

Publications

12-2017

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Angela Chia-Chen Chen
Arizona State University

Michael Todd
Arizona State University

Ashish Amresh
Embry-Riddle Aeronautical University, amresha@erau.edu

Usha Menon
University of Arizona

Laura Szalacha
University of Arizona

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Chen, A. C., Todd, M., Amresh, A., Menon, U., & Szalacha, L. (2017). A Pilot Study of Computerized, Tailored Intervention to Promote HPV Vaccination in Mexican-Heritage Adolescents. *GSTF Journal of Nursing and Health Care*, 5(1). Retrieved from <https://commons.erau.edu/publication/857>

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A Pilot Study of Computerized, Tailored Intervention to Promote HPV Vaccination in Mexican-heritage Adolescents

Angela Chia-Chen Chen,¹ Michael Todd,² Ashish Amresh,³ Usha Menon,⁴ Laura Szalacha⁵

Abstract — This study examined feasibility, acceptability, and preliminary effects of a computer-tailored intervention aimed at promoting HPV vaccination in Mexican-heritage adolescents aged 11-17. Among 46 Mexican-heritage parents who had one or more eligible children who had not received HPV vaccines, 91% ($n = 42$) completed the intervention and assessments via touchscreen tablet computers in a vaccine clinic. Mean knowledge scores increased significantly from pre- to post-intervention. After the intervention, 95% ($n = 40$) of parents intended to get their children vaccinated; 50% ($n = 21$) of them consented to vaccination immediately, resulting in 24 adolescents being vaccinated at that time. All parents reported learning via tablets to be easy; two nurses reported that intervention delivery in the clinic was feasible. Mean acceptability rating was high ($M = 3.56$, range 1 - 4). This tailored intervention proved to be feasible and acceptable, and it showed preliminary short-term effects on intent and getting the first HPV vaccine dose.

Keywords - adolescent health; computerized; tailored intervention; health promotion; health behavior; HPV; Latino; vaccine

I. INTRODUCTION

Human papilloma virus (HPV) infection is the most common sexually transmitted infection in the United States, as almost all sexually active individuals contract it at some point in their lives [1]. Costs related to HPV prevention and treatment are \$8 billion U.S. annually [2]. For females, HPV is strongly associated with cervical cancer, with over 70% of cervical cancer being caused by infection with HPV types 16 and 18 [3]. For males, HPV causes genital warts and head/neck, penile, and anal cancers. Male HPV infection also increases risk of HPV infection in their female sexual partners [1]. The high morbidity, mortality, and economic burden attributed to cancer-causing HPV call for researchers to address this public health concern through vigorous prevention efforts, including HPV vaccination. HPV vaccines have been shown to be efficacious in preventing related cancers and diseases, and are recommended for routine vaccination of boys and girls at age 11 or 12 years [1, 4].

In the United States, Latinas have the highest age-adjusted incidence rate for HPV-associated cervical cancer, as compared with counterparts in other racial/ethnic groups [5]. Because parental consent is required for children under age 18 to receive HPV vaccination [6], parents' decision-making about vaccinating their adolescent children is the key for promoting HPV vaccination and thus the focus of our intervention. Latino parents have been found to be significantly less likely than

white parents to be aware of HPV vaccines [7]. Parental concerns relating to HPV vaccines' effectiveness and safety, confusion about the causative link between HPV and cervical cancer, lack of knowledge about the vaccines, and concerns that vaccination may encourage early sexual behavior have been identified by Latino parents as reasons not to vaccinate against HPV [8, 9]. Other barriers to receiving HPV vaccines include lack of health insurance, poverty, language and acculturation barriers, and limited access to healthcare [9, 10, 11].

Cultural beliefs have been found to be associated with cancer screening behaviors in Latinos [12]; however, to date, few studies have examined relationships between cultural beliefs and Latino parents' decisions to have their children vaccinated against HPV. While empirical understanding of Latino parents' decision-making about HPV vaccination for their adolescent children is growing, few interventions have been designed to promote HPV vaccination in both Latino adolescent boys and girls. To address these gaps, the intervention described here was designed to incorporate cultural beliefs (e.g., fatalism) reported in research regarding cancer screening behaviors [13, 14] to promote HPV vaccinations in both boys and girls.

