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Television viewing and hostile personality trait increase the risk of injuries

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Abstract

Background—Individuals with high levels of hostility may be more susceptible to the influence of television on violence and risk taking behaviors.

Aim—This study aimed to examine whether hostile personality trait modifies the association between TV viewing and injuries.

Methods—It is a prospective study of 4,196 black and white adults aged 23 to 35 in 1990/1. Cross-lagged panel models were analyzed at three 5-year time periods to test whether TV viewing predicted injuries. Covariates were gender, race, and education.

Results—Individuals who watched more TV (0 hours, 1–3 hours, 4–6 hours, and 7 hours) were more likely to have a hospitalization for an injury in the following 5 years across each of the three follow-up periods [OR = 1.5 (95% CI = 1.2, 1.9), 1.5 (1.1, 1.9), and 1.9 (1.3, 2.6)]. The cross-lagged effects of TV viewing to injury were significant in the high hostility group [OR = 1.4 (95% CI = 1.1, 1.8), 1.3 (1.0, 1.8), and 2.0 (1.3, 2.9)] but not in the low hostility group [OR = 1.3 (95% CI = 0.6, 2.2), 1.1 (0.6, 2.1), and 1.4 (0.7, 2.8)]. Additionally, a statistically significant difference between the two models ($P < 0.001$) suggested that hostility moderated the relationship between TV watching and injury.

Conclusions—These findings suggest that individuals who watch more TV and have a hostile personality trait may be at a greater risk for injury.

Keywords

Television; Injury; Hostility

Introduction

Television is one of the most ubiquitous and encompassing influences on behavior of Americans. (1–3) In 2011, 98.9% of U.S. households had a television, and 83.7% had more than two televisions, demonstrating the almost complete presence in the population's daily lives. The US Census Bureau reported in 2009 that an individual spent on average 4.7 hours watching TV per day.(2) In addition to the increased proliferation of TV sets and individual TV exposure time, the breadth of viewing options and the number of advertisements on TV has increased over the past several decades in profound ways. In 1972, before cable TV became widely available, 31% of all households could receive nine or more television channels.(3) By 1986, this proportion increased to 85%, and the number of channels per household has since increased exponentially.(3)

TV programming and advertisements are rich in messages, scenes, and products which may promote harmful behaviors; including aggressive and risk taking behaviors that are thought to lead to both intentional and unintentional injury.(4) A large body of literature has provided considerable evidence that TV viewing is positively associated with risky behavior. This includes risk taking, aggression, antisocial behaviors and alcohol and drug use.(5) Results from cross-sectional epidemiologic studies have consistently shown that the amount of TV or film violence is positively associated with aggression.(6–8) A meta-analysis of 28 controlled experiments focused on short-term effects of TV viewing and found that individuals who watch a violent scene were more likely to behave aggressively toward others during social interactions.(7) A meta-analysis of 217 epidemiologic studies conducted by Paik and Comstock found highly significant associations between television violence and aggression.(8)

Despite the large number of studies and consistent results, several important questions remain unanswered. Impulsivity and aggression are closely related, and studies have found that television watching is associated with risk-taking behavior or impulsivity. (9) However, few studies have assessed TV viewing prospectively in association to an important consequence of risk taking, i.e. injury.(10) Injuries are a leading cause of morbidity and mortality in the United States accounting for 50.6% of all deaths among those 1–44 years of age. In addition, it is unclear whether this association exists for all individuals or for a specific subset of individuals, i.e. those who are high in hostile attitudes toward others. We follow a model based on problem behavior theory which posits that all behaviors carry some meaning.(11) This is represented by a collection of problem behaviors that constitute a pattern and are related to risk taking. They may include deviance, underage drinking, drug use, and violence.(12) Hostile attitudes toward others are considered to be a personality trait that often is associated with anger and aggressive responses.(13) Hostile people express anger more frequently and intensely than people with low hostility.(14) Following our theoretical model, The content of TV programs may evoke negative emotional responses and

aggressive behaviors, especially among people with a predisposition towards hostility. (15) Additionally, the amount of TV viewing and hostile feelings are highly correlated, which implies that hostile people may spend more time watching TV than those with low hostility. (16) Given that people with hostile attitudes toward others may be more susceptible to TV-induced negative emotions and more likely to be exposed to TV violence, they may have a particularly high risk of future injuries.

