

# Utilizing Persuasive Technology Package to Elevate Dietary Awareness

*Full paper*

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## Abstract

A recent study in Saudi Arabia uncovered certain prevalent health-risk behaviors in the adolescent population. One of the most prevalent behaviors identified by this study is health-risk dietary behavior. In general, adolescents in Saudi Arabia reported poor dietary behaviors. Adolescents in Saudi Arabia have received minimal attention over the past decades. This study aims to examine the efficacy of using a persuasive technology package to elevate the level of awareness about the importance of dieting during adolescence. Since adolescence is viewed as an opportune time to alter health-risk behaviors that are known to cause chronic diseases, this study targets parents and providers of adolescents. The study employs an awareness video and a text messaging campaign. The preliminary results of this study indicate promising potential for promoting healthy diet choices in adolescents.

## Keywords

Adolescents, health, awareness, design science research, global health, persuasive technology, diet.

## Introduction

Most of the chronic diseases that persist in adulthood could be prevented earlier in life. Adolescence is viewed as an opportune time to prevent unhealthy behaviors known to cause poor health in the long run (Washi and Ageib 2010; Resnick et al. 2012). A recent study (AlBuhairan et al. 2013), titled “Jeeluna”, was carried out in Saudi Arabia on a large sample of adolescents. The study uncovered certain health-risk behaviors in the adolescent population that are prevalent among the nation. The most prevalent health-risk behaviors were dietary, activity-related, traffic safety, sleep, bullying and violence (AlBuhairan et al. 2013). Adolescents in Saudi Arabia have received minimal attention over the past decades (AlBuhairan et al. 2013). Nowadays, there is an escalating need for government officials to focus healthcare policies and efforts on preventive ones rather than remedial (Catalano et al. 2012).

The Jeeluna study was conducted recently, marking the first step in addressing the health crisis of adolescents in Saudi Arabia. One of the most prevalent behaviors that this study uncovered is dietary behavior (AlBuhairan et al. 2013). In general, adolescents in Saudi Arabia reported poor dietary behaviors. Even though the study does not explain why adolescents have shown health-risk dietary behaviors, similar studies have found that lack of access and education were the most prevalent causes of poor diet in adolescents (Murphy et al. 2014). For instance, if the parents/guardians are not aware of what constitutes a healthy diet or choose not to incorporate it in their daily life, adolescents will have no choice but to consume what is available.

While adolescents in Saudi Arabia reported poor dietary behaviors, there have been very minimal efforts to address this problem. Research shows that adolescence is an opportune time to prevent the onset of certain health-risk behaviors that are known to persist in adulthood (AlBuhairan et al. 2013). The present generation of people aged 10–24 worldwide is the largest in history. Adolescence is the life phase in human development where opportunities of adult health are shaped (Sawyer et al. 2012). Hence, many

health care experts are now arguing that tackling health-risk dietary behaviors in the early ages helps significantly in improving the overall well-being in adulthood (Rahim et al. 2014).

Nowadays, technology is advancing at rapid speeds, hence, providing researchers with excess channel options to communicate with their subjects. For most behavioral studies, the research teams need to identify a specific channel in order to convey their message to their subjects. In addition, the ever rising number of channels to communicate with subjects adds some complexity for researchers. For instance, a researcher has to consider a large number of factors when deciding upon which technology communication channel to utilize (i.e., SMS, smartphone application, webpage, etc.).

This study examines the efficacy of using persuasive technology to change health-risk behaviors that are prevalent among the adolescent population in Saudi Arabia. Using design science research paradigm, we have designed new artifacts to address this problem. Our artifacts have been built utilizing knowledge from both persuasive technology and healthcare IT field.

## **Background**

According to (Brinol 2005), persuasion is the attempt of modifying behavior by verbal means which sometimes includes coercive method of which all apply to reason and emotion. The previous definition, which is somewhat agreed upon in the persuasive communication literature, implies that persuasion can be at times coercive and at times, doesn't benefit the recipients long term goals. (Fogg 2003) argues that the focus of "computers as persuasive technologies – or Captology" is on the intentions of the persuader. Moreover, he argues that Captology focuses on planned persuasive effects not side effects that come as the results of using the technology. In other words, the technology needs to be designed in a way that accounts for the intended purpose –to change certain behaviors or attitudes (Fogg 2003).

