CYBERPSYCHOLOGY, BEHAVIOR, AND SOCIAL NETWORKING
Volume 18, Number 7, 2015

DOI: 10.1089/cyber.2015.0051

Development of a Coding Instrument to Assess the Quality and Content of Anti-Tobacco Video Games

Julia M. Alber, MPH, PhD,[1] Anna M. Watson, MPH,[2] Tracey E. Barnett, PhD,[2] Rebeccah Mercado, MS,[1] and Jay M. Bernhardt, PhD, MPH[3]

Abstract

Previous research has shown the use of electronic video games as an effective method for increasing content knowledge about the risks of drugs and alcohol use for adolescents. Although best practice suggests that theory, health communication strategies, and game appeal are important characteristics for developing games, no instruments are currently available to examine the quality and content of tobacco prevention and cessation electronic games. This study presents the systematic development of a coding instrument to measure the quality, use of theory, and health communication strategies of tobacco cessation and prevention electronic games. Using previous research and expert review, a content analysis coding instrument measuring 67 characteristics was developed with three overarching categories: type and quality of games, theory and approach, and type and format of messages. Two trained coders applied the instrument to 88 games on four platforms (personal computer, Nintendo DS, iPhone, and Android phone) to field test the instrument. Cohen's kappa for each item ranged from 0.66 to 1.00, with an average kappa value of 0.97. Future research can adapt this coding instrument to games addressing other health issues. In addition, the instrument questions can serve as a useful guide for evidence-based game development.

Introduction

Tobacco use is the single most preventable cause of disability, disease, and death in the United States.[1] Each year, more than 480,000 people die prematurely from tobacco use or secondhand smoke exposure.[2] Smoking is associated with deaths due to heart disease, lung cancer, chronic obstructive pulmonary disease, and many other health issues.[2] Despite the risks of tobacco use, an estimated 19% of adults and 18% of high school students continue to smoke cigarettes in the United States.[3]

Public health professionals have developed a wide range of tobacco prevention interventions and policies to address tobacco use in the United States.[4] One innovative approach being utilized for the prevention and cessation of tobacco uses electronic video gaming. From 1999 to 2009, the percentage of individuals aged 8–18 years old who play video games rose from 38% to 60%.[5] In a study conducted by the Pew Research Center's Internet American Life Project, researchers found that 47% of teens aged 12–17 years old owned a smartphone, 23% owned a tablet computer, and 93% owned or had access to a computer.[6] The study also found 95% of the teens are online.[6] Given the wide-scale use among adolescents and the interactive nature of video games, Internet and mobile application–based video games provide an ideal mechanism for reaching and engaging this population for tobacco prevention and cessation.

Baranowski et al. defined games as ''a physical or mental contest with a goal or objective, played according to a framework, or rule, that determines what a player can or cannot do inside a game world.''[7] Games have been used in several prevention and cessation programs in high school students and adults,[8–11] and previous research has shown the use of electronic games as an effective method for increasing content knowledge about the risks of drugs and alcohol use for adolescents.[12–15] Additionally, researchers found that a computer–based, interactive substance abuse treatment and prevention program increased drug abuse prevention knowledge and decreased the frequency of smoking among adolescents.[16] For example, in a meta-analysis of computer-delivered interventions for alcohol and tobacco use, researchers analyzed the effect sizes from 42 randomized controlled trials, and found the average weighted effect size (d) across the studies to be 0.20, $p < 0.001$.[17] Based on the

[1]Center for Health Behavior Research, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
[2]College of Public Health and Health Professions, University of Florida, Gainesville, Florida.
[3]Center for Health Communication, Moody College of Communication, University of Texas at Austin, Austin, Texas.

results of the meta-analysis, the authors concluded that computer-based treatments for tobacco and alcohol consumption can produce significant effects, and are cost-effective and highly accessible.

Several health behavior theories have been used when designing and implementing technology-based tobacco prevention and cessation interventions, such as the Health Belief Model, Social Cognitive Theory (SCT), and the Theory of Planned Behavior (TPB).[18–20] During the development of Pick-Klop, a smoking cessation game, researchers applied constructs from SCT and the TPB, hypothesizing that the modification of attitudes and knowledge toward smoking, as well as confidence in one's ability to quit smoking (i.e., self-efficacy), predicted quitting in smokers.[18] The results from a randomized controlled trial of the Pick-Klop intervention showed a decrease in tobacco use and fewer remaining smokers among the intervention group.[18] The Health Belief Model is also often applied during the development of tobacco prevention and cessation strategies. As part of a quasi-experimental study, researchers applied the Health Belief Model to a smoking cessation intervention with a technology component. In this study, researchers hypothesized that improving individual's knowledge and attitudes specifically related to (a) the severity of smoking, (b) their susceptibility of suffering the side effects of smoking, (c) the benefits of quitting smoking, and (d) methods for overcoming the barriers to quitting would ultimately change their smoking behavior.[19] Results of the study showed significant improvements in smoking behavior among the participants.

