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Evaluating a Minor Storyline on *ER* About Teen Obesity, Hypertension, and 5 A Day

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This study evaluates the effects of an ER (NBC) storyline about teen obesity, hypertension, and 5 A Day on knowledge, attitudes, and behavior. The storyline depicted an African American teen who presented at the emergency room with burns from a workplace injury. Upon diagnosis, the teen was discovered to have hypertension and counseled to eat more fruits and vegetables and get more exercise. The evaluation was conducted using three separate datasets, one of which provided data on a sample of primetime viewers before and after the storyline aired. Results showed that the storyline affected self-reported behavior change and had modest impacts on knowledge, attitudes, and practices. Interestingly, these effects were stronger for men than for women, possibly due to men's lower knowledge levels at baseline. Issues including identification with characters and the value of even modest effects on large audiences and the implications of our findings for future evaluations of entertainment education (EE) and other health communication programs are discussed.

Public health advocates have a variety of communication strategies available for the promotion of general and specific health behaviors. At the individual level, providers attempt to encourage their patients or clients to adopt healthy behaviors (Roter & Hall, 1992). At the community level, coalitions can be formed with partners to improve structural and environmental conditions (Pentz et al., 1989). At the population level, policies can be created that promote healthy lifestyles (Institute of Medicine [IOM], 2002), and mass media can be used to convey health information and attempt to persuade the population to adopt healthy choices (Hornik, 2002; Piotrow, Kincaid, Rimon, & Rinehart, 1997; Rice & Atkin, 2001; Steckler et al., 1995; Wallack & Dorfman, 1996).

Mass media interventions can consist of advertising campaigns such as the Office of National Drug Control Policy's National Youth Anti-Drug Media Campaign (NIDA/NIH, 2002). Mass media interventions also can involve coproductions, such as those created in developing countries, that use soap operas or other narratives with stories that provide examples of healthy lifestyle choices in hopes that the audience will model and adopt these behaviors (Piotrow et al., 1997; Rice & Atkin, 2001; Singhal & Rogers, 1999). A third health promotion

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strategy using mass media is to serve as a resource to scriptwriters on health content for existing entertainment programming, and to encourage the inclusion of important public health topics and key messages. The hope is that if the writers incorporate accurate information and messages in their storylines the audience may adopt more healthy behaviors (Beck, 2004, Brodie et al., 2001; Glik et al., 1998; Kennedy, O'Leary, Beck, Pollard, & Simpson, 2004; Whittier, Kennedy, Seeley, Lawrence, & Beck, 2005).

Like coproductions, this strategy is based on Bandura's (1977) social learning theory (subsequently incorporated into social cognitive theory; Bandura, 1986), which focuses on the importance of observational learning and behavioral modeling. According to Bandura (2001) individuals are most likely to model the behavior of individuals or fictional characters with whom they identify. Prior EE research likewise supports the idea that individuals tend to look to similar others when assessing their own beliefs and behaviors. This identification process explains, in part, why women similar in age and ethnicity were so strongly influenced by Nancy Reagan's selection of surgery for breast cancer treatment, why White female viewers the same age as Nancy in *thirtysomething* were more strongly moved by that character's cancer experiences (Sharf & Friemuth, 1993; Sharf, Friemuth, Greenspon, & Plotnick, 1996), and why young women of Spanish descent identify with and live vicariously through the lives of female characters in telenovelas (Singhal & Rogers, 1999). Indeed, research suggests that identification with characters is related positively to increased attention, mental rehearsal of arguments, and modeling of behavior (Sharf & Friemuth, 1993; Sharf et al., 1996; Sood, 2004). This suggests that a particular health-related storyline may not equally be attended to, remembered, and modeled by all audience members.

One of the most prominent examples of using existing television programs to promote prosocial behaviors was the national campaign to promote the use of designated drivers. After experiencing tragic loss due to alcohol–related motor vehicle accidents, advocates formed Mothers Against Drunk Driving (MADD). MADD and other advocacy groups lobbied to strengthen drunken driving laws to punish those driving under the influence (Montgomery, 1989; 1993). In addition, advocates lobbied to have messages about drunk driving and information or role models regarding designated drivers on popular entertainment shows (Winsten & DeJong, 2001).

