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Do the psychosocial risks associated with television viewing increase mortality? Evidence from the 2008 General Social Survey-National Death Index Dataset

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Abstract

Background—Television viewing is associated with an increased risk of mortality, which could be caused by a sedentary lifestyle, the content of television programming (e.g., cigarette product placement or stress-inducing content), or both.

Methods—We examined the relationship between self-reported hours of television viewing and mortality risk over 30 years in a representative sample of the American adult population using the 2008 General Social Survey-National Death Index dataset. We also explored the intervening variable effect of various emotional states (e.g., happiness) and beliefs (e.g., trust in government) of the relationship between television viewing and mortality.

Results—We find that for each additional hour of viewing, mortality risks increased 4%. Given the mean duration of television viewing in our sample, this amounted to about 1.2 years of life expectancy in the US. This association was tempered by a number of potential psychosocial mediators, including self-reported measures of happiness, social capital, or confidence in institutions. While none of these were clinically significant, the combined mediation power was statistically significant ($p < 0.001$).

Conclusions—Television viewing among healthy adults is correlated with premature mortality in a nationally-representative sample of US adults, and this association may be partially mediated by programming content related to beliefs or affective states. However, this mediation effect is the result of many small changes in psychosocial states rather than large effects from a few factors.

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Disclosures

None.

INTRODUCTION

Those who watch more hours of television are also more likely to be obese, to smoke, to have a poor diet, to lead a sedentary lifestyle, and to have lower social capital.[1–3] In addition, a wide array of psychosocial and behavioral traits of individuals have been tied to television viewing.[4–6] These social and behavioral risks have also been hypothesized to translate into higher mortality, and a large body of literature supports these hypotheses.[7–13]

A number of international studies draw correlations between self-reported television viewing time and both all-cause and cardiovascular mortality among healthy adults.[14–21] It is not unreasonable to suspect that this is also true in the US, where television viewing accounts for more than half of all leisure time, and averages approximately 2.8 hours per day for those age 15 and over.[22] These studies assume that the underlying mechanism linking hours of television viewing and mortality is a sedentary lifestyle.[23] However, even among those who exercise regularly, greater viewing time is associated with a host of negative health outcomes (waist circumference, systolic blood-pressure, 2-h plasma glucose) in a dose-response manner.[24] In addition, the sedentary lifestyle hypothesis also does not explain why people who watch a good deal of television are also more likely to smoke and eat poorly.[2, 25, 26]

Such risks are more likely linked to the content of television programming, as advertisers promote unhealthy foods and smoking (via product placement). It is also possible that those who watch television respond to food industry advertisements by consuming more food, or more calorie-dense or processed fast food, which is more likely to take up airtime than advertisements for healthy foods.[27–29] Indeed, risky health behaviors have been independently linked to high exposure to commercials viewed on television.[30]

It is also possible that the content of television programming may alter emotional states, influence perceptions, and weaken social capital.[4–6] For instance, exposure to violent images on television could increase autonomic tone and stress. Given that some spend a large proportion of their lives viewing emotionally-intensive content on television, it is therefore plausible that the fictional world of television produces physiological effects similar to adverse emotional exposures in the real world. Psychological stress, increased autonomic tone, and negative affective states and beliefs have been independently linked to behavioral risk factors and physiological changes that lead to poor health and increased mortality.[10, 31] Social capital is also thought to be strongly linked to health, and those who watch a good deal of television likely participate less in community activities and have fewer social ties.[3, 8, 32–34] Those who watch a good deal of television may have ideas or attitudes that are correlated with poor health and lower longevity (such as distrust of medicine or of government). Finally, there could be some inherent characteristic of those who watch a large amount of television that increases health risks. For instance, it could be that people who happen to be sick or otherwise lethargic also watch more television.

