
Effects of episodic variations in web-based avian influenza education: influence of fear and humor on perception, comprehension, retention and behavior

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Abstract

In order to provide empirical evidence on the role of a web-based avian influenza (AI) education program for mass communication and also ultimately help young children learn and develop healthy behaviors against AI and all types of influenza, an education program with two episodic variations (i.e. fear and humor) has been developed and examined with 183 fifth-grade elementary students. A quasi-experimental design was employed to find potential differential effects on the context-specific risk perception, AI knowledge acquisition, retention and behavior. The study results reveal that the fear appealed AI web-based education program was much more effective than the humor-based program in improving risk perception and educating the students about healthy behaviors (i.e. against influenza infection). However, a significant behavior change or improvement of health practices was not apparent on the post-tests (i.e. 1 month after the treatment) in either episode of the program.

In order to effectively communicate (e.g. in terms of cost, timeliness and learning outcomes) and promote health literacy and healthy behaviors, there have been increasing interest and efforts to study the effectiveness of web-based education (WBE) programs in recent years [1, 2]. Some of the studies resulted in developing and enhancing education programs with various themes and tones covering topics including the most devastating diseases such as HIV/AIDS (see [3]). However, despite avian influenza (AI) being a highly infectious disease with the potential to cause a pandemic flu, there is no empirical study on AI WBE programs to date.

This study provides empirical evidence on the role of a web-based AI education program for mass communication, which is to ultimately help young children learn and develop healthy behaviors against AI and all types of influenza. More specifically, this study investigates which episodic variation (EV) of the WBE (i.e. fear or humor) most positively influences context-specific risk perception, AI knowledge acquisition (comprehension), retention and behavior.

Background

Avian influenza

'Avian influenza virus' refers to the influenza A virus (a genus of the Orthomyxoviridae family of viruses) found chiefly in birds. Since early February 2004, outbreaks of several variations of AI have been reported in multiple locations throughout the United States (H5N2 in Texas and H7N2 in Delaware, New Jersey and Maryland) as well as in

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several regions of Asia, Europe and Africa [4, 5]. While the influenza A virus is not directly transmitted among humans, infection in the form of bird-to-human contact can become very serious when it occurs. Since 2003, 209 humans out of 340 confirmed H5N1 (i.e. highly pathogenic subtype) cases have died [4, 6–10]. Although there is no evidence of direct transmission from human-to-human, all influenza viruses have the ability to mutate, and there is little or no immune protection against them in the current human population. Thus, a variant of the influenza A virus could one day become able to directly spread from one person to another [5].

Status of AI prevention education

Although there have been numerous cases of AI outbreaks in the global community, to date the general public mostly learn highly superficial knowledge about the deadly influenza through conventional news media, but hardly through official prevention education programs. Even official AI education programs such as the one developed in South Korea [11] are still limited mostly to only overseas travelers or farmers having close contact with poultry.

Recently, Mounier-Jack and Coker [12] reviewed national preparedness plans of eight countries [China (and Hong Kong), Vietnam, Thailand, Cambodia, Laos, Indonesia, Australia and New Zealand] and found that the localized programs were somewhat in line with World Health Organization's (WHO) guidelines, but no nation-wide robust education plan was clearly presented in any of the countries reviewed.

WHO and national Centers for Disease Control (CDCs) have determined that highly structured risk education and well-planned and executed communication methodologies are the most important strategies for preventing an influenza pandemic. Nonetheless, at best, there has been only sporadic success in establishing an international system of public health surveillance [13]. In addition, many countries have yet to acknowledge and prepare for the magnitude of possible AI pandemic spread. Gostin [14] asserts that medical countermeasures

will not impede pandemic spread and experimental H5N1 vaccines may not be effective against a novel human subtype, even if there were a way to supply them in a timely fashion. Furthermore, AI antiviral drug resistance (i.e. Tamiflu) has been recently reported in human H5N1 cases [15].

