COVID-19 pandemic (Velde et al., 2021). Therefore, our findings should be interpreted with caution.

4.6 Future research

Further research should consider longitudinal study designs to establish the causal relationships between screen time, physical activity and sleep problems during the COVID-19 period. Furthermore, it is important to investigate how the unique circumstances of the COVID-19 period, specifically the lockdown restrictions, affected sleep problems, screen time, playing a sport and playing outdoors. Our existing dataset can be used considering the questionnaire completion date of the participants. This timing can be linked to different phases of the pandemic and the restrictive measures, to identify the precise influence on the studied factors. It is also recommended to investigate the differences in the associations between sociodemographic groups. Since statistically significant differences were observed between these factors among sleep problems, screen time and physical activity, it would be valuable to include the sociodemographic factors as effect modifiers in the regression analyses. This could bring valuable insights for future prevention research for GGD Amsterdam.

Conclusion

In summary, this cross-sectional study found that after adjusting for confounders, a screen time over two hours per day heightened the likelihood of having sleep problems, compared to a screen time of maximum 2 hours per day for both age groups (5 yr.: OR=1.83, 95% CI=1.31-2.55 and 10 yr.: OR=1.62, 95% CI=1.24-2.13). However, playing a sport (OR=1.49, 95% CI=1.05-2.11), playing outdoors (OR=1.50, 95% CI=1.18-1.92) and having *un*favourable behaviour (OR=3.00, 95% CI=1.55-5.81) only showed statistically significant associations with sleep problems among the 10–year olds. The sociodemographic factors of the study population moderated the associations, which suggests that the confounders played an important role in the association between physical activity, screen time and sleep problems. Furthermore, there were statistically significant differences observed for both age groups across sleep problems, screen time and physical activity. While our study has several strengths, given the limitations, findings should be interpreted cautiously. Altogether, this study emphasises the importance to take the sociodemographic factors into account by the Youth Health Care in regard to screen time and physical activity of children.

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Appendix A

Introductiepagina

Beste ouder/verzorger,

Welkom bij de vragenlijst van Jij en Je Gezondheid. Deze vragenlijst hoort bij het gezondheidsonderzoek dat de jeugdgezondheidszorg (JGZ) uitvoert bij kinderen in de basisschoolleeftijd. De vragen gaan over de gezondheid en de ontwikkeling van uw kind. Ook wordt gevraagd naar factoren die de gezondheid en ontwikkeling van uw kind kunnen beïnvloeden, zoals de opvoeding of omgeving. Het invullen van de vragenlijst duurt ongeveer 10 tot 20 minuten. Alleen de JGZ-professionals werkzaam op uw school hebben inzage in de antwoorden op de vragen uit de vragenlijst.

Het invullen van de vragenlijst helpt u een beeld te krijgen van de gezondheid en ontwikkeling van uw kind. U kunt zelf aangeven wat er goed gaat en waarover u vragen of zorgen heeft. Als u de vragenlijst heeft ingevuld, ontvangt u direct passende tips en informatie. Heeft u vragen of zorgen? De jeugdarts of jeugdverpleegkundige denkt graag met u mee en helpt u bij het zoeken naar een passende oplossing.

U kunt de vragen ook laten voorlezen, door op het luidspreker icoon [icoon] links naast de vraag te klikken.

Algemene informatie

1. Door wie wordt deze vragenlijst ingevuld?

    o Moeder
    o Vader
    o Beide ouders
    o Anders, namelijk ………………………………

Uw emailadres en telefoonnummer kunnen door de jeugdarts of jeugdverpleegkundige gebruikt worden om met u in contact te komen. Mogelijk gebruiken we uw telefoonnummer voor een herinnerings-SMS voorafgaand aan een afspraak bij de jeugdgezondheidszorg. Uw contactgegevens worden overgenomen in het digitale dossier van uw kind. Wanneer u nogmaals wilt inloggen in deze vragenlijst (bijvoorbeeld om de vragenlijst later af te maken of om de adviezen nog eens te bekijken) dient u uit veiligheidsoverwegingen in te loggen met een pincode die u via uw 06- nummer ontvangt.

