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ORIGINAL ARTICLE

Understanding the correlates of adolescents' TV viewing: A social ecological approach

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Abstract

Objective. To examine associations between social ecological factors and Dutch adolescents' TV viewing. **Design.** Cross-sectional examination of predictors of adolescents' TV viewing. **Participants.** A total of 338 adolescents, aged 14 years (55% boys). **Measurements.** Adolescents self-reported their age, ethnicity and TV viewing (dichotomized at two hours/day) and responded to items from all three social ecological domains; individual (cognitions based on the Theory of Planned Behaviour and TV viewing habit strength, and other behaviours, such as computer use), social (parental rules about TV viewing and parental TV viewing behavior) and physical environmental factors (TV in bedroom, physical activity equipment available). Parents reported demographic factors (e.g., ethnicity, education level), and their own TV viewing (mins/day); adolescents' weight status (not overweight vs. overweight/obese) was calculated from objective measures of height and weight. Logistic regression analyses examined associations between socio-ecological factors and adolescents' TV viewing, and whether associations were moderated by adolescents' sex, parents' education and ethnicity. **Results.** Compared with others, overweight/obese adolescents (odds ratio (OR) = 3.0; $p \leq 0.001$), those with high computer use (OR = 2.3; $p \leq 0.0001$), with high TV viewing habit strength (OR = 1.3; $p \leq 0.0001$), and those whose parents had high levels of TV viewing (OR = 2.4; $p \leq 0.01$) were more likely to exceed two hours of TV viewing per day. The association with habit strength was moderated by gender, and the association with parents' TV viewing was moderated by parents' education and ethnicity. **Conclusions.** Interventions should target parents' TV viewing behaviors and aim to amend habitual, 'mindless' TV viewing among adolescents.

Key words: Sedentary behavior, adolescent, television, habits, social ecological model

Introduction

Dramatic increases in the prevalence of overweight and obesity among young people have been seen in recent years (1). High levels of sedentary behaviors, particularly television (TV) viewing, are associated with increased risk of overweight and obesity during youth (2). Boone and colleagues have shown that high levels of TV viewing during adolescence is a strong predictor of risk of obesity in adulthood (3). Findings of that study suggest that adolescence may be a key time to intervene in order to prevent such

outcomes. Indeed, TV viewing is a common pastime among young people, with 65% of US youth watching TV for two or more hours/day and 25% watching TV for more than four hours/day (4). Data from the Health Behavior of School-Aged Children survey suggests that over 75% of Dutch adolescents exceed TV viewing guidelines (5). To be able to successfully intervene on adolescent TV viewing, it is important to identify the correlates of TV viewing in this group.

Behavioral theories provide a framework for studying key factors associated with health behaviors,

such as TV viewing. For example, the Theory of Planned Behavior (TPB) incorporates several intrapersonal constructs shown to be important correlates of various health behaviors (6). Constructs such as attitudes towards the behavior, perceived norms about and perceived control of the behavior, and intention to perform the behavior, may be useful to consider when examining adolescents' TV viewing. Verplanken (7) also suggests that when exploring constructs from TPB, additional constructs, such as habit strength, should be considered when examining health behaviors. Habit strength is a psychological construct that measures the degree of automaticity and identity of the behaviour of interest (7), and has previously shown associations with TV viewing and sugar-sweetened beverage consumption among Dutch youth (8). Most studies have examined other individual-level correlates of TV viewing, such as demographic factors; and report positive associations for non-white ethnicity, and inverse associations for parental education (a proxy for socioeconomic position) (9). Self-efficacy has shown positive associations (10), but associations between TV viewing and physical activity have been mixed (9). Other common leisure-time behaviors, such as computer use and organized sport, may also be important to consider given that many young people are highly active, but also spend extensive time in sedentary pursuits (11).