Overall, reactive mode communication (e.g. official radio or television broadcast during the peak outbreak period as a reaction to an actual outbreak) of information on AI has not resulted in a sustainable behavior change [16, 17] or significant risk perception [18]. Such a lack of systematic preparation and general public's indifference to AI is in line with Slovik's theory of risk perception, which suggests that familiar, naturally occurring risks elicit much less concern than unfamiliar, human-made risks [19]. For example, no evidence was found that even the actual outbreaks of AI in Europe in October 2005 influenced perceptions of risk [20].

In sum, the lack of perception of significant risks and behavior change in many countries calls for renewed efforts with highly practical recommendations [17] along with effective educational solutions that will improve risk perception and develop sustainable behavior change in a timely and massive scale. Also, such solutions must focus more on educating children because they account for more than half of all AI cases in regions such as Thailand [16]. At the same time, it is important to help young individuals build healthy behaviors from an early age.

Web-based health education

One of the key advantages of WBE is that a variety of educational information can be conveyed to people all over the world instantaneously with relatively little cost. Due to the recent proliferation of more affordable Internet access (e.g. broadband access at homes and mobile web through low-cost cell phones in developing countries), its low latency of transmission and inherent flexibility (e.g. anytime and anywhere), WBE possesses great potential to become a cost-effective and scalable mass education medium which can be as effective as (see [21] for a meta-analysis) or better than traditional approaches in disease prevention education or health communication [22–25].

Also in numerous empirical studies of health education, WBE has been generally found to be effective in providing a rich learning experience, which resulted in positive learning outcomes [1, 2].

Effects of fear and humor appeals in health education

WBE programs in health education are often designed with certain themes or tones, and since time immemorial, educators (as well as marketers, salespeople, politicians and writers) have considered and tested many ways to persuade, and evoke a lasting reaction from, their respective audiences. The tone and emotional appeal of an educational message, in addition to its pure content, has a significant impact on its internalization by learners. The specific use of appeals to fear versus humor has been examined by researchers across many disciplines, attempting to identify which is more effective for delivering intended messages.

Fear appeal

Fear appeals are traditionally based on highly persuasive, often drastic, messages that emphasize harmful physical or social consequences of failing to follow strategic recommendations. This incites fear, a negative valence with a high level of arousal [26]. Experts believe that fear-based approaches may cause arousal leading to a candid interest and subsequently to better information processing [27]. The fearful tactic often conjures a novel and vivid image in the learner's mind which may force them to process the information more carefully.

As shown in Table I, many studies in health and communication have been conducted to find possible effects of fear-based education programs. There seems to be an optimal level of fear to induce intended influences on both perceptual and behavioral variables. In general, two key issues seem apparent. First, fear appeal research must be combined with cognitive processes to address how individuals deal with the danger presented [36]. Second, fear appeals produce both self-protective actions such as attitude, risk perception or behavior

Table I. *Research on fear appeal with positive influences*

Researchers	Context	Variables	
		Independent	Dependent
		Level of fear	Changes
Beck and Davis [28]	Anti-smoking	High	Attitude
Rogers and Deckner [29]	Anti-smoking	High	Behavior
Schwarz <i>et al.</i> [30]	Anti-smoking	High	Behavior
Laventhal and Singer [31]	Dental hygiene	High	Behavior
Stephenson and Witte [32]	Skin cancer	High	Behavior
Krisher <i>et al.</i> [33]	Mumps	Moderate	Behavior
Janis and Feshbach [34]	Dental hygiene	Low	Behavior
Janis and Feshbach [35]	Dental hygiene	Low	Behavior

changes as intended effects and also defensive responses such as avoidance and denial as unintended effects [37–39].

Humor appeal

One of the most successful styles of advertising uses humorous cartoons [40], which have been proven to be successful in some contexts with regard to capturing attention of individuals spanning many demographics. However, there have been few attempts to capitalize on cartoon-like humorous illustrations to convey health education information. The claimed justification is that humor-based demonstrations may stimulate a sense of arousal, leading to increased positive feelings toward the message, followed by a decrease in one's defensive reactions toward his or her perception of the intended outcomes [27].