The use of interactive components found within games can provide a mechanism to address and change theoretical constructs in a way that promotes engagement and appeals to one's sense of connectedness and self.[21] Furthermore, video gaming technology appeals to a wide range of individuals, and is able to entertain users while promoting change in theoretical constructs (e.g., attitudes), making it a valuable channel for reaching and engaging individuals for health promotion interventions such as tobacco prevention and cessation.[21]

While there are many tobacco-related games available online or as downloadable versions, little is known about the content and quality of tobacco-specific games. Previous research has examined the content of games in other areas related to health promotion such as exercise,[22–24] but there have been no instruments developed to examine the quality and content of tobacco cessation and prevention-related electronic games systematically. Such an instrument could be used to evaluate existing games and develop future games, which is particularly important given the number of adolescents and young adults actively using game-capable devices. Therefore, the purpose of this article was to describe the development of a coding instrument to examine the type and quality, use of theory, and utilization of health communication techniques of electronic games for tobacco cessation and prevention.

Materials and Methods

Item development

The initial coding instrument draft included 27 overarching categories with 119 specific items. These items covered three overarching video game concepts: game type and quality, theory and approach, and type and format of health messages. A review of relevant literature and review from experts in tobacco prevention and health communication were utilized to inform revisions to the coding instrument. The first full draft of the coding instrument included three main sections: type and quality of game, theory and approach, and type and format of messages, which are each described below.

Type and quality of game. This section measured three areas: type of game, game appeal, and story and characters. These questions were partially informed by Hsu et al.'s work describing six design features important for appealing to game buyers: novelty and powerfulness, appealing presentation, interactivity, challenging, sense of control, and rewarding.[25] Within each of these six factors are more specific features, which were used to inform five categories of items in the coding instrument under the category of game appeal: novelty, interactivity, challenging, sense of control, and rewarding. Appealing presentation was excluded because its interpretation was judged to be overly subjective from the expert review.

Another literature resource that informed instrument development was Baranowski et al.'s article exploring the characteristics of 25 video games that included health-related behavior change components.[7] Their article categorized the games by genre, story, and target group, and these categories and examples helped inform instrument questions and item selections. Health promotion research suggests that stories have the potential for affecting health behavior,[22] and two items were developed to measure the presence of story. Items to measure the type of game (i.e., action, adventure, puzzle/strategy, role playing/simulation, quizzes/trivia) were adapted from El-Nasr's book on game analytics.[26] After playing a pilot sample of games, it became apparent that a variety of character types appear in games. So, items to assess the types of characters items were developed and added to the instrument (i.e., realistic, unrealistic, human, animals, or nonhuman other than animal). The initial draft had a category to assess population of interest, but this category was removed after expert feedback due to the subjective nature of the assessment.

Theory and approach. This section of the coding instrument measured the theoretical constructs and educational approach used in each video game. According to games for health research, incorporating health promotion theory into games can help make them more effective.[27,28] The items related to theory included in the coding instrument were informed by three major health behavior theories and one communication theory: Health Belief Model, the TPB, SCT, and the Knowledge Gap Theory.[29–32] These theories have been applied to tobacco prevention and cessation among adolescents.[33–35] Furthermore, according to Lu et al., games that are developed using applicable psychological and behavioral theories, such as SCT and TPB, show greater chances of inducing healthy changes in adolescents.[22]

Lantz et al. provide three types of educational approaches for tobacco prevention interventions: informational deficit or rational model, affective education model, and social influence resistance model.[36] Based on their review, items were added to the video game coding

instrument to capture the type of anti-tobacco educational approach used in each game.[36]

Type and format of message. This section of the video game coding instrument was organized around several sections: type of appeal, type of tobacco messages, message frame, repetition and unique messages, message tailoring, and length of message display. According to Perloff, persuasive messages with factual evidence, as well as an argument that use two-sided arguments (pros and cons), are more likely to be effective,[37] and items were developed to examine the message appeal and frame.