Beyond these individual-level influences, the broader social and physical environments (as posited in ecological models (12)) are also likely to be important influences on adolescents' TV viewing time (13). Salmon and colleagues found that family factors, such as frequency families watched TV together, as well as parents' TV viewing were positively associated with children's TV viewing (14); although conflicting findings have been reported (15). Importantly, few studies have explored individual, social and physical environmental factors concurrently for associations with adolescents' TV viewing (13). Norman et al. (2006) examined social ecological influences on sedentary behaviors (including TV viewing) among adolescents and found various individual, social and physical environmental factors were associated with girls' sedentary behaviors; however, only individual-level factors were associated among boys (10). These findings suggest that influences on sedentary behaviors may be moderated by sex, and the authors proposed that influences on TV viewing may also be moderated by other factors. Kremers and colleagues have hypothesized that influences on TV viewing may vary between population sub-groups and that demographic factors, such as SES and ethnicity, may be important moderating factors to consider (16).

Using a constructed model incorporating individual factors from TPB as well as social and physical

environmental factors from a social ecological framework, the aims of this study were: 1) to examine individual, social and physical environmental factors associated with adolescents' TV viewing; and 2) to examine whether sex, SES and ethnicity moderated the associations between individual, social and physical environmental factors, and adolescents' TV viewing.

Methods

Study design

This study was part of a larger project examining energy balance-related behaviours and their determinants among Dutch adolescents, known as the 'ENDORSE' (Environmental Determinants of Obesity in Rotterdam's SchoolchildrEn) study (17). The present paper draws upon baseline data collected in 2005/2006. The ENDORSE study was nested within the Youth Monitor Rotterdam (YMR) surveillance system, which monitors the health and well-being of young people (0–19 years) living in Rotterdam, the Netherlands. The Municipal Health Service Rotterdam approved the ENDORSE study for inclusion in this surveillance system and the Medical Ethics Committee of the Erasmus University Medical Center reviewed the proposal and gave a declaration of no objection for the project. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research.

Sample selection and recruitment

Secondary schools that participate in the YMR were approached to participate in the ENDORSE study ($n=56$). Twenty-four schools agreed to participate, from which 17 were randomly selected for participation, after stratification according to location (center, north, east, south, and west of the city), in order to ensure diversity in the sample. Within each school, a random sample of approximately five classes in the first year of secondary school (aged approximately 12–13 years) and the third year of secondary school (aged approximately 14–15 years) were chosen to participate, with 1 668 adolescents eligible. One parent of each child was asked to participate in the study. Some data were available for 1 361 children; however, due to missing self-report data and a low response rate from the parent survey (approximately 42%), complete data were available for 338 adolescents. Adolescents with complete data were slightly younger ($p \leq 0.01$), had a slightly higher proportion of parents in a paid job ($p \leq 0.01$), a higher proportion were of non-Western ethnicity ($p \leq 0.0001$), and

fewer exceeded TV viewing guidelines ($p \leq 0.01$) compared with those without missing self-report and/or parent-reported data.

Procedures

Adolescents were asked to complete a survey while at school in the presence of a teacher and research assistant. This survey took approximately one hour to complete. Adolescents were also provided with an envelope for their parents containing a plain language statement, a parent-report survey, a reply-paid envelope in which to return the survey, and an entry card into a raffle to win one of five electronic music devices. Adolescents' body weight and height were measured directly by trained research assistants at school.

Measures

Adolescent questionnaire

Demographics: Participants' age was derived from their date of birth (provided by the school), and date of measurement. Adolescents self-reported their gender and country of birth of themselves and their parents. Ethnicity was determined based on the country of birth of the parents, according to the Statistics Netherlands definition (18). The respondents were divided into three groups: 'Native Dutch'; 'Western-immigrant' and 'non-Western immigrant' adolescents. Adolescents were considered Western-immigrants if one or both parents were born in a European country, North America, Oceania, Indonesia or Japan. Adolescents with one or both parents born in a country other than the aforementioned countries or regions were considered non-Western immigrant children. Due to the small numbers of adolescents classified as Western immigrants, this category was combined with 'Native Dutch' adolescents for analyses.

TV viewing: Self-reported leisure-time TV viewing in the previous week was assessed with the relevant questions from the Activity Questionnaire for Adolescents and Adults (AQuAA). The structure of this instrument was adapted from a previously validated and reliability tested tool (19). Adolescents reported on how many days (0–7 days) they watched television during leisure-time in the last week. Adolescents also reported the duration of TV viewing each day (hours/minutes). The frequency and duration were multiplied, then divided by seven to provide average TV viewing (mins/day). In line with guidelines for daily TV viewing (20), TV viewing was dichotomized into those who met (< 120 mins/day) and those who exceeded (≥ 120 min/day) TV viewing guidelines.