Relatively speaking, fewer studies have been conducted on the effectiveness of humor-based health education curricula and have tended to be fairly one-sided. This approach has been challenged by some researchers resulting in little or no effect

on information acquisition and motivation [41]. In another study, a significant number of adolescents preferred realistic images to humorous ones [42]. Also, Fisher [43] argued that the use of humor did not show significant retention of instructional material and resulted in lower scores relative to more serious applications. As shown in Table II, there have been reports of positive influences resulted from humor approach, but most of the outcomes are focused on perceptual measures and scarcely on behavioral variables.

Inconclusive findings on fear and humor effects

From the studies conducted on the use of an episodic theme variation, it seems fairly certain that either method has the potential to be effective in health education curricula. However, there has been no solid evidence to provide a map to effectively guide curriculum designers. In addition, a substantial number of research studies have compared the effectiveness of the two styles (fear and humor) primarily on the basis of audience’s interests and preferences, but they have fallen short in empirical evidence related to measuring effectiveness on learners’ risk perception, comprehension or behavior especially for AI.

Table II. *Research on humorous appeal with positive influences*

Researchers	Context	Variables	
		Independent	Dependent
Clabby [44]	Communication	Cartoon	Comprehension
Sheldon [45]	Nursing	Humor	Anxiety
Delp and Jones [46]	Wound care instruction	Cartoon	Comprehension
Leiner <i>et al.</i> [47]	Vaccination	Cartoon	Comprehension
Baggaley [48]	AIDS	Light humor	Perception
Lee and Ferguson [27]	Anti-smoking	Humor	Interest

Method

Subject

The sample population consisted of 183 fifth-grade (10- to 11-years old) students, 86 male and 97 female, drawn from six classes of one elementary school in South Korea. The student identity was masked with unique identifiers designed only for this study. The participating school was located in the outskirts of a large city and was one of the public schools. After institutional review board approval and informed consent, the student was assigned based on their class number (i.e. Class number 1, 3 and 5 to humor group—90 students and 2, 4 and 6 to fear group—93 students).

Although there had been a few AI outbreak cases in Korea before the study, the student did not have any formal or informal training on AI or any health-related education programs at the school.

Measures

All of the measures were created based on guidelines, recommendations and literatures available from WHO, CDC and affiliated international and national public health organizations.

Perception

The perception section consisted of six questions with 1–5 Likert-scale responses. The perception measure was employed because it has been shown to be an important determinant of behavior change, predicting future success or failure in behavior change programs [49].

The questions asked students how certain they were about the facts and risks of AI, or better known as bird flu, and how certain they were about the ways to protect themselves from getting infected by AI. Each of the six questions was paired with a variant with reverse coding to monitor internal consistency. The overall Cronbach’s alpha coefficients resulting from exploratory factor analysis, drawn from responses of both groups, for the perception questions were between 0.778 and 0.888.

Comprehension

The test of actual knowledge acquisition (comprehension) on AI contained 13 multiple-choice questions. Examples of the questions were ‘What are the common symptoms of avian influenza in humans?’ and ‘Which countries have been affected by Bird Flu outbreaks in poultry?’ The answers to the questions in the test were the actual topics covered in the web-based presentations.

Behavior

The self-reported behavior section listed 15 practices which were either relevant or irrelevant to preventing AI influenza. Examples of the practices, relevant to preventing AI influenza, were ‘I often wash my hands using soap or other cleaning products’ and ‘I eat poultry meat only if it is cooked well’. Examples of the practices which may be considered good behaviors, but may not be directly related to preventing influenza, were also included and they were such as ‘When I watch TV, I keep a distance of 8–10 feet between my eyes and TV’ and ‘When I am eating, I do not talk with a mouth full of food’. The non-AI-related behaviors were mixed in the measure to discourage students from responding without reading the survey and to increase the response reliability.

Students were instructed to report only the behaviors they practice at the time of taking the survey. In the scoring of the behaviors, only the AI preventive practices (seven items) were counted and other irrelevant behaviors (eight items) were ignored.