Recommendations from the National Cancer Institute suggest that main health promotion messages should be repeated in health communication interventions, which informed the addition of items to measure message repetition.[38] The Centers for Disease Control and Prevention guide on health literacy suggests that messages should be tailored to the intended population of interest,[39] which informed the addition of items to determine if the messages were generic or tailored to the player. Items to assess message length were developed after playing pilot games when it became apparent that message length varied considerably between games.

Sample game selection

In order to create a list of commercially available tobacco prevention and/or cessation–related video games, a search was conducted via Google and within the two largest online markets for smartphone apps: Google Play for Android smartphones and tablets, and Apple iTunes for iOS iPhone and iPad devices. The first search was conducted over the last 2 weeks of June and the first 2 weeks of July 2013, and an additional search was conducted over the last 2 weeks of November 2013 to update the list and to remove any games from the sample that were no longer available. The following search terms were utilized, although saturation was reached fairly quickly: ''smoking prevention games for kids,'' ''smoking prevention games for youth,'' ''smoking prevention games for teens,'' ''anti-tobacco games,'' ''smoking cessation games,'' ''smoking prevention,'' ''quit smoking,'' ''stop smoking,'' and ''smoking cessation.'' The first 150 links for each search term in the Google search engine were examined for possible inclusion, and all apps in the Google Play and Apple iTunes stores that were found using these search terms were reviewed for possible inclusion.

A sample of tobacco-related video games was created by examining the title and description of each app or Web site. Any app or Web site that indicated it included a game or was itself a game related to smoking cessation or smoking prevention was included on the list, creating an initial total of 151 possible games. When the list was subsequently updated, it was found that 10 games were no longer available, and it was further determined that 12 did not contain a gaming component. Therefore, a total of 129 games were included in the final list to be analyzed.

Expert review

To establish content validity, two experts in tobacco prevention and health communication reviewed the initial draft of the coding instrument to consider the comprehensiveness of the items and to evaluate tobacco prevention strategies and communication methods. The experts were also asked to describe if any items seemed too subjective and should be removed from the coding instrument. Finally, the experts were asked to add, change, or remove items based on their knowledge of tobacco prevention communication strategies. When necessary, experts met to discuss any disagreements in order to provide a consensus answer.

Pilot tests

Two trained coders independently conducted a pilot test using the 11 games from the various platforms (see Table 1). Coders played each game five times through from beginning to end, or for 15 consecutive minutes, whichever was shorter. Coders then coded each of the games, referring back to the game as needed. The items on the checklist were categorized as dichotomous variables, ''1'' if it was present in the game, ''0'' if not. Cohen's kappa values were calculated for each item to determine the level of rater agreement per item. The games were pilot tested a total of five times, with minor revisions to the instrument and coding instructions, until an acceptable average kappa was obtained, and each item had a Cohen's kappa ≥ 0.70. Kappa values between 0.61 and 0.80 are considered substantial agreement.[40–42] Kappa values were calculated using IBM SPSS Statistics for Windows v21 (IBM Corp., Armonk, NY).

Field test

The same two trained coders used the latest form of the coding instrument to code the sample of tobacco-related games retrieved from the Internet search ($n = 121$). Some games ($n = 8$) had become unavailable since the Internet search and were removed from the list of games to code. Games that required users to play the game over several days in order to gain access to the majority of the game content were excluded from the study. In total, 88 games (74.4%) were coded in the field test. The Cohen's kappa was obtained for each item, and ranged from 0.66 to 1, with an average kappa of 0.97. Cronbach's alpha ($\alpha = 0.70$) was used to measure the internal consistency of the items ($n = 17$) measuring the construct ''game appeal.'' The entire instrument development process is described in Table 2.

Results

The categorical sections of the final coding instrument included type and quality of games, theory and approach, and type and format of messages. The final version of the coding

Table 1. Games Used in Pilot Test

Game	*Platform*
Blast a Butt	Computer
Butt Out Tobacco Trivia	Computer
Crave Out!	iTunes
Don't Blow It	Google Play
Smoking Time Machine	Google Play
Stamp Out Smoking	Computer
Tobacco Free Teens	Computer
Type or Die	Computer
Up in Smoke	iTunes
Wak-a-monsta	Google Play
What's Your Come Back	Computer