Computer-tailored health education addressing individual knowledge, attitudes/beliefs, and healthy behaviors has shown promising results in promoting preventive behaviors, such as cancer screening [15, 16]. Kreuter and colleagues [17] defined tailored interventions as "any combination of information or change strategies intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and derived from an individual assessment" (p. 277). Using tailored messages in computer-based health education can provide personally adapted feedback about an individual's current health behaviors, factors associated with the behaviors, and suggestions to motivate the individual for changing or maintaining behavior [15]. Individuals who receive tailored information are more likely to remember the customized messages, which can lead to desired behavioral change [18]. Tailored, interactive, computer-based health education can be delivered in clinic settings when having discussions about health may be most relevant. As healthcare providers often find it challenging to provide HPV education in clinical settings due to the competing demands, our computer-tailored intervention operated by parents while waiting for the health services offers an innovative and feasible approach.

The purpose of this study was to examine the feasibility, acceptability, and preliminary effects of a bilingual, computer-tailored intervention for Latino parents to increase HPV vaccination in their adolescent children aged 11-17.

II. METHODS

A. Design and sample

We used a one-group, pre- and post-test, quasi-experimental design. Given the demographic profile of Latinos in Arizona, we targeted Mexican-heritage parents/caregivers in the study [19]. We also interviewed two healthcare providers to elicit opinions about integrating the intervention into their daily clinic routine.

A parent was recruited if s/he (a) self-identified as Latino of Mexican descent, (b) was 18 years old or older; and (c) had one or more children aged 11-17 years old who had not been vaccinated for HPV. English fluency was not required, given the bilingual (English/Spanish) features of the intervention and multicultural and multilingual resources of the research team. Only one parent from each family could participate in this study. If eligible parents had more than one child aged 11-17 years old who had not received the HPV vaccination, we asked parents to answer questions based on the oldest child. A healthcare provider was recruited if s/he was (a) a licensed health professional who provided direct care to individuals who visit the vaccine clinics and (b) was 21 years old or older.

B. Procedures

We posted flyers in high-traffic areas in one vaccine clinic serving a predominantly low-income, Latino population, and advertised in local Hispanic organizations. A bilingual (English/Spanish) research assistant (RA) was at a table advertising the study and screened potential participants. Individuals meeting inclusion criteria were told about the study purpose and procedures, and completed informed consent.

The RA demonstrated how to access the intervention and assessments via a touchscreen tablet with a wireless data connection for both the pre- and post-intervention (T1 and T2, respectively) assessments, which were completed in the clinic. Participants received \$15 for completing each assessment. The RA answered participants' questions and noted all additional assistance given to them as part of the evaluation. Each interview took about 30 minutes and was audiotaped upon the participant's permission. Each participating provider received a small gift to acknowledge their time and effort.

C. Ethical considerations

This study was approved by the University Institutional Review Board and Maricopa County Department of Public Health (MCDPH). We received informed consents from participants before conducting the study. Data was collected via an anonymous survey with a pre-assigned code, and was secured in a HIPAA-compliant and encrypted server with multilevel password protection, enterprise-level firewalls, and antivirus barriers.

D. Theoretical framework and intervention

Our study was guided by an integration of the PRECEDE-PROCEED Model (PPM) [20], the health belief model [21] and the theory of planned behavior [22], which are known to explain adoption of HPV vaccination behavior [23], into a single conceptual framework (Fig.1).

