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Childhood and adolescent television viewing and internalising disorders in adulthood

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ABSTRACT

Time spent watching television during childhood and adolescence has been linked to socio-emotional and physical health problems in adulthood. It is unclear whether excessive television viewing is a risk factor for internalising mental health disorders such as anxiety and depression. Longitudinal associations between television viewing in childhood and adult diagnoses of anxiety and depression were investigated in a population-based birth cohort from Dunedin, New Zealand. Mean weekday television viewing time was reported by parents and adolescents between ages 5 and 15 years (1977–1987). Diagnoses of any anxiety disorder and major depression were made using standard criteria from symptoms reported for the previous year at ages 18, 21, 26, 32, and 38 years (between 1990 and 2012). Analyses adjusted for sex, parent and teacher reports of worry/fearfulness at age 5, and socioeconomic status during childhood. Diagnoses were counted if present at any of these assessments. Approximately half of all participants met criteria for anxiety disorder or depression during at least one adult assessment. Participants who had watched more television during childhood and adolescence were more likely to have a diagnosis of anxiety in sex-adjusted analyses (OR [95% CI] 1.22 [1.05, 1.41], $p = 0.01$), although this association weakened after adjustment for early childhood worry/fearfulness and socioeconomic status. There was no association between television viewing and depression in sex- or fully-adjusted analyses. Excessive television viewing during childhood and adolescence may be a risk factor for developing an anxiety disorder in adulthood, but does not appear to influence the long-term risk for major depression.

1. Introduction

Television and other screen-based media play a major role in modern life, affecting social interactions, family routines, and leisure activities, all of which impact upon child development. Watching television is a particularly common and enduring experience in childhood: American children spend more hours interacting with screen based media than any other waking activity (Rideout, 2015). Excessive childhood television viewing time has been linked to several long-term social, physical and mental health problems in adulthood including unemployment, obesity, poor fitness, raised blood cholesterol, smoking, sleep problems, attention difficulties, and externalising problems such as antisocial behaviour (Owens et al., 1999; Hancox et al., 2005; Landhuis et al., 2007; Johnson et al., 2002; Robertson et al., 2013). However, there has been little research into the long-term effects of television viewing in childhood and internalising mental health disorders, such as depression and anxiety.

Several cross-sectional studies of children and adolescents have reported an increased risk of depression (Bickham et al., 2015; Primack et al., 2009) anxiety (Maras et al., 2015) and psychological distress among those with greater total screen time, television viewing, and lower physical activity levels (Hamer et al., 2009; Cao et al., 2011; Liu et al., 2016a), although some studies have found no association (Casiano et al., 2012). In adults, a longitudinal study of university graduates found that time spent watching television or using computers was associated with an increased risk of internalising mental health disorders up to 6 years later (Sanchez-Villegas et al., 2008).

Although many children now have access to a wide variety of other media beyond television, television is still the most accessible screen-based medium and television viewing times remain high (Rideout, 2015; AAP Council on Communications and Media, 2016; Reid Chassiakos et al., 2016), with many new media platforms being used to watch television programs. Hence the influence of excessive television viewing on long-term risk for health remains highly relevant and is also a worthwhile target for interventions aimed at decreasing screen time. We investigated the long-term associations between childhood and adolescent television viewing and adult internalising disorders in a population-based birth cohort study followed to age 38. We

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hypothesised that time spent watching television in childhood and adolescence would be associated with an increased risk of anxiety and depression in adulthood.

2. Methods

Study members were born in Dunedin, New Zealand, between April 1972 and March 1973 (Poulton et al., 2015). The cohort was formed when 1037 children (91% of eligible births; 535 [52%] boys) attended the initial follow-up at age 3 years. Further follow-up assessments were undertaken at ages 5 (n = 991), 7 (n = 954), 9 (n = 955), 11 (n = 925), 13 (n = 850), 15 (n = 976), 18 (n = 993), 21 (n = 992), 26 (n = 980), 32 (n = 972) and 38 (n = 961) years. Ninety-five percent of living Study members continue to participate. Cohort families represented the full range of socioeconomic status in the South Island of New Zealand, and were mostly of New Zealand–European ethnicity. Written informed consent was obtained for each assessment (from parents up until age 15 and participants thereafter) and the study was approved by the Otago Ethics Committee.