Table 2. Overview of Coding Instrument Development

Stage	*Description*	*Process*
1	Identifying existing tobacco prevention and cessation games	Google search for key terms, 141 games retained, 12 removed that did not meet criteria, 129 remained
2	Review content of sample of games	11 games representing the three different platforms played to determine amount of time appropriate to gain idea of game content
3	Identifying best practices in relevant literature	Review literature to determine common characteristics of coding instruments and theoretical concepts and important characteristics related to tobacco prevention and cessation messaging
4	Initial item development	27 items developed based on literature review; three main sections: type and quality of game, theory and approach, and type and format of messages
5	Expert review	One tobacco expert and one health communication expert were asked to review coding instrument
6	Pilot tests	11 games coded, coding instrument revised until kappa values on each item were at least 0.70, coding instrument was pilot tested and revised five times
7	Coding guide developed	Using feedback from experts, coding guide was developed
8	Field test	Total sample of identified games were coded, each item was analyzed, experts were used to settle any disagreements, problem items removed

instrument can be found in Appendix 1. The majority of the items (67/72, 93.1%) were retained. From the initially developed items (119 items), 51 items were removed after expert review, pilot testing, and field testing.

Items were removed if the item seemed too subjective, received low interrater reliability, or experts suggested removing the item. Items ($n=7$) related to novelty (one of the characteristics of game appeal) were removed because the items were too subjective. Example item: scenarios are unpredictable, game characteristics were colorful or vibrant, audio matches the emotion of the game. Items related to target audience ($n=4$) were removed after low interrater reliability. Several items ($n=26$) related to constructs were removed after expert review showed overlap in many of the constructs. Items related to health education approach ($n=5$) were removed, as experts decided these items overlapped with other educational approach items. Items related to type of argument, biased and neutral statements, fear, and type of appeal were removed ($n=6$) after consistently receiving low interrater reliability and expert decision that these items were too subjective to include in the instrument. The final coding instrument contained 67 characteristics under three overarching categories: type and quality of games, theory and approach, and type and format of messages.

The type and quality section contains a total of 28 items, which are subdivided into seven sections: ''type of game'' (6 items), ''interactivity'' (3 items), ''challenging'' (2 items), ''sense of control'' (4 items), ''rewarding'' (6 items), ''story'' (2 items), and ''characters'' (5 items). The sections ''interactivity,'' ''challenging,'' ''sense of control,'' ''rewarding,'' and ''story'' measure game appeal.

The theory and approach section contains a total of 11 items, which are subdivided into two sections: ''theoretical constructs'' (8 items) and ''educational approaches'' (3 items).

The final section, type and format of messages, contains a total of 27 items, which are subdivided into 7 sections: ''type of appeal'' (2 items), ''type of tobacco message'' (14 items), ''message framing'' (2 items), ''type of argument'' (2 items), ''message characteristics'' (3 items), and ''message displayed'' (4 items).

Discussion

The results of this methodological study provide a coding instrument for describing the content of tobacco prevention and cessation games. The instrument could be used to evaluate current games to understand what strengths and deficiencies they contain related to theoretical and educational approaches from the current health communication and tobacco prevention and cessation literatures. While selected items were removed during the process from the initial item bank, only items that the experts felt were objective, represented important characteristics of tobacco prevention and cessation and health communication, consistently had high interrater reliability, were retained in the final instrument.

This video game coding instrument can also be used as a resource while developing new video games for tobacco prevention or cessation to determine the game quality and appeal, theoretical construct inclusion, and message content frame and approach. Furthermore, health promotion professionals could adapt this instrument as a tool for determining which games may be the best resource for health promotion programs and interventions.

Researchers or other professionals wishing to use this instrument should use the coding guide developed for the instrument, which provides a detailed description of how to interpret each of the items included in the instrument. Users should also be familiar with the intended use of the instrument and how to interpret findings. This coding instrument was designed with the purpose of describing characteristics of games related to the prevention and cessation of tobacco use. Based on the use in this study, the coding instrument may not be appropriate for games that cannot be completed in one setting. In addition, this instrument may not be appropriate for games that are primarily trackers or apps with a sole purpose to track the number of cigarettes or other behaviors

over a period of time. Finally, it is important to note that the coding instrument is a descriptive tool, not a scale or scales, as the categories do not represent overarching constructs.

Items in the coding instrument should be selected if the game content contains the item characteristic. Because there are multiple sections, a summed total for the instrument is not appropriate and higher values cannot be seen as ''better'' games. Therefore, this instrument is intended to allow users to understand the characteristics of the games. The characteristics that are important for the game depends on the purpose of the game. For example, research suggests the characteristics used for describing ''game appeal'' are important elements of making a game appealing.[7,25] There are a total of 17 characteristics in the instrument related to ''game appeal'': interactivity (3 items), challenging (2 items), sense of control (4 items), rewarding (6 items), and story (2 items). A higher number of these characteristics could make the game more appealing.

