“Polio Eradication” Game May Increase Public Interest in Global Health

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Abstract

Background: Interactive games that highlight global health challenges and solutions are a potential tool for increasing interest in global health. To test this hypothesis, we developed an interactive “Polio Eradication” (PE) game and evaluated whether playing or watching was associated with increased public interest in global health.

Materials and Methods: The PE game is a life-size, human board game that simulates PE efforts. Four players—a researcher, a transportation expert, a local community coordinator, and a healthcare worker—collaborate as an interdisciplinary team to help limit ongoing and future polio outbreaks in Pakistan, represented on the game board. Participants who played or observed the game and those who did not participate in the game, but visited noninteractive global health exhibits, completed a survey on participation outcomes. We used relative risk regression to examine associations between cofactors and change in global health interest.

Results: Three variables predicted increased global health interest among the game participants: Having little or no previous global health knowledge prior to playing the game (risk ratio [RR]=1.28; 95 percent confidence interval [CI], 1.13–1.45), not currently being involved in global health (RR=1.41; 95 percent CI, 1.07–1.85), and visiting Seattle (RR=1.25; 95 percent CI, 1.04–1.51).

Conclusions: Our results suggest that a hands-on, interactive game may increase the public’s interest in global health, particularly among those with minimal previous knowledge of or involvement in global health activities.

Introduction

INTERACTIVE GAMES PRESENT an attractive platform to engage target audiences in public health messages. The past decade saw an explosion of interest in games that go beyond an entertainment focus. Interactive educational games (called “serious games”) make learning fun and exciting in a stress-free environment that facilitates understanding and increases knowledge retention.^{1–3} A literature review of health game research reported a surge of health game publications in 2008 and 2009, with diversification of clinical applications of such games.⁴ The most common target outcomes of these health game interventions were exercise, rehabilitation, and behavioral change. Games have been used in the health sector as educational tools to improve the performance of health professionals⁵ and as incentives to

stimulate patients’ adherence to healthy behaviors and lifestyles.^{6,7} Exergames (i.e., interactive digital games that combine exercise with gameplay) have demonstrated health benefits, particularly among adolescents.^{8–12} For example, light- to moderate-intensity activity games like “Wii™ Sports” (Nintendo, Kyoto, Japan) have been associated with improved academic performance, improved cognitive functioning, and increases in physical activity.

We propose that interactive games can also serve as potential tools to boost the visibility of global health among the lay public. Koplan et al.¹³ defined global health as an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide. Among others, two key features of global health are that (1) it focuses on issues that directly or indirectly affect health and transcend national boundaries and (2) it

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often involves highly interdisciplinary team collaborations within and beyond health sciences. Here we describe a game that reflects this definition by enabling players to tackle the challenge of polio eradication (PE) using solutions that require interdisciplinary collaborations and highlight the importance of health equity among all nations.

We hypothesized that an interactive game format would be particularly effective in engaging and educating older children, adolescents, and young adults. To test this hypothesis, researchers at the University of Washington's Department of Global Health (Seattle, WA) partnered with game developers from Harebrained Schemes (Redmond, WA) to develop an interactive "PE" game aimed at engaging the lay public in global health and educating them about current efforts and successes.

This article presents an evaluation of the association between playing or watching the PE game and change in interest in global health among members of the public who visited a free, public, global health exhibit in Seattle during the summer of 2012. Specifically, we investigated whether participants who played or watched the game reported more interest in global health compared with those who only visited other exhibits but neither played nor watched the game. We also assessed whether, compared with older adults, children, adolescents, and young adults (all less than 20 years of age) found the game a more engaging way to learn about global health.

Materials and Methods

The PE game was part of a 6-month series of exhibits that commemorated the 50th anniversary of the 1962 Seattle World's Fair. During approximately 6 weeks of the celebration, the exhibits focused on global health, with a goal of raising public awareness of global health needs, advances, and career opportunities, as well as the importance of global health locally. The Washington Global Health Alliance, a consortium of Washington State academic, research, philanthropic, and non-governmental organizations involved in global health, collaborated with several other local organizations to sponsor a Global Health Activities Tent located at Seattle Center. The fully enclosed tent housed several exhibits, including the PE game.