At ages 5, 7, 9, and 11 years, parents were asked how much time Study members spent watching weekday television. At ages 13 and 15, Study members themselves were asked how long they usually watched television on weekdays and at weekends. Our summary variable was a composite of child and adolescent viewing calculated as the mean viewing hours per weekday between ages 5 and 15 years as previously described (Hancox et al., 2004). Data were also assessed using weekday child and adolescent viewing separately to determine if television viewing during these different ages had different effects on adult mental health outcomes.

Diagnoses of depression and anxiety were based on the Diagnostic and Statistical Manual of Mental Disorders (DSM) at assessments between the ages of 18 and 38 years. Symptoms were ascertained using the Diagnostic Interview Schedule (DIS), which is a structured questionnaire designed to determine the presence of major psychiatric disorders in the DSM. In keeping with the version current at the time, the Diagnostic Interview Schedule was based on the DSM III-R criteria at age 18 and DSM-IV at ages 21, 26, 32, and 38 years. Questions were modified to meet the requirements of the Dunedin study (Feehan et al., 1994). Examples of these changes were: wording being changed from "ever" to "in the last year" and using New Zealand instead of American terminology. Study members were considered to have an anxiety disorder if they met DSM criteria for any of: generalised anxiety disorder, social phobia, simple phobia, panic disorder, or agoraphobia in the year prior to any assessment. They were considered to have had a major depressive episode if they met the DSM criteria for this in the year prior to any of the assessments.

Childhood socio-economic status was assessed from the average parental occupational status from birth to age 15 years as previously described (Hancox et al., 2004; Poulton et al., 2002). Parents were assigned a code on a scale of 1 to 6 based on the educational level and income associated with that occupation in the New Zealand census (1 = professional, 6 = unskilled labourer). Average childhood SES was calculated by using the results from the parent with the highest score at each age and then calculating the mean of those scores from birth to age 15 years.

Children's internalising problems at age 5 were assessed using parent and teacher reports for the Rutter Child Scale for worry/fearfulness (Rutter et al., 1970). Parents and teachers were asked whether the following statements applied: "often worried, worries about many things", "tends to do things on his own - rather solitary", "often appears miserable, unhappy, tearful, or distressed", "tends to be fearful or afraid of new things or new situations", "fussy or over-particular child", "has tears upon arrival at school".

2.1. Statistical analyses

Logistic regression was used investigate associations between mean childhood television viewing time as the main predictor and diagnoses of depression or anxiety disorder between 18 and 38 years of age as the dependent variable. To assess whether associations were different for male and female Study members, initial analyses tested for sex interactions. All analyses adjusted for sex and further analyses also adjusted for parent and teacher ratings of worry/fearfulness at age 5 and childhood socioeconomic status. Mean television viewing time was also categorised according to the American Academy of Pediatrics' previously recommended limit of 2 h viewing a night (Council on Communications and Media, 2013). Analyses were done using Stata (StataCorp, n.d.) and considered to be significant at $p < 0.05$.

3. Results

Study members watched an average of 2.35 mean hours of television each weekday between the ages of 5 and 15 years as previously reported (Table 1; Hancox et al., 2004). Girls spent less time watching television than boys (mean (SD) 2.24 (0.89) and 2.42 (0.86) hours respectively, $p = 0.002$). Sixty-two percent of the cohort (612/993) watched an average of > 2 h of television per weeknight between ages 5 and 15. Women between the ages of 18–38 years were more likely to have a diagnosis of anxiety than men (62% and 39% respectively, $p < 0.001$) and were also more likely to have a diagnosis of depression (57% and 35% respectively, $p < 0.001$).