The purpose of this study was to describe the prospective association between changes in television viewing over time and incidence of hospitalization for injuries, and to test whether the effects were stronger among more hostile individuals in a prospective cohort study of young adults. Following our theoretical model, we hypothesize that the risk for injury will increase with more TV viewing, and that this risk will be higher in those who have the hostility trait.

MATERIALS AND METHODS

Participants - CARDIA

The Coronary Artery Risk Development in Young Adults (CARDIA) Study is a multi-center prospective study of cardiovascular disease risk evolution in Black and White young adults (18 – 30 years of age at baseline in 1985/6) in four U.S. metropolitan regions. (17) At baseline, 5,115 Black and White young adults who were between the ages of 18 and 30 years were recruited. Recruitment selection at the first assessment made the study population approximately balanced for race (Blacks and Whites), gender, age (18–24 years and 25–30 years), and education (high school or less and more than high school). Participants were recruited from four geographic locations 1) Birmingham, Alabama, 2) Chicago, Illinois, 3) Minneapolis, Minnesota, and 4) Oakland, California. Participants have been followed for 25 years, including eight clinic exams conducted in 1985/6 (baseline, or exam year 0), 1987/8 (year 2), 1990/1 (year 5), 1992/3 (year 7), 1995/6 (year 10), 2000/1 (year 15), 2005/6 (year 20) and 2010/11 (year 25). A total of 5115 participants attended the baseline exam. A detailed description of CARDIA can be found elsewhere. (17) This analysis project was approved by the University of Pittsburgh IRB (#259-01).

Measures

Duration of TV viewing was assessed by a self-administered questionnaire asked at years 5, 10, 15, and 20. Subjects who reported that they watched TV were asked, “On the average, about how many hours per day do you watch television?” We grouped hours of television watching into the following categories: 0 hours, 1–3 hours, 4–6 hours, and 7 hours per day.

Injuries were assessed through hospitalizations reported at each clinic exam (i.e., years 5, 10, 15, and 20) as well as each interim follow-up year via telephone and mail. Injuries were aggregated according to the schedule of each clinic exam in CARDIA. For example, injuries at year 10 reflect all injuries from years 6 through 10. Information collected included admission date, reason for hospitalization, intentionality and body parts involved. A hospitalization was defined as an overnight stay in a hospital, alcohol or drug rehab center. CARDIA recorded the primary reason for hospitalization first, followed by secondary reason

and affected body part. Additionally, study interviewers recorded exactly what the participant stated regarding hospitalization. If the participant reported an injury, the interviewers collected further information on type of injury (e.g., sprain/strain, broken bone/fracture, burn, poisoning, knifing).

To increase the accuracy and specificity of classifying injury hospitalizations, we supplemented the original CARDIA coding with a second injury-specific coding scheme of hospitalizations by researchers with expertise in injury coding. The authors manually reviewed and recoded the cases using ‘narrative text mining’ to screen each hospitalization more rigorously for injuries and capture more detail on the type of injury. A case was defined as injury if the text included predefined words known to be descriptive of injuries. Examples include “accident”, “motor vehicle crash”, “motorcycle”, “pedestrian”, “bike”, “poisoning”, “drug overdose”, “assault”, “shooting”, “stabbing”, “beating”, “neglect”, “abuse”, “battered”, etc. This process has been previously used. (18) This coding scheme was based on the ICD-9-CM external cause of injury codes in the range of E800.0-E869 and E880-E929. To assess reproducibility between the coders, a random sample of 500 cases was chosen for all three coders to code. The intraclass correlation coefficient for an injury was 0.993 (95% confidence interval 0.992, 0.994) suggesting very good agreement. Thus, we defined a case as an injury if either the original CARDIA code or the new injury code was positive.

The Cook-Medley hostility questionnaire, a 50-item scale with a true-false format, was administered at the year 5 exam. (13) The questions prompt the participant to rate their propensity towards certain feelings and attitudes in certain life situations, reflective primarily of mistrust and suspicion. This questionnaire has good convergent and discriminant validity. (13) We chose to use the median cutpoint as our primary definition of hostility for parsimony. When the potential modifier is discrete, separately estimated regression coefficients for each level of the potential modifier are provided and they can be compared for equivalency.

Age, gender, and race were assessed at baseline and verified at year 2. Education was assessed at each exam. Education was quantified as the number of years of school completed at each exam. It was categorized into “<12 years”, “12 years”, and “>12 years.”