In this paper, we explore the association between television viewing and mortality in a representative sample of the US adult population using the 1978–2008 General Social Survey-National Death Index (2008 GSS-NDI) dataset. We hypothesize that television viewing is linearly associated with mortality and that the association between television viewing and mortality is mediated by programming content. Specifically, we hypothesize that television viewing impacts emotional states (e.g., happiness) and beliefs (e.g., confidence in the government). To eliminate those who might watch television because they are ill, we limit our sample to those who self-report good or excellent health at the time of interview.

METHODS

Study population and design

We used data from the 1978–2002 General Social Surveys (GSS) linked to the National Death Index (NDI) through 2008 (2008 GSS-NDI).[35] The GSS is a representative sample of the United States non-institutionalized adult population conducted on a new population sample at each wave. The 2008 GSS-NDI is a new dataset in which questions from 18 waves of the GSS are prospectively linked to mortality data by cause of death. Details of the dataset are available elsewhere.[35]

The 2008 GSS-NDI contains all 32,830 subjects from the 18 waves of the GSS collected between 1978 and 2002 who could either be matched to NDI records, or were determined to be alive as of 2008. Only subjects who reported being healthy when surveyed were included in the analyses to control for poor health acting as a confounding variable when predicting subsequent mortality (9,344 subjects). Although self-reported health cannot be considered the equivalent of a detailed health assessment, it has been shown to correlate highly with objective health measures[36, 37] and to be predictive of mortality.[38–40] The GSS did not contain questions about television viewing behavior during two waves (1984, 1987) and self-rated health was not obtained in three waves (1978, 1983, 1986). However, these omissions were systematic (each wave is nationally-representative) and do not affect the representativeness of the sample.

Television viewing time was determined by the answer to the following question, “On the average day, about how many hours do you personally watch television?” with answers between 0 and 24 hours being valid. Television viewing time respondents reported when surveyed is used throughout. In our analytic sample, mean reported television viewing was 2.7 hours daily, which was similar to the 2.8 hours of daily viewing the United States time use reports have reported.[41] Demographic measures, including age, race, educational attainment, income, and employment status were determined by self-report and were used as covariates in the analyses. The “baseline” specification of our models used these variables in addition to television viewing as each is a known or plausible confounder in the association between television viewing and mortality. That is, unemployed people are much more likely than employed people to be in poor health and are also more likely to view television than either employed people or healthy people. While we include only participants with good or excellent self-reported health, some hypothesize that unemployment might itself be causally associated with poor health outcomes. Therefore, it is plausible that healthy unemployed people may both be more likely to watch television, and, for reasons unrelated to television viewing, become sick in the future.

In addition to the baseline specification, we included a number of potential mediating (intervening) variables to test whether they explain the relationship between television viewing and mortality. These included: “people can be trusted,” “most people would try to take advantage of you if they got a chance”; “would be afraid to walk alone at night [within a mile of the respondent’s house]?”; “people try to be helpful?”; “would you say that you are very happy, pretty happy, or not too happy?”; “how much satisfaction [do] you get from... [measured here as hobbies and friends]; “It’s hardly fair to bring a child into the world”; “I have little control over the bad things in life,”; “should not plan for much in life.”; “Would you say you have ... confidence” in: [measured as organized religion, the federal government, the scientific community]; “government should not pay for medical care”; “government should do less”; “government should not help the poor.”

Statistical analyses

We used discrete-time hazard models to examine the differences in hazard rates by reported daily television viewing.[42] This approach lends itself to situations where time is measured discretely, as it is in our sample.[43, 44] These models were used rather than Cox models after testing proportionate hazards assumptions.[43]