Individual factors: As described in Table II, adolescents self-reported their attitudes towards TV viewing (two separate items), their subjective norms about the behavior (one item), perceived behavioral control (two separate items), their intention to perform the behavior in the next six months (one item), and, modelling by assessing their perceptions of their parents' and friends' TV viewing (two separate items). Response options to all items were on a five-point scale ranging from, for example, very good (+2) to very bad (−2), but due to the distribution of responses, items were recoded to dichotomous statements to indicate agreement. Three additional items were combined to assess TV viewing habit strength (Cronbach's $\alpha = 0.82$), based on the habit scale proposed by Verplanken (2006) (7). Response options to all items were on a five-point scale ranging from, for example, strongly agree (+2) to strongly disagree (−2), but due to the distribution of responses, items were recoded to dichotomous statements to indicate agreement.

Adolescents' participation in other leisure-time behaviors was also assessed, using the AAQuA questionnaire. Separate questions assessed on how many days they did organized sport and used the computer during leisure-time in the last week (0–7 days), and how long (on average) each session lasted (hours/minutes). The frequency and duration of each session were multiplied, and then divided by seven to provide the average organized sport and computer use (mins/day). These variables were significantly skewed; therefore they were dichotomized at the median for analyses.

Social factors: The presence of parental rules about TV viewing were examined with two items (Table II on a dichotomous yes/no scale; 'Do your parents have rules about how long you can watch TV for?'; and 'Do your parents have rules about when you can watch TV?'. These two items were summed to create a scale (range 0–2) of parental rules about TV viewing (Cronbach's $\alpha = 0.67$). An additional item that reduced the internal reliability of the summed TV viewing rules scale and was therefore not included in that scale, examined whether the adolescent was allowed to watch TV at home; 'If you want to watch TV at home, are you allowed to?' This final item was reverse coded, to indicate restriction of TV viewing.

Physical environmental factors: The presence of a television in the adolescents' bedroom was assessed using a single item on a yes/no response scale (Table II). Adolescents also reported whether they had any of 10 different physical activity equipment items (e.g., a bike, skateboard) available at home, which were

added to create a score for the total number of equipment items (possible range 0–10 items).

Parent questionnaire

Demographic information about the adolescents and their family were obtained from the parent survey. Parents reported their highest level of education for themselves and their partner with response options ranging from completed primary (elementary) school through to tertiary education or higher. These response options were categorized into low, medium and high level of education. The number of people (including themselves) living in their household was also reported. Using identical questions to those in the adolescent questionnaire, parents reported on how many days (0–7 days) they watched TV during leisure-time in the last week. Parents also reported the duration of TV viewing each day (hours/mins). The frequency and duration of each session were multiplied, then divided by seven to provide average TV viewing (mins/day). This variable was significantly skewed; therefore it was dichotomized at the median for analyses.

Weight status

Trained research assistants objectively-measured participants' height using a portable stadiometer (Seca 225) to the nearest 0.1 cm and weight using calibrated digital scales (Seca 888 Class 111) to the nearest 0.1 kg. From these data, body mass index was calculated. For the purposes of analysis, participants were classified into not overweight and overweight, or obese categories, based on International Obesity Task Force criteria (21). Due to the small number of participants in the obese category, overweight and obese categories were combined for analyses.

Data analysis

All analyses were conducted in Stata version 10.0/SE. Characteristics of the sample were examined using descriptive statistics. Logistic regression analyses were performed to examine bivariable associations between individual, social and physical environmental factors, and adolescents' TV viewing, with odds ratios (OR) and 95% confidence intervals (CI) reported. The factors shown to be significantly associated with adolescents' TV viewing in bivariable analyses ($p \leq 0.05$) were then entered into a multivariable logistic regression model. Factors significantly associated with adolescents' TV viewing in the multivariable model were then examined for a moderating effect by child's sex, ethnicity or parents' level of education, by including only the significant variable and the

potential moderator in a separate model. Where a potential interaction was indicated ($p \leq 0.10$), the sample was stratified accordingly and logistic regression models were generated separately for each of the moderating variables. All analyses were adjusted for clustering based on the unit of recruitment (school).