There was no evidence that associations between childhood television viewing and adult anxiety or depression diagnoses were different between boys and girls (interaction p values between sex and television were $p = 0.622$ and $p = 0.479$ for anxiety and depression respectively). Therefore subsequent analyses were completed for the whole sample with an adjustment for sex.

Childhood mean television viewing time was associated with a higher risk of a diagnosis of anxiety in adulthood at any assessed age between 18 and 38 (Table 2). This association was not statistically significant after controlling for parent and teacher scores rating of childhood worry/fearfulness, and childhood socioeconomic status ($p = 0.059$).

Table 1
Descriptives for the variables used in analyses.

Predictor variables	Ages (years)	N	Mean	Std dev
Television viewing				
Childhood TV viewing hours	5–11	993	2.06	0.83
Adolescent TV viewing hours	13–15	886	3.13	1.44
Childhood and adolescent TV viewing	5–15	993	2.35	0.86
Childhood SES	0–15	989	3.24	1.13
Worry/fearfulness				
Teacher ratings	5	959	1.20	1.64
Parent ratings	5	959	1.96	1.80

Anxiety & depression diagnoses	Ages (years)	n/N	Women	Men
Anxiety diagnoses	18	205/930	133	72
	21	170/957	116	54
	26	212/976	125	87
	32	202/963	119	83
	38	189/952	123	66
Any anxiety diagnosis	18–38	500/1003	298	202
Depression diagnoses	18	163/935	109	54
	21	161/957	106	55
	26	161/976	94	67
	32	157/963	98	59
	38	155/951	93	62
Any depression diagnosis	18–38	460/1003	277	183

Table 2
Associations between mean childhood television viewing time and adult internalising disorders.

Outcome	Adjustments	n	OR (95% CI)	p
Anxiety	Sex	993	1.22 (1.05, 1.41)	0.010
	Full[a]	935	1.17 (0.99, 1.40)	0.059
Depression	Sex	993	1.05 (0.91, 1.22)	0.507
	Full[a]	935	1.08 (0.91, 1.27)	0.390

Diagnoses of internalising disorders include any diagnosis at age 18, 21, 26, 32, or 38. Analyses are by multivariable logistic regression. OR (95% CI) are the odds ratios and 95% confidence intervals associated with each hour of mean television viewing per weeknight between ages 5 and 15 years.

[a] Fully adjusted analyses adjust for sex, parent and teacher reports of worry/fearfulness at age 5, and childhood socioeconomic status.

Table 3
Associations between watching > 2 h of television per day during childhood and adult internalising disorders.

Outcome	Adjustments	n	OR (95% CI)	p
Anxiety	Sex	993	1.50 (1.15, 1.95)	0.003
	Full[a]	935	1.39 (1.04, 1.86)	0.026
Depression	Sex	993	1.05 (0.81, 1.37)	0.717
	Full[a]	935	1.02 (0.77, 1.36)	0.878

Diagnoses of internalising disorders include any diagnosis at age 18, 21, 26, 32, or 38. Analyses are by logistic regression. OR (95% CI) are the odds ratios and 95% confidence intervals associated with watching an average of > 2 h of television per weeknight between ages 5 and 15 years. n/N (%) are the numbers of participants who watched > 2 h of television per weeknight.

[a] Fully adjusted analyses adjust for sex, parent and teacher reports of worry/fearfulness at age 5, and childhood socioeconomic status.

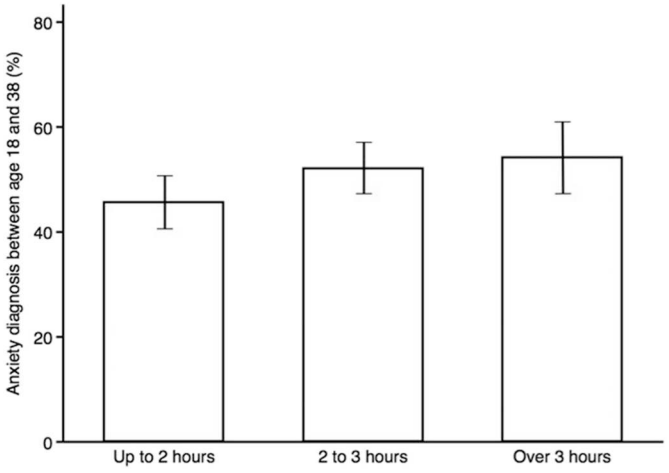

Fig. 1. Diagnoses of adult anxiety disorders according to mean childhood television viewing time. Error bars show 95% confidence intervals: $p = 0.033$ for trend across groups.

