Increasing Environmental Health Literacy about Toxic Substance Exposures through Television Drama Storylines

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Entertainment Education

- The broadcast media have a key role to play in increasing health literacy (IOM, 2004)
- Entertainment Education (EE) is an approach to population-level behavior change codified by Miguel Sabido in the 1970's
- EE involves embedding health and other educational messages into entertaining media formats

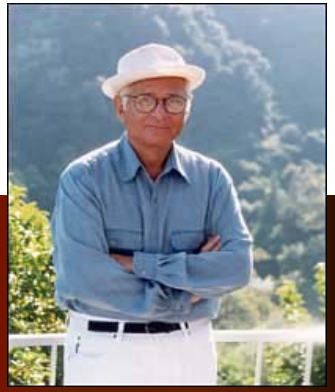
Traditional EE

- Based on Bandura's Social Cognitive Theory which emphasizes observational learning
- Weaves health messages into serialized dramas (telenovellas or soap operas)
- Has been shown to be effective in increasing knowledge, other determinants of health behavior, and behavior itself in >12 developing countries (Singhal et al., 2004)
- Requires creative control of character development and plots

Today in the United States...

USC ANNENBERG

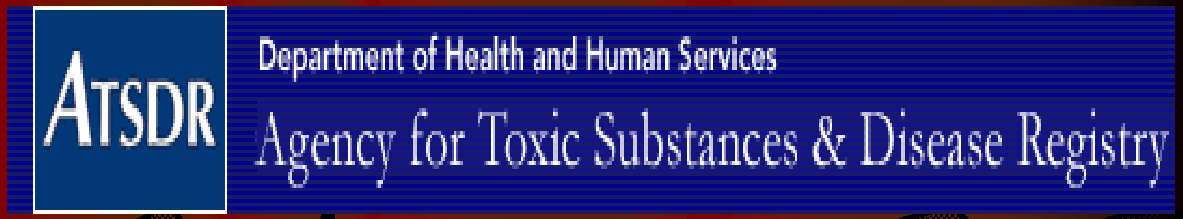
The Norman Lear
CENTERTAINMENT



Hollywood, Health & Society

- Sentinel for Health Awards
- Tip sheets, scientific consultation

H,H&S Funding



Previous EE Outcomes

- Short-term gains in knowledge about:
  - emergency contraception (Brodie, et al., 2001)
  - teen obesity, hypertension, and the 5-a-Day recommendation (Valente, et al., 2007)
  - breast cancer screening (Wilkin, et al., 2007)
- Increased intentions to:
  - be screened for syphilis & tell others to be screened (Whittier, et al., 2005)
  - donate an organ (Movius, et al., 2007)
- Increased recommendations:
  - from men to women for breast cancer screening (Wilkin, et al., 2007)
  - to choose organ donation on a driver's license (Movius, et al., 2007)
- Increased calls to hotlines for:
  - AIDS/STD (Kennedy, et al., 2004)
  - Cancer (Wilkin, et al. 2007)

Effect Enhancement

- Regular viewership (Pollard & Beck, 2000)
- Narrative involvement, or “transportation” (Green & Block, 2000; Slater & Rouner, 2002)

“Waste Not”

- *Numb3rs*
- Among the top 30 network shows, 10.15 million viewers on one night in Spring 2007
- Aired Nov. 17, 2006, on CBS

- Investigation of an unusually high incidence of ailments among children attending a school where a collapsed playground uncovered an illegal storage dump of toxic wastes. Cancer clusters identified around other city schools.

“Loophole”

- *Law & Order: SVU*
- Highest rated L&O show, #14 among viewers 1-49, 6.4 million households (Feb. 12-18, 2007)
- Aired Feb. 6, 2007, on NBC

- Investigation of a suspected child pornography case uncovers chemical company tests of potentially toxic products on a child in an apartment building.

Research Questions

RQ1. Will exposure to the shows increase environmental health literacy?

RQ2. Will such knowledge gains be retained over a 4-month period?