Results

Sample characteristics

Complete data were available for 338 children (55% boys; Table I). Participants were aged 14 years, and most were not overweight. Approximately half the parents had a medium level of education, most parents had a paid job and approximately one-third of the sample were non-Western immigrants. Adolescents reported watching TV on average for approximately two hours/day, and about 50% of participants exceeded recommendations (i.e., watched ≥ 120 mins/day).

Table II shows the distribution of responses to individual, social and physical environment items. Most adolescents reported positive attitudes towards TV viewing, and a large proportion of the sample were able to choose when they watched TV and intended to continue the behavior. Parents of participants reported watching TV for approximately two hours/day. Few adolescents reported having rules about their TV viewing and more than half had a TV in their bedroom.

Individual, social and physical environmental factors predicting exceeding TV viewing guidelines

Table III shows the results of unadjusted and adjusted logistic regression analyses. Thirteen items, including

Table I. Characteristics of the sample.

Sample characteristics	n = 338
Age (mean, SD), years	14.0 (± 1.14)
Family demographics	
Highest parental education (%)	
Low	18.6
Medium	45.0
High	36.4
Parents in paid occupation (%)	87.9
Average # people living in household (range 2–8)	4.1
Ethnicity (%)	
Dutch	58.3
Western immigrant	8.3
Non-Western immigrant	33.4
Adolescents' leisure-time television viewing (mins/day; SD)	127.7 (± 115.87)
Adolescents' watching > 120 mins/day (%)	48.2

SD: Standard deviation.

Table II. Distribution of individual, social and physical environmental influences on adolescents' TV viewing.

	Percent or Mean (SD)
Individual-level factors	
Attitudes: (%)	
I think TV viewing is good	56.2
I think TV viewing is pleasant	86.7
Subjective norm: (%)	
If I watch TV, my parents think it's good	44.7
Parents watch a lot of TV	32.0
Friends watch a lot of TV	70.7
Perceived behavioral control: (%)	
Able to determine own TV viewing	83.4
Easy to watch TV at home	87.6
Intention: (%)	
Intend to watch TV in next six months	92.0
Habit: (%)	
TV viewing is something I do often	74.6
TV viewing is something I do almost automatically	59.5
TV viewing is something that is typically me	53.9
Weight category (%):	
Not overweight	79.3
Overweight	16.6
Obese	4.1
Other behaviors:	
Adolescents' leisure-time computer use (mins/day; SD)	116.7 (\pm 134.03)
Adolescents' leisure-time organised sport (mins/day; SD)	73.2 (\pm 90.66)
Social factors	
Parents have rules about how long can watch TV (%)	31.1
Parents have rules about when can watch TV (%)	32.8
Am allowed to watch TV at home if I want to (%)	94.7
Parents' leisure-time TV viewing (mins/day; SD)	122.38 (\pm 90.26)
Physical environmental factors	
TV in bedroom (%)	59.2
# physical activity equipment items (mean)	4.0

SD: Standard deviation.

factors from each of the individual, social and physical environmental domains were significantly associated with higher odds of adolescents exceeding TV viewing guidelines. However, when included in the multivariable model, only four remained significant. Weight status was significantly associated with exceeding TV viewing guidelines, with adolescents in the overweight or obese category having three times the odds of watching more than two hours/day compared with those in the non-overweight group ($p \leq 0.001$). Adolescents with a high score on TV viewing habit strength had 1.3 times the odds of watching more than two hours/day ($p \leq 0.0001$) compared with other adolescents. Adolescents who had high levels

of computer use ($p \leq 0.0001$) had 2.3 times the odds, and those who had parents with high levels of TV viewing had 2.4 times the odds of exceeding TV viewing guidelines ($p \leq 0.01$) compared with other adolescents.