Children who watched an average of > 2 h of television were more likely to have a diagnosis of anxiety in adulthood (during at least one assessment between 18 and 38) than those that watched less than 2 h (Table 3, Fig. 1). This association remained statistically significant after controlling for additional covariates.

Childhood mean television time was not associated with the risk of a diagnosis of depression between ages 18 and 38 (Table 2) in either sex-adjusted or fully-adjusted analyses. Children who watched an average of > 2 h of television were not more likely to have a depression diagnosis in adulthood (Table 3, Fig. 2).

Over the course of the data collection, 132 of the 993 (13%) participants in Table 2 missed at least one assessment for adult anxiety and

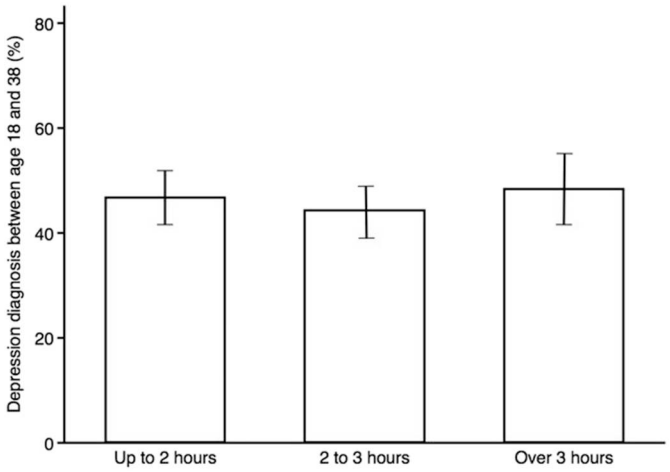

Fig. 2. Diagnoses of adult depression according to mean childhood television viewing time. Error bars show 95% confidence intervals: $p = 0.865$ for trend across groups.

136 (14%) missed at least one assessment for depression. Those with missing assessments had fewer opportunities for the diagnoses to be made, but it is also possible that participants with internalising disorders would be more likely to miss an assessment. Adjusting the analyses for the number of assessments attended made no material difference to the analyses for either anxiety or depression diagnoses. However, restricting the analyses to only those with complete data slightly reduced the strength of association between television viewing and a later diagnosis of anxiety. This association remained significant in the sex-adjusted analysis (OR = 1.19, 95% CI = 1.02 to 1.40, $p = 0.031$), but was not significant in the multiply-adjusted analyses (OR = 1.14, 95% CI = 0.95 to 1.36, $p = 0.157$). Excluding those with any missing depression diagnoses made no material difference to the analyses of the association between television viewing and depression.

Television viewing time during childhood and adolescence was also analysed separately: a diagnosis of adult anxiety was associated with viewing in adolescence in both unadjusted and fully adjusted analyses, but not with cumulative television use up to age 11 (Table 4). Neither childhood nor adolescent television viewing times were associated with an adulthood diagnosis of depression (Table 4).

A trajectory analysis using categories based on more (or less) than 2 h of viewing per night in childhood and adolescence shows that only those with persistently high viewing times have an increased risk of anxiety (OR = 1.57, 95% CI = 1.09 to 2.27, $p = 0.015$) compared to

Table 4
Associations between mean childhood or adolescent television viewing time and adult internalising disorders.