Individual observations in the data are expanded into a person-year format with one record for each year an individual was observed. Our dependent variable ‘*death*’ takes on the value of 0 or 1 depending on whether the individual died or survived in year s . Survival time, or duration, is estimated using the discrete time points of the years since time of survey up until death or censoring ($s=1, 2, \dots, t$). In this way, we can determine the proportion of individuals alive in each year s , which is the estimated survival for that period.[45] Therefore, survival probability at time s is:

$$S(t) = \prod_{s=1}^t [1 - h_s]$$

Often, discrete time hazard models use a general specification of time which involves one dummy indicator per each period of the follow up. Because our data have as many as 31 years of follow up, that specification would greatly reduce statistical power. We evaluated linear, quadratic, and higher order polynomial specifications of time which are all more parsimonious functional forms, and chose the quadratic form because it provided the best model fit.[46] We specify the hazard rate using the complementary log-log link (cloglog). This has the advantage of being comparable to the Cox proportional hazard in continuous time since the exponentiated coefficients from a discrete-time hazard model with the cloglog link is interpreted as a hazard ratio.[45] The cloglog discrete-time hazard rate h for individual i is:

$$\text{cloglog}(h_i) = \ln\{-\ln(1 - h_i)\} = \alpha D_i + \alpha D_i^2 + \beta X_i$$

where D is years of duration, $\alpha D + \alpha D^2$ is the baseline hazard, and X is a matrix of covariates.

We tested the proportionality assumption underlying discrete-time hazard models by interacting the duration variable with television hours. These interactions were not significant, indicating that the association between television watching and mortality does not depend on the length of time a respondent is in the sample.

To understand mediating (intervening variable) effects, first consider the effect of TV on the hazards of mortality using the baseline specification above (that is television viewing as the independent variable and mortality as the dependent variable without the intervening variable). Next consider an intervening variable, i , such as fear of crime. Assume that watching the nightly news increases fear responses while walking outside. Assume further that fear responses damage health by discouraging outdoor exercise and producing allostatic load. If these effects are responsible for some or all of the association between television viewing and mortality, then adding the participant’s perception of fear of walking outside should reduce mortality hazards in the baseline model (because these effects are now being held constant). We used methods examined by MacKinnon et al that are appropriate for survival analyses and the variable coding employed in our present analysis.[47, 48] We also apply a traditional approach (Baron and Kenny, reviewed in 48) because we believe it best illustrates the mediation effect.

As the final test, we employ “seemingly unrelated regression” (SUR) models to all of the mediation variables at once. In using SUR, we obtain a single variance–covariance matrix for all regression equations, enabling us to account for the joint determination of outcomes.^{22,23} By estimating equations as a set, we detected whether effects were generally beneficial (or adverse) over a broader health category with multiple outcomes. Because estimates from our SUR model assessed statistical significance for only 2 broadly defined categories, we did not have to correct for multiple comparisons.

Finally, to estimate the policy relevance of television viewing, we translated the excess mortality risk associated with television viewing into an estimate of its impact on life expectancy. This requires two assumptions: 1) the association is causal, and 2) the association reported within the analytic sample is an unbiased estimate of the effect size of television viewing on mortality. Life expectancy provides a statistic that is easier to understand than the hazard ratio, because it clearly quantifies how observed risk translates into average changes in total life years.^[49] Hazard ratios were adjusted to life expectancy values by; 1) adjusting age-specific mortality risks at baseline for excess risks associated with excess television viewing using a life table, and 2) recalculating the overall cohort life expectancy within the life table using these new adjusted age-specific mortality probabilities.

RESULTS

Table 1 shows the demographics for the sample, comparing those who report watching less than 3 hours of television daily against those who report greater than 3 hours viewing time.

This split was used for illustrative purposes to show the differences in high versus low viewing subjects, and chi-square analysis was used to test for differences between the groups. Roughly 44% of the sample report watching 3 or more hours of television per day, and these people are more likely to be female, black, have less than a high school degree, to have lower household income, and to work less. While the average participant in the overall 2008 GSS-NDI representative sample watched 2.9 hours of television per day, the average participant reporting good or excellent health reported watching 2.7 hours of television per day. Table 2 presents the mortality risk associated with increasing hours of television viewing within our sample.