The survey also asked the student gender and prior learning experience with AI. Those who had prior AI learning experiences were able to indicate the types of communication channel experienced. The choices included books, TV, Internet, school classroom and family members. These items were collected to later analyze their possible influence on risk perception, comprehension and behavior.

Procedure

For this study, a quasi-experimental, non-equivalent control group, pre-test–post-test design [50] was used. Students in both fear and humor groups were

first given the survey to measure their perception, knowledge and actual practices relevant to AI. The next day, the students were presented with the AI web-based program in the two EVs according to their group assignment. Immediately following the presentation, students in both groups responded to the same survey again as the post-test. Since the post-test was taken the next day of the pre-test, self-reported behavior practices were not included in the post-test. One month after the post-test, a delayed test was given to the students in both groups with the same survey covering all three measures: perception, comprehension and behavior.

Curriculum

The web-based AI education program had two EVs in Korean. One incorporated fear appeal in the overall presentation and the other incorporated a humorous episode along with comic illustrations. Both programs were 7-min long and narrated with the identical phrases and words by the same narrator. Both programs had a mixture of images, cartoons, diagrams and illustrations. The fundamental idea was to draw either comic appeal or serious appeal from the content.

Fear version AI program

The fear version incorporated more serious and gruesome contents in the form of pictures and illustrations. For example, pictures of sick, dying or dead poultry and a human infected by AI virus were incorporated as shown in Fig. 1.

Humor version AI program

The humor version used humoristic illustrations with anthropomorphic agents in the presentation. For example, the humorous cartoon illustration showed the picture of a sick chicken and a human on a bed wearing an ice pack on their head as shown in Fig. 2.

Analyses and results

After the experiment, the scores from pre-test, post-test and delayed post-test (with 99% response rate)



Fig. 1. Sample images incorporated in the fear appeal version.

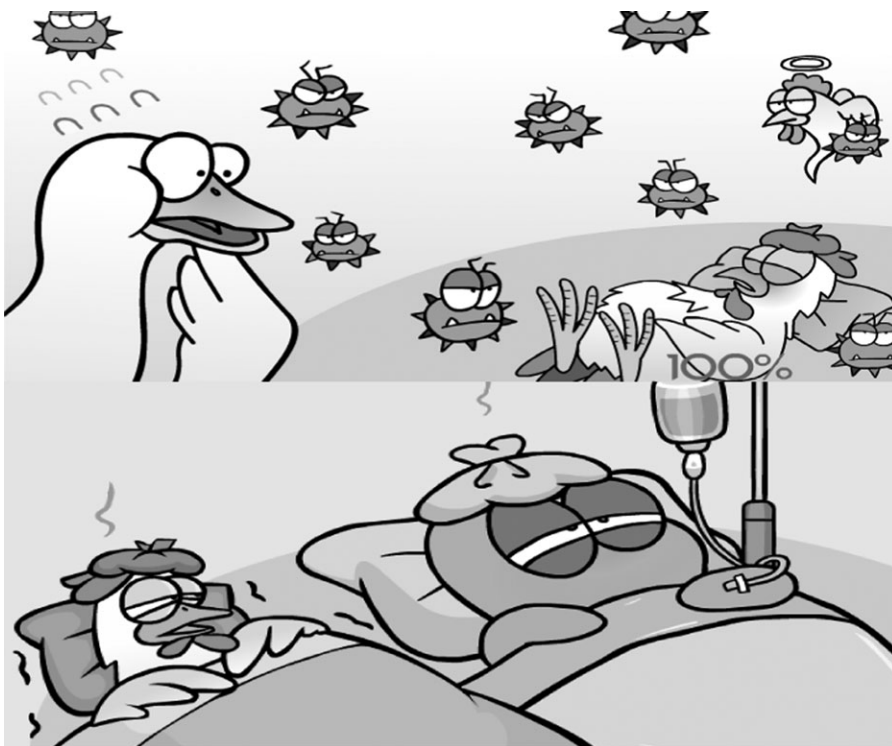


Fig. 2. Sample illustrations incorporated in the humor version.

were analyzed. Table III provides the descriptive statistics of the tests in perception, comprehension (AI knowledge acquisition) and behavior change.