ANALYSES

SAS version 9.2 was used to conduct preliminary analyses of possible inconsistencies, outliers and variations in the data, as well as identifying clinically and statistically relevant cut points. Logistic regression was used to assess the significance of bivariate associations. Mplus version 6 was used for structural equation modeling (SEM) to test the primary hypotheses. This approach allows us to test and visualize each of the cross-lagged paths individually while controlling for important confounders of race, gender, and education. Three five-year cross-lagged assessments were conducted; 5 years follow-up to 10 year follow-up, 10–15, and 5–20 years. We used autoregressive, cross-lagged panel models to evaluate the directional effects and the correlated changes between TV viewing and injuries. To test the first aim, we fit an autoregressive model plus cross-lagged paths directing from

TV to injury plus cross-lagged paths from injury to TV in the entire sample. Baseline covariates and hostility were included in the SEM models. To examine whether a predisposition to hostile behavior may modify the association between TV viewing and the outcome, analyses examining the main effect of TV were stratified by level of hostility. Coefficients were transformed to odds ratios. We tested for an interaction by comparing separate SEM models stratified by hostility and modification indices were used to identify a model with good model to the data. Multi-group structural equation modeling analysis was used to verify whether the high and low hostility models were significantly different.

RESULTS

Sample characteristics

There were 4,196 participants who had complete data for our variables for at least one follow-up period. These were included in the analysis and final SEM models. Table 1 presents demographic and hostility personality trait information at year five by hostility group. At year 5, the average age was 30 years. Slightly greater than 25 percent had a high school education and more than 68 percent had more than a high school education. Those in the higher hostility group defined by the median were significantly younger (29.5 vs. 30.5 years, $p < 0.01$) more likely to be male (58.7% vs. 41.3%, $p < 0.01$), Black (67.3% vs. 32.7%, $p < 0.01$) and have less than a high school education (80.4% vs. 19.6%, $p < 0.01$).

Bivariate associations

Table 2 shows the bivariate associations of risk factors and injury at each time point. At years 5, 10 and 15, males, Blacks, and those with less than a high school degree were more likely to report an injury. Those in the high hostility group were also more likely to report an injury at these time points. (3.7% vs. 2.4%, 5.0% vs. 2.4% and 5.2% vs. 2.0%, $P \leq 0.01$).

Table 3 describes the bivariate associations between injury and previous TV viewing habits by levels of hostility. As the amount of TV viewing increased, there was a greater proportion of individuals reporting an injury in the following time-period for both the high and low hostility groups. However, the differences are greater in the high hostility group. For example, in the low hostility group, for the association between year 5 and year 10, 2.2 percent of the individuals who reported no television viewing reported an injury in the follow-up period while 4.2 percent of the individuals who reported greater or equal to 7 hours of television viewing reported an injury. For the high hostility group the difference was 2.0 percent vs. 8.0 percent.

Table 4 presents the bivariate associations between hostility and TV viewing and injury for each follow-up year. Across all the exam years, those in the high hostility group had a higher probability of watching TV more than four hours per day and having injury compared with low hostility.

Structural equation models

Figure 1 presents the SEM cross-lagged model examining the relationship between TV and injury for individuals with high hostility. The blocks at the top represent TV viewing at each

time point, and the blocks on the bottom represent whether an injury occurred. Arrows represent the direct relationships tested and their directions with solid lines being statistically significant at the $P < 0.05$ level and the dashed lines not significant. Figure 2 presents the model for those with low hostility. Because of the bivariate associations, we adjusted for gender, race and education in the model. The OR's represent the odds of an injury given a one category increase in the duration of TV watching. There was considerable temporal stability in reported TV viewing over the follow-up periods (OR = 5.4, 7.4, and 8.0 respectively for high hostility group; 7.2, 13.5, and 13.0 for low hostility group), as well as for injury risk with the exception of year 15 to year 20 (OR = 5.9 and 4.4 for high hostility group; 2.4 and 4.3 for low hostility group). The cross-lagged effects of TV viewing to injury were significant in the high hostility group but not in the low hostility group (except for TV viewing at year 10 to injury at year 5). Table 5 summarizes the odds ratios for TV viewing and injury in the cross-lagged effects SEM models in the figures.