Among healthy adults at the time of interview, the prospective risk of all-cause mortality increases 4% with each additional hour of television viewed above and beyond controls for age, gender, race, graduation from high school, income, work status and year of interview. Television viewing was associated with significantly increased mortality risk regardless of gender or if the participant had a high school diploma. Finally, being in the highest age category (70+) was associated with increased risk of television-associated mortality, as was being unemployed. Overall, television viewing accounts for 1.2 years of lost life expectancy in the US.

Furthermore, we examined a number of variables that had the potential to mediate the relationship between television viewing and mortality (Table 3). The second column in Table 3 reports the television viewing coefficient from the baseline regression, adjusted to include only those respondents not missing the mediator variable (sample size is shown in the first column). Mediators that were statistically significant by Olaf and Finn mediation tests are noted for each mediator. The third column in Table 3 shows the television viewing coefficient from the regression after adding each mediator variable. For a given variable to mediate the relationship between television viewing and mortality, the coefficient should

change noticeably between columns 2 and 3, indicating the potential for mediation. Finally, in column 4, we present the coefficient of the mediator on mortality.

The results presented in Table 3 show that none of the investigated measures acted as a significant mediator of the relationship between television viewing and mortality by classic Baron and Kenny tests. Reduced trust, satisfaction, overall happiness, confidence in institutions, pessimism, fear of neighborhood environment, or father's occupational prestige did not attenuate the relationship, nor were they independently associated with an increased risk of mortality after controlling for socio-demographic covariates and television viewing. However, using highly powered tests (that also carry a higher risk of false positive results), we find that some of these variables are in fact mediators. Moreover, these apparently smaller mediation effects may, together significantly mediate the association between television viewing and mortality ($p < 0.001$).

We also present a graph of mortality risk by follow-up time for the sample in Figure 1. This figure presents the hazard ratios for two subgroups--those who watch more than 3 hours of television on average daily, and those who report watching less than 3 hours.

DISCUSSION

We use a prospective, nationally-representative cohort study to show that each additional hour of television viewing per day is associated with a 4% increase in all-cause mortality. On average, American adults watch approximately 3 hours of television per day, amounting to a 12% increase in all-cause mortality. Were our hazards ratio reflective of the causal association of television viewing on mortality, reducing television viewing by 3 hours would bolster life expectancy in the US to 79.6 years from 78.5 years. This is approximately equal to that of the European Union, and would move the United States from 51st place internationally to roughly the 36th place in terms of global life expectancy.[50] These estimates are somewhat lower than those reported from a cause-deleted life table approach based on a meta-analysis of existing studies.[17] (These differences arise from the lower estimated prevalence and hazards in the present study.)

Overall, Americans are spending more time in front of the television, spending more television viewing time alone, and spending increasing amounts of time in front of a variety of electronic devices.[51] Americans are also becoming more obese and less healthy over time, and life expectancy is declining among some populations within the United States.[52, 53]

However, relative hazard rates for those who watch less than 3 hours relative to those who watch more than 3 hours of television a day remain stable over the length of follow up, increasing with one's overall risk of mortality (Figure 1). This suggests that television viewing risks are similar today to those in 1978. Thus, while rates of sitting may be increasing over time, the mortality risks associated with hours of TV viewing do not appear to be changing with American waistlines or diets. This is an important observation for a number of reasons. First, while the nation has undergone a number of socio-demographic changes since the late 1970s, television viewing has proved a constant risk on a per hour viewed basis. This lends credence to the idea that we are not simply measuring selection effects because the population viewing television has likely undergone similar demographic shifts. Second, the content of television has changed dramatically over time. Advertisements for harmful products are much less common today than 3 decades ago. Thus, if television content is mediating mortality effects, it is likely related to primary content (e.g., in action shows or the nightly news) rather than harmful advertising per se.