Initial *t*-tests reveal that the pre-test means of the humor group were not statistically different from the means of all three measures of the fear group,

Table III. Mean scores from humor and fear group in perception, comprehension and behavior

	Pre	Post	Delayed
Fear ($n = 93$)			
Perception	19.01	21.94	20.89
Comprehension	8.53	10.44	10.28
Behavior	22.46		22.14
Humor ($n = 90$)			
Perception	18.64	20.39	20.48
Comprehension	8.05	9.74	9.54
Behavior	22.73		22.83
Overall ($n = 183$)			
Perception	18.83	21.17	20.69
Comprehension	8.3	10.1	9.92
Behavior	22.6		22.48

indicating a homogenous subject population in the two groups.

Analyzing statistical significance and effect sizes

Pre-test and post-test comparisons (paired t -tests)

Perception A paired t -test was conducted between the pre-tests and post-tests and the effect sizes were calculated. All effect sizes reported and interpreted in this study followed the formula and practical guidelines suggested by Cohen [51].

For the humor group, the test score difference of 1.75 between the pre-test (mean = 18.64/SD = 4.28) and the post-test (mean = 20.39/SD = 3.66) in the perception measure was statistically significant at $P < 0.001$ with an effect size of 0.44. For the fear group, the test score difference of 2.93 between the pre-test (mean = 19.01/SD = 3.37) and post-test (mean = 21.94/SD = 3.23) was also statistically significant at $P < 0.001$ with a much larger effect size of 0.89, indicating that the fear appealed AI WBE program had much larger positive influence on the improvement of the students' risk perception.

Comprehension In terms of the comprehension measuring the actual context knowledge about AI, the score difference of 1.69 between the pre-test (mean = 8.04/SD = 2.40) and post-test (mean =

9.74/SD = 2.20) in the humor group was statistically significant at $P < 0.001$ with the effect size of 0.74. For the fear group, the test score difference of 1.9 between the pre-test (mean = 8.54/SD = 2.32) and the post-test (mean = 10.44/SD = 2.16) was statistically significant at $P < 0.001$ with the larger effect size of 0.85, indicating that the fear appealed AI WBE program again had a larger effect on the students' comprehension.

Humor and fear group post-test comparisons (independent t -tests)

Perception The effectiveness of the fear appealed AI WBE was again confirmed in the independent t -test analyzing the post-test score difference between the humor group and fear group. The test score difference of 1.55 between the humor group (mean = 20.39/SD = 3.66) and fear group (mean = 21.94/SD = 3.23) in the risk perception measure was statistically significant at $P < 0.01$.

Comprehension The score difference of 0.7 between the humor group (mean = 9.74/SD = 2.20) and the fear group (mean = 10.44/SD = 2.16) in the comprehension test was also statistically different at $P < 0.05$, supporting that the fear appealed AI WBE was more effective than the humor-based WBE in educating the students about AI.

Humor and fear group delayed test comparisons (independent t -tests)

Perception The test score difference in the measure of perception was not statistically significant, indicating that both humor and fear appealed AI WBE were equally effective in maintaining the increased level of risk perception at least for 1 month after the post-test.

Comprehension For the comprehension measure, the test score difference of 0.74 between the humor group (mean = 9.54/SD = 2.31) and the fear group (mean = 10.28/SD = 2.06) was statistically significant at $P < 0.05$, but with a small effect size of 0.32, still supporting that the fear version is more effective than humor version even 1 month later.

Behavior For the measure of behavior practice, the miniscule test score difference between the

humor group and the fear group was not statistically significant. This insignificance was also confirmed in a paired *t*-test for both humor and fear groups.

Analysis of coefficients of linearity between variables

In order to better understand the larger effects found with the fear appealed WBE program on perception and comprehension in the post-test and examine possible variables influencing perception, comprehension and behavior in the delayed test, a stepwise multiple regression analysis was conducted with the EV (i.e. fear versus humor), gender, prior AI learning experience and prior AI learning channel as independent variables.