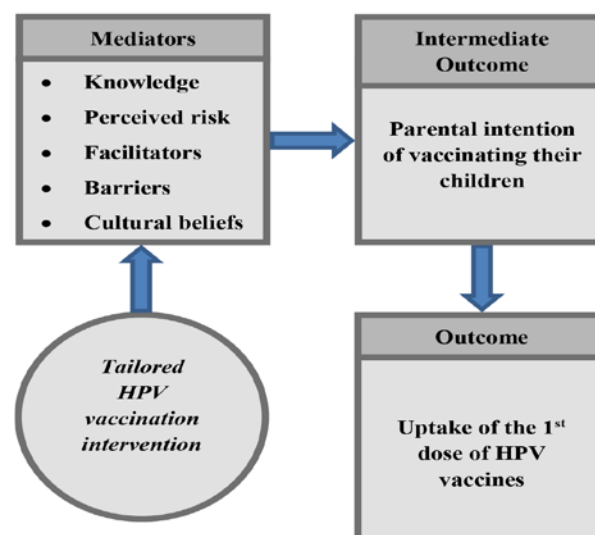


Figure 1. Theoretical Framework

We included tailored messages for each of the theoretical constructs in our framework. Messages addressing knowledge included messages about HPV risk in the adolescent population, HPV's link with cervical cancer and other diseases, how to prevent HPV, HPV vaccine types, dose and safety issues, and local resources for HPV testing and treatment. Messages addressed Latino parents' perceived risk regarding their child's acquisition of HPV infection based on child's age, sex, race/ethnicity, sexual behavior and orientation, family history of cancer, signs and symptoms, general health or other reasons. We developed messages regarding facilitators for HPV vaccination, such as healthcare provider's suggestions, encouragement from religious leaders/pastors, and beliefs that HPV vaccination will save a child's life. Messages assessed barriers (e.g., lack of health insurance, worry about the safety of the vaccines), so educational messages could be tailored based on barriers identified by each participant. Three messages about cultural beliefs relevant to HPV vaccination (e.g., faith in God can protect my child from the disease) were also included.

After participants logged into their own accounts and chose a preferred language (English or Spanish), they were presented with a nurse avatar. We used a turn-based system in which the nurse avatar spoke and the participant was presented with response options. After participant responses, the avatar presented her answers via text and speech. For instance, for a mother with a 14-year-old boy who perceived low risk because "My boy is not sexually active so he does not need the HPV vaccines," the avatar would provide a feedback message to address this misconception: "Many parents do not feel their boys are at risk for HPV infection because they are not yet sexually active. For the HPV vaccines to work best, it is very important for preteens to get all recommended shots before any sexual activity begins." Participants who did not endorse a particular risk factor would not receive a feedback message and would be led to next "perceived risk" option. Figure 2 presents example screens of the intervention.

We would also like to thank Sigma Theta Tau International for funding this research.

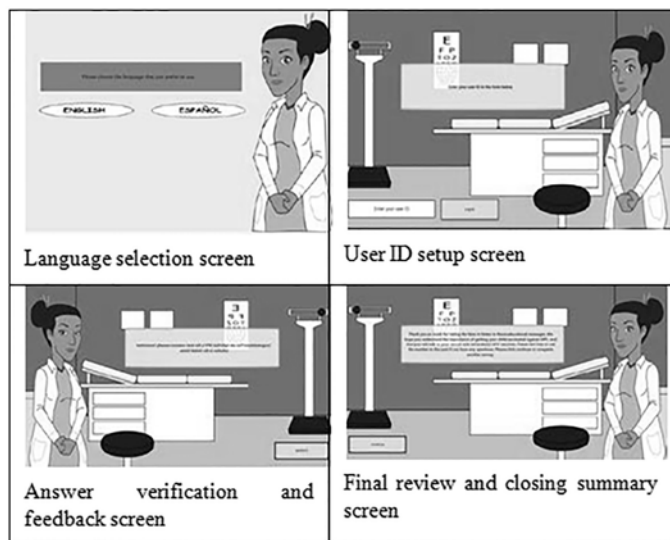


Figure 2. Example Screens of the Intervention

A resource sheet with current local and state-level information about vaccine clinics and health insurance coverage would pop up on the computer screen when a participant indicated a need (e.g., uncertainty about eligibility for free or discount HPV vaccines). A detailed description of the intervention software and the conversation tree for participant interaction has been presented elsewhere [24].

E. Measures

We adapted questions from existing valid and reliable measures. All measures were tested in a group of 6 Mexican-heritage parents and had high face and content validity.

Feasibility was assessed by parent-reported ease of use, response rate (percentage of eligible individuals agreeing to participate), and number of completed assessments. We also interviewed 2 nurses in the clinic for their opinions about integrating the intervention into the daily clinic routine.

Acceptability was measured using a 12-item questionnaire developed and tested in our prior research [15, 25] to assess participants' ratings of the appropriateness of the content and wording, graphic design and color, clarity of directions, length of the program, and likelihood of recommending the program to other parents who share the same cultural background. All items used a 4-point Likert-type scale with response options ranging from strongly disagree (1) to strongly agree (4).

HPV-related knowledge: We adapted 14 true/false questions addressing known risk factors for HPV infection, HPV-related diseases, and methods of detection from Allen and colleagues [7].

Perceived risk: Eight true/false items (e.g., my child is too young to get HPV vaccines, my child is not sexually active so [she/he] does not need the HPV vaccines) were used to assess parents' perceived risk of their children being infected with HPV.

Facilitators: Nine yes/no items corresponding to a list of factors reported in prior research [26] to promote HPV vaccination behaviors (e.g., positive attitudes toward HPV vaccination, support from spouse/partner or significant others,

resources that assist with scheduling appointments for the HPV vaccination, healthcare provider's recommendation) were used to assess parents' perceived facilitators.

