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Working with Potential Users to Develop an HIV/STI Prevention Video Game for Rural Adolescents

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Abstract

In the USA, African American adolescents aged 13 to 19 years remain disproportionately affected by the negative consequences of sexually risky behaviors. A similar disproportionate impact is experienced by African American adolescents residing in the rural Deep South. Gaming interventions hold promise because they can be designed to be developmentally appropriate and accessible to dispersed populations. We conducted an intervention development qualitative study using focus groups with a total of 129 rural adolescents in three phases. In Phase I, sociocontextual influences on sexual health were explored with 84 participants in two waves of focus groups; to identify critical content for a video gaming intervention. Focus group audio recordings obtained from participants were transcribed verbatim. Transcripts of focus group discussions and observation notes were analyzed using content analysis procedures. The most commonly identified content areas included: making the intervention reflective participants' daily lives; making sexual health messages implicit not explicit; addressing the role of social media, and tailoring messages to individual players. In Phase 2, using an intervention mapping approach, findings from the first phase were used to develop context specific storylines and essential messages for the video gaming intervention. In phase 3, a different set of 45 participants found the developed game prototype acceptable and relevant. Findings from this study demonstrate the feasibility of partnering with potential users in a multi-phase process of developing a gaming intervention. Healthcare professionals can incorporate gaming principles into educational interventions to enhance engagement populations at risk and patients. More research is needed on the effectiveness of gaming interventions.

Keywords

HIV/STI prevention; Video game; Rural adolescents

Background

African American adolescents aged 13 to 19 years remain disproportionately affected by HIV in the U.S. While only 14% of U.S. adolescents are African American, they account for an estimated 61% of diagnoses of HIV infection in 13 to 19 year olds. To attain the goal of an AIDS free generation, ongoing efforts are needed to identify developmentally appropriate strategies that promote sexual health among African American youth. Tapping into the ubiquitous nature of gaming technologies to address adolescent decision making and sexual health needs prompted this multiphase research study. Video gaming interventions hold promise because they are easily accessible to geographically dispersed populations, maximize intervention fidelity, and circumvent traditional, organizational, and individual barriers to program implementation such as the costs of facilitator delivered interventions. Interventions that increase access to HIV prevention are particularly needed in the HIV epicenter of the Deep South region of the U.S.. Few sexual risk reduction interventions have been developed specifically with and for young AA adolescents living in the rural Deep South.

Video gaming interventions are gaining momentum as viable tools for addressing a number of health promoting behaviors [1-5]. Video games provide an enticing medium for attracting attention and promoting changes in adolescent health related behavior [4]. Gaming interventions are theorized to change behavior through three different mechanisms. These mechanisms include: 1) creating an immersive state in which players become absorbed in game play while absorbing personally relevant experiences from game characters; 2) establishing a state of high concentration in which the player experiences a balance between skills and challenge; and 3) meeting the players' needs for mastery, autonomy, connectedness, diversion, or challenge [2,6,7]. Recent studies with young rural adolescents provide evidence of the developmental appropriateness of electronic games as

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a preventive intervention for this population [8]. However, research regarding the use of electronic games in promoting the sexual health of young adolescents is quite limited.

The purpose of the study was to develop a prototype for an electronic sexual health adventure game for young African American rural adolescents. The goal of the gaming intervention was to help African American rural adolescents improve decision-making and learn behavioral strategies that assist them with the reduction of sexual risk behaviors. The aims of the multiphase study were to 1) explore sociocontextual factors associated with HIV risk behavior to identify critical content for a gaming intervention; 2) create an HIV prevention game prototype; and 3) assess the relevance and acceptability of the gaming prototype with members of the target population. The conceptual model used to guide this study was an adapted version [9] Integrative Model of Adolescent Health Risk Behavior. In this model, when adolescents find themselves with an opportunity to engage in risky behaviors, protective and escalatory factors for such behaviors influence decision-making processes that eventually result in choices to engage in or avoid the risky behaviors. Protective and escalatory factors can independently or interdependently arise from personal, interpersonal and cultural/environmental factors. The study represents a user centered iterative approach to gaming intervention development which involves identifying user needs and working with potential users to meet identified needs. The focus of this manuscript is on the development process of the sexual health gaming intervention.