Encouraging the inclusion of public health messages on entertainment television is not a new idea. Recently, however, it is a strategy being embraced by some organizations as another potentially cost-effective tool in the nation's struggle to promote a healthy population. Translating to the United States the success of entertainment education programs from developing countries where individuals have only a handful of often government-owned media outlets, however, is not without serious challenges. Changes in media technology have fragmented broadcast television audiences further, with potential viewers now accessing cable channels and the Internet for entertainment as well. Still, popular primetime television shows on the major networks reach millions of viewers every evening with higher ratings than competing cable shows (Nielsen/Galaxy: 11/01/2004–11/28/2004). For example, over each of the final three episodes in 2004, the NBC medical drama, *ER*, is estimated to have reached an average of 24.8 million U.S. viewers ages 2 and up (Nielsen/Galaxy: 4/26/2004–5/30/2004). Given the potential audience reach and the health-related content of *ER* and dozens of other primetime television shows, they offer a

potentially effective and efficient way to reach a large audience with important health messages.

One of the most significant health threats facing Americans today is obesity, weight gain, and poor nutrition. The Centers for Disease Control and Prevention (CDC) estimates that 64% of U.S. adults are overweight or obese (30% of U.S. adults are overweight) and 16% of children and adolescents ages 6–19 are overweight, which is double the rates of the 1970s (National Health and Nutrition Examination Survey [NHANES, 1999–2002], National Center for Chronic Disease Prevention and Health Promotion). These health threats not only substantially increase health care costs but also negatively impact quality of life. To reverse this trend, public health advocates are faced with the challenge of getting Americans to improve their diet by eating more fruits and vegetables and becoming more active.

The Intervention

This study reports on the effectiveness of a storyline on teen obesity, hypertension, and healthy eating habits on a popular NBC primetime drama, *ER*. Writers from *ER* contacted the Hollywood, Health & Society (HH&S) project at the University of Southern California [USC] Annenberg Norman Lear Center to request information on the prevalence of hypertension and heart disease among overweight teens. A phone consultation with a CDC expert resulted, and the prevalence of hypertension and heart disease linked to youth obesity was discussed, along with other topics and key messages including 5 A Day, lifestyle, environment, and access to care. In a follow-up meeting, a group of public health experts briefed the writers on the impact of obesity on diabetes and cancer, and the importance of physical activity and healthy food choices such as those recommended by the 5 A Day campaign.

The resulting storyline was brief, involving a new character who presents at the *ER* with a burn injury acquired while working at a fast food "joint" (worker safety information was provided as well). The character, Elgin, was an overweight African American teenager who has poor eating habits, lives in a poor urban housing project, has responsibility for child care in his single-parent family, and is diagnosed with hypertension during this visit to the emergency room. The doctor prescribes medication and counsels him to improve his eating habits and exercise more frequently. The story ran over three episodes from April 29 to May 13, 2004. The importance of eating fruits and vegetables and exercising was discussed again in the second episode, when Elgin is discovered with shortness of breath and not taking his medication. In the final episode, Elgin has a cardiac event and is rushed into the emergency room on a gurney. The term 5 A Day was briefly mentioned in the third episode before Elgin was released from the hospital (see Appendix A for more details). After Dr. Pratt has treated Elgin he says, "What do we learn from this?" Elgin responds, "5 A Day, exercise some, and find myself a job at a fruit and vegetable stand or something."

This storyline coincided with multiple public health campaigns that were in the field to create public awareness about childhood and adult obesity, their disease consequences, and the benefits of physical activity and eating a diet rich in fruits and vegetables. A search of the Lexis-Nexis database revealed more than 1,000 U.S. television and radio spots and 883 print articles on the topic of obesity between January 1 and June 1, 2004. By April 2004, when the first episode of the Elgin storyline aired, many states were addressing the childhood obesity epidemic through school-based nutrition and physical activity initiatives according to the CDC. Example campaigns

include CDC's VERB campaign, Shape Up America! and U.S. Department of Health and Human Services' Small Steps campaign. In addition to national efforts in 2004, 40 states and cities were funded by the federal government to address physical inactivity, poor nutrition, and tobacco use; and 28 states funded by the CDC were planning or implementing or both overweight and obesity programs.

Given its brevity and the saturation of similar messages from multiple other media, we did not expect this minor storyline intervention to have a large behavioral impact on the population. Nonetheless, this intervention was not expensive, consisting of (1) initial outreach performed by HH&S staff; (2) telephone consultation by George Mensah, acting director of the CDC's National Center for Chronic Disease Prevention and Health Promotion; (3) information provided by the CDC's National Institute for Occupational Safety and Health; (4) print materials provided by the National Cancer Institute–CDC 5 A Day program; and (5) the briefing with additional experts. Thus, for a small investment, a potentially large audience could be reached. As argued elsewhere, an intervention that has even a minimal impact on a large audience could be as cost effective as an intervention with low reach but high impact (Valente, 2002).

Challenges in Evaluating a Moving Target

Methodologies for evaluating individual-, community-, and population-level interventions are quite varied. Evaluating national media campaigns poses a number of unique challenges, including the difficulty of identifying and tracking comparison groups. Consequently most population-level studies use both panel and cross-sectional samples and attempt to establish a dose–response association between intervention exposure and outcomes (Valente, 2002).