Moderating effects of sex, parental education and ethnicity

Moderating analyses showed an interaction effect between adolescents' sex and their TV viewing habits ($p \leq 0.1$). When the sample was stratified by sex, high habit strength was associated with increased odds of exceeding TV viewing guidelines among both boys (OR=1.3; 95% CI=1.1–1.4) and girls (OR=1.5; 95% CI=1.3–1.7). An interaction was also evident between TV viewing habits and parental education level ($p \leq 0.1$). When the sample was stratified according to parental education, a high TV viewing habit strength was significantly associated with exceeding TV viewing guidelines among adolescents whose parents had a low (OR=1.3; 95% CI=1.1–1.5), medium (OR=1.3; 95% CI=1.1–1.4) or high level of education (OR=1.5; 95% CI=1.3–1.9).

Adolescents' sex showed an interaction with adolescents' computer use ($p \leq 0.1$), with high computer use being significantly associated with increased odds of exceeding TV viewing guidelines among girls (OR=4.6; 95% CI=2.2–9.6) but not among boys. Adolescents' sex also showed interactions with parents' TV viewing ($p \leq 0.1$), with parents' TV viewing significantly associated with increased odds of exceeding TV viewing guidelines among both boys (OR=1.9; 95% CI=1.1–3.3) and girls (OR=3.9; 95% CI=2.0–7.8). Ethnicity also showed an interaction with parents' TV viewing ($p \leq 0.1$), with parents' TV viewing significantly associated with increased odds of exceeding TV viewing guidelines among adolescents' of Dutch or Western ethnicity (OR=3.9; 95% CI=2.3–6.8) but not among those of non-Western ethnicity.

Discussion

This cross-sectional study utilized a social ecological approach to examine factors from individual, social and physical environmental domains as correlates of adolescents' TV viewing. In multivariable analyses, weight status, habit strength for TV viewing, and computer use were significant individual correlates, and parents' TV viewing was a significant social environmental correlate. Furthermore, individual-level variables derived from TPB, one of the most frequently used behavioural determinants models (22), were not associated with higher likelihood of exceeding

Table III. Odds ratios (OR) and 95% confidence intervals (95% CI) from logistic regression analyses^a examining correlates of adolescents' exceeding TV viewing guidelines.

	Unadjusted OR (95% CI)	Adjusted ^b OR (95% CI)
Individual-level factors		
Weight category (ref: not overweight)	2.9 (1.61–5.24)†	3.0 (1.60–5.57)‡
I think TV viewing is good	1.9 (1.41–2.59)†	-
I think TV viewing is pleasant	1.9 (1.32–2.60)†	-
Parents watch a lot of TV	1.6 (1.11–2.14)§	-
Friends watch a lot of TV	1.4 (1.09–1.81)§	-
If I watch TV, my parents think it's good	1.4 (1.00–1.92)*	-
Able to determine own TV viewing	1.4 (1.08–1.77)*	-
Easy to watch TV at home	1.6 (1.13–2.13)§	-
TV viewing habit scale	1.4 (1.24–1.50)†	1.3 (1.16–1.41)†
Computer use	2.6 (1.59–4.20)†	2.3 (1.47–3.59)†
Social factors		
# of rules about TV viewing	0.6 (0.44–0.86)§	-
Parents TV viewing	2.6 (1.68–4.08)†	2.4 (1.38–4.03)§
Physical environmental factors		
# pieces physical activity equipment	0.9 (0.77–0.99)*	-

^aReference category was watching <120 mins/day TV.

^bAnalyses adjusted for all other significant variables and clustering by class.

* $p \leq 0.05$, § $p \leq 0.01$, ‡ $p \leq 0.001$, † $p \leq 0.0001$.

TV viewing guidelines. These findings suggest that TV viewing may not be a well-considered, planned behavior among adolescents, but may rather be influenced by individual biological factors, habit strength, and parental factors.