Similarly, games should apply theoretical constructs, as research suggests games that utilize theory are important for developing effective games.[27,28] This would be relevant when examining the theoretical constructs and educational approaches used by the games. Games should address at least one theoretical construct and could apply more than one educational approach.

Finally, when examining the number of tobacco messages, one should consider that the Centers for Disease Control and Prevention suggests health communication products should contain no more than three or four points.[39] Recommendations also suggest two-sided arguments are more likely to alter attitudes than one-side arguments.[37] For example, a game with a two-sided argument would provide the benefits of quitting smoking (e.g., decreased heart disease risk) and the potential difficulties associated with quitting (e.g., irritability). Additionally, a message that provides evidence is more likely to be effective than those message that lack evidence.[37] According to the Centers for Disease Control and Prevention,[4] ''messages that elicit strong emotional response, such as personal testimonials and viscerally negative content, produce stronger and more consistent effects on audience recall, knowledge, beliefs and quitting behaviors.'' Furthermore, health communication messages that are tailored to their population of interest are more successful than those that do not.[39]

Limitations

The games used for the development of the coding instrument were those available during the time frame of the development process. Additionally, not all gaming platforms were included, although popular platforms were selected for the process. Behavioral tracking applications and games that required play over a period of several days to gain access to game content were also not included in the analysis. It is possible that other games that were not included in this study may have affected the development of the coding instrument.

Conclusion

As game-capable devices continue to be widely used among adolescents and young adults, researchers should be able to determine which games present characteristics that promote tobacco prevention and cessation. The coding instrument developed in this article provides a tool for researchers in the public health field to evaluate the content and quality of tobacco-related games. The instrument allows researchers to describe games based on the game type and quality, use of theory, and educational and messaging approaches. The coding guide should be used to ensure proper use and interpretation of the coding instrument. Future research should explore applying this coding instrument to tracking applications and repeated-play games that take longer than one setting to complete. In addition, practitioners and game developers should consider using and/or adapting this coding instrument to help inform effective game development.

Acknowledgments

The work was supported by the Food and Drug Administration (FDA) Center for Tobacco Products and the National Cancer Institute (NCI) Office of Communication and Education. The content is solely the responsibility of the authors and does not necessarily represent the official views of the FDA, NCI, or NIH.

Author Disclosure Statement

No competing financial interests exist.

References

1. Centers for Disease Control and Prevention. (2012) Tobacco use. www.cdc.gov/chronicdisease/resources/publications/aag/osh.htm (accessed Mar. 20, 2014).
2. U.S. Department of Health and Human Services. (2014) *The health consequences of smoking—50 years of progress: a report of the surgeon general*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General.
3. Centers for Disease Control and Prevention. (2013) Trends in current cigarette smoking among high school students and adults, United States, 1965–2011. www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm (accessed Mar. 20, 2014).
4. Centers for Disease Control and Prevention. (2014) *Best practices for comprehensive tobacco control programs—2014*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.
5. Rideout VJ, Foehr UG, Roberts DF. (2010) *Generation M2: media in the lives of 8- to 18-year-olds*. Menlo Park, CA: Kaiser Family Foundation.
6. Madden M, Lenhart A, Duggan M, et al. (2013) Teens and technology 2013. Pew Research Center's Internet & American Life Project. www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_TeensandTechnology2013.pdf (accessed May 7, 2014).
7. Baranowski T, Buday R, Thompson DI, et al. Playing for real: video games and stories for health-related behavior change. American Journal of Preventive Medicine 2008; 34:74–82.
8. Stein-Seroussi A, Stockton L, Brodish P, et al. Randomized controlled trial of the ACTION smoking cessation curriculum in tobacco-growing communities. Addictive Behaviors 2009; 34:737–743.
9. Girard B, Turcotte V, Bouchard S, et al. Crushing virtual cigarettes reduces tobacco addiction and treatment discontinuation. CyberPsychology & Behavior 2009; 12:477–483.