For studies of health content in television shows, the challenge is magnified because the researcher usually does not have control over the message, its dose, or timing. As a result, the evaluator is challenged to measure the effects of a moving target, as script and storyline changes can occur at any time during the production process. The researcher often is forced to develop measurements at baseline that may or may not reflect the finished program content. In this case, we measured knowledge of 5 A Day without being certain 5 A Day would be mentioned in the program, and we adopted generic measures of nutrition attitudes and behaviors from other surveys without being certain they would be reflected in the final program content. The research hypotheses follow:

H1: Exposure to an *ER* storyline concerning the importance of nutrition and physical activity would be associated with increased:
H1a: self-reported behavior change;
H1b: awareness–knowledge of the meaning of "5 A Day";
H1c: positive attitudes toward nutrition; and
H1d: consumption of fruits and vegetables.

Methods

Because of the inherent challenges of evaluating the effectiveness of television content, we decided to cast a wider net to employ several surveys using a variety of sampling and data collection strategies, previously shown as an effective way to compare findings across groups and therefore detect any changes in a more comprehensive

Table 1. Survey dates and sample characteristics

	Magid associates	*ER* website	ConsumerStyles	ConsumerStyles analytic sample*
Dates	April 19–28 & May 20–28	April 19–May 28	April 21–June 10	May 16–June 10
Method	Internet	Internet	Mail	Mail
Sample Type	Panel & Cross section	Cross section	Cross section	Cross section
Number of items	24	24	5	5
Response Rate	24.4%	Unknown	62%	62%
Sample Size	3,191	3,805	6,207	853

*We restricted the ConsumerStyles survey to heavy television viewers who responded after May 16, 2004.

manner (Kiernan, Kiernan, Oyler, & Gilles, 2005; Lindley, Nicholson, Kirby, & Lu, 2003; Lyons, 2004; Rhodes, DiClemente, Cecil, Hergenrather, & Yee, 2002). First, we partnered with a private research company, Frank N. Magid Associates, to recruit a sample of primetime television viewers to take an electronic survey. Some of these respondents were regular *ER* viewers, while most were not. Second, we had the same survey posted on the *ER* Web site so that dedicated viewers who visited the *ER* website could complete the survey. Third, we included a few questions from the survey in the 2004 Porter Novelli ConsumerStyles questionnaire administered to a nationally representative adult sample of the U.S. population via mail. These three surveys provided both panel and cross-sectional samples as well as Internet and mail data collection techniques. Table 1 provides summary information on the three samples.

Magid

Frank N. Magid Associates maintains a database of primetime television viewers willing to be solicited to participate in research. Magid solicited 6,000 of these subscribers to participate in a survey about health issues. As an incentive to increase our response rate (Birnholtz, Horn, Finholt, & Bae, 2004), we offered three $100 gifts chosen by lottery. Participants were able to complete the survey 10 days prior to airing the first episode of the storyline between April 19 and April 28, 2004. Of the 6,000 people solicited, 1,467 completed the baseline survey (24.4%).[1] After the third episode, another solicitation was sent to 7,000 participants, 6,000 of whom were the same. We again offered three $100 gifts as an incentive. Of the 7,000 solicited, 1,724 completed the follow-up survey (24.6%). Some 807 respondents completed the survey at both baseline and follow-up, constituting a panel sample.

ER Website

As an effective way to gather a convenience sampling from our target audience of *ER* viewers, we constructed an online survey using SurveyMonkey.com, in which standard recommended user interface features such as radio buttons, check boxes, and

[1]This response rate is a conservatively low estimate, as we do not know how many of the e-mail addresses in the database were inactive at the time of the solicitation.

skip patterns (Dillman, 2000) were used to maximize ease of use and minimize data entry errors or omitted questions. From April 19 through May 28 a link to the survey was posted on the *ER* website, inviting visitors to complete the survey. We do not know how many people visited the *ER* website and saw the invitation to the survey, so we cannot calculate a response rate for the website respondents. Some 5,196 people began the survey, but 1,391 (26.7%) exited before completing it. These respondents were dropped from the analysis. Most exited the survey before answering substantive questions regarding nutrition outcomes and demographic characteristics, so comparisons between those who completed and those who did not were not possible. Some 3,805 respondents completed all items.

Porter Novelli ConsumerStyles Survey

ConsumerStyles is one of a pair of linked mail surveys sent to a nationally representative sample of adults ages 18–49 based on seven U.S. Census Bureau demographic characteristics. The survey is developed by Porter Novelli, a social marketing and public relations firm and licensed by the CDC for audience analysis in health communication planning. Surveys were mailed to respondents just as the *ER* storyline was airing, so respondents would have been able to complete the survey during and just after the storyline aired. Data were collected from 6,207 randomly selected adults living in the United States.