Barriers: Twenty-one yes/no items corresponding to a list of perceived barriers reported in previous research [11, 27, 28], including access to HPV vaccines (cost, insurance coverage, whether they have regular primary care provider, transportation), potential side effects of the vaccines, number of required vaccine shots, worry that vaccination will lead to earlier sexual initiation or encourage more frequent sexual activity of their children, was used to assess parents' perceived barriers against vaccinating their children.

Cultural beliefs related to HPV vaccination: we adapted 3 items from the Cancer Screening Fatalism subscale of the Cultural Cancer Screening Scale (CCSS) [29] that had adequate reliability and predictive validity in Latino women for breast and cervical cancer screening. All items (e.g., God will project my child so HPV vaccines are not needed) used a 5-point Likert-type scale with response options ranging from strongly disagree (1) to strongly agree (5). The total score ranges from 3 to 15; lower scores indicate more favorable beliefs/attitudes toward HPV vaccination.

Intention: Parental intention to vaccinate their children against HPV was assessed with one yes/no item.

Appointment: One yes/no item assessed whether or not the parent had made an appointment for their child's HPV vaccination. Parents who had not made appointments were asked why and probed regarding any factors that may have prevented them from doing so.

Vaccination: One yes/no item was used to assess whether or not the target child received the first dose of HPV vaccines.

Sociodemographics: Participants answered 13 items regarding their own age, sex, birthplace, education, employment, religion, and number of children; age(s) and sex(es) of their child(ren); whether the child(ren) received reduced or free lunch in school, and whether the participant received HPV education from other sources. A well validated and reliable 12-item acculturation measure for Hispanics/Latino [30] was used to assess the participant's level of acculturation using a 5-point Likert-type scale: (1) only Spanish, (2) more Spanish than English, (3) both equally, (4) more English than Spanish, and (5) only English. Item scores were averaged to form a general acculturation score; higher scores reflect higher levels of acculturation.

F. Data analysis

Study data collected via computers were saved and managed using REDCap [31], a secure, web-based data collection application and then imported into SPSS 22.0 [32] for analysis. We first conducted univariate analyses (e.g., means, frequencies, standard deviations) to describe distributions of study variables. Paired-sample t-tests were used to examine pre-post changes in key variables (i.e., measures of HPV knowledge, perceived HPV risk, facilitators, perceived barriers, and cultural beliefs). Given the study's relatively small sample size, we chose to explore associations that were significant at $p < 0.10$.

Qualitative data generated from recorded interviews with the two nurses were transcribed with all identifiers removed. Prior to coding, the trained RA compared audiotapes with transcripts to ensure accuracy and assign an ID number to each nurse. One investigator and the RA independently conducted a qualitative analysis of the transcripts. Key themes were identified and refined through immersion in the data and team discussion. We discussed discrepancies in codes and themes until consensus was reached.

III. RESULTS

A. Sample characteristics

Out of 46 participants, 42 (91.3%; mean age 40 years, SD = 7.9) completed the intervention and both T1 and T2 assessments, 39 (92.8%) of whom were mothers. The median number of children in the household was 3 (range 1-6). The sample was generally of lower socioeconomic status and not strongly acculturated to Anglo-American culture. Twenty-three (54.7%) had not finished high school, 41 (98%) reported that their children were eligible for free or reduced priced school lunch, 31 (73.8%) chose the Spanish version of the intervention and assessments, and the mean acculturation score was 2.63 (SD = 0.94). These statistics suggest a lower sociodemographic status of our participants who also prefer to speak Spanish and less acculturated to the U. S. culture. Table 1 demonstrates detailed information about the sample.

TABLE 1. Sample Characteristics (N = 42)

Variables	n	%
Biological sex		
Father	3	7.1
Mother	39	92.9
Nation of birth		
Mexico	33	78.6
United States	8	19.0
Other countries	1	2.4
Education attainment		
High school/GED	23	54.8
Less than high school diploma	19	45.2
Employment status		
Full time (>= 40 hours per week)	19	45.2
Part-time (< 40 hours per week)	2	4.8
Not working	21	50.0
Religion		
Catholic	28	66.7
Protestant or Christian	8	19.0
Mormon	2	4.8
No religion	4	9.5
Child received free or reduced lunch		
Yes	41	97.6
No	1	2.4
Main Source of HPV Information before Intervention		
Heard about HPV from family	2	4.8
Heard about HPV from friends & neighbors	0	0.0
Heard about HPV from healthcare providers	8	19.0
Heard about HPV from child's school	1	2.4
Heard about HPV from TV, radio or newspaper	2	4.8
Heard about HPV from religious leader	0	0.0
Never heard about HPV before intervention	29	69.0