Individuals who watched more TV were significantly more likely to have a hospitalization for an injury in the following 5 years across all the follow-up periods (OR = 1.5, 1.5, and 1.9 respectively). High hostile individuals who watched more TV were significantly more likely to have an injury 5 years later at year 5 to injury at year 10 and TV at year 15 to injury at year 20. For example, for high hostile individuals, watching more TV at year 5 was associated with 40% higher odds of injury at year 10. Additionally, watching more TV at year 15 was associated with a doubling in the odds of injury at year 20. There were no statistically significant cross-lagged effects observed in low hostile individuals. On the other hand, those in the high hostility group demonstrated significant cross-lagged effects from injury to TV viewing (OR = 2.0 and 2.3 from year 10 to year 20), whereas those in the low hostility group did not. A statistically significant difference was observed between the two hostility-stratified models using the chi-square test for difference ($\chi^2 (18) = 46.98, P < 0.001$). This result implies that the models are statistically different, suggesting that hostile personality is a moderator of the association between TV viewing and injury risk.

DISCUSSION

We found that television exposure was associated with higher rates of injuries. Though few studies have looked at injury as an outcome, these results reinforce the literature that suggests television viewing is associated with increased aggression and risk taking behavior. Importantly however, we found that the association between TV viewing and injury was modified by hostility. Our results suggest that the five-year lagged effect of TV viewing on injury was significant and positive in those with high hostility, and not significant in those with low hostility. In other words, an increase of TV viewing at year 5 was associated with an increase in risk of injury at year 10.

Several possible mechanisms may explain these associations. Social cognitive theory states that individuals often imitate new behaviors that they witness, and thus might lead one to participate in more high-risk behaviors if they watch more television.(19, 20) Others suggest that media violence and high-risk activities increase psychological arousal, intensifying subsequent behavior such as aggression on risk taking or impulsivity. (19, 21, 22) Additionally, it is thought that the images on television may desensitize an individual to

specific behaviors such as violence or risk taking.(23–25) Though the results presented here include 5 year time lags, evidence suggests that TV viewing habits remain consistent. TV viewing exhibited significant temporal stability ($B = .640, .793, \text{ and } .730$). Other work also provides evidence. For instance, Huesmann et al., found that childhood exposure to media violence predicts young adult aggressive behavior. (26)

Experimental studies have found that media violence is associated with increased aggression. A meta-analysis examined the effects of media violence on viewers' aggression. (7) Exposure to media violence increased aggressive behavior. Results from cross-sectional epidemiologic studies have consistently shown that the amount of TV or film violence is positively associated with aggression and antisocial behavior.(6–8) A longitudinal study assessed association between TV-violence viewing at ages 6 to 10 and adult aggressive behavior approximately 15 years later. (26–29) The authors found that TV viewing was significantly associated with adult aggression. Previous work has shown that these behaviors are related to injury. (30) These data provide evidence for our results that show an association between TV viewing and injury risk five years later.

A meta-analysis of 217 epidemiologic studies conducted by Paik and Comstock found highly significant associations between television violence and aggression or antisocial behavior and criminal violence. (8) In 1994, Potts and colleagues further examined the effects of short television vignettes on children and found that those who viewed a high-risk-taking clip reported higher levels of risk-taking.(31) Kennedy reported in 2000 that children who took more risks watched more programs that included high-risk behaviors.(9, 32) This could to increases in injury supporting our current findings.

A large body of literature has provided considerable evidence that TV viewing is positively associated with risky behavior. This includes taking chances, aggression, antisocial behaviors and alcohol and drug use.(5) TV programming and advertisements are rich in messages, scenes, and products which may promote harmful behaviors, including aggressive and risk taking behaviors that are thought to lead to both intentional and unintentional injury. (4) Our results demonstrate that TV exposure is associated with injury. As high-risk behaviors, risk taking and impulsivity are associated to injury.(30)

Whether the influence TV viewing may have on injury risk may depend on psychosocial factors, such as high expression of hostility has not been considered to date. In the CARDIA Study, Sidney and colleagues reported that those with high TV viewing were at increased odds of having high hostility.(16) Yet, to our knowledge, this is the first study to directly assess the important hypotheses that the direct association between TV viewing and injury may be modified by a propensity towards a hostile disposition.

These results support our theoretical model of television exposure. Potts et al.(33) found a mean overall rate of 15 injuries per hour on television, and typically only minor consequences were shown. In another study, researchers found that for every scene in which a character uses a seatbelt there will be 180 acts of reckless driving.(32) Grube et al.(34) found that exposure to beer commercials influenced 5th and 6th grade schoolchildren to have more favorable beliefs about drinking alcohol. Rajecki et al.(35) found that 64% of TV food

commercials targeting youth included some combination of violence (observed in 62% of commercials), conflict (41%), and trickery (20%).