RQ3. Will there be a dosage effect of exposure to both shows?

RQ4. Will the effects of exposure be moderated by feeling transported by the storyline?

Method

- Nielsen Web Panel (designed to be nationally representative, includes 23,050 households)
- 3 survey waves (W1 – W3)
- W1 invitations sent to 23,050 panelists; 17% response rate
- W2 sent to 2,790 panelists who watch Numb3rs; 41% response rate
- W3 invitations sent to 5,678 people
- 43% of W2 respondents reported watching Numb3rs > 5 times a year, and 40% of W3 reported watching L&O:SVU > 5 times
- Surveys were described to prospective respondents as requiring 5-8 minutes.

Method (cont.)

- Some items were rated on a 1-10 scale (e.g., not at all likely to very likely), some YES/NO
- Analysis employed linear and logistic regression techniques
- Independent variables were entered via backwards regression
- Models were adjusted for:
  - age, gender, education, race
  - medical or environmental occupation
  - number of days per week respondent watches primetime TV
  - exposure to information about environmental waste through other sources, including TV, internet, billboards, radio, newspaper, magazines or movies.

Results Reported in Abstract

- Within-household longitudinal analysis data for W1 & W2
- Predominantly female (63%), white (89%), college educated (84%), middle-class (84% had incomes >$50,000) sample, mean age = 45
- Significant associations between viewing Numb3rs and awareness that:
  - Underground toxic waste can increase cancer risk
  - Leukemia can result from toxic exposure
  - Cancer clusters studied with odds ratios & GIS
  - Benzene can contaminate underground water
- No increase in perceived risk from unmentioned chemicals

Results

- Remaining results are from analysis of W2 and W3 cross-sectional data
- 60% female, 89% white, 67-69% with a minimum of a college degree, 61-64% with household incomes greater than $50,000/year and an average age of 45 or 43 years, respectively
- 38% of W2 (440/1,147) and 19% (412/2,139) of W3 reported seeing Numb3rs
- 14% of W3 (295/2,139) reported seeing L&O
- 4% of (84/2,139) W3 reported seeing both shows
- 87% of W3 reported also taking W1; 29% of W3 reported also taking W2

RQ1: Immediate knowledge gains?

Questions	Wave 2 associations with exposure to Numb3rs "Waste Not" (N = 1,147)	Wave 3 associations with exposure to Law & Order SVU "Loophole" (N = 2,139)
Underground toxic waste can contaminate drinking water systems	p = .0003	ns
It is difficult to prove a link between environmental toxins and cancer cases	ns	p < 0.000
Children are more likely than adults to develop health problems after exposure to hazardous chemicals	Not asked	p = .002
There is an antidote for short-term exposure to some hazardous chemicals	Not asked	p = .036
Underground toxic waste has been linked to cancer cases	OR = 1.61 (1.12-2.33)	ns

RQ1: (cont.)

Questions	Wave 2 associations with exposure to Numb3rs "Waste Not" (N = 1,147)	Wave 3 associations with exposure to Law & Order SVU "Loophole" (N = 2,139)
Toxic waste exposure can cause:		
•Behavioral/learning problems	p = .025	ns
•Blindness	p = .049	ns
•Neurological deficits	p = .041	ns
Cancer clusters are studied by:		
•Calculating odds ratios	OR = 1.57 (1.22-2.01)	ns
•Mapping addresses of cases	OR = 1.96 (1.19-3.23)	ns
Contribute to toxic contamination of underground water:		
•Benzene	OR = 1.74 (1.33-2.29)	ns
•Heavy metals	OR = 1.88 (1.36-2.59)	ns
•TCEs	ns	OR = 1.29 (1.01-1.66)

Answer to RQ1 = YES, Despite…

Clear ceiling effects (e.g., >90% prior knowledge) for:

- exposure to toxic waste can cause cancer/tumors
- pesticides have been linked to cancer cases

No knowledge gains for:

- birth defects, difficulty breathing, leukemia & rash can be sequellae of toxic exposure
- cancer clusters are identified through health department records

RQ2: Were initial knowledge gains evident 4 months later?