Surveys were returned as early as May 3, but these respondents would not have been able to see the storyline across the 3 episodes. Only respondents who returned surveys after May 16 would have been able to see all 3 episodes, so we restricted this analysis to the 1,657 respondents who returned surveys after May 16. In these data, missing responses on two control variables were recoded to sample averages. For 48 respondents (2.9%), missing data for "hours of TV watched" recoded to the mean of 12, and for 96 respondents (5.8%), missing data for "education level" were recoded to the mode "some college."

Sample Characteristics

Table 2 reports the sample characteristics from the three surveys. The Magid samples were primarily female, young-to-middle-age adults, predominantly White, with some college or a college degree. Most respondents had incomes between $25,000 and $50,000 and were married. The *ER* website sample was similar to the Magid one, but it was slightly younger and more likely to be single. Amount of regular viewing was also somewhat different between the samples: Magid respondents reported more weekly television viewing (nearly 20 hours per week) than the *ER* website (15.8 hours per week) and ConsumerStyles (12 hours per week) respondents. To achieve comparable sample characteristics across the three samples, we restricted analysis in this article to heavy television viewers, defined as those who watched 9 or more hours of television per week (the sample median) in this sample. Thus, the ConsumerStyles sample is composes of randomly selected heavy television viewers who returned surveys after May 16 ($N = 853$).

Outcome Measures

Four outcome variables were measured as indicators of storyline effectiveness. Self-reported behavior change was measured by asking, "In the past 3 months, did you

Table 2. Study sample characteristics

	Magid associates					
	Cross sectional		Panel			
	Baseline $N = 1{,}467$	FU $N = 1{,}724$	Baseline $N = 807$	FU $N = 807$	*ER* website $N = 3{,}805$	Consumer-Styles $N = 853$
% Male	31.2	30.2	32.6	32.1	8.9	45.5
Age						
<18	0.14	0.1			12.8	0
18–24	9.6	7.9	7.2	7.4	31.4	2.8
25–34	26.5	26.9	24.5	24.8	32	18.4
35–44	27	25	26	25	12.3	26.6
45–54	22.7	24.9	26.9	27.1	8.3	26.5
55–64	11.6	12.3	12.4	12.1	2.7	11.7
65+	2.4	2.9	3	3.5	0.4	13.9
Ethnicity						
White	87.6	87.9	88.1	88	86.2	56.9
African American	4.5	3.9	3.8	4	3.3	19.5
Hispanic/Latino	3.3	3	2.8	2.7	3.5	17.6
Asian American	3	3.2	3.8	4	2.9	2.6
Other	1.6	2.1	1.4	1.4	4.1	3.5
Education						
Some HS or less	1.7	1.2	0	1.4	10.4	10.2
Completed HS	18.8	19.3	20.1	18.7	13.5	26.4
Some college	39.1	40.7	38.8	39.9	36.7	43.5
College	40.4	38.9	41.1	40	39.4	19.9
Income						
$0–$24,999	13.7	15.2	12.8	13.1	16.2	32.6
$25,000–$49,999	39.9	38.5	38.3	37	51.7	24.3
$50,000–$75,000	25.4	24.2	26.5	27.6	17.4	18.4
$75,000+	21	22.1	22.4	22.2	14.8	24.7
Marital status						
Married	60	59.3	60.7	59.8	38.2	70.8
Single	23.4	23.3	22.1	22.4	53.2	11.6
Divorced/ separated	11.9	11.8	12.8	13	4.2	12.5
Widowed	4.6	5.6	4.5	4.7	4.3	5.2
Controls						
Hours TV	19.8	19.9	19.2	20.4	15.8	17.2
Health status	3.31	3.3	3.3	3.3	3.2	3.1
Exposure outcomes	1.42	1.48	1.43	1.47	3.33	0.9
5 a Day knowledge	69.6	73.2	70.5	77.7	73.4	82.5
Nutrition attitudes	76.9	78.5	77.2	78.5	73.8	78.5
Nutrition practices	72.1	72	72.4	72.5	70.4	59.5
Self-reported behavior	15	16.2	14	15.7	12.7	4.7

do any of the following after seeing something on *ER*: (a) walk or exercise more; (b) protect myself from burns when cooking; (c) get blood pressure checked; (d) call a clinic, health care place, or hotline number for information; (e) eat more fruits and vegetables; (f) visit a clinic, doctor, or nurse; (g) give someone advice about a health issue; (h) other."[2] Cronbach's alpha for the self-reported behavior change scales ranged from 0.68 to 0.77 in the different samples. Since this count variable was not normally distributed, we dichotomized it by coding as "1" anyone who reported taking any action.[3]

Correct knowledge of 5 A Day was measured by asking respondents, "What does 5 A Day refer to? (a) Walking 5 blocks a day; (b) taking 5 dietary supplements a day; (c) eating 5 servings of fruits and vegetables a day; (d) meditating 5 minutes a day; (e) drinking 5 glasses of water a day; (f) other, and (g) don't know." Respondents who said eating 5 servings of fruits and vegetables a day were coded as correct; all others were coded as incorrect.