There are several limitations in our study. Although we do not have a direct measure of the validity of the CARDIA TV question, we and others have found good support for its reliability and criterion validity.(16, 36–38). We also expect the magnitude of injury misclassification to be consistent across levels of TV viewing (non-differential misclassification), such that any association that we observe between TV and injury risk would likely be underestimated (biased toward the null due to non-differential misclassification). Importantly, we do not have information on the type or preference of TV content watched. It should also be noted that we did not have very large numbers of hospitalizations for injuries and thus it was possible that we were underpowered to detect modest effect sizes.

Future studies are needed to address the role of specific TV viewing habits, especially programming preferences. Experimental studies examining whether modifying TV use may impact psychosocial attributes and lifestyle behaviors will be critical towards understanding the relevant pathways and mechanisms that may guide future policy proposals regarding TV exposure and content. Studies with separate outcomes of intentional and unintentional injury would be helpful to clarify whether aggression or impulsivity mediates the association between TV viewing and injury risk. In addition, the mechanisms of injury should be elucidated to allow for greater targeted prevention.

CONCLUSIONS

These results are highly significant for public health. The exposure of interest, TV viewing, and the outcomes, injuries, are common in society. As such, even a modest association between the exposure and outcomes could have high public health significance. Prevention programs aimed at reducing exposure to TV viewing should target both content of TV programs as well as reducing the amount of TV viewing. Additionally, experimental studies examining whether reducing TV viewing may impact psychosocial characteristics and lifestyle habits would be essential to addressing whether any associations observed in the present observational study may be truly causal. Violent TV programs are associated with hostile and aggressive behaviors. (39–43) As such, future studies are needed to address specific TV viewing habits, especially programming preferences. Studies with detailed measures of TV contents may provide information to build specific warnings of TV content rating systems not only by age but also by personality traits. Reduction in TV viewing time and TV content rating systems may reduce injury risk, especially among those who are high in hostility.

References

1. Television Bureau of Advertising, Inc. MEDIA TRENDS TRACK, TV Basics: Television Households. 2010. (http://www.tvb.org/rcentral/mediatrendstrack/tvbasics/02_TVHouseholds.asp). (Accessed)