Television viewing has been theorized to be related to loss of trust in individuals and institutions, and for reductions in social capital.[54, 55] Although debated in the literature, [56] researchers have found a loss of interpersonal trust with increased television viewing. [57] Each of these factors, in turn, is thought to increase one's risk of mortality.[3, 8, 32–34, 58] Our analyses suggest that social capital, confidence in institutions, happiness and satisfaction with elements of one's life, and low support for social welfare all fail to temper the relationship between extended viewing and excess mortality when considered separately. However, when considered together, using very powerful tests, we find that these small effects together do partially mediate the relationship between television viewing and mortality. SUR does not require any of the individual mediators to be statistically significant, and has proven useful where lower sample size limits statistical power and where multiple comparisons across many categories are being made and an overall statistical result is needed for the broader category.[59–61]

We find no differential effects for socioeconomic status or social class on the relationship between television viewing and mortality, which is also consistent with other studies.[15, 16] Our findings are similar in size to those in one other study,[15] but somewhat smaller than hazard ratios elsewhere.[14–16] In each of these previous studies, all of which were conducted outside the US, only relatively healthy, thin, and fit participants were included in the analyses. Our analysis of the 2008 GSS-NDI examined only those participants who self-reported being in good or excellent health, but did not control for exercise or energy expenditure (factors that, at any rate, did not explain the television-viewing mortality association in previous work).

There are remaining hypotheses that plausibly link television viewing to mortality. Some have postulated this increased mortality risk to be related to chronic, unbroken periods of sitting independent of other forms of physical activity.[62] Suppression of skeletal muscle lipoprotein lipase activity has been observed with increased sedentary time. Lipoprotein lipase activity is necessary for triglyceride uptake, high-density lipoprotein cholesterol production, and glucose uptake.[63] It is also possible that there are simply unmeasured factors that account for the association we and others have observed.

Our study is subject to a number of important limitations. Because some participants in the full sample may have been in poor health as a result of their television viewing, excluding such participants may artificially reduce the effect size. In addition, we are not able to explicitly examine whether more lethargic people choose to watch more hours of television as the GSS lacks measures of physical activity. While our sample was adequately powered to detect a reasonable mediation effect (an effect size of approximately a 10%) at a power of 0.8 and a $p < 0.05$, we by no means included all putative psychosocial mediators in this relationship. Moreover, some of the mediators, particularly “cannot control for bad things in life,” and “should not plan much in life,” were vastly underpowered. While we overcome this limitation by employing more robust tests for mediation, the chance of false positive results also increases with the use of such tests. Finally, we are unable to investigate whether there is increased consumption of unhealthy foods or increase in unhealthy behaviors driven by increased television viewing.

Conclusions

Emotional states and beliefs associated with the content of programming may collectively be a determinant of television viewers' longevity. However, no single factor we study stands out as an important mediator in this relationship. Given this, it is not possible to propose content regulations in the name of public health. Rather, the policy implications of our study must be viewed more broadly. That is, interventions to more generally encourage physical

activity and socialization rather than television viewing might go a long way toward improving population health. For instance, just halving television viewing time in the US could conceivably increase national life expectancy by over half of a year.

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Figure 1.

Adjusted Hazard Rates Associated With Reporting 3 or More or Less Than 3 Hours of Television Viewing per day, United States. General Social Survey 1978–2002 With Mortality Follow Up Through 2008a

a Adjusted to control for age, gender, race, education, income, survey wave, and employment status.

Table 1

Demographic Characteristics of Subjects Reporting Less Than 3 or 3 or More Hours of Television Viewing Per Day, United States. General Social Survey 1978–2002 with mortality follow up through 2008^a