2. Wat is uw emailadres?

3. Wat is uw telefoonnummer?

4. Wat is uw 06-nummer? [Als bij vraag 3 een 06-nummer is ingevuld verschijnt dit 06-nummer automatisch hier, het is wel aanpasbaar]

5. Wat is het geslacht van uw kind? [alleen vragen indien niet bekend in KIDOS]

6. Wat is de postcode van het woonadres van uw kind? [alleen vragen indien niet bekend in KIDOS]

7. In welk land is uw kind geboren? [keuze menu alle landen; CBS lijst aangehouden]

8. In welk land is de moeder van uw kind geboren? [keuze menu alle landen; CBS lijst aangehouden]

9. In welk land is de vader van uw kind geboren? [keuze menu alle landen; CBS lijst aangehouden]

10. Bij wie woont uw kind de meeste dagen van de week? (Kies één antwoord)
o Bij beide ouders samen
o Ongeveer de helft van de tijd bij de ene ouder en de helft van de tijd bij de andere ouder (co-ouders)
o Bij de moeder en haar partner
o Bij de vader en zijn partner
o Alleen bij de moeder
o Alleen bij de vader
o Anders, namelijk………………………

11. Wat is de hoogst afgemaakte opleiding van uzelf?
o (Enkele jaren) lagere school
o Diploma lbo/mavo/vmbo
o Diploma havo/vwo/mbo
o Diploma hbo/universiteit
o Anders, namelijk…………………………………..

12. Wat is de hoogst afgemaakte opleiding van uw partner?
o (Enkele jaren) lagere school
o Diploma lbo/mavo/vmbo
o Diploma havo/vwo/mbo
o Diploma hbo/universiteit
o Anders, namelijk…………………………………..
o Ik heb geen partner

13. Is uw kind, in het afgelopen jaar, onder behandeling of controle geweest van een arts of andere zorgverlener? Zo ja, waarvoor? (Er zijn meer antwoorden mogelijk)
o Nee
o Ogen
o Oren
o Lengte en/of gewicht
o Bewegen
o Spreken en/of taal
o Leren en/of lezen
o Gedrag en/of emoties
o Opvoeding
o Astma/astmatische bronchitis
o Andere (langdurige) aandoening/ziekte, namelijk…………………

Slapen
Kinder Slaap Diagnose Lijst (KSDL)

Heeft uw kind de afgelopen 4 weken problemen gehad met:
1. Inslapen en/of doorslapen?
    O Nooit (0)
    O Zelden (0)
    O Soms (0)
    O Meestal (1)
    O Altijd (2)

2. 's Morgens wakker worden?

3. Concentratie en/of geheugen?

4. Stemming en/of humeur?

5. Slaperigheid en/of vermoeidheid?

6. Snurken of andere ademhalingsproblemen?

7. Nachtmerries of nachtelijke angsten met heftige reacties zoals zweten?

8. Slaapwandelen?

9. Verschijnselen als tandenknarsen, hoofdbonken, hoofdrollen, wiegen etc.

Bewegen
Frequentie

Denk bij het invullen van de volgende vragen aan de afgelopen week. Wanneer de afgelopen week niet een normale week was (door bijvoorbeeld ziekte of vakantie), denk dan terug aan een normale week.

1. Hoeveel uur per week sport of beweegt uw kind bij een vereniging of club? Bijvoorbeeld dansles, turnen, voetbaltraining, judo, zwemles.
O (Bijna) nooit (0)
O Korter dan een half uur per week (1)
O Een half uur tot 1 uur per week (2)
O 1 tot 2 uur per week (3)
O 2 uur per week of langer (4)

2. Hoeveel uur per dag speelt uw kind buiten? Denk hierbij aan activiteiten zoals rennen, klimmen, fietsen, skateboarden.
O (Bijna) nooit (0)
O Korter dan een half uur per dag (1)
O Een half uur tot 1 uur per dag (2)
O 1 tot 2 uur per dag (3)

O 2 uur per dag of langer (4)

3. Hoeveel uur per dag zit uw kind achter een beeldscherm zoals de TV, computer, tablet of smartphone? Beeldschermgebruik voor schooltaken telt hier niet mee.
O (Bijna) nooit (0)
O Korter dan een half uur per dag (1)
O Een half uur tot 1 uur per dag (2)
O 1 tot 2 uur per dag (3)
O 2 uur per dag of langer (4)