B. Feasibility and acceptability

We examined feasibility by response rate (percentage of eligible individuals agreeing to participate), number of participants who completed the intervention, and participant-reported ease of use. Of 54 eligible individuals, 46 (85 %) agreed to participate in this study. The primary reason given for not participating was lack of time (e.g., prescheduled commitments, had to go back to work or pick up other children). Forty-two out of 46 enrolled participants (91.3%) completed the tailored intervention and both T1 and T2 assessments. The four participants who did not complete T2 assessments cited lack of time as the primary reason. All participants reported that the computerized intervention was easy to use. Both nurses in the clinic responded positively about the intervention as "it was user friendly," "did not take extra time from staff to implement it," and "more cost-effective than individual or group education."

The intervention was quite acceptable with an average acceptability score of 3.56 (SD = 0.56, range 1-4).

C. Preliminary effect of the intervention

After the intervention, 40 (95%) of participants who completed the intervention intended to get their children vaccinated, and 2 (5%) wanted to wait until they could discuss vaccination with their healthcare providers. Twenty (50%) of 42 participants consented to their adolescents receiving their first HPV vaccine dose and a total of 24 adolescents (1 child from each of 18 families, and 2 children from each of 3 families) were vaccinated immediately in the clinic after the intervention.

HPV-related knowledge: The mean HPV-related knowledge scores differed significantly from pre-intervention (M = 9.3, SD = 2.21) to post-intervention (M = 13.9, SD = 0.37); $t(41) = -13.77, p < 0.001$.

Facilitators, barriers and perceived risks: The total facilitators scores increased significantly from pre- to post-intervention (M = 6.1 vs. M = 6.8, $t [41] = 2.78, p = 0.008$). No statistically significant pre- vs. post-intervention differences were found for barriers (M = 1.7 vs. M = 1.8, $t [41] = -.16, p = 0.877$) or perceived risk (M = 0.8 vs. M = 0.6, $t [41] = 0.63, p = 0.534$) scores.

Cultural beliefs: Even though most participants already disagreed or strongly disagreed with the three myths about HPV vaccination at pre-intervention, total cultural beliefs scores decreased significantly (M = 5.8 vs. M = 4.4, $t [42] = 4.71, p < 0.001$).

Qualitative data: Participants and nurses provided qualitative feedback to help improve sample recruitment, intervention content and implementation. Participants suggested recruiting Mexican-heritage parents via flyers in the clinics and at community organization sites, by word of mouth, in brochures disseminated at schools and community events, and providers' referrals. Most participants thought the content was linguistically and culturally relevant, easy to understand and feasible to do while they were waiting in the clinic. However, several participants wished that they could do the T2 (post-intervention) assessment at later time since they had other

pre-scheduled commitments and had not planned to participate in study activities. They suggested adding more “live” videos, such as Mexican-heritage parents sharing their experiences, to make the intervention more interesting and appealing. Because participants found this tailored intervention useful, they suggested development of a similar intervention for adolescents.

Nurses acknowledged the importance of HPV vaccination education but were struggled with allocating time for educating parents and their adolescent children in addition to their daily responsibilities. They expressed excitement about this low-cost, feasible intervention that increased both parental interest and HPV vaccination initiation.

IV. DISCUSSION

Our findings suggest that *WeCare*, a bilingual, computerized intervention tailored to Mexican-heritage parents of adolescent children was feasible and acceptable. Participants’ strong intentions to have their children vaccinated, the high vaccination rate immediately post-intervention, and the qualitative feedback also lend preliminary support for the effectiveness of the intervention.

Similar to prior research (see review by [26]), our participants identified “prevents HPV,” “saves my child’s life,” “knowing where to get the vaccine,” and “provider’s recommendation” as four primary reasons to facilitate HPV vaccination behavior. Four primary barriers, including “safety concern about vaccines,” “it encourages early sex,” “no provider’s recommendation,” and “language barrier” (providers do not speak Spanish) reported by our participants were also consistent with other research findings [8, 9, 10, 11, 33]. One reason for our promising findings is that our computerized intervention implemented via tablet in a walk-in vaccine clinic addressed important facilitators and barriers identified above.