PE was chosen as a central theme for the game both to inspire visitors with information about a landmark global health priority and to provide an example of the multifaceted nature and complex challenges of global health, which requires interdisciplinary teams and the support of local experts and leaders. Having plagued much of the industrialized world in the early 20th century, today, polio is endemic in only three countries: Afghanistan, Nigeria, and Pakistan. Since 1988, the Global Polio Eradication Initiative has facilitated unprecedented collaborative efforts among multi-lateral agencies, national governments, and private-sector organizations. This has resulted in a reduction of reported global polio cases of >99%; however, several barriers still challenge achieving eradication by 2018.^{14–17}

The PE game

The PE game, similar to a human chessboard, used a simple, interactive, hands-on format to simulate both the range of challenges that global health professionals face and

the diverse array of individuals and professions needed to work together to meet these challenges. Development of the game was based on the theory of collaborative learning in which interactions and communications with others influence the learning process.^{18,19} The game development process involved collaboration between public health leaders in PE and game designers. The game was made out of a 7-×7-foot grid of different colored carpet squares to show various geographical features (e.g., towns, cities, and rivers in our representation of Pakistan, one of the three remaining polio-endemic countries) (Fig. 1).

A minimum of four players was required to play the game. Players were cast as a researcher, a transportation expert, a local community coordinator, or a healthcare worker and had distinct responsibilities. Every turn, each player had the opportunity to make one of two possible moves. For example, during a turn, the transportation expert could either fly a helicopter to any city on the map and gather vaccines or drive a truck in one direction along the road, dropping off one or more vials of vaccines in each town passed, in order to deploy vaccine where it was most urgently needed.

All four players were expected to collaborate, using either of their move options in the context of cards drawn from "infection," "event," and "player" decks to help limit ongoing and future outbreaks in Pakistan. Therefore, players worked together as an interdisciplinary team to strategize about how best to use their available resources to produce vaccines, transport the vaccines to unvaccinated areas, and get the healthcare worker to these areas to administer the vaccines. Cards drawn from the "infection" deck determined the spread of polio, and "player cards" provided special one-use "lucky breaks" that players used as they tried to accomplish their goals. Random "event cards" depicting situations applicable to both positive, real-life scenarios (e.g., a false alarm of a polio infection) and negative, unforeseen circumstances (e.g., inadequate ice for cold-chain vaccine supply) were introduced during gameplay. Players had to tackle these challenges, using their available moves, in order to win. For example, given time constraints of a spreading epidemic, the researcher could choose to remain in the current laboratory far from the outbreak and produce more vaccine or to move to a facility near the epicenter but produce less vaccine. Players won the game when all polio infections were eliminated from the game board; conversely, players lost the game when the infection spread to three or more major Pakistani cities. The rules, responsibilities of each role, and method of gameplay were explained by the game coordinator before each game, and players were encouraged to ask questions about these and other aspects of the game. On average, the game took 10–15 minutes to play.

Participants and data collection

The Global Health Exhibit opened to the public free of charge between July 3 and August 19, 2012. Everyone who entered the Global Health Activity Tent was eligible to play or watch the PE game and visit other exhibits; all exhibits were contained in one 90-×60-foot tent. At the end of each game, we asked both players and observers of the game (game participants) to complete a survey. Observers qualified as game participants only if they watched one full game. For the comparison group (tent participants), we obtained a

FIG. 1. “Polio Eradication” game board. The game board depicts a map of Pakistan, one the remaining polio-endemic countries. Players begin the game at the diamond-shaped square and move along roads (gray lines) in any direction toward the next town or city, based on the players’ selected actions. Polio infection spreads into towns (white and yellow squares) or cities (red squares) in directions shown on the card drawn from the infection card stack. Random polio outbreaks occur in yellow squares. The blue square represents a lake, brown/tan squares represent the deserts, and green squares represent grasslands. (Color graphics available online at www.liebertonline.com/g4h)

convenience sample by randomly inviting the visitors exploring other exhibits who had not played or observed the game to complete the survey.

We designed and administered a semistructured questionnaire to gather information on participants’ socio-demographics and the impact of the game or other exhibits on participants’ interest in global health. We asked game participants to provide self-assessments of how much they knew about global health prior to playing or watching the game and what they learned from the game. We also asked all participants whether they were currently involved in global health activities in any capacity and whether their involvement in the game or visit to other exhibits changed their level of interest in global health. We provided participants with two options for participating in the survey: To be interviewed by student interns staffing the PE game or to complete the questionnaires themselves. The questionnaires were tested during the first pilot study week of the exhibition and were revised based on feedback. Student interns staffing the PE game were trained on interview protocol during the pretest, and one of the researchers was present at the PE game for the entire duration of the exhibition to monitor for quality assurance on the questionnaire administration.