10. Krebs P, Burkhalter J, Snow B, et al. Development and alpha testing of quit it: an interactive video game to enhance skills for coping with smoking urges. Journal of Medical Internet Research 2013; 15:1.
11. Khazaal Y, Chattonn A, Prezzemolo R, et al. ''Pick-Klop,'' a group smoking cessation game. Journal of Groups in Addiction & Recovery 2010; 5:183–193.
12. Rodriguez DM, Teesson M, Newton, NC. A systematic review of computerised serious educational games about alcohol and other drugs for adolescents. Drug & Alcohol Review 2014; 33:129–135.
13. Schinke SP, Schwinn TM, Ozanian AJ. Alcohol abuse prevention among high-risk youth: computer-based intervention. Journal of Prevention & Intervention in the Community 2005; 29:117–130.
14. Klisch Y, Miller L, Beier M, et al. Teaching the biological consequences of alcohol abuse through an online game: impacts among secondary students. CBE—Life Sciences Education 2012; 11:94–102.
15. Klisch Y, Miller LM, Wang S, et al. The impact of a science education game on students' learning and perception of inhalants as body pollutants. Journal of Science Education & Technology 2011; 21:295–303.
16. Marsch L, Bickel W, Grabinski M. Application of interactive, computer technology to adolescent substance abuse prevention and treatment. Adolescent Medicine: State of the Art Reviews 2007; 18:342–356.
17. Rooke S, Thorsteinsson E, Karpin A, et al. Computer-delivered interventions for alcohol and tobacco use: a meta-analysis. Addiction 2010; 105:1381–1390.
18. Khazaal Y, Chatton A, Zullino D, et al. Impact of a board-game approach on current smokers: a randomized controlled trial. Substance Abuse Treatment, Prevention & Policy 2013; 8:1–14.
19. Renuka P, Pushpanjali K. Effectiveness of health belief model in motivating for tobacco cessation and to improving knowledge, attitude and behavior of tobacco users. Cancer & Oncology Research 2014; 2:43–50.
20. Cheek C, Fleming T, Lucassen MF, et al. Integrating health behavior theory and design elements in serious games. JMIR Mental Health 2015; 2:e11.
21. Thompson D. Designing serious video games for health behavior change: current status and future directions. Journal of Diabetes Science & Technology 2012; 6:807–811.
22. Lu A, Baranowski T, Thompson D, et al. Story immersion of videogames for youth health promotion: a review of literature. Games for Health Journal 2012; 1:199–204.
23. Cowan L, Van Wagenen S, Brown B, et al. Apps of steel: are exercise apps providing consumers with realistic expectations? A content analysis of exercise apps for presence of behavior change theory. Health Education & Behavior 2013; 40:133–139.
24. Lyons E, Hatkevich C. Prevalence of behavior changing strategies in fitness video games: theory-based content analysis. Journal of Medical Internet Research 2013; 15:101–111.
25. Hsu S, Lee F, Wu M. Designing action games for appealing to buyers. CyberPsychology & Behavior 2005; 8:585–891.
26. Seif El-Nasr M, Drachen A, Canossa A. (2013) *Game analytics: maximizing the value of player data*. London: Springer-Verlag, pp. 24–29.
27. Cullen K, Watson K, Baranowski T, et al. Squire's quest: intervention changes occurred at lunch and snack meals. Appetite 2005; 45:148–151.
28. Papastergiou M. Exploring the potential of computer and video games for health and physical education: a literature review. Computers & Education 2009; 53:603–622.
29. Hoachbom GM. (1958) *Public participation in medical screening programs: a socio-psychological study (Public Health Service Publication No. 572)*. Washington, DC: Government Printing Office.
30. Ajzen I. The theory of planned behavior. Organizational Behavior & Human Decision Processes 1991; 50:179–211.
31. Bandura A. (1986) *Social foundations of thought and action: a social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
32. Tichenor P, Donohue G, Olien C. Mass media flow and differential growth in knowledge. Public Opinion Quarterly 1970; 34:159–170.
33. Høie M, Moan I, Rise J, et al. Using an extended version of the theory of planned behaviour to predict smoking cessation in two age groups. Addiction Research & Theory 2012; 20:42–54.
34. Mantler T. A systematic review of smoking. Youths' perceptions of addiction and health risks associated with smoking: utilizing the framework of the health belief model. Addiction Research & Theory 2013; 21:306–317.
35. Van Zundert R, Nijhof L, Engels R. Testing Social Cognitive Theory as a theoretical framework to predict smoking relapse among daily smoking adolescents. Addictive Behaviors 2009; 34:281–286.
36. Lantz PM, Jacobson PD, Warner KE, et al. Investing in youth tobacco control: a review of smoking prevention and control strategies. Tobacco Control 2000; 9:47–63.
37. Perloff RM. (2009) *The dynamics of persuasion communication: communication and attitudes in the 21st century*. New York: Routledge.
38. National Cancer Institute at the National Institutes of Health. (2008) Pink book—making health community programs work. www.cancer.gov/cancertopics/cancerlibrary/pinkbook (accessed Mar. 17, 2014).
39. Centers for Disease Control and Prevention. (2009) Simply put: a guide for creating easy-to-understand materials. www.cdc.gov/healthliteracy/pdf/simply_put.pdf (accessed May 1, 2014).
40. Viera A, Garrett J. (2005) Understanding interobserver agreement: the kappa statistic. Family Medicine 2005; 37:360–363.
41. Laila B. From text to codings: intercoder reliability assessment in qualitative content analysis. Nursing Research 2008; 57:113–117.
42. McHugh ML. Interrater reliability: the kappa statistic. Biochemia Medica 2012; 22:276–282.