Predictor	Outcome	Adjustments	n	OR (95% CI)	p
Childhood TV	Anxiety	Sex	987	1.13 (0.96, 1.32)	0.136
		Full[a]	935	1.07 (0.90, 1.27)	0.467
	Depression	Sex	987	1.02 (0.87, 1.19)	0.794
		Full[a]	935	1.03 (0.87, 1.22)	0.718
Adolescent TV	Anxiety	Sex	868	1.16 (1.06, 1.28)	< 0.001
		Full[a]	829	1.15 (1.04, 1.28)	0.008
	Depression	Sex	868	1.05 (0.96, 1.15)	0.307
		Full[a]	829	1.06 (0.96, 1.18)	0.234

Diagnoses of internalising disorders include any diagnosis at age 18, 21, 26, 32, or 38. Analyses are by logistic regression. OR (95% CI) are the odds ratios and 95% confidence intervals associated with each hour of mean weeknight television viewing per weeknight during childhood (age 5 to 11 years) of with mean daily viewing in adolescence (ages 13 and 15 years).

[a] Fully adjusted analyses adjust for sex, parent and teacher reports of worry/fearfulness at age 5, and childhood socioeconomic status.

those who watched an average of < 2 h during both childhood and adolescence. There was no increased risk of anxiety in those who exceeded 2 h of viewing at only one developmental stage (p values > 0.65). There were no significant associations in relation to depression (all p values > 0.78).

4. Discussion

We have found evidence that spending more time watching television in childhood and adolescence is associated with a higher chance of having an anxiety disorder in early to mid-adult life. Children who exceeded the recommended average of no more than 2 h of television per day were more likely to meet standard criteria used for diagnosing an anxiety disorder at some time between ages 18 and 38 years. This association was of borderline statistical significance after adjusting for multiple covariates, however, television viewing in adolescence (reported at age 13 and 15) was significantly associated with adult diagnoses of anxiety, even after adjustment for covariates. Contrary to our hypothesis, we found no evidence that mean childhood television exposure from age 5 to 15, nor television viewing during either childhood or adolescence, was associated with adult depression.

We believe that this is the first longitudinal study to assess the association between childhood and adolescent television viewing and adulthood diagnoses of anxiety. Although the strength of the association was modest, the findings are important in view of the high disease burden of anxiety disorders and the fact that watching television still dominates school-aged children's media use (Rideout, 2015), and represents a modifiable risk factor. The association was independent of a number of potential confounding factors, including parents' assessment of worry/fearfulness at age 5, and childhood socioeconomic status. This increased risk of anxiety was only observed among those who watched an average of more than 2 h of television per night during both childhood and adolescence. There are few studies of television use and anxiety and, although some cross-sectional studies in adults have found a positive association, a recent systematic review found there to be insufficient evidence reach a conclusion on the impact of television viewing on internalising disorders (Teychenne et al., 2015). As far as we are aware, only one other longitudinal study has been done, which found no significant association between combined leisure time television viewing and computer time and anxiety in university graduates followed for up to 6 years (Sanchez-Villegas et al., 2008).

As with any observational study, we cannot prove causation, but there are a number of plausible mechanisms by which excessive television viewing could lead to anxiety disorders. Although television can be a social experience it can also easily be viewed in isolation. Failure to engage in more social activities during childhood or adolescence could lead to greater anxiety when dealing with other people later in life. It is also possible that the association between and television viewing and anxiety was due to reverse causation: because television viewing can be done at home and alone, it may appeal to those with social anxiety. However, the association persisted after adjusting for parent and teacher ratings of worry/fearfulness at age 5 making reverse causation less likely. Although we also adjusted for socio-economic status, it remains possible that other factors associated with participants' families of origin are confounding this association.