Statistical analysis

We used summary statistics (e.g., frequencies and percentages) to describe the study participants, and a Fisher’s exact test was used to compare game participants with tent participants. We fit log-binomial regression models to examine the association of demographic factors such as age (6–13, 14–19, 20–30, and >30 years old), gender, and race/ethnicity, of amount of prior global health knowledge before playing the game or visiting the tent (little–nothing, mod-

erate, and a great deal), and of current involvement in global health (yes or no) with whether there was a change in level of interest in global health (yes or no; if yes, how?). We further used this relative risk regression approach to compare changes in global health interest among all game participants with that among tent participants and among game participants <20 years with that among tent participants of similar age.²⁰ All statistical analyses were conducted using STATA (version 11.2; StataCorp, College Station, TX).

Qualitative analysis

An open-ended question asked participants to describe what they had learned from the game. Key words from their responses were extracted and categorized into four global health themes: (1) Challenges or barriers in global health, (2) the role of interdisciplinary teams in global health, (3) the importance of teamwork among global health practitioners, and (4) knowledge about polio eradication. We analyzed the proportion of participants in each category and calculated *P* values to observe whether what participants had learned differed significantly by age group.

Results

Between July 22 and August 19, 2012, 197 game participants and 120 tent participants completed the survey. Approximately 50 people visited the tent per day, and an estimated 30 percent of these participated in the study. We excluded 43 participants whose surveys were missing key information such as age and whether or not playing the game or visiting other exhibits increased their interest in global health. Among those excluded from our analysis were five participants <6 years of age, as most were unable to answer

questions independently. Responses from 164 game participants and 110 tent participants >6 years of age with complete data were analyzed and are included in our results. Overall, the game participants were younger, with 33 percent ($n=54$) 6–19 years of age and 38 percent ($n=62$) >30 years of age, compared with tent participants, of whom 10 percent ($n=12$) were 6–19 year olds and 48 percent ($n=53$) were >30 year olds ($P<0.001$). There were no statistically significant differences in gender and race/ethnicity between the game and tent participants (Table 1). Just over half (53 percent and 57 percent of the game and tent participants, respectively) were visiting Seattle ($P=0.53$). Not being currently involved in global health was associated with game

participation compared with tent participation ($P=0.03$). After adjusting for age, this association persisted but was no longer significant ($P=0.09$).

Three variables were found to be predictors of increased global health interest among the game participants: Having little or no previous global health knowledge prior to playing the game (risk ratio [RR]=1.28; 95 percent confidence interval [CI], 1.13–1.45), not currently being involved in global health (RR=1.41; 95 percent CI, 1.07–1.85), and visiting Seattle (RR=1.25; 95 percent CI, 1.04–1.51) (Table 2).

We compared change in global health interest among game participants with that among tent participants, by age (Fig. 2). Game participants answered the question “Did the

TABLE 1. DESCRIPTION OF STUDY PARTICIPANTS

Variable	Game participants ($n=164$)	Tent participants ($n=110$)	P value
Age group (years) (total)	164	110	<0.001
6–13	41 (25)	6 (5)	
14–19	13 (8)	6 (5)	
20–30	48 (29)	45 (41)	
>30	62 (38)	53 (48)	
Gender (total)	156	107	1.00
Female	93 (60)	64 (60)	
Race/ethnicity (total)	155	105	0.46
African American	3 (2)	4 (4)	
American Indian/Alaska Native	1 (1)	1 (1)	
Asian Pacific Islander	26 (17)	15 (14)	
Hispanic/Latino	11 (7)	5 (5)	
White/Caucasian	107 (68)	80 (76)	
Other	4 (3)	—	
Rather not respond	3 (2)	—	
Visiting Seattle (total)	161	108	
Yes	86 (53)	62 (57)	0.53
Visiting other exhibits within the tent changed interest level in global health (total)	129	106	
Yes	99 (77)	74 (70)	0.24
Currently involved in global health (total)	154	110	
Yes	42 (27)	44 (40)	0.03
Would want to be involved in global health in the future (total)	147	99	
Yes	110 (75)	72 (73)	0.77
Enjoyed playing the “Polio Eradication” game (total) ^a	161		
Yes	152 (95)		
What participants learned from playing or watching the “Polio Eradication” game (total) ^a	164		
Challenges/barriers in global health	57 (38)		
Interdisciplinarity in global health	26 (17)		
Teamwork in global health	54 (36)		
Polio eradication knowledge	57 (38)		
Other	30 (20)		
Amount of previous global health knowledge before playing the game (total) ^a	153		
Little—nothing	52 (34)		
Moderate	80 (52)		
A great deal	21 (14)		
Playing the “Polio Eradication” game changed interest level in global health (total) ^a	151		
Yes	116 (77)		