2. Council on Education for Public Health. Schools of Public Health and Public Health Programs Accredited by the Council on Education for Public Health. CEPH; 2008. (http://www.ceph.org/files/public/Master_List.v.12.pdf). (Accessed)
3. Nielsen, AC. Nielsen report on television. Northbrook, IL: 1987.
4. Speltz ML, Gonzales N, Sulzbacher S, et al. Assessment of injury risk in young children: a preliminary study of the injury behavior checklist. *J Pediatr Psychol*. 1990; 15(3):373–83. [PubMed: 2380878]
5. Dietz WH, Strasburger VC. Children, adolescents, and television. *Curr Probl Pediatr*. 1991; 21(1):8–31. discussion 2. [PubMed: 2022120]
6. Huesmann LR, Moise-Titus J, Podolski CL, et al. Longitudinal relations between children's exposure to TV violence and their aggressive and violent behavior in young adulthood: 1977–1992. *Dev Psychol*. 2003; 39(2):201–21. [PubMed: 12661882]
7. Wood W, Wong FY, Chachere JG. Effects of media violence on viewers' aggression in unconstrained social interaction. *Psychol Bull*. 1991; 109(3):371–83. [PubMed: 1829535]
8. Paik H, Comstock GA. The effects of television violence on antisocial behavior. *Communication Research*. 1994; 21:516–46.
9. Kennedy C. Examining television as an influence on children's health behaviors. *Journal of Pediatric Nursing*. 2000; 15(5):272–81. [PubMed: 11077764]
10. Centers for Disease Control and Prevention NCHPaC. Injury: The Leading Cause of Death Among Persons 1–44. 2014 (Accessed May 23, 2014 2014).
11. Krctmar M, Greene K. Connections Between Violent Television Exposure and Adolescent Risk Taking. *Media Psychology*. 2000; 2:195–217.
12. Fraser MW. Aggressive behavior in childhood and early adolescence: An ecological–developmental perspective on youth violence. *Social Work*. 1996; 41:347–61. [PubMed: 8669001]
13. Barefoot JC, Dodge KA, Peterson BL, et al. The Cook-Medley hostility scale: item content and ability to predict survival. *Psychosom Med*. 1989; 51(1):46–57. [PubMed: 2928460]
14. Smith TW. Hostility and health: current status of a psychosomatic hypothesis. *Health Psychol*. 1992; 11(3):139–50. [PubMed: 1618168]
15. Dagmar Unz FS, Winterhoff-Spurk Peter. TV News - The Daily Horror? *Journal of Media Psychology: Theories, Methods, and Applications*. 2008; 20(4):141–55.
16. Sidney S, Sternfeld B, Haskell WL, et al. Television viewing and cardiovascular risk factors in young adults: the CARDIA study. *Ann Epidemiol*. 1996; 6(2):154–9. [PubMed: 8775596]
17. Friedman GD, Cutter GR, Donahue RP, et al. CARDIA: study design, recruitment, and some characteristics of the examined subjects. *J Clin Epidemiol*. 1988; 41(11):1105–16. [PubMed: 3204420]
18. McKenzie K, Scott DA, Campbell MA, et al. The use of narrative text for injury surveillance research: a systematic review. *Accid Anal Prev*. 2010; 42(2):354–63. [PubMed: 20159054]
19. Cantor J. Media violence. *J Adolesc Health*. 2000; 27(2 Suppl):30–4. [PubMed: 10904203]
20. Bandura A, Ross D, Ross SA. Vicarious Reinforcement and Imitative Learning. *J Abnorm Psychol*. 1963; 67:601–7. [PubMed: 14084769]
21. Zillmann D, Weaver JB. Psychoticism in the effect of prolonged exposure to gratuitous media violence on the acceptance of violence as a preferred means of conflict resolution. *Personality and Individual Differences*. 1997; 22(5):613–27.
22. Zillmann D, Weaver JB. Effects of prolonged exposure to gratuitous media violence on provoked and unprovoked hostile behavior. *Journal of Applied Social Psychology*. 1999; 29(1):145–65.
23. Cline VB, Croft RG, Courier S. Desensitization of children to television violence. *J Pers Soc Psychol*. 1973; 27(3):360–5. [PubMed: 4741676]
24. Linz DG, Donnerstein E, Penrod S. Effects of long-term exposure to violent and sexually degrading depictions of women. *J Pers Soc Psychol*. 1988; 55(5):758–68. [PubMed: 3210143]
25. Mullin CR, Linz D. Desensitization and resensitization to violence against women: effects of exposure to sexually violent films on judgments of domestic violence victims. *J Pers Soc Psychol*. 1995; 69(3):449–59. [PubMed: 7562390]