Nutrition attitudes were measured with the following scale: "On a scale from 1 equals 'not at all' to 7, which equals 'very important,' please tell me how important each of the following health benefits are to you when choosing the foods you eat and drink: (a) lowering my risk of cancer, (b) lowering my risk of heart disease, (c) lowering my risk of high blood pressure, (d) lowering my risk of diabetes, (e) lowering my cholesterol, (f) managing my weight, and (g) feeling better physically." Factor analysis indicated that the items loaded on one factor in all datasets. Cronbach's alpha ranged from 0.88 to 0.94. The 7 items were averaged and normed to 1.0 and then dichotomized on the baseline or overall mean in each sample.

Nutrition practices, consumption of fruits and vegetables, were measured with a scale: "From 1, equals not at all, to 5, which equals daily, please indicate how often you eat each of the following: (a) fresh fruit, (b) 100% fruit juice, (c) fresh vegetables, (d) 100% vegetable juice." Factor analysis indicated that the items loaded on one factor in all datasets. Cronbach's alpha ranged from 0.50 to 0.64. The items were averaged and normed to 1.0 and then dichotomized on the baseline or overall mean in each sample.

Exposure to the *ER* storyline was measured with five questions: an unprompted question, "What do you usually watch on Thursday nights?" "How frequently do you watch *ER* (3–4x/mo. = 1 & always = 1)," and whether the respondent reported watching any of the three specific episodes in the storyline (April 29, May 6, May 13). These five items were summed to create an exposure index (range 0–5). (Note: the ConsumerStyles survey did not include the unprompted question, "What do you usually watch on Thursday nights?") Exposure was highest for the *ER* website sample (3.33) and next highest for the Magid samples (1.42 pre-test to 1.47 post-test) and lowest for the ConsumerStyles sample (0.90). The lower exposure for the ConsumerStyles sample is due perhaps to having one fewer item in the scale and not being selected based on their television viewing habits.

[2]We debated whether to phrase the question "as a result of..." or "as a consequence of seeing it on *ER*" but found the question phrasing cumbersome.

[3]We also measured self-reported interpersonal communication by asking whether they talked to anyone about seven different activities after they watched *ER*. These results were nearly identical to the behavior change ones, so, for the sake of space, we do not report them here.

Analysis Plan

Analyses consisted of measuring dose–response between outcomes and *ER* exposure controlling for demographic characteristics. For the panel data we used lagged regression controlling for baseline outcomes. Control variables included sex, age, ethnicity, education, income, marital status, hours of television viewing, and self-reported health status.

Results

Table 3 reports the association between self-reported behavior change and *ER* exposure with controls. Those who reported watching *ER* were more likely to report engaging in some behavior after watching *ER*. For example, self-reported behavior was associated with *ER* exposure by an adjusted odds ratio of 1.65 ($p < .01$) in the Magid cross-sectional data, indicating *ER* viewers were 65% more likely to say they did something after watching an episode between April 28 and May 16, 2004.[4]

ER exposure also was associated with correct knowledge of the meaning of 5 A Day in the Magid data in the cross-sectional sample, but it did not attain statistical significance in the panel subsample. For example, the adjusted odds ratio (AOR) for exposure and 5 A Day knowledge was 1.05 ($p < .05$), indicating that those who watched *ER* had a 5% higher rate of knowledge than those who did not. In the Magid panel sample, exposure was associated with 5 A Day knowledge when baseline exposure was included in the model. This indicates that increased exposure between baseline and follow-up was associated with increased knowledge. Exposure was not associated with knowledge in the *ER* website sample. Exposure was positively associated with knowledge in the ConsumerStyles sample (AOR = 1.19, $p < .05$). Exposure was not associated with nutrition attitudes or behaviors in any of the samples.

Figure 1 provides a bar graph illustrating the dose–response association between *ER* exposure and self-reported behaviors. All seven outcomes, walking or exercising more, protection from injuries at work, checking blood pressure, calling a clinic or doctor, eating more fruits and vegetables, visiting a clinic or doctor, and giving someone advice were higher for high levels of *ER* exposure, when compared with low and no exposure ($p < .01$). The percent of respondents who reported taking no action was 88% for no exposure, 71% for low exposure, and 65% for high exposure ($p < .01$). We also calculated change in outcomes by change in exposure with similar results except that walking and injury prevention did not vary statistically significantly by change in exposure.

