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Mediators of the Relationship Between Maternal Education and Children’s TV Viewing

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Introduction

High levels of television viewing by children are associated with a range of negative social and health effects including aggressive behaviour, poor school achievement, social problems, poor self-rated health, consumption of high energy drinks and snacks, low fruit consumption, lack of participation in organised physical activity, and overweight. In an attempt to reduce such negative effects, it has been recommended that parents limit the amount of time their children spend watching television. However, some parents may be better equipped than others to act upon such recommendations. For example, maternal education level is consistently found to be inversely associated with children’s television viewing.

Maternal education also appears to be related to certain aspects of the family television environment. The Social Ecological model proposed by Davison and Birch provides a useful framework for investigating influences on health-related behaviors such as television viewing. According to this model, the family television environment can include both the physical (number and location of televisions) and the social environments (rules and practices associated with television viewing) within the family home. Maternal education has been found to be inversely associated with a child having a television in their bedroom and to be positively associated with parental concern about the amount of time their child spends watching television. Further, aspects of the family television environment, including frequency of families watching television together, mealtime television viewing, parents’ television viewing habits and having a television in the child’s bedroom have also been found to be associated with children’s viewing time.

This study aims to develop a greater understanding of the relationships between maternal education, the family television environment, and the amount of time children spend watching television.
Specifically, aspects of the family television environment that may mediate the relationship between maternal education and children’s television viewing time will be investigated. By developing an understanding of the potential mediators we will be better able to tailor interventions targeting mothers with lower levels of education, which aim to reduce television viewing and its associated consequences.

Methods

Sample

The sample consists of 1484 families involved in the Health, Eating and Play Study (HEAPS), conducted in 2002/2003. HEAPS employed a stratified random sampling technique to select schools for participation in the study. All government and Catholic elementary schools in suburban Melbourne, Australia with a total enrolment exceeding 200 students were classified into socio-economic status (SES) quintiles using the Australian Bureau of Statistics Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-Economic Disadvantage. In order to ensure representation from a spread of SES groups, schools classified in the highest, middle and lowest quintiles were eligible for sampling (schools in the 2\textsuperscript{nd} and 4\textsuperscript{th} quintile were excluded). Thirteen schools from each of the three included quintile groups were randomly selected with a probability proportional to school size. A total of 24 schools (9 high, 7 middle and 8 low SES area schools) agreed to participate. All families of children in their first year of school (mean age 6 years; younger children) at all 24 schools and families of children in school year levels 5 and 6 (mean age 11 years; older children) at 17 of the 24 schools were invited to take part. (Study 2 was initially a study of school-entry age children only. Opportunistically, children in years 5 and 6 were also included during 2003 data collection. The 17 schools from which the older children were included were evenly distributed across the low, middle and high SES groups)
The study received ethics approval from the Deakin University Human Ethics Committee, the Victorian Department of Education and Training and the Catholic Education Office. Under existing ethical guidelines it was necessary to seek active written consent from parents for each child’s participation and no information could be accessed regarding characteristics of non-respondents. Written parental consent was received for 1562 children (42% response). No area-level socio-economic gradient was noted in response rates (41% response at high, 39% at middle and 48% at low SES area schools). Due to incomplete independent and/or dependent variable data, 78 children were excluded from analyses for this paper.

**Measures**

All data were provided by the child’s main carer who completed a questionnaire at home. Respondents provided information on their own and, where applicable, their partner/co-carer’s highest level of schooling. The six response options were condensed to three levels of education: less than secondary school (“never attended school”, “primary school”, “some high school”), secondary school (“completed high school”, “technical or trade school certificate/apprenticeship”) and post-secondary (“university or tertiary qualification”). Based on reported gender of the respondent and co-carer, maternal (mother or female co-carer) education was derived.

Respondents reported the amount of time their child spends watching television (including commercial, non-commercial, cable/pay TV, videos and DVDs) on a usual school day and usual weekend day (scale ranging from “0” to “6 or more” hours, in half hour segments). School day estimates were multiplied by five and weekend day estimates were multiplied by two, the totals were summed and divided by seven to generate average viewing time (minutes per day) which was slightly positively skewed (skewness 0.93). Intra-class correlations and percent agreement were used to assess test-retest reliability. For continuous variables, an ICC above 0.75 was considered as indicating excellent reliability, an ICC between 0.4 and 0.75 as fair to good reliability, and an ICC below 0.4 as poor reliability. For categorical variables, percent agreement values above 66% were
considered fair. The ICC showed this measure to be reliable in repeated administrations (ICC = 0.78, 95% CI = 0.69, 0.84, p<0.001).

Respondents also answered 22 items (assessing 21 mediators) providing information on their family’s television viewing environment. These items were developed, based on a social ecological framework, to incorporate factors such as family television viewing practices, family television rules, parental modelling, division of responsibility, and access to sedentary pursuits at home. Two identical items enquired about how much the respondent and co-carer care about how much time they spend watching TV (“not at all”, “a little bit”, “quite a bit” or “very much”). As with level of education, based on reported gender of the respondent and co-carer, maternal level of care about their own television viewing was derived. The remaining 20 items are detailed in Table 1. Some of these items were developed and reliability-tested as part of a previous study, and were modified for use here.