Adolescents' who scored high on the TV viewing habits scale had increased odds of exceeding TV viewing guidelines, which supports previous research that found habit strength for TV viewing was a strong correlate of two health behaviours, TV viewing behaviour, and habitual consumption of sugar-sweetened beverages among Dutch youth aged 13 years (8). Although the direction of the association between habit strength and TV viewing is unable to be determined from the current cross-sectional study, and the measure of TV viewing is based on self-report data, these findings do suggest that habit strength is worthy of further investigation. Studies aiming to reduce TV viewing might consider targeting raising awareness of the behavior through self-monitoring or may even attempt to 'break' TV viewing habits by encouraging adolescents to commit to spending less time in this behavior (e.g., behavioral contracting).

Findings from the present study that adolescents whose parents reported high levels of TV viewing had more than twice the odds of exceeding TV viewing guidelines compared with other adolescents is also consistent with previous research (9,14), and ethnicity and parents' education moderated this association. Those parents who were high TV viewers, who were of Dutch or Western ethnicity, or had medium to high levels of education, were more likely to have

adolescents that exceeded TV viewing guidelines. The mechanism for the interaction between TV viewing and ethnicity is currently unknown. TV viewing patterns may also be different in Dutch or Western families compared with families of non-Dutch origin, although further research is required to explore this. The mechanism for the interaction between TV viewing and parental education is also unknown; however, one explanation may be that a higher level of parental education (a proxy for family-level SES) does not have the 'protective' effect from certain health risk behaviours that may be expected. Alternatively, it is possible that parents watching with their children may be more engaged in activities with their children, even if these may not be 'healthy' behaviors, and they may be viewed favorably by parents with higher levels of education as positive family time. Thus, the interaction between TV viewing and education could be an indicator of 'family togetherness' (23). Further, there is some evidence that not all TV is considered 'bad' (24), and children from families with higher levels of education may be watching educational shows. Future research should consider taking a whole family approach and examine parents' TV viewing behaviour in more depth.

Findings from the current study suggest that adolescents who were overweight or obese were almost three times more likely to exceed TV viewing guidelines compared with other adolescents. Although some have argued that the relationship between TV viewing and weight (for example) may not be clinically significant (25), previous cross-sectional studies have also demonstrated this association (9).

However the direction of this association cannot be determined from the current study or other cross-sectional research. It may be that watching large amounts of TV increases risk for weight gain, or alternatively being overweight may encourage increased participation in sedentary pursuits instead of more active pastimes. TV viewing appears to be one of a number of unhealthy behaviors that cluster together. Previous research has shown that high TV viewing is associated with increased consumption of sweet beverages and savory snacks (16,26), and in the present study, high levels of computer use was also associated with increased odds of exceeding TV viewing recommendations. Further research that considers multiple sedentary behaviours that appear to cluster together (e.g., TV viewing and computer use), as well as other unhealthy behaviours, such as snack and sugar-sweetened beverage consumption, for associations with weight status may shed further light on this complex relationship.

There are some limitations of the present study. Adolescents' and parents' TV viewing was self-reported, which may be subject to poor recall, and may have resulted in reporting bias (e.g., socially desirable responses). The present study is cross-sectional; therefore inferences about causality cannot be made. The measure of habit strength used contains an item examining whether participants do the behavior 'often', which may be perceived to overlap with the measure of frequency used as the outcome variable. There were also a large number of individual-level variables and fewer physical environmental factors examined, and there are also likely to be several other factors not measured in this study, which may be important for adolescents' TV viewing. Parental data were not available for all adolescents who participated in the ENDORSE study; therefore findings may not be generalizable to adolescents whose parents did not participate in the study. Indeed, adolescents with complete data were less likely to exceed TV viewing guidelines than those without missing self-report or parent-report data, suggesting this may have resulted in a selective sample.

This study is one of the first to take a social ecological approach to examining adolescents' TV viewing, as well as one of the first to examine potential moderators of the associations between social ecological factors and TV viewing. Further research is required to determine the direction of the associations found and whether they are consistent across different age groups, as well as to further explore the role of parental education and ethnicity. Given the health implications of large amounts of TV viewing, these findings are important to consider in the context of the development of effective interventions to reduce time spent in these types of sedentary

pastimes. The present study suggests that health education to target adolescents' attitudes and motivation to reduce TV viewing may not be very promising. Interventions should rather target parents' TV viewing behaviors and should be aimed at reducing habitual, 'mindless' TV viewing.

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