Address correspondence to:
Dr. Jay M. Bernhardt
University of Texas at Austin
1105A Whitis Ave (A1105)
Austin, TX 78712

E-mail: jay.bernhardt@austin.utexas.edu

(Appendix follows →)

Appendix

Appendix 1. Coding Instrument

Name of Game:

Coder's Name:

Instructions: Each game should be played five times completely through, or for 15 minutes total, whichever is shorter. The game should be played first and the coding instrument should be completed, referring back to the game as necessary to complete the instrument.

Messages include any information that the coder has access to within the game.

Section A. Type and Quality of Game

Section 1A. Type of Game

1. What type of game is it? Check all that apply.
   - ☐ **Action**
     Definition: Quick reflexes, accuracy, timing. Examples: sports, shooters
   - ☐ **Adventure**
     Definition: Involves exploration and problem solving; need strategy to advance. Examples: Games with jumping, climbing, and exploring worlds to collect item and/or solve a problem.
   - ☐ **Puzzle/Strategy**
     Definition: Primary purpose is puzzle or problem solving. Examples: Games with pattern recognition and word completion.
   - ☐ **Role Playing/Simulation**
     Definition: Player immerses themselves in the character's situation or plays through real world situations. Examples: Games where players play as a character through a fantasy world or real world scenarios.
   - ☐ **Quizzes/Trivia**
     Definition: Primary purpose of game is for the user to answer questions related to tobacco. Examples: Jeopardy
   - ☐ **Other**
     Please specify:_____

Section 2A. Game Appeal

2. Which qualities apply to the game? Check all that apply.
   - ☐ Interactivity
   - ☐ Instructions are provided
   - ☐ Game provides feedback on user's performance. (Example: repeat level, good job, includes increase in score or points)
   - ☐ Difficulty increases throughout the game

Challenging

   - ☐ Game has multiple levels indicated by a message or display
   - ☐ Game requires gaming skill development to master the game (requires repetition of play)

Sense of control

   - ☐ Player can select difficulty level
   - ☐ Player can select character or personalize avatar (examples: selecting gender, a certain alien)
   - ☐ Player can select environment/background
   - ☐ Player can unlock new features to improve skill level

Rewarding

   - ☐ Player receives score that can be built upon over the course of the game
   - ☐ Player receives virtual tokens or coins based on performance
   - ☐ Player can redeem tokens or coins for items within the game
   - ☐ High scores can be seen within the game
   - ☐ Player can view their personal high scores
   - ☐ Player can share achievements or score through social media platform or sharing network (examples: sharing outside the game on Facebook, emailing, or texting)

Section 3A. Story and Characters

3. Does the game have a story? Check all that apply.
   - ☐ A plot exists in the game
   - ☐ A series of events occur during the game

4. Select the type of character(s) used in the game. Select all that apply. Characters are any object or person seen in the game that at least has eyes.
   - ☐ Realistic (non-animated)
   - ☐ Unrealistic
   - ☐ Human
   - ☐ Animal
   - ☐ Nonhuman other than animal