All 22 items underwent test-retest reliability testing as part of this study. Due to the time required to complete the entire questionnaire, the original questionnaire was divided in two for the retest and separate sub-samples derived from the main study sample were asked to complete one half of the survey two weeks after they had completed the initial (entire) questionnaire. A random subsample of 137 study parents completed the first half of the original questionnaire a second time (encompassing the majority of items involved in this paper) and a random subsample of 39 study parents completed the second half of the original questionnaire a second time (encompassing 5 items used in this paper). Intra-class correlation or percent agreement statistics (for continuous and categorical variables, respectively) were calculated for each questionnaire item; results are presented in Table 1.

<< Insert Table 1 about here >>
Analyses

Children’s gender is consistently found to be unrelated to television viewing while it appears that older children may watch more television than younger children. These associations were observed in the current sample (independent samples t-test for gender, p=0.37; and for age group, p<0.001), therefore data were analysed for the sample as a whole and separately for younger (Grade Prep) and older (Grade 5-6) children. To account for the cluster-based sampling, all analyses included school as the cluster unit to give a robust variance estimate that adjusts for within-cluster correlation.

Baron and Kenny’s approach to testing mediation was used in this study. Individual linear and logistic regression analyses were used, as appropriate, to assess which potential mediating variables met the initial two conditions for mediation: (1) the independent variable (maternal education) being significantly associated with the potential mediator and (2) the potential mediator being significantly associated with the dependent variable (children’s television viewing). For these initial criteria an inclusive significance level of p<0.10 was set. The final condition of mediation is that inclusion of the potential mediator reduces the association between the independent and dependent variables. To test this, separate linear regression analyses were conducted for each potential mediator including the potential mediator and maternal education as the independent variables. To test for collinearity, pairwise correlations (r>0.7) and variance inflation factors (VIF≥10) for potential mediators were assessed. Finally, a multivariable regression analysis was conducted including maternal education and all potential mediators simultaneously. The decrease in the size of the regression (beta) coefficient was used as an indicator of the magnitude of mediation and R² was used to provide an indication of the proportion of variance in children’s television viewing accounted for by each model. All analyses were conducted in 2006.
Results

Characteristics of the 1484 children in the sample are presented in Table 2. In both age groups the sample was distributed across area-level SES and maternal education categories, providing a socio-economically diverse sample. Mean daily television viewing for the total sample exceeded three hours and was higher in older than younger children. Only four children in the entire sample spent an average of 2 hours or less per day watching television and thus potentially met the Australian guidelines for electronic media use. Maternal education was strongly inversely related to daily television viewing in the total sample ($\beta = -31.0$, $95\%$ CI $= -38.7$, -23.2), and among younger ($\beta = -25.3$, $95\%$ CI $= -35.9$, -14.8) and older children ($\beta = -34.2$, $95\%$ CI $= -43.7$, -24.8).

Assessment of whether potential mediators meet initial conditions for mediation

Of the 21 potential mediators assessed, six were not related ($p>0.10$) to maternal education (first initial condition to be met for mediation) and a further two were not related to daily television viewing (second initial condition to be met for mediation) in either age group. Of the remaining 13 potential mediators, one (co-carer supports television rules) was excluded as it was only related to both maternal education and daily television viewing in younger children and its inclusion resulted in the loss from analyses of children from single-parent families. The final 12 potential mediators (see Table 3) were included in subsequent analyses; only children with complete data (independent variable, dependent variable and all 12 potential mediators) were included ($n=1348$).

The vast majority of pairwise correlations among mediator variables did not exceed $r=0.2$. Only one pair of potential mediators was correlated at $r>0.7$: frequency of child eating dinner in front of the TV with frequency of parent(s) eating dinner in front of the TV with the child ($r=0.80$). The variance inflation factors of all of the individual mediators were low ($<10$) (range 1.06, 3.17). As the variance inflation factors were low and exclusion of either variable in the final multivariable
model resulted in negligible change in beta values, neither of the highly correlated variables was excluded from the analyses involving all the potential mediators concurrently.