Methods

The study was conducted with a total sample of 129 rural adolescents in three phases after the investigators' Institutional Review Board approval was obtained. Participants met the following inclusion criteria: 1) AA adolescent, 2) age 12 to 16, 3) residence in a state-designated rural county, and 4) HIV negative or unknown status. Adolescents who could not read and write English were excluded from participation. Qualitative descriptive inquiry, an approach that allows for descriptions of a phenomenon of interest with low levels of interpretation to give voice to participants [10,11]; was used in this study. This approach was particularly relevant as the data gathered was used to inform the development of an intervention that reflected the lives of potential users. Once potential participants were identified, screened, and completed written informed consent and assent, they were assigned to a focus group. Sociodemographic forms were used to elicit information about age, educational level, socioeconomic status, and family structure. Focus group sessions were approximately 90 minutes long and implemented using a focus group interview guide. Verbatim transcripts of the audiotapes and focus group observation notes provided the primary data for analysis. Data saturation occurred before the fourth focus group session in both Phase I and Phase III. However, we continued with scheduled focus groups to ensure that the voices of both males and females in all age groups in the target population were represented in the gaming intervention.

In Phase I, a total of 84 adolescents participated in eight focus group sessions. Four of these focus groups focused on exploring the sociocontextual influences on sexual health and identify critical content for an engaging gaming intervention to address identified factors. Four follow-up focus group sessions were conducted to validate these findings and explore additional gaming components that could increase adolescents' interest in the game. Each focus group consisted of 10 or 11 participants, segmented by age group (12-14, 14-16) and gender (male, female). Focus groups were facilitated by a research assistant who had formal training and experience in leading focus groups with rural adolescent. The primary author who has led multiple funded qualitative studies was present in all focus group sessions and took observation notes. Qualitative content analysis using QSR N-Vivo® was used to code data initially in relation to research aims and theoretical framework. Verbatim transcripts of focus group discussions and observation notes were independently coded by two members of the research

team. After the initial coding was completed, meetings were held to validate the coding schema and reconcile differences. When coding was completed, participants' quotes reflecting the final themes were compared across the age and gender for similarities and differences.

In Phase II, the interdisciplinary research team used findings from Phases I to develop a storyboard for the electronic game. An intervention mapping approach developed by Bartholomew, and colleagues [12], was used to develop game components. Specific change objectives for reducing HIV risks among rural adolescents and strategies for meeting these objectives were developed. These objectives were based on context specific findings related to the major concepts of the conceptual framework (protective/escalatory factors, opportunities to have sex, decision making processes, and choices) and existing literature. Contextually relevant intervention components incorporating personal, interpersonal and environmental levels of influences were then developed for each strategy with reality-based scenarios/missions that allow participants to experience opportunities for risky behaviors, make decisions and observe the virtual consequences of their choices. The content developed for the game storyboard was subsequently programmed the prototype.

The design of the prototype was guided by The Elaboration Likelihood Model, [13-15] that proposes that gaining and maintaining a person's attention is the first step in transforming information to promoting behavior change. Details of the required features of the game were identified in collaboration with content experts, engineers, and game designer/programmer who were members of the prototype development team. The iterative process of the prototype development lasted for close to a year and included weekly meetings with the designer/programmer.

In designing the gaming intervention, evidence based gaming procedures that facilitate behavior change (e.g., credible, attractive and likeable characters; identifying and refuting threats to goal attainment, goal setting, modeling and skill development) were incorporated. Findings from Phase I on aspects of games that make the games fun and desirable for repeated play for African American rural adolescents were incorporated into the design. Consistent with the self-determination theory, the gaming intervention was designed to allow players of the game to have control (autonomy) over the creation of an avatar (relatedness) for which they could customize the looks and name of the avatar (relatedness), and navigate thorough challenges (competence) that are directed by real time choices within the game. For example players have full control over the creation of their avatar including specific such as skin color, eye color, hair color and length and type of clothing worn by the avatar. It is hypothesized that the greater the degree to which relatedness, competence, and autonomy needs are met, the greater the level of self-directed motivation to play the game and engage in risk reduction behaviors [2].