Post-test measure variable

Perception With the perception in the post-test as the dependent variable, two models were selected and the *F* statistics of analysis of variance for both models were significant (Model 1, $F = 9.214$, $P < 0.001$, and Model 2, $F = 7.903$, $P < 0.001$). The first model had the EV as the predictor and the second model had the combination of EV and prior AI learning experience. The multiple correlation coefficient for the first model was 0.220 and 0.284 for the second model. The stepwise algorithm chose EV as the most significant predictor (coefficient = 1.547, $P < 0.001$) among other independent variables. The second model with EV and prior AI learning experience had coefficients (EV = 1.394 and prior AI learning experience = 1.387), both at $P < 0.01$. In sum, the results indicate that EV was the most significant influencing factor for the perception level in the post-test.

This analysis confirms that the fear appeal was most influential in the positive change of risk perception level in the post-test. The second model predicts that beside EV, prior AI learning experience is most likely to influence perception in the post-test.

Comprehension With the comprehension in the post-test as the dependent variable, one model was selected and the *F* statistics of analysis of variance for the model was significant ($F = 4.656$,

$P < 0.05$). The multiple correlation coefficient for the model with EV as the predictor was 0.158. Overall, the stepwise algorithm chose the EV as the most significant predictor (coefficient = 0.696, $P < 0.05$) among other variables, indicating that the student's performance on comprehension in the post-test was also most significantly influenced by EV.

Behavior in the delayed test

With behavior in the delayed test as the dependent variable, no model was selected with enough significance. Prior AI learning experience was the most possible predictor (with correlation coefficient = 0.579) for behavior, but no variable (i.e. among all independent variables entered) was significantly correlated to be a predictor for the student's behavior in the delayed test.

Discussion

The larger effect sizes found with the fear appealed AI WBE program in the post-test suggest that the fear version was more effective than the humor version for the fifth-grade elementary students in improving risk perception and educating AI facts and preventive measures. These findings support the earlier studies (e.g. [26]), suggesting that messages emphasizing harmful physical or social variances of failing to follow health recommendations incite fear. Therefore, fear appeal presentation incorporating vivid, real images in the present study may have caused arousal leading to a candid interest and subsequently better information processing as suggested by Lee and Ferguson [27].

Although the superiority of fear appeal versus humor was clearly noted for risk perception and AI comprehension, a significant behavior change or improvement of health practices was not apparent on the post-tests (i.e. 1 month after the treatment) in either episode of the program. This finding is not in line with earlier studies (e.g. [49]).

In sum, the significant correlation found between risk perception and behavior (i.e. coefficient =

0.283, two tailed, $P < 0.001$) does support the notion of tight dependence of behavior change on risk perception, but still increased risk perception and better understanding of AI did not lead the elementary students to significantly change their behaviors or substantially improve health practices (i.e. according to the self-reported measure in the study).

Behavior change

There has been a substantial amount of studies on theories and models for behavior change in the health education context (e.g. [52–54]) and also on web-integrated health education programs that lead to behavior changes (See [55] for healthy eating habits, [56] for diabetes management, [23] for cardiac patients, [57] for increasing physical activities, etc.). Considering previous studies, a few key learning points around the absence of significant behavior change (i.e. one of the pitfalls in this study) will be discussed in following sections.

Repetitive reminders

Elder *et al.* [58] suggest that along with perceptual development measures, it is often advised to provide the learner with repeating cues or periodic reminders in order to develop and sustain intended behaviors. Types of reminders may include tailored individual messages [55] or periodic suggestions through online coaching [56] or even a computer-generated feedback mechanism [59].

Although, it was solely a reactive health education approach, the substantial decline of HIV/AIDS-infected patients among young men in Thailand in 1990s was made possible by aggressive media campaigns in a massive scale and constant reminders of safe sex by distributing more tangible reminders such as condoms [60]. Therefore, reminders could have helped the present study and enhanced the AI WBE program in leading the student to develop and sustain healthy behaviors.