Section B. Theory and Approach

Section 1B. Theory

5. Check the theoretical constructs that were applicable to the game content.
   - ☐ **Attitudes**
     Definition: This refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question. It entails a consideration of the outcomes of performing the behavior.
   - ☐ **Perceived barriers**
     Definition: Belief about the tangible and psychological costs of the advised action side effects
   - ☐ **Perceived benefits**
     Definition: Belief in the efficacy of the advised action to reduce risk or seriousness of impact
   - ☐ **Perceived severity**
     Definition: Belief about how serious a condition and its sequelae are (conditions)
   - ☐ **Perceived susceptibility**
     Definition: Belief about the chances of experiencing a risk or getting a condition or disease (often statistics)
   - ☐ **Self-efficacy**
     Definition: Beliefs about personal ability of a group to perform behaviors that bring desired outcomes. Provides user with information, resource, or skill to prevent or stop behavior
   - ☐ **Subjective norm**
     Definition: The perceived social pressure to perform or not to perform the behavior. It relates to a person's beliefs about whether peers and people of importance to the person think he or she should engage in the behavior
   - ☐ **Knowledge**
     Definition: Factual and interpretive information leading to understanding or usefulness for taking informed action.

Section 2B. Approach

6. Which educational approaches are used in the game? Select all that apply.
   - ☐ **Information deficit or rational model**
     Definition: Provides information about health risks and negative consequences
   - ☐ **Affective education model**
     Definition: Attempts to influence beliefs, attitudes, intentions, and norms
   - ☐ **Social influence resistance model**
     Definition: attempts to build skills needed to identify and resist negative influences from advertising and peers

Section C. Type and Format of Messages
Messages include written or spoken words within the game.

7. What type of appeals were used?
   - ☐ Logical/factual (statement of fact)
   - ☐ Emotional (emotions such as sadness, sympathy)
8. What type of tobacco messages were used in the game? Check all that apply.
   - ☐ **Additives/Chemicals**
     Definition: Any chemical used in tobacco products that have negative health consequence such as ammonia, butane, cadmium, etc.
   - ☐ **Long-term negative health consequences**
     Definition: Increased risk of heart disease, cancer or premature aging high blood pressure
   - ☐ **Short-term negative health consequences**
     Definition: increased pulse rate and cough, poor athletic performance, aggravation of asthma
   - ☐ **Positive health effects from stopping tobacco use**
     Definition: Positive changes in the body due to the cessation of tobacco use such as decreased blood pressure
   - ☐ **Negative social consequences**
     Definition: Cosmetic effects such as stained teeth, bad breath, wrinkles, etc.

- ☐ **Harm reduction**
  Definition: Using chew tobacco instead of cigarettes to reduce the effects of secondhand smoke (must still be a tobacco product, not nicotine replacement or gum or other device to help quit)
- ☐ **Negative environmental effects**
  Hint: Littering, introducing dangerous substances and/or chemicals to aquatic environments
- ☐ **Positive environmental effects**
  Definition: Describing how NOT smoking will decrease the negative environmental effects
- ☐ **Quitting strategies**
  Definition: Setting a quit date, joining a support group, etc.
- ☐ **Addiction control**
  Definition: Pharmaceutical assistance such as nicotine replacement patches, gum, and prescription medicines
- ☐ **Secondhand smoking risks**
  Definition: Tobacco's effects on those who are not smoking
- ☐ **Tobacco industry deceptive practices**
  Definition: Presenting images or statements that vilify the tobacco industry
- ☐ **Resistance skills/skill building**
  Definition: Practicing saying no, resisting marketing attempts
- ☐ **Policies**
  Definition: Tobacco is illegal under 18, possible fines for underage use of tobacco

9. How were the messages in the game framed? Check all that apply.
   - ☐ **Gain framed**
     Definition: the benefits of stopping tobacco use
   - ☐ **Loss framed**
     Definition: the costs of continuing to use tobacco
10. Are the same messages in the games repeated throughout the game? Select one option.
    - ☐ Yes
    - ☐ No
11. Are different messages seen in the game? Select one option.
    - ☐ Yes
    - ☐ No
12. Does it appear that the messages are being tailored based on the player's characteristics (age, sex, etc.)? Consider if the game asks you for personal information that would allow the game to tailor it. Select one option.
    - ☐ Some of the messages are tailored
    - ☐ None of the messages are tailored
13. Which type of argument is utilized in the messages delivered in the game? Select all that apply.
    - ☐ One-sided
      Definition: Discusses only the pro *or* the cons
    - ☐ Two-sided
      Definition: Discusses both the pros *and* the cons
14. How long are the messages displayed? Select all that apply.
    - ☐ 10 seconds or less
    - ☐ 11 seconds to 20 seconds
    - ☐ More than 20 seconds
    - ☐ Message remains until user clicks or character prompts message to disappear