The effects of the *ER* storyline may vary by demographic characteristics because different audiences may identify differently with the storyline and because different audiences may have different outcome levels before exposure. For example, in the Magid sample women had significantly higher 5 A Day knowledge (78.3%) than men (56.2%) at baseline, indicating possible ceiling effects for women. This was also the case for nutrition attitudes, as women had significantly higher nutrition attitudes than men (58.6% and 53.5%, $p < .01$). Consequently, we analyzed the association between exposure and outcomes separately by men and women.

[4]There was also a decrease in the percent of respondents who said they took no action after watching *ER*.

Table 3. Adjusted odds ratios indicating the association between *ER* exposure and nutrition knowledge, attitudes, and practices for 3 survey samples by sex

	Self-reported behavior	5 a Day knowledge	Nutrition attitudes	Nutrition practices
Exposure				
Magid X-sectional ($N = 3{,}191$)	1.65**	1.05*	1.03	1.03
Magid panel ($n = 807$)	1.83**	1.06	0.95	1.05
ER website ($N = 3{,}805$)	1.19**	0.99	1.02	1.01
ConsumerStyles ($N = 853$)	2.18**	1.19*	1.03	0.99
By gender				
Magid X-sectional women ($n = 2{,}213$)	1.62**	1.03	1	0.99
Magid X-sectional men ($n = 978$)	1.77**	1.10*	1.07&	1.13**
Magid panel women ($n = 544$)	1.76**	0.96	0.92	0.99
Magid panel men ($n = 263$)	2.13**	1.25**	1.06	1.25**
ER website women ($n = 3{,}468$)	1.17**	0.99	1.02	1
ER website men ($n = 337$)	1.45**	0.99	0.97	1.07
ConsumerStyles women ($n = 465$)	2.23**	1.13	0.94	0.94
ConsumerStyles men ($n = 388$)	2.31**	1.24*	1.0	1.01

& $p < .10$; * $p < .05$; ** $p < .01$.

NB: All regressions control for age, sex, ethnicity, income, education, marital status, hours TV viewing, and health status; and panel sample ones control for baseline outcome.

Table 3 repeats the regression analyses separately for women and men. Results for the women were quite similar to those for the full samples and indicate a lack of association between exposure and outcomes, with the exception of self-reported behavior change. For men, however, exposure is associated with knowledge of 5 A Day, marginally associated with nutrition attitudes, and significantly associated with nutrition behaviors. For example, the AOR for exposure's association with knowledge among men was 1.10 ($p < .05$) in the Magid cross-sectional data, indicating that those who watched *ER* were 10% more likely to know what 5 A Day means. These results indicate that effects were stronger among men than among women.

Because the main characters in the storyline were African American, we also thought results might be stronger among African Americans. Regressions for African Americans only revealed that the magnitude of association between exposure and self-reported behavior change was higher for African Americans than that reported for the whole sample in all three cross-sectional datasets (results not shown).[5] Associations between exposure and the other outcomes (knowledge, attitudes, and behavior) among African Americans, however, were not statistically different from 0, with the exception that the Magid cross-sectional sample had an AOR of 1.20 ($p < .10$) for exposure and behavior.

Two advantages of the Magid sample are that it contained both *ER* viewers and nonviewers and had data on primetime viewers before and after the storyline. Table 4 reports calculations designed to further specify the magnitude of effects

[5]There were not enough African Americans in the panel sample to estimate models.

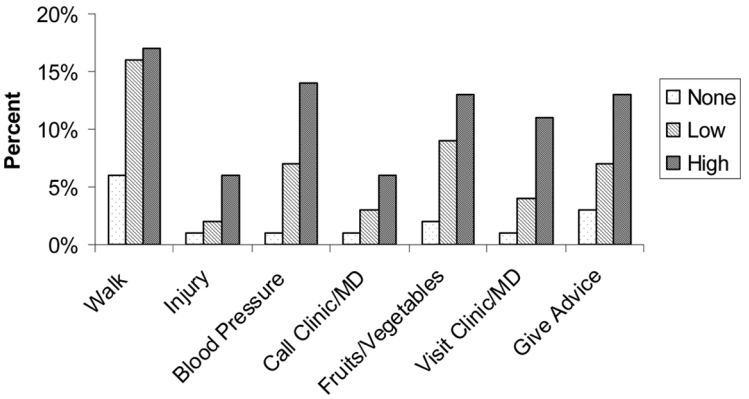

Figure 1. Dose–response association between *ER* exposure and self-reported outcomes.

attributable to the *ER* storyline. Using the panel data collected with the Magid sample, we found that correct knowledge increased between baseline and follow-up samples ($n = 807$). Among those who completed baseline and follow-up surveys, knowledge increased 7.2 percentage points. Much of this increase can be attributed to testing or sensitization effects or both. Among nonviewers, the increase was 5.9 percentage points, whereas among viewers it was 8.1, a 2.2 percentage point difference. Thus, exposure to *ER* may have created a 2.2 percentage point increase in correct knowledge of 5 A Day. Although a 2.2 percentage point increase may seem small, when translated across 24.8 million viewers, this effect is large for a minimally expensive intervention.