Appendix B

Details: Slapen (KSDL)				
Aanleiding onderwerp	• JGZ richtlijn Gezonde slaap en slaapproblemen (2017).			
Bron vragenlijst	• In de JGZ-richtlijn staat dat slapen bij ieder contactmoment ter sprake moet komen. Voor kinderen in de basisschoolleeftijd wordt geen specifieke screeningsvragenlijst aanbevolen. Bij de signalering van slaapproblemen en slaapstoornissen zijn de zorgen van ouders en/of jeugdigen zelf leidend. Daarbij kan worden volstaan met een oriënterende vraag zoals: Heeft u zorgen over het slapen? In de richtlijn worden vervolgens vier anamnese vragen aanbevolen (omtrent de slaapduur, het slaapgedrag, slaperigheid overdag en ongebruikelijke/vreemde gedragingen 's nachts). • De vragen in de KSDL komen overeen met de beschreven slaapstoornissen in de JGZ richtlijn. • MCHaaglanden maakt al een aantal jaar gebruik van deze screeningslijst. Er wordt gescreend op slaapstoornissen (12 uit de DSM-5, 85 uit de ICSD).			
Literatuur	• Niet van toepassing.			
Ingevoerd per	• Schooljaar 2017-2018.			
Missings	• Er is voor dit onderwerp maximaal 1 missing toegestaan. Een eventueel missende waarde wordt vervangen door de gemiddelde score van de ingevulde vragen.			
Score	• De scores worden bij elkaar opgeteld.			
Afkapwaarden	Geslacht	Leeftijd	Groen	Rood
	Alle	4-6	0-1	2-18
Toelichting oproepindicatie	• In *Jij en Je Gezondheid* wordt er standaard opgeroepen bij een rode verkleuring.			
Gezondheids-boodschappen	• Er zijn gezondheidsboodschappen voor dit onderwerp.			
Logboek aanpassingen	• De introductie is aangepast zodat deze passend is binnen JEJG. Was oorspronkelijk: U kunt deze lijst na overleg met uw partner samen invullen. Stuur de lijst mee terug of neem de ingevulde lijst vervolgens mee naar de eerste afspraak op de poli. Denkt u bij elke vraag aan de situatie van de afgelopen 4 weken en geef aan in de kolommen achter de vraag hoe vaak het gestelde ongeveer voorkomt. • Vraag 10 was oorspronkelijk: Nachtmerries of nachtelijke angsten met heftige reacties zoals bijvoorbeeld zweten? Aangepast omdat "zoals bijvoorbeeld" dubbel is. • Vraag 12 was oorspronkelijk: Verschijnselen als bedplassen, tandenknarsen, bonken, rollen, wiegen etc.? Aangepast omdat bedplassen al apart wordt uitgevraagd en omdat bonken en rollen onduidelijk is. Volgens de JGZ richtlijn gaat het om hoofdbonken en hoofdrollen. • In de pre-pilot gaven we de antwoorden 'meestal' en 'altijd' en score 1. De rode verkleuring werd gegeven bij een score 1-14. In de pilot hebben we dit aangepast. Het antwoord 'meestal' krijgt een score 1. Het antwoord 'altijd' krijgt een score 2. De rode verkleuring wordt gegeven bij een score 2-28. • Vraagstellingen 7, 8, 9, 13 en 14 zijn verwijderd (september 2018) nav bevindingen pilot. Daardoor zijn afkappunten ook aangepast naar 2-18.			

7. Herhaaldelijke slaapaanvallen?
8. Plotselinge spierslapte bij emoties?
9. Kortdurend 'verlamde' benen of armen bij inslapen en/of ontwaken?
13. Een vervelend gevoel in de benen mét een onbedwingbare bewegingsdrang?
14. Deze beenklachten vooral in de avond en nacht? [Indien vraag 13 is Zelden, Soms, Meestal of Altijd]