Point of information in Show #1	***Association with exposure to Numb3rs episode 4 months earlier***
Behavior/Learning problems	p = 0.022
Calculating ORs	OR = 1.74 (1.39-2.18)
Mapping addresses	OR = 2.15 (1.27-3.61)
Benzene	OR = 1.69 (1.29-2.21)
Heavy metals	OR = 1.77 (1.27-2.45)

RQ2: (cont.)

Point of information in Show #1 Sub-threshold @ W2	***4-month association with exposure to Numb3rs episode***
Difficult to prove a link	p = 0.033
Perchlorate	OR = 1.62 (1.30-2.03)
TCEs	OR = 1.59 (1.26-2.00)
Investigate HD records	OR = 1.41 (1.09-1.82)
Locate possible hazardous sites	OR = 1.48 (1.16-1.89)
Ringer items	
Hair loss, muscle aches & pains, antidote for exposure	p = 0.018; 0.010, <0.001

RQ3: Was there a dose effect?

Themes in Both Shows	***W3 Dose Response***
Difficult to prove a link	p = 0.000
Children at higher risk	p = 0.001
Behavior/learning problems	p = 0.003
Leukemia	Sub-threshold initially, p = 0.007
Birth defects	ns
Skin rash	ns
Neurological deficits	ns
Hair loss, muscle aches & pains	Ringer items p = 0.02; 0.01

RQ4. Did transportation moderate EE effects?

- A 7-item transportation scale was modified from one developed by Green and Block
- 7-point response scale; Not at All to Very Much
- Based on W3 survey data, the scale has an internal consistency score of 0.73 as measured by coefficient alpha
- Transportation analyses looked only at those exposed to L&O:SVU (n = 295) -- exposure to *Sinkhole* was included as an 'other exposure'

Transportation Items

- I found my mind wandering while watching the show.
- The show effected me emotionally.
- I wanted to find out how the episode ended.
- When the show ended, I found it easy to put out of my mind.
- The events in the show are relevant to my everyday life.
- I could picture myself in the scene of the events in the show.
- The events in the show seemed realistic.

RQ4: Answer is Yes

- Transportation Scale score was a significant predictor for 16 items
- Some of these items were “ringers”
- Several of these themes were included only in show #1 (Numb3rs)

RQ4. Did transportation moderate EE effects?

Questions	***Scale as a predictor of knowledge***
Exposure to the toxic waste can cause:	
Behavioral/learning problems	p<0.001
Birth defects	p<0.001
Cancer/tumors	p<0.001
Difficulty breathing	p<0.001
Leukemia	p=0.001
Neurological deficits	p<0.001
Rash/skin irritation (D)	p=0.006
Linked to cancer cases:	
Pesticides	OR = 1.07 (1.02-1.12)

Summary

This study added to previous EE evaluation literature by demonstrating:

- immediate gains in Environmental Health Literacy
- no unintended increase in levels of the belief that it's easy to link toxic exposures to cancer
- retention of gains over a 4-month period
- a dose-response effect
- a transportation enhancement effect

A number of findings were unexpected and raise questions to be addressed in future EE research.

Limitations

- Low and variable response rate
- Bias from a possible lack of representativeness in the web panel
- There were no measures of behavior change (e.g., environmental advocacy) to associate with episode exposure

Conclusions

- EE is an excellent way to get fairly technical information across to the public, and may prime viewers to learn about the topic from other sources.
- It should not be surprising that a transporting episode – one perceived to be a good story – would have greater effects. Need to explore what makes a story good, e.g., the value of the inclusion of children.
- Despite depiction of a corrupt government official in one show, there was no exposure-related change in the opinion, "Environmental policies and regulations protect me and my family from exposure to toxic substances in the environment." Lack of creative control over content did not have unintended effects.
- H,H&S has once again succeeded in its health-related advocacy and should be supported.