Interestingly, our participants did not identify any cultural beliefs (e.g., faith in God can protect my child from the disease) as facilitators of, or barriers to, HPV vaccination. Furthermore, prior research [e.g., 36, 37] suggests mixed findings about parents’ decision-making for HPV vaccination for their boys vs. girls. Our findings indicate that Mexican-heritage parents’ intention to vaccinate their adolescent children did not differ by their biological sex. One possible explanation for these inconsistent findings is our participants’ high confidence in healthcare providers’ knowledge and willingness to follow their recommendations regarding HPV vaccination. Healthcare providers’ recommendation has been identified as one critical facilitator factor for HPV vaccination [26]. Although our intervention is not intended to be a substitute for guidance from healthcare providers, it did prompt Mexican-heritage parents to seek HPV vaccination for their adolescent boys and girls by increasing HPV-related knowledge, clarifying common myths portrayed from unreliable sources, and providing essential resources (e.g., phone number and address of local free vaccine clinics, information about health insurance etc.). It also facilitated

communication between providers and participating parents, one of the key facilitators for their HPV vaccination behavior.

The findings reported here should be interpreted with caution. This pilot study’s small sample size did not allow for thorough testing of mechanisms implied in our conceptual model. Also, we could not estimate the actual rates of initiating or completing HPV vaccination (some parents may have initiated or completed vaccinations at a later time). Lacking a comparison group, this pilot study did not afford the opportunity to examine how the observed intention to vaccinate and rate of immediate initiation of vaccination might have differed from clinic clients who were not given the intervention. Lastly, study findings may not generalize beyond low-income Mexican-heritage populations.

V. IMPLICATIONS AND CONCLUSION

Despite the Healthy People 2020 target of 80% HPV vaccination rate (all doses) for all youth by age 15, the national HPV vaccination rate (all doses) for youth 13-17 years had reached only 39.7% for females and 21.6% for males in year 2014 [34]. Universal HPV vaccination in boys and girls at 11-12 years is cost-effective for preventing HPV-related cancers and other diseases [35]. Occasions when parents and adolescents visit free walk-in vaccine clinics to get non-HPV mandated vaccines (e.g., booster dose of Tdap, meningococcal vaccine) are ideal opportunities to promote initiation and completion of non-mandatory HPV vaccines.

To our knowledge, this is the first bilingual, computer-tailored intervention designed for Mexican-heritage parents to increase HPV vaccination rates among their adolescent boys and girls. Our findings showed that incorporating *WeCare* into the everyday routine of a busy vaccine clinic is feasible and promising in promoting initiation of HPV vaccination in both boys and girls. The tailored intervention delivered via tablet is highly acceptable in Mexican-heritage parents with limited health literacy. To address limitations of this pilot study, future randomized controlled trials with sample sizes large enough to adequately examine intervention efficacy and effectiveness, and the pathways through which intervention may increase vaccination initiation and completion rates should be conducted.

ACKNOWLEDGMENT

We wish to acknowledge study participants and the director and nurses of the Maricopa County Department of Public Health vaccine clinics for their invaluable contributions. We would also like to thank Sigma Theta Tau International for funding this research.

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AUTHORS' PROFILE

1. Angela Chia-Chen Chen PhD, RN, PMHNP is an Associate Professor of Arizona State University College of Nursing & Health Innovation and a Visiting professor at UCSF Center for AIDS Prevention Studies, United States. This paper is based on one of her projects focusing on health promotion and disease prevention in ethnic minority population.

2. Michael Todd, PhD, is a Research Professor in the College of Nursing & Health Innovation at Arizona State University, Phoenix, AZ, United States. He is a senior research methodologist and statistician.

3. Ashish Amresh, PhD, is the Program Chair for the Simulation Science, Games and Animation degree at Embry-Riddle Aeronautical University, United States. He has built several gaming programs at Arizona State University and worked as Graphics Software Engineer at Ronin Entertainment known for Star Wars: Force Commander and Bruce Lee: Quest of the Dragon games. His research interest is Game Based Learning and he has been looking at improving K-12 STEM learning outcomes and Health Behavior Change via the design and development of serious games.

4. Usha Menon, PhD, RN, FAAN is a Professor & Associate Dean for Research and Global Advances at University of Arizona College of Nursing, Tucson, AZ, United States.

5. Laura Szalacha, EdD is a Clinical Professor & Director, Research Methods and Statistics at University of Arizona College of Nursing, Tucson, AZ, United States.