When the initial storyboard (design document) was completed, we then identified the matching software application and coding language for creating the game in our University's Enabling Technology Laboratory. The UNITY game engine platform was chosen because it accommodated the anticipated requirement of transforming the storyboard into the prototype. We also selected a programming language (Cplusplus) that was compatible to the UNITY game engine. The actual composing of instructions that enabled the performance of particular functions (coding) of the game were completed by the programmer under the direct supervision of the first author. As components of the game were created, each component was evaluated separately by the programmer and the first author and the two met to evaluate the components and determine areas of improvement and overall fit with the prototype. The whole research team then evaluated the game and made any needed refinements before the prototype was evaluated by study participants in Phase III.

In Phase III of the study, the acceptability and relevance of the game prototype was assessed with 45 members of the target population. The game storyboard (Figure 1) and initial components

of the game were presented in four focus group sessions segmented by age and gender as in Phases I. The focus group session consisted of discussions and feedback on: 1) the relevance and acceptability of the game, and 2) additional gaming design components needed to make the game most interesting to young adolescents. Audiotapes of focus group discussion were transcribed verbatim and combined with observation notes for analysis. The qualitative software QSR N-Vivo® was used in coding and sorting data in relation to relevance, acceptability, and areas for improvement.

Results

A total of 129 rural adolescents participated in the study. Close to half (48.8%) of the participants were girls and the mean age of the participants was 14.6 (SD=1.5) years. About half of the participants (48.8%) lived with both parents and about 36% lived in mother-led households. The majority of participants (52%) reported mothers as the primary wage earner in the household, 16% reported fathers as the primary wage earner, and 20.2% reported both parents as primary wage earners. Half of the sample (50%) reported their parents/guardians as their primary source of HIV prevention information and sex education. HIV prevention knowledge was moderate among participants with a mean score of 70% (Minimum=20%; Maximum=100%; SD=1.7).

Findings from focus groups conducted in Phases I revealed the following major themes: 1) sex in adolescence is normative; 2) the primary concern for sexually active adolescents is pregnancy prevention not the prevention of sexually transmitted infections; 3) misconceptions and stigma are associated with sexually transmitted diseases; 4) adolescents prefer implicit rather than explicit sexual health messages; 5) the gaming intervention should reflect their daily struggles at home, school, and community; and 6) the game should be controlled by the player. Findings from follow-up focus

group sessions indicated that our initial findings resonated with participants.

The electronic gaming intervention that resulted from Phase II was designed to assist African American rural adolescents develop judgment (planning for the future, problem solving, and long-term perspective), decision-making skills, behavioral strategies that can ultimately lead to a reduction in sexual risk behaviors. In line with Keeler and Kaiser's conceptual model, the intervention focuses on modifiable contextual (intrapersonal, interpersonal and environmental/cultural) factors, risk stimulus and judgment. Virtual settings for missions (scenarios with specific tasks) within the game included the homes, school bus, school, afterschool activity centers and sports venues reflecting settings frequented by the target population of adolescents residing in rural community. In Phase III, participants viewed the game mechanics and components represented in the storyboard as acceptable and relevant, however they recommended that the graphics be enhanced to increase appeal. Table 1 represents a summary of each phase of the study including number of participants, data collected and findings.

Discussion and Implications

In this multi-phase study we partnered with the target population to generate data that informed the design of a gaming intervention. Our interdisciplinary team developed a game storyboard and programmed initial game components in a prototype. These game plans (storyboard) and initially programmed components were then evaluated by members of the target population. Working with community members early in the process of intervention development has been advocated as essential in ensuring relevance [16,17]. Using this approach in intervention development also assured the game addressed critical contextual factors associated with sexual risky behaviors and enhanced the potential for