Our finding that there was no association between childhood television viewing and a diagnosis of depression contrasts with the previously reported link between childhood television viewing and depression in earlier longitudinal studies (Bickham et al., 2015; Primack et al., 2009). Possible reasons for this discrepancy include differences in the societies in which the participants lived, the ages of the participants, and the nature of follow-up. In the earlier studies a single assessment of media use was obtained during adolescence and a single follow-up for depressive symptoms was made 2 or 7 years later. By contrast, our study assessed television viewing across multiple ages from age 5 to 15 years with multiple follow-up assessments between 3 and 23 years later. We also used DSM criteria for major depression rather than measures of depression symptoms. A recent meta-analysis of both the cross-sectional and longitudinal evidence found no associations between television time and depression, although total screen time and computer use in particular was associated with the risk of depression (Liu et al., 2016b). A systematic review of sedentary behaviour and mental health in adolescents also found strong evidence for an association between sedentary behaviour/screen time and depression symptoms, but found little evidence specifically on television viewing (Hoare et al., 2016). At the time that our cohort was growing up, there were few home computers and we cannot assess whether other screen-based activities increase the long-term risk for depression, but taken together with the findings of the meta-analysis and systematic review, our findings suggests that childhood television viewing is unlikely to be a major risk factor for depression in early to mid-adult life.

This study has a number of important strengths. Television viewing time was recorded over multiple ages during childhood and adolescence and mental health outcomes were also assessed over multiple ages using standard diagnostic instruments. We can adjust for a number of potential confounding factors including both parent and teachers' assessments of the participants' worry/fearfulness scores at age 5 years. Having an independent adult comment on the child's worry/fearfulness may avoid the reporting bias inherent in familial reports where parents may have similar symptoms. However, our measure of worry/fearfulness at age 5 may not completely capture a child's tendency towards anxiety and reverse causation remains possible.

Limitations include the fact that we only have data on internalising disorders for the year immediately prior to each assessment. Although the follow-up has been very high over such a long period of time, many participants missed at least one mental health assessment. Adjusting for this made little difference to the findings (the effect sizes), but the association between television viewing and anxiety was not statistically significant in the fully-adjusted analysis if this was restricted to those with complete mental health data for every adult assessment age. Estimates of television viewing were also based on parent- and self-reports and will have inaccuracies and may also be prone to social desirability reporting bias. Furthermore, we could not objectively validate these self-reported viewing times. It seems unlikely, however, that these limitations would systematically bias the associations with later internalising disorders.

It is also important to note that the television and media environment has changed greatly since the 1970s and 1980s when this cohort was growing up. In contrast to today's rapidly evolving media environment, the participants in this research had a comparatively static media environment when their viewing was measured (1977–1988) with television being the only significant screen-based option. Although we do not know what cohort members were viewing, there were only two state-run television channels in New Zealand during this period of their lives. Consequently, the findings from this cohort may be an under-estimation of effects that would be found for young people's current television and screen based media use.

Despite these limitations, our findings suggest that excessive television viewing in childhood and adolescence is associated with an increased risk for anxiety in adulthood. As the first longitudinal study to examine this issue over this timeframe, it is important that this finding is replicated. It is also important to examine the effects of newer forms of screen-based media on children's long-term risk for mental health problems (AAP Council on Communications and Media, 2016; Reid Chassiakos et al., 2016). The widespread use of these new forms of media, with their potential benefits as well as risks, has led the American Academy of Pediatrics to move away from recommending a set screen time for children and adolescents in favour of developing a family media plan (AAP Council on Communications and Media, 2016; Reid Chassiakos et al., 2016). However, we found that exceeding the previously suggested threshold of an average of no more than 2 h a day of television viewing was associated with a greater risk of having a

diagnosis of anxiety in adulthood. It seems reasonable to confirm this threshold as a guideline for passive screen-use by school-aged children and adolescents, especially in light of researching indicating that other forms of sedentary behaviour may also be a risk for anxiety (Teychenne et al., 2015).

5. Conclusion

In summary, we found that the time spent watching television during childhood and adolescence was associated with a greater risk of being diagnosed with an anxiety disorders during early to mid-adult life. This association was independent of a number of potential confounding factors. We did not find evidence that childhood and adolescence television viewing time was associated with the risk for later depression. The generalisability of the findings to the current media environment are uncertain but given the changes that have occurred since this cohort were growing up, these findings may under-estimate the impact of current television and screen time on internalising disorders.

Declaration of Competing Interest

None.

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