Length of intervention

Another shortcoming of the present study is in the time span of the education program. It took only

a 7-min WBE program with gruesome images to drastically improve and sustain risk perception and comprehension on AI over 1 month, but developing healthy behaviors seem to take much longer and repetitive reminders and reinforcements. The average time span of previous behavior change programs (see [23], [55], [56] or [57]) was at least 4 months.

Due to various limitations encountered in the study (lack of support, funding, personnel, etc.), there were virtually no repetitive reinforcements or reminders over an adequate period, probably contributing to the lack of significant changes in behaviors.

Mode of observation

Welk *et al.* [61] reviewed the nature of children's behavioral patterns and how the unique nature of children may influence the assessment of physical activity. He reports that in order to accurately measure children's behaviors, an instrument must be sensitive enough to detect, code or record sporadic and intermittent activity. Nonetheless, children are less likely to make accurate self-report assessment than adults.

In the present study, the interview results of the fear group strongly indicated that the gruesome images made the student think that it is really important to wash their hands often, use soap if possible and eat only thoroughly cooked poultry products. Also, the students indicated that they would follow the guidelines and practice healthy behaviors presented in the AI program. In reality, however, it was revealed that the fifth-grade elementary students were not clearly distinguishing between 'what they would be doing' versus 'what they are actually doing' at home. This suggests that the self-reported behavior measure, in contrast to a direct observation for measuring children's behaviors, may be less accurate and reliable.

Variables in populations

The small-scale pilot tests of the AI WBE program (i.e. in English and Korean) in the earlier stage revealed that the substantial portion of the concepts

was understood by children as young as fourth- or even third-grade American and Korean students with little supplementary explanations. Although the final version of the program was chiefly designed for the general public, still there was lack of rigorous consideration of age, gender, ethnicity, socioeconomic status or geographical location in the overall program design process.

Previous studies suggest the need for systematically addressing audience characteristics in the development of health education programs. For example, Kerr *et al.* [62] suggest the need for multiple targeted messages to address the problem of 'one size does not fit all'. Also, Liang *et al.* [63] asserts that risk-taking behaviors and behavioral patterns differ by age and gender. In addition, for young-aged individuals, peer pressure and modeling by parents and teachers need to be employed as part of the behavior change program [64].

In addition, there seem to be performance variations based on ethnicity and perhaps socioeconomic status. For example, Baranowski *et al.* [65] reported that web-based component of an obesity reduction program for African-American girls and their parents was not effective and also Gore [66] reported that Hispanic children lagged behind the Whites on accessing the health-related web information (i.e. most likely due to digital divide).

Furthermore, the present study was conducted with young Korean children mostly living in the outskirts of a large city where the presence of live poultry markets or farms is rare. Perhaps, if the study had been conducted at a region where access to live poultry farms was prevalent, the study results on behavior change may have been different because the prevalent presence of live poultry would have served as constant reminders.

Lastly, how the EVs (i.e. fear or humor) would be received by other ethnic groups with different cultural background is unknown at this time.

Overall, the lack of rigorous consideration of age, gender, ethnicity or socioeconomic status, and geographical location in the program design process and also in the planning and execution of the research may have contributed to the absence or 'failed investigation' of behavior change.

Conclusion

Humans do not have natural resistance to H5N1. There are constant recurring cases of H5N1 in the global community. Unless it happens in our backyard, our risk perception on AI will continue to be very low. The lack of perception of significant risks and behavior change in many countries calls for renewed strategies that will significantly improve risk perception and induce behavior change in a timely and massive scale.

The present study shows the evidence of developing risk perception on AI. However, it failed to show the evidence of significant behavior change. As discussed, a WBE program may be enhanced and better implemented with rigorous considerations of the target audience characteristics and by incorporating supportive measures such as repetitive reminders and reinforcements (i.e. ideally with long enough behavior development period). Future studies may incorporate a combination of audience variables to identify optimal design attributes for target audiences. Also, the future health education program development and implementation process may be enhanced by addressing the shortcomings identified in the study.

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Conflict of interest statement

None declared.

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