26. Huesmann LR, Eron LD, Lefkowitz MM, et al. Stability of aggression over time and generations. *Developmental Psychology*. 1984; 20(6):1120–34.
27. Björkqvist, K., Österman, K., Kaukiainen, A. The development of direct and indirect aggressive strategies in males and females. In: Björkqvist, KN., Pirkko, editors. *Of mice and women: Aspects of female aggression*. San Diego, CA, US: Academic Press; 1992. p. 51-64.
28. Eron LD, Banta TJ, Walder LO, et al. Comparison of data obtained from mothers and fathers on child-rearing practices and their relation to child aggression. *Child Dev*. 1961; 32:457–72. [PubMed: 13697258]
29. Eron, LD., Walder, LO., Lefkowitz, MM. *Learning of aggression in children*. Boston: Little, Brown; 1971.
30. Cherpitel CJ. Alcohol, injury, and risk-taking behavior: data from a national sample. *Alcohol Clin Exp Res*. 1993; 17(4):762–6. [PubMed: 8214410]
31. Potts R, Swisher L. Effects of televised safety models on children's risk taking and hazard identification. *J Pediatr Psychol*. 1998; 23(3):157–63. [PubMed: 9640894]
32. Kennedy CM. Television and young Hispanic children's health behaviors. *Pediatr Nurs*. 2000; 26(3):283–4. [PubMed: 12026392]
33. Potts R, Doppler M, Hernandez M. Effects of television content on physical risk-taking in children. *J Exp Child Psychol*. 1994; 58(3):321–31. [PubMed: 7844498]
34. Grube JW, Wallack L. Television beer advertising and drinking knowledge, beliefs, and intentions among schoolchildren. *Am J Public Health*. 1994; 84(2):254–9. [PubMed: 8296950]
35. Rajecki DW, McTavish DG, Rasmussen JL, et al. Violence, conflict, trickery, and other story themes in TV ads for food for children. *Journal of Applied Social Psychology*. 1994; 24:1685–700.
36. Fitzgerald SJ, Kriska AM, Pereira MA, et al. Associations among physical activity, television watching, and obesity in adult Pima Indians. *Med Sci Sports Exerc*. 1997; 29(7):910–5. [PubMed: 9243490]
37. Kronenberg F, Pereira MA, Schmitz MK, et al. Influence of leisure time physical activity and television watching on atherosclerosis risk factors in the NHLBI Family Heart Study. *Atherosclerosis*. 2000; 153(2):433–43. [PubMed: 11164433]
38. Crespo CJ, Smit E, Troiano RP, et al. Television watching, energy intake, and obesity in US children: results from the third National Health and Nutrition Examination Survey, 1988–1994. *Arch Pediatr Adolesc Med*. 2001; 155(3):360–5. [PubMed: 11231802]
39. Centerwall BS. Television and violence. The scale of the problem and where to go from here. *JAMA*. 1992; 267(22):3059–63. [PubMed: 1588720]
40. Christakis DA, Zimmerman FJ. Violent television viewing during preschool is associated with antisocial behavior during school age. *Pediatrics*. 2007; 120(5):993–9. [PubMed: 17974736]
41. Huesmann LR, Moise-Titus J, Podolski CL, et al. Longitudinal relations between children's exposure to TV violence and their aggressive and violent behavior in young adulthood: 1977–1992. *Dev Psychol*. 2003; 39(2):201–21. [PubMed: 12661882]
42. Johnson JG, Cohen P, Smailes EM, et al. Television viewing and aggressive behavior during adolescence and adulthood. *Science*. 2002; 295(5564):2468–71. [PubMed: 11923542]
43. Singer MI, Miller DB, Guo S, et al. Contributors to violent behavior among elementary and middle school children. *Pediatrics*. 1999; 104(4 Pt 1):878–84. [PubMed: 10506229]

Figure 1. SEM cross-lagged model and odds ratios between TV viewing and injury among people with high hostility

Solid line: * $p < 0.05$; dashed line: $p \geq 0.05$

Figure 2. SEM cross-lagged model and odds ratios between TV viewing and injury among people with low hostility

Solid line: * $p < 0.05$; dashed line: $p \geq 0.05$

Table 1

Demographic distribution of participants by levels of hostility at baseline (year 5)

Characteristic	Low hostility (N = 1974)	High hostility (N = 2222)	p value	Total (N = 4,196) N (%)
Age (y)	30.5 ± 3.5 ^a	29.5 ± 3.7	< .01 ^c	30 ± 3.6
Gender				
Male	782 (41.3) ^b	1111 (58.7)	< .01 ^d	1893 (45.1)
Female	1192 (51.8)	1111 (48.2)		2303 (54.9)
Race/ethnicity				
Black	663 (32.7)	1365 (67.3)	< .01 ^d	2028 (48.3)
White	1311 (60.5)	857 (39.5)		2168 (51.7)
Highest education				
<12 years	50 (19.6)	205 (80.4)	< .01 ^d	255 (6.1)
= 12 years	360 (33.5)	716 (66.5)		1076 (25.6)
>12 years	1564 (54.6)	1301 (45.4)		2865 (68.3)

^aMean ± SD (all such values)^bN (%) (all such values)^cResults were tested by one-way ANOVA analysis^dResults were tested by χ^2 test

Table 2

Bivariate associations between injury and its risk factors at each exam time^a

	Injury at Year 5			Injury at Year 10			Injury at Year 15			Injury at Year 20		
	N* (Total) [§]	%	p value	N* (Total) [§]	%	p value	N* (Total) [§]	%	p value	N* (Total) [§]	%	p value
Age (y)	30 ± 3.6 ^b		.38	35 ± 3.6		.68	40 ± 3.6		.44	45 ± 3.6		.07
Gender												
Male	82 (1882)	4.4	<.01	74 (1633)	4.5	.03	76 (1528)	5.0	<.01	39 (1428)	2.7	.42
Female	45 (2247)	2.0		66 (2082)	3.2		53 (1962)	2.7		44 (1922)	2.3	
Race/ethnicity												
Black	81 (1993)	4.1	<.01	88 (1749)	5.0	<.01	75 (1603)	4.7	.01	39 (1515)	2.6	.74
White	46 (2136)	2.2		52 (1966)	2.6		54 (1887)	2.9		44 (1835)	2.4	
Highest education at year 20												
<12 years	14 (248)	5.7	<.01	21 (349)	6.0	<.01	33 (331)	10.0	<.01	21 (314)	6.7	<.01
= 12 years	47 (1062)	4.4		46 (813)	5.7		32 (589)	5.4		19 (612)	3.1	
>12 years	66 (2819)	2.3		73 (2553)	2.9		64 (2570)	2.5		43 (2424)	1.8	
Hostility												
Low (< Median)	46 (1942)	2.4	.01	42 (1769)	2.4	<.01	34 (1677)	2.0	<.01	33 (1629)	2.0	.10
High (≥ Median)	81 (2187)	3.7		98 (1946)	5.0		95 (1813)	5.2		50 (1721)	2.9	