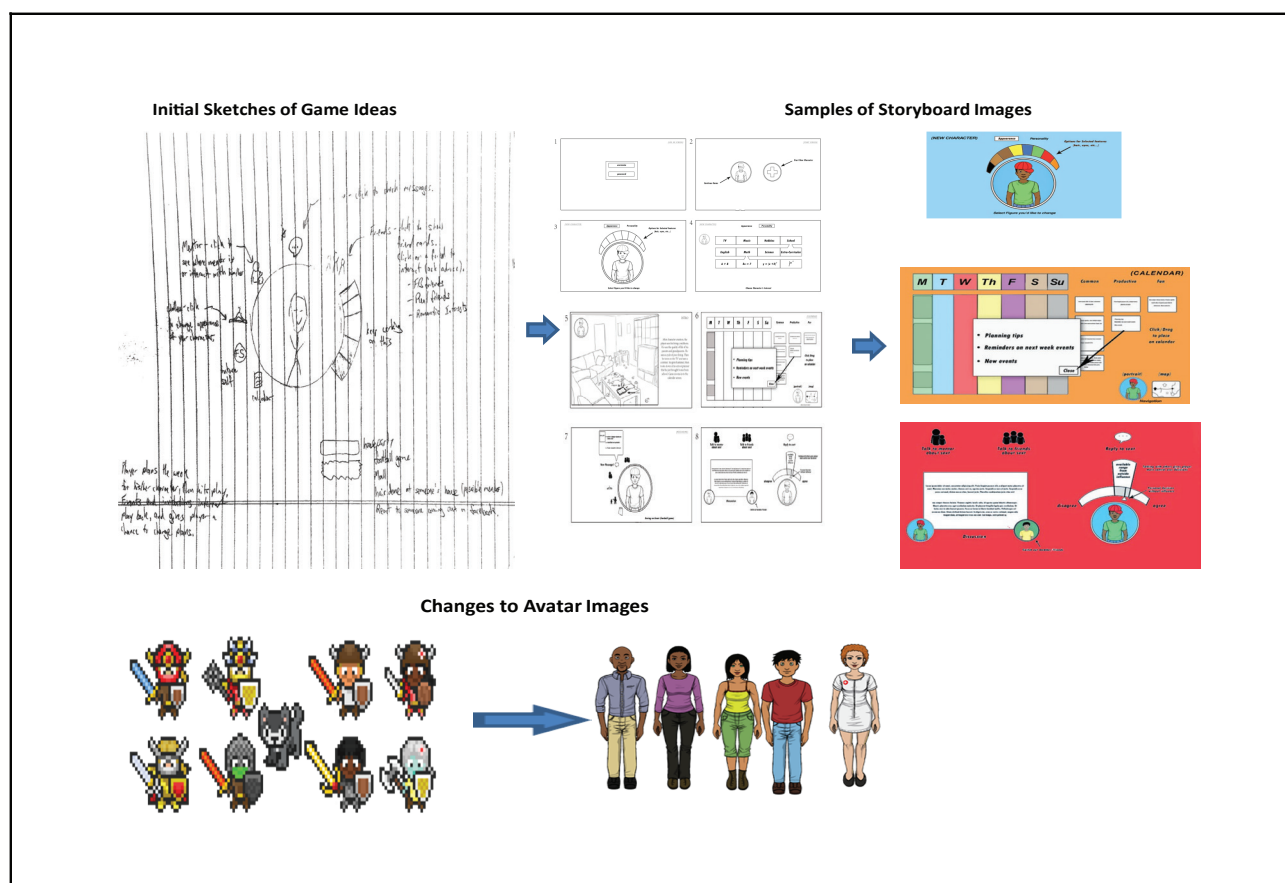


Figure 1: A sample of images depicting changes to the storyboard content

Phase	Sample	Procedures	Findings
Phase 1	84	Eight focus groups sessions - 4 initial and 4 follow up	1. Participants viewed sex as normative
		Audio recordings transcribed verbatim	2. Participants said the primary concern for sexually active adolescents is pregnancy prevention not the prevention of sexually transmitted diseases
		Transcripts and observation notes analyzed	3. Participants expressed misconceptions and stigmas associated with sexually transmitted diseases
			4. Participants preferred implicit rather than explicit sexual health messages
			5. Participants wanted the gaming intervention to reflect their daily struggles at home, school, and community
			6. Participants wanted the game to be controlled by the player
Phase 2	None	Interprofessional research team -	1. Game storyboard/design document
		1. Developed design document	2. Initial programmed components
		2. Selected game engine and programming language	
		3. Coded initial game components	
Phase 3	45	Four focus group sessions	1. Participants viewed the game mechanics and components
		1.The acceptability and relevance of the game	2. Participants wanted enhancements to graphics to increase game appeal
		2. Potential areas for improvement	
		Audio recordings transcribed verbatim	
		Transcripts and observation notes analyzed	

Table 1: A summary of features and findings of each study phase

sustainability [18,19]. In all, the content of the game was packaged in a manner that addressed potential users’ preferences and also met their sexual health information needs.