Discussion

Several cautions should be noted with the interpretation of these results. First, the measurements taken here are self-reported data on knowledge, attitudes, and behavior and television and *ER* viewership. We did not calibrate recall measures with other, more objective, indicators that might provide more valid assessments of nutrition and other health behaviors. Further, the exposure measure is based on respondent recall rather than on confirmed viewing or Nielsen ratings. Second, the samples were not nationally representative probability samples. The Consumer Styles sample was based on a nationally representative population, but we restricted

Table 4. Knowledge scores for Magid panel data

	Baseline	Follow-up	*N*	Difference
Baseline only	68.5	NA	660	NA
Follow-up only	NA	69.2	907	NA
Both	70.5	77.7	807	7.2
Never watched	68.3	74.2	386	5.9
Watched	72.1	80.2	421	8.1

Of the 807 panel respondents, 533 (66.5%) knew at both baseline and follow-up, 94 (11.6%) learned, 36 (4.5%) forgot, and 144 (17.8%) remained unknowing.

analysis to heavy viewers, and the other two samples were solicited via the Internet. Thus, these analyses may not be generalizable to the overall population.

There was a robust positive association between exposure to a minor obesity and nutrition storyline on *ER* and self-reported behavior change across all samples. We found modest positive associations between *ER* exposure and increases in knowledge of the meaning of 5 A Day. There was no association, however, between *ER* exposure and the nutrition attitude scales and inconsistent evidence on behavior for the entire sample. Documenting effects on self-reported behaviors indicates that some perceived behavior change probably occurred from being exposed to this storyline, but not the type measured in the attitude and behavior scales.

The modest association between *ER* exposure and knowledge of 5 A Day is particularly encouraging given that the storyline provided only a brief mention of 5 A Day, requiring the viewer to pay attention to hear it. Clearly, we would have preferred to have a more significant mention of 5 A Day in the storyline and more air time devoted to nutrition and physical activity. Our experience working with writers, directors, and producers, however, has indicated that, in general, entertainment trumps education and that prosocial content most likely will be constrained to a few minutes per episode. How much air time is enough to generate desired effects is unknown at this time and is probably also a function of how well the message is crafted, how entertaining is the topic, how much the audience identifies with the character experiencing the health topic, and how well it is integrated into the storyline and narrative.

Despite the brevity of the mention, we detected a modest impact on nutrition knowledge as measured by correct knowledge of 5 A Day. Significantly, most women already knew the meaning of 5 A Day and thus had higher knowledge rates than men. Women also had higher nutrition attitudes and behaviors than men. These ceiling effects prompted us to examine the storyline effects separately by sex. We found that effects were stronger for men than for women.

In addition to ceiling effects, however, the greater increase among males in our sample may be due, in part, to their greater degree of identification with a male character as would be predicted by Bandura's social cognitive theory. Subgroup analysis showed that *ER* exposure was more strongly associated with outcomes for men than for women. Men in this study had lower rates of nutrition knowledge, attitudes, and practices, and so exposure to TV programming promoting healthy eating choices had a greater chance of increasing these outcomes for men than for women.

Since much of the EE approach is predicated on homophily between the viewer and the model, we expected to find more pronounced effects for African American viewers (since the main character and model was African American). The relatively low number of young African American males in the sample, however, may mean we did not have the power to detect this effect. One limitation of the current study is the low percent of African Americans in the study sample. Currently there is no research indicating relative strengths of demographic characteristics' contributions to homophily and behavior modeling effectiveness. The literature is clear that individuals model those who are "like themselves," but to what extent does "like oneself" depend on gender, ethnicity, age, body type, hair color, profession, etc.? Gender is probably one of the most salient characteristics, but whether it is more salient than ethnicity, and how much more, is unclear. Future research should explore the relative importance of demographic characteristics of characters such as

gender, race, age, and self-reported level of identification, storyline involvement, and other factors in EE.