^{*}: the number of injured individuals[§]: the total number of individuals in each subgroup^aResults were tested by logistic regression^bMean ± SD (all such values)

Table 3

Rate of injury according to previous TV viewing habits and level of hostility

		<u>Injury at Year 10</u>		<u>Injury at Year 15</u>		<u>Injury at Year 20</u>	
		N	%	N	%	N	%
Average TV viewing hr/day							
<u>Low hostility</u>	0	5	2.30	2	1.62	2	1.83
	1-3	27	12.91	25	11.92	23	11.42
	4-6	7	20.6	4	15.9	3	14.6
	7	1	2.4	0	2.1	1	15
Average TV viewing hr/day							
<u>High hostility</u>	0	3	1.50	4	9.0	1	10.9
	1-3	55	12.04	52	11.41	24	10.61
	4-6	28	4.44	23	3.64	16	2.78
	7	10	12.5	8.0	7.7	5	6.9

N: the number of injured individuals

Total: the total number of individuals in each TV viewing subgroup

Table 4

Bivariate association between hostility and TV viewing and injury

	<u>High Hostility</u>		<u>Low Hostility</u>		p-value
	N	%	N	%	
<u>Year 5</u>					
Average TV viewing hr/day (N=4,147)					
0	169	7.7	252	12.9	<.01
1-3	1363	62.1	1443	73.9	
4-6	522	23.8	227	11.6	
7	141	6.4	30	1.5	
Injury (N=4,129)					
No	2106	96.3	1896	97.6	0.01
Yes	81	3.7	46	2.4	
<u>Year 10</u>					
Average TV viewing hr/day (N=3,568)					
0	94	5.0	177	10.4	<.01
1-3	1266	67.7	1311	77.3	
4-6	425	22.7	185	10.9	
7	86	4.6	24	1.4	
Injury (N=3,715)					
No	1848	95.0	1727	97.6	<.01
Yes	98	5.0	42	2.4	
<u>Year 15</u>					
Average TV viewing hr/day (N=3,336)					
0	118	6.9	196	12.1	<.01
1-3	1183	68.9	1246	77.0	
4-6	343	20.0	159	9.8	
7	74	4.3	17	1.1	
Injury (N=3,490)					
No	1718	94.8	1643	98.0	<.01
Yes	95	5.2	34	2.0	

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Year 20	High Hostility		Low Hostility		p-value
	N	%	N	%	
Average TV viewing hr/day (N=3,161)					
0	109	6.8	195	12.5	<.01
1-3	1050	65.8	1209	77.3	
4-6	334	20.9	135	8.6	
7	103	6.5	26	1.7	
Injury (N=3,350)					
No	1671	97.1	1596	98.0	0.10
Yes	50	2.9	33	2.0	

Table 5

Four-wave cross-lagged effect model: TV viewing and injury

	<u>Whole population</u>	<u>High Hostility</u>	<u>Low Hostility</u>
<i>Odds ratio (95% confidence interval)</i>			
TV at Year 5 - INJURY at Year 10	1.5 (1.2, 1.9) *	1.4 (1.1, 1.8) *	1.3 (0.6, 2.2)
TV at Year 10 - INJURY at Year 15	1.5 (1.1, 1.9) *	1.3 (1.0, 1.8)	1.1 (0.6, 2.1)
TV at Year 15 - INJURY at Year 20	1.9 (1.3, 2.6) *	2.0 (1.3, 2.9) *	1.4 (0.7, 2.8)

Note:

*
p < 0.05.

Results of whole population are controlled for gender, race, education, and hostility.

High and low hostility models are controlled for gender, race, and education.

Odds ratios represent odds of an injury according to each one category increase in TV duration.