The content of the game was tied to themes identified in Phase I of the study. To address identified information needs, the game prototype incorporated dialogue with family members, peers, and mentors as protective or escalatory influences in game missions that focused on correcting misconception, setting life goals, developing strategies to achieve life goals, and enhancing specific sexual behavior skills to reduce sexually risky behaviors and prevent unwanted pregnancies. Sexual health messages were implied rather than explicit, as preferred by participants and based on procedural rhetoric theory in game design which proposes that games influence players through arguments embedded in the structure of game rules [20]. In this study, participants’ preference for implied rather than explicit messages appears to contradict public health literature [21] in which the effectiveness of explicit messages is often lauded. However, some studies do not support the effectiveness of explicit messages. For example, studied the effects of explicit versus subtle food labels on health food choices [22]. Their findings indicate that participants were more likely to choose the healthy food when these foods were labeled with the subtle health message than when they were labeled with the explicit health message. Moreover, researchers with expertise in developing health games have maintained that explicit display of content in gaming interventions is considered problematic and more likely to be boring and alienating to potential players [23].

Player control over character creation, choice of missions and activities within missions was an essential part of the game. Tailoring allowed for missions to be based on choices within the

game. The gaming intervention begins with a login screen, followed by a detailed character creation process. The storyline begins with the avatar described as a new student who is the same age as the player; has moved to a rural community named *Rahp City* and is about to start a new academic year. The player’s task is to guide the new student/avatar to successfully navigate daily challenges at home, school and community in *Rahp City* and stay healthy. The game is time-based and allows the player to make choices in two hour increments with the clock running. The player makes choices that guide the avatar to gain points (displayed on the screen within the game) related to academic, physical health, social, psychological qualities while navigating different challenges in a storyline that advances based on the player’s choices. For example, at school the avatar can socialize during school hours or work hard on academic subjects. In after-school activities the avatar can be guided to socialize with other students who also have varying degrees of the four qualities, sexual risk behaviors, and storylines associated with them. As the avatar spends more time with each character, the avatar builds the same qualities, becomes friends with the character, and opens up storylines associated with him or her (e.g. invitation to an unsupervised party, invitation to a basketball game, opportunities to provide risky or safe advice on sexting, casual sex and underage drinking). The player also has to balance socializing after school with completing the homework which is also displayed on the screen. Weekends have options based on friendship levels with other characters in the game or spending time with family members. A final scene reveals consequences of game play choices and behaviors 20 years into the future. The player is then challenged to replay the game making different choices to examine the consequences of different choices.

Findings from this study have implications for practice and future research. More research is needed to determine the effectiveness of games and the specific components of gaming interventions that improve desired health outcomes. Given that games have the distinct advantage of offering experiential and exploratory learning [5]; nurse educators and public health professionals could tap into the interest in gaming and incorporate gaming principles into teaching materials to increase learners' engagement in learning processes. Public health professionals working with adolescents need to consider technology enhanced approaches to sexual health education as alternative or complementary to traditional person delivered interventions or educational materials. Once developed, gaming interventions are easily scalable, preserve the fidelity of the intervention and can circumvent traditional barriers to access in areas where transportation issues are common. Findings from this study are limited to the perceptions of rural adolescents participating in the study and may not apply to all adolescents. Future studies could shed more light on how to design games that address the sexual health needs of young rural adolescents by including more perspectives.

Conclusion

In designing sexual health video games, balancing entertainment aspects and essential messages is critical for optimizing the likelihood of achieving desired outcomes. In our multiphase study, we used a conceptual model that was amenable to exploring adolescents' perceptions of individual, interpersonal and environmental levels of protective and escalatory influences on sexual risk behaviors. Formative data regarding such perceived influences and evidence-based behavioral and gaming design strategies that enhance the likelihood of changing real life behaviors were incorporated into the design of the intervention. The use of formative data from Phase I allowed for the development of a contextually relevant and individually tailored gaming intervention in Phase II. Working with adolescent from the beginning of the design of the intervention though the evaluation of the prototype in Phase III resulted in a game that reflected the daily lives of potential users.

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