Game participants played/watched the game, and tent participants did not play or watch the game. Data are number (percent).

^aQuestions answered only by game participants.

TABLE 2. ASSOCIATION BETWEEN SOCIODEMOGRAPHIC FACTORS AND CHANGE IN LEVEL OF INTEREST IN GLOBAL HEALTH AMONG THOSE WHO PLAYED OR OBSERVED THE “POLIO ERADICATION” GAME

Factor	RR (95 percent CI)	P value
Little–no previous knowledge of global health prior to playing “Polio Eradication” game	1.28 (1.13–1.45)	<0.001
Not currently involved in global health	1.41 (1.07–1.85)	0.02
Want to be involved in global health in the future	1.06 (0.87–1.28)	0.57
Gender (reference female)	1.01 (0.84–1.21)	0.95
Age group	1.07 (0.99–1.15)	0.07
Visiting Seattle	1.25 (1.04–1.51)	0.02
Ethnicity	1.01 (0.96–1.07)	0.61

CI, confidence interval; RR, risk ratio.

Polio Eradication game change your level of interest in global health?” and tent participants answered the question “Did visiting other exhibits in the tent change your level of interest in global health?” Ninety-five percent of the game participants reported that they enjoyed playing or watching the game, with 77 percent ($n=116$) reporting an increased interest in global health. Similarly, 70 percent ($n=74$) of tent participants reported an increased global health interest after visiting other exhibits within the tent (Table 1). Of the game participants, the largest proportions reporting increased global health interest were among the 6–13 and 14–19 year olds (approximately 90 percent in each group) (Fig. 2). However, increased interest in global health did not differ significantly by age group ($RR=1.07$; 95 percent CI, 0.99–

1.15; $P=0.07$) in univariate analysis. In contrast, 83 percent of the 6–13 year olds and only 67 percent of the 14–19 year olds of tent participants indicated increased interest in global health. Overall, game participants were marginally more likely to report increased global health interest compared with tent participants, although this difference did not achieve statistical significance ($RR=1.10$; 95 percent CI, 0.94–1.28; $P=0.22$). We observed a similar, but more marked, trend when comparing participants <20 years of age in the game and tent groups ($RR=1.19$; 95 percent CI, 0.85–1.67; $P=0.32$).

We categorized game participants’ responses about what they had learned from playing or observing the game into four themes. Some participants highlighted more than one theme in their responses. Equal proportions (38 percent) said the game had provided insights into some of the challenges or barriers that exist in global health work, or they had learned about PE, per se. Another third emphasized that they had learned about teamwork, and 17% reported that they had learned about the interdisciplinary nature of global health practice (Table 1). Other important lessons such as general knowledge about the spread and prevention of diseases in low-resource countries, the need for strengthened systems for tackling health-related issues, and the value of proper educational programs on vaccines were mentioned by 20 percent. When stratified by age category, the largest proportions (24 percent) of 6–13 year olds had learned about teamwork, 62 percent of 14–19 and 37 percent of >30 year olds about PE, and 46 percent of 20–30 year olds about challenges and barriers in global health work. However, the differences in participants’ responses by age group were not statistically significant.

Participants also described how either the PE game or other exhibits within the tent had changed their level of interest in global health. Seventy-five percent ($n=110$) of game participants and 73 percent ($n=72$) of tent participant

FIG. 2. Percentage of participants reporting increased global health (GH) interest by age category. (Color graphics available online at www.liebertonline.com/g4h)

said they want to be involved in global health work in the future in various capacities, including as students, teachers, healthcare service providers, researchers, employees in nongovernmental organizations, and volunteers. Comments from the game participants crystalized some of the reactions to the PE game. For example, one participant, a 15 year-old student, said, "I didn't realize how close polio is to eradication." Another participant who is a videogame producer older than 30 years said, "It removes some mystery around what a person can do." Other comments included "I am very interested now! I didn't realize polio was still an issue," from an 18-year-old student, and "I've always been interested in the topic, but did not get a chance to study it in school. The activity and the entire exhibit make it more realistic and closer to me than previously," from a business analyst between 20 and 30 years of age.