Details: Bewegen (frequentie)					
Aanleiding onderwerp	• JGZ richtlijn Overgewicht (2012). • Een actieve leefstijl en gezond gewicht is speerpunt in het Amsterdamse gezondheidsbeleid (Amsterdamse Aanpak gezond Gewicht).				
Bron vragenlijst	• De vragen zijn gebaseerd op de vragen die zijn opgesteld voor het VO. • Team JEJG heeft deze vragen zelf opgesteld in nauw overleg met de adviseurs voeding en bewegen en de JGZ klankbordgroep.				
Literatuur	• Niet van toepassing.				
Ingevoerd per	• Schooljaar 2017-2018.				
Missings	• Voor beide subschalen zijn geen missings toegestaan.				
Score	• Subschaal bewegen: de scores van vragen 2 en 3 worden bij elkaar opgeteld. • Subschaal beeldschermgebruik: score op vraag 4.				
Afkapwaarden bewegen	Geslacht	Leeftijd	Groen	Oranje	Rood
	Alle	4-6	3-8	2	0-1
Afkapwaarden beeldschermgebruik	Geslacht	Leeftijd	Groen	Rood	
	Alle	4-6	0-3	4	
	• Op basis van het databestand (GGD Amsterdam) van schooljaar 2018-2019 zijn de afkappunten voor bewegen aangepast. Vanaf 2019-2020 wordt de P90 en P95 van dit databestand aangehouden. Er is gekozen om de data van GGD Drenthe van 2018-2019 niet in de analyses mee te nemen omdat de data van Drenthe slechts bepaalde vooraf gekozen scholen betrof. • In de JGZ-richtlijn wordt alleen aangegeven dat vanaf 2 uur beeldschermgebruik per dag 'zorgelijk' is. Zie verdere toelichting logboek.				
Toelichting oproepindicatie	• Voor dit onderwerp worden ouders en kinderen niet individueel voor een consult uitgenodigd omdat we van mening zijn dat dit thema goed op groepsniveau (universele preventie) opgepakt kan worden. Alle ouders ontvangen via de persoonlijke gezondheidsboodschappen passende tips en adviezen. • Wanneer sprake is van overgewicht worden kinderen op basis daarvan opgeroepen.				
Gezondheids-boodschappen	• Er zijn gezondheidsboodschappen voor dit onderwerp.				
Logboek aanpassingen	• Eerder bestond er een oranje categorie bij beeldschermgebruik voor 1 tot 2 uur per dag. In de JGZ-richtlijn staat benoemd dat vanaf 2 uur per dag als 'problematisch' gezien kan worden. Eerder hadden we gekozen voor een oranje boodschap om een signaal te geven in de trend van 'het moet niet nog meer worden'. Maar sommige ouders gaven aan dat ze de oranje boodschap als 'belerend' vonden overkomen en dat ze het aantal uur beeldschermgebruik absoluut niet te veel vonden. Ook JGZ-professionals gaven aan dat dit een groep was waar ze weinig mee kunnen. De groep 'oranje' scoorders (1 tot 2 uur per dag) was ook nog eens aanzienlijk in de pilot (26%). Naar aanleiding van deze bevindingen besloten de groep oranje niet langer te behouden (2018). • Afkappunten bewegen zijn tussentijds aangepast, zie toelichting onder 'Afkapwaarden'.				

Appendix C

Table A. Chi-square tests, showing the differences between the 5– and 10–year olds by the sociodemographic factors of the study population.

	Chi-square	Sig.
School year	0.54	0.82
Sex	0.01	0.95
Ethnicity	**32.05**	**<0.001**
Education level of parents	**33.55**	**<0.001**
Socioeconomic status of the neighbourhood	1.11	0.93
Family composition	**71.75**	**<0.001**

Table B. Chi-square tests, showing the differences between the school years by the sociodemographic factors of the study population, for the 5–year olds.

5–year olds		
	Chi-square	Sig.
Sex	1.30	-
Ethnicity	0.27	-
Education level of parents	**11.15**	**0.02**
Socioeconomic status of the neighbourhood	4.67	-
Family composition	0.08	0.97

Table C. Chi-square tests, showing the differences between the school years by the sociodemographic factors of the study population, for the 10–year olds.

10–year olds		
	Chi-square	Sig.
Sex	0.18	-
Ethnicity	0.88	-
Education level of parents	**10.05**	**0.03**
Socioeconomic status of the neighbourhood	6.94	-
Family composition	1.27	0.66