Like most mass media evaluations, this study could not randomly assign subjects to conditions and could not control who was exposed to the intervention. Consequently, selectivity effects and other biases affect interpretation of results. Further, measures used to judge effectiveness were not perfectly matched to the media message because we used existing instruments and surveys. Another noteworthy limitation was our reliance on attitude scales for measuring outcomes, with no data on body mass index or current weight. Future studies should collect data on weight and height to determine if current weight status moderates the effectiveness of media interventions for obesity and physical activity. Thus, the results should be interpreted with caution. To combat these biases we created an exposure index and studied the dose–response relationship between exposure and outcomes.

The association between exposure and knowledge was evident in both the Magid and ConsumerStyles samples. Both samples consist of heavy television viewers, and so these results should be generalized only to that segment of the population. Heavy television viewers constitute a large share of U.S. households and also represent a segment at risk for obesity and hypertension. The intervention thus reached a segment in need of nutrition information.

With the dramatic growth in web usage over recent years (Madden & Rainie, 2003), on-line data collection methods have become an increasingly popular strategy for researchers in the field of social and behavioral sciences. Many advantages exist such as the potential to reach many survey respondents, particularly target samples who are considered to be hard to reach or marginalized (Rhodes, Bowie, & Hergenrather, 2003; Whittier et al., 2005); rapid turn-around rates; ease of construction and distribution; and cost effectiveness due to the reduced need of printing, postage, and data entry. The advantages of on-line data collection apply just as effectively when used to survey a sample of television viewers to evaluate the impact as a result of exposure to health content portrayed on a specific show. This is especially true if demographic characteristics of the survey sample can be adjusted to mirror that of the particular show. For example, we used an existing panel of primetime television viewers (provided by Magid) and fans of *ER* who visit the show's website to capture respondents who are viewers, the majority of whom are Caucasian, within the 18–49 age range.

Challenges of on-line survey data collection still remain, including self-selection bias, inability to calculate true response rates, reliance on self-reported data, and ethical considerations such as potential of compromised anonymity or confidentiality (Rhodes et al., 2003). Given the purpose of our study and desired target sample of television viewers, however, we believe that the benefits outweigh the costs. Our multimodal approach of three samples (two on-line, one mail) further confirm that on-line data collection findings, when nationally representative samples are not required, largely can be consistent with findings from traditional mail surveys (Gosling, Vazire, Srivastava, & John, 2004).

Much of the evidence for EE effects has come from developing countries in which advocates coproduce communications with embedded prohealth messages (e.g., Piotrow et al., 1997; Rogers et al., 1999). It has been uncertain whether EE approaches can work in the United States where coproductions are less feasible and the media environment more saturated. This study has shown that minor storylines can be effective at influencing audiences. Although modest, the impact is

substantial when translated into audience share. Further, the impact is cost effective, as the expenses associated with this intervention were minimal. To be sure, not all consultations with media outlets will result in successful message placements, and some effort may be devoted to shows and programming that are never broadcast (Glik et al., 1998). Nevertheless, some do work, and the challenges facing advocates and evaluators can be overcome.

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Appendix A

Synopsis of *ER* Storyline

April 29, 2004

This episode introduces the 17-year-old African American boy (Elgin), who is overweight and works at a burger joint. He slipped at work and burned his hands on a grill when trying to break his fall. He wants to return to work to finish his shift, but Neela and Pratt tell him that it will be a few days—his hands are wrapped. He works nights and his Mom works days to provide for the family—four younger siblings from a different Dad.

Neela and Pratt say that he is too young to have such high blood pressure and suspect that he is using drugs. The drug test comes back negative, but Pratt still thinks that his blood pressure is high because of his fear of doctors. A medical student asks him if he's seen a kid this young with high blood pressure.

May 6, 2004

Neela finds out that Elgin called in sick from work and was not answering the phone at home. Pratt thinks that 17 year olds do not get high blood pressure, but Neela suggests that this can lead to congestive heart failure and sudden death from cardiac arrhythmia. They decide to make a home visit since he lives only 10 minutes away and find him sweating and panting after climbing a few flights of stairs. His blood pressure is still high and they find out that he has not been taking his medicine. Elgin says, "You said I'd get better if I walked a little more." Neela explains that he "might be able to stop taking it in 6 months if you exercised, lost some weight, and ate more fruits and vegetables." The doctors advise him to come back to the ER to get an EKG and chest X-ray. Later in the episode, Elgin is rushed into the ER for congestive heart failure.

May 13, 2004

Elgin is recovering in Cardiology. Pratt comes and asks, "What do we learn from this?" He says, "5 A Day, exercise some, and find myself a job at a fruit and vegetable stand or something." Notably, Elgin was tossing a rubber broccoli, but it was difficult to discern this.

Elgin asks if his family can come and see Pratt once in a while since they do not have a doctor. Pratt reminds him to stay on his meds and ends up taking him home in the evening because his mother never showed up.