Discussion

Our study explored whether a novel, hands-on simulation game would stimulate interest in global health among the lay public, particularly among children and adolescents. The overall observed trend suggests that the PE game played a role in increasing global health interest among participants, particularly among those new to global health. Participants who reported increased global health interest also indicated interest in future global health involvement, particularly as students, teachers, or researchers. Emerging interest in future global health involvement associated with game participation particularly among the younger participants suggests that the PE game may be useful within an academic setting. The human-size, hands-on game format permitted wider audience participation that cut across age groups. The PE game design can be implemented at a low cost and offers flexibility of game rules that can be tailored to various target audience. Simulation games that involve situations analogous to real-world scenarios provide learners with active construction of knowledge and may be useful for capacity development among public health professionals by providing learning experiences that allow them to practice decision-making skills for specific responsibilities and roles.⁵ Additionally, people with limited or no global health experience can get insight into the activities that occur in this arena, which may also stimulate interest in exploring global health volunteer or career opportunities.

We observed an association between not having previous knowledge of global health or not being currently involved in global health, and increased interest in global health after playing the game. About 53 percent of the game participants were visiting Seattle, and this was also a predictor of increased global health interest. The observed difference in game impact on visitors and local residents may be explained by a differential motivation among these groups to visit the Activities Tent. For example, Seattle residents who may have more exposure to global health activities as a result of close proximity to or jobs with numerous local, global health organizations may have been among those currently involved in global health activities and, therefore, did not indicate increased interest in global health after participating in the study.

We hypothesized that an interactive game format like the PE game would be particularly effective in engaging older

children and adolescents, and we observed an overall trend of increased global health interest among younger participants (<20 years of age). However, this result was not statistically significant. This may be because of the small sample size of this age group, particularly among the tent participants. When asked, the majority of the younger game participants admitted that they were unaware of the existence of polio. A plausible explanation for this is the fact that polio has been eliminated in most countries of the world for several decades and is not headliner news in most developed countries. Nonetheless, as the world increasingly becomes globalized, the significance of global health, particularly in preventing international spread of diseases, cannot be overemphasized. The PE game informed participants about the challenges of combating diseases in low-resource settings and how the successes achieved ultimately translate to a collective global triumph.

Limitations to this study include a small sample size, a nonrandomized study design, our inability to control for biases arising from participants' unique individual experiences, and lack of analysis of user-user interactions. The type of exhibit visited may have significantly influenced tent participants' responses to the survey questions. Likewise, responses of game participants who visited other exhibits before playing the game may have been based on comparison with these exhibits. Furthermore, the family-friendly PE game board was colorful and tended to attract younger participants. Thus, while game participants had a wider age range, including children, adolescents, young adults, and adults, tent participants were largely composed of adults with a few children and adolescents. Another limitation to this study is that the outcome variable measured reported change in global health interest, which may not reflect actual change in interest. It is notable visiting the tent exhibits also increased interest in global health pointing to the potential success of alternative strategies. Future research should examine alternative game designs (e.g., electronic or hands-on format) and their impact across various sub-populations and settings (e.g., primary versus secondary school students in class compared with nonacademic settings).

In conclusion, our findings suggest that a hands-on, interactive game on global health challenges may increase interest in global health among the lay public. Such games have the potential to raise awareness about, and change public attitudes toward global health issues. They may be particularly useful in engaging youths in global health activities and global citizenship.

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J.W., N.A.H., J.N.W., and W.A.O. designed the “Polio Eradication” game, and J.W. produced it. J.N.W. conceived the study. T.A.O., J.N.W., and R.V.B. developed the survey and designed the study. T.A.O. and N.A.H. collected data. T.A.O., T.R., and R.V.B. cleaned and analyzed the data and, with J.N.W., interpreted it. T.A.O., R.V.B., T.R., and J.N.W. wrote the manuscript. J.W. and T.A.O. created the figures. T.A.O., R.V.B., T.R., J.W., N.A.H., W.A.O., and J.N.W. reviewed and approved the final manuscript. T.A.O. had full access to all the data in the study and had final responsibility for the decision to submit for publication.

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