**Effect of potential mediators on relationship between maternal education and children’s television viewing**

Table 3 presents beta values and reduction in beta values, for the association between maternal education and children’s television viewing, for each potential mediating model. For each individual mediator, inclusion in the linear regression model resulted in a decrease in beta values (between the range of 3.2% and 15.2%) for the association between maternal education and television viewing. However, the association between maternal education and children’s television viewing remained significant (p<0.001) in all models. This supports the hypothesis that these family television environment variables partly mediate the association between maternal education and children’s television viewing. The two variables describing the number and placement of televisions in the home appeared to have the greatest mediating effect. That is, the mediator models including each of these variables individually resulted in the greatest reduction in beta coefficients for the association between maternal education and children’s television viewing. While the impact of a television in the child’s bedroom was similar for older and younger children, inclusion of number of televisions in the home resulted in a greater reduction in the beta coefficient for the association between maternal education and children’s television viewing in older than younger children. Of the social family television environment variables, frequency of eating dinner in front of the television with the child and rules about television viewing during mealtimes appeared to have the greatest mediating effects. In most cases the magnitude of reduction in beta values for the association between maternal education and television viewing were similar for both age groups. However, frequency of eating snacks with the child while watching television and restricting how much time the child spends watching television had a greater magnitude of effect in younger than older children (13.4% versus 7.9% reduction in beta).
Inclusion of all mediators concurrently resulted in a 39% reduction in the beta value, suggesting these family TV environment variables account for more than one-third of the association between maternal education and children’s television viewing. Similarly large reductions in the beta value were observed for the younger (33.2%) and older (34.8%) groups of children. Again, the association between maternal education and children’s television viewing remained significant in these models (p<0.001 for total sample and older children; p=0.001 for younger children).

Discussion

Children in this study generally spent more time watching television than the two hours per day recommended by current guidelines. Consistent with previous research, children whose mothers had attained lower levels of education tended to spend more time watching television than those whose mothers had higher levels of education. This study suggests that the strong inverse relationship between maternal education and children’s television viewing is partly mediated by certain aspects of the family television environment, although temporal relationships can not be ascertained from this cross-sectional data. In particular, physical aspects of the family television environment (number of televisions in the home and presence of a television in the child’s bedroom) and family rules and practices associated with eating while watching television appeared to be most important. Together, the 12 family television environment mediators accounted for more than one third of the association between maternal education and children’s television viewing time. The strongest mediators of the relationship between maternal education and children’s television viewing were those related to the physical aspects of the family television environment. While separate studies have reported that the presence of a television in the child’s bedroom is inversely associated with maternal education and positively associated with children’s television viewing
time,\textsuperscript{9} we were able to show that having a television in the child’s bedroom may also mediate the association between maternal education and children’s television viewing. The number of television sets in the home was also a mediator of the association between maternal education and children’s television viewing. It appears that the greater television viewing time observed for children with less educated mothers is partially related to the different physical environments provided by these mothers. Thus providing mothers, particularly those with lower levels of education, with messages about the importance of limiting children’s access to television sets in the home may be a useful strategy to reduce children’s television viewing time.

The social aspects of the family television environment that most strongly mediated the association between maternal education and children’s television viewing were those related to rules and practices within the family related to eating while watching television. An association between mealtime television viewing and children’s television viewing time has previously been reported,\textsuperscript{10,13} but we have demonstrated that these rules and practices may be inequitably distributed depending on maternal education level. Parents with lower levels of education are less likely to report having household rules related to television viewing.\textsuperscript{20} Less educated mothers may have more difficulty, or place lesser importance on limit setting with regard to their child’s television viewing, with higher levels of viewing the consequence. Equally, less educated mothers may be raising their children in more challenging physical environments (e.g., smaller homes, smaller backyards, neighbourhoods with greater safety concerns and fewer outdoor play spaces) and may use television as a babysitter or an alternative to fee-incurring after-school activities.

Although this study achieved only a modest response rate, the participants spanned a broad range of socio-economic backgrounds. In addition, the repose rate is similar to that achieved in other health surveys, and there is evidence that response rates for most major studies have been falling over the past few decades and that it is not necessary to have high response rates to ensure a broad spectrum of respondents are represented.\textsuperscript{21} While the test-retest reliability results for some of the potential
mediator variables were modest, those variables that most strongly mediated the association between maternal education and children’s television viewing demonstrated greater reliability on repeat administration. The large number of statistical tests performed means that it is possible that some of the associations detected were chance findings, however a larger number of associations were detected than would be expected by chance. Like all associational analyses based on cross-sectional data, the ability to draw firm temporal or causal conclusions of mediating effects from these data are limited. However, maternal education could plausibly be assumed to be established prior to the family television environment and children’s television viewing practices. Alternative explanations for these findings should also be considered. It is possible that an additional unmeasured factor, such as overall family SES, influences maternal education, the television environment, and television viewing time. Furthermore, this study did not assess the potentially important role of the father or co-carer, who may also have an influential role in shaping the physical environment. The strengths of this study include a large sample, allowing stratification by age group and the consideration of multiple potential mediators of the relationship between maternal education and children’s television viewing time.

The findings of this study have important implications for the development of interventions or public health messages aimed at reducing television viewing time, and its associated consequences, in children from low maternal education families. As maternal education is often considered a proxy for family socio-economic status, these findings may be able to be generalised to families facing other forms of socio-economic disadvantage (e.g., those where parents have low incomes, or low occupational status). Specifically, it appears that messages focusing on removing televisions from children’s bedrooms, limiting the number of televisions in the home, turning the television off during mealtimes and discouraging eating (meals or snacking) while watching television, may have the greatest potential to effect change in viewing patterns and particularly to reduce elevated viewing times among children whose mothers’ have lower levels of education.
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References