	Watches Less Than 3 Hours Of Television Per Day	Watches 3 Hours Or More Of Television Per Day
Number of subjects	5,214	4,130
Average age	43.6	44.4
Female (%) ***	53.2	56.8
Race (%) ***		
White	88.8	80.0
Black	7.0	16.3
Other	4.2	3.7
Less than high school degree (%) ***	11.8	22.0
Income (%) ***		
<\$20,000	15.8	28.7
\$20,000–45,000	32.0	36.9
>\$45,0000	52.2	34.5
Decade (%) **		
1980s	36.1	39.1
1990s	51.6	48.5
2000s	12.3	12.3
Work status ***		
Full time	67.4	47.6
Part time	11.4	11.0
Unemployed	5.9	13.5
Retired	4.0	6.2
School	3.0	3.1
Other	8.4	18.6
N deaths	990	1,058

 $P < .001$,

**
 $P < .01$,

*
 $P < .05$

^aThis is the analytic sample of respondents who report good or excellent self rated health only

Table 2

Hazard Ratio for Subjects for Hours of Television Viewing Per Day and Analyses Within Selected Subgroups, United States. General Social Survey 1978–2002 with mortality follow up through 2008^a

	Observations	Hazard Ratio	Confidence Interval
Full Sample	9,344	1.04 ***	(1.02–1.06)
Subgroup Analyses			
Age			
Under 25	981	1.01	(0.93 – 1.09)
25–34	2,491	1.04	(0.98 – 1.10)
35–44	2,194	1.02	(0.97 – 1.08)
45–59	2,002	1.02	(0.98 – 1.07)
60–69	850	1.03	(0.98 – 1.08)
70 and over	755	1.05 *	(1.01 – 1.09)
Gender			
Female	5,116	1.04 **	(1.01 – 1.07)
Male	4,228	1.05 **	(1.02 – 1.08)
Race			
White	7,933	1.04 ***	(1.02 – 1.07)
Black	1,040	1.04	(0.99 – 1.09)
Other	371	0.83	(0.67 – 1.01)
Education			
Less than high school degree	1,523	1.04 *	(1.01 – 1.06)
More than high school degree	7,821	1.04 **	(1.01 – 1.07)
Income			
<\$20,000	2,007	1.03	(1.00 – 1.07)
\$20,000–45,000	3,191	1.07 ***	(1.03 – 1.10)
>\$45,000	4,146	1.03	(1.00 – 1.07)
Decade			
1980s	3,497	1.04 **	(1.01 – 1.07)
1990s	4,695	1.05 **	(1.02 – 1.09)
2000s	1,152	1.00	(0.92 – 1.09)
Employment status			
Full time	5,478	1.02	(0.98 – 1.06)
Part time	1,050	0.99	(0.91 – 1.07)
Unemployed	460	1.05	(0.90 – 1.22)
Retired	859	0.97	(0.84 – 1.11)
School	245	1.06 **	(1.02 – 1.10)
Other	1,209	0.88	(0.71 – 1.10)

P<.001,

^{**}
 $P < .01$,

^{*}
 $P < .05$

^aThis is the analytic sample of respondents who report good or excellent self rated health only

Table 3

Mediation Analysis With The Analytic Sample Size, The Baseline Hazards Of Television Hours On

Putative Mediator (Olkin & Finn P Value)	N
Less trusting	3136
People are not fair	2826
Feel afraid in neighborhood ***	8002
People are not helpful	2843
Less general happiness **	9309
Less satisfied with hobbies **	2151
Less satisfied with friends *	2156
Unfair to bring a child into world ***	4954
Cannot control bad things in life **	683
Should not plan much in life ***	683
Less confidence in military ***	3705
Less confidence in organized religion ***	3688
Less confidence in the federal government	3699
Less confidence in the scientific community ***	3561
Government should not pay for medical care	1940
Government should do less	1907
Government should not help the poor	1938

 $P < .001$,**
 $P < .01$,*
 $P < .05$ ^aThis is the analytic sample of respondents who report good or excellent self- rated health only^bTelevision viewing hazard ratio from the baseline regression model (television hours as the independent variable and mortality hazards as the dependent variable) but no mediator added^cTelevision viewing coefficient in the baseline regression model (b above) with the mediator variable added^dCoefficient of the mediator within model c above