The beauty of persuasive technology stems from its wide range of applicability. Recently, persuasive technology interventions have been applied to wide range of problem domains. Ranging from health awareness and behavior change to energy conservation efforts, persuasive technology has shown high efficacy and applicability. Research studies, such as (Miranda et al. 2013), have proven the potential applicability of persuasive intervention packages to address the wide range of problem domains including texting and driving behavior. (Miranda et al. 2013) suggest preliminary evidence for the efficacy of a persuasive technology package that combines documentary video about potential harms that texting and driving can cause and daily text message reminders to enforce behavior change.

Many prior studies show the use of persuasive technology to effectively address health-risk behaviors. Studies, such as (Purpura et al. 2011), have utilized persuasive technology to encourage individuals to address the larger goals of physical activity and its relationship with promoting healthy weight. Furthermore, in light of recent calls to address the global health crisis associated with overweight and obesity, (Khalil and Abdallah 2013) examine the efficacy of persuasive technology on influencing physical activity. This study harnesses social dynamics to increase the utility of their designed artifact that counteracts the problem of lack of physical activity. From the positive user responses, (Khalil and Abdallah 2013) concluded that the application had a positive effect on the participants and their level of physical activity.

The advancements in information technology provide a promising future for tackling different problem domains. IT is increasingly being used to design interventions to address many chronic diseases. According to (Chatterjee and Price 2009), in the near future, the health care system will be overburdened by the number of patients vs. the number of physicians. Hence, (Chatterjee and Price 2009) makes the call to utilize persuasive technology to take a proactive approach in promoting healthier generations. In the long-run, research in the persuasive technology literature illustrates the potential of this technology in promoting healthy lifestyle, which will aid the overburdened health care system (Chatterjee and Price 2009).

## **Theoretical Framework**

This study draws upon two important theoretical principles to provide scientific ground for this research. First, this study aims to use the Health Belief Model to provide theoretical explanations of why people are less likely sometimes to take proactive measures regarding disease prevention. Second, this study uses the

framework by Oinas-Kukkonen et al. to inform its design. Given the fact that persuasive technology addresses human persuasion in general, we narrowed the Persuasive Systems Design framework to be applicable on a narrower study that focuses on public health. Therefore, we combined the Persuasive Systems Design Framework with the health belief model to focus on health.

### ***Health Belief Model (HBM)***

The Health Belief Model (HBM), developed by a group of social psychologists in the 1950s, has been guiding the design of various studies in the health care domain. The HBM was developed to aid experts in understanding the reason why people are not taking preventative measures, such as early screenings, to prevent certain diseases (Janz and Becker 1984). The HBM posits that an individual is influenced by four major dimensions, when it comes to making health-related decisions. These dimensions are perceived susceptibility, severity, benefits, and barriers (Janz and Becker 1984). This study builds on the fact that individuals are influenced by these four dimensions. An individual needs to first be convinced that he/she is susceptible to certain chronic diseases. The second aspect is the individual's perceived severity of those chronic diseases. After that, the individual is then examining the benefits and gains that he/she will attain from any kind of preventative measure. Finally, the individual is assessing his/her ability to perform the recommended preventive measure (Janz and Becker 1984).

### ***Persuasive Systems Design (PSD) Framework***

This study uses the Persuasive Systems Design (PSD) framework by (Oinas-Kukkonen and Harjumaa 2009) to inform the design of the persuasive technology intervention strategy. The framework discusses the process of designing and evaluating persuasive systems along with providing some guidelines regarding what kind of content, software functionality, etc. is needed in the final designed artifact. The design of any persuasive system consists of three major components: a persuader with an intention, a user to be persuaded, and finally, a persuading message to convey the intent of the persuader, either in a direct or indirect way. However, these components are dependent on the context in which the persuasive system is being designed (Oinas-Kukkonen and Harjumaa 2009).

Recently, various persuasive technology studies have been deployed to examine its efficacy in the health care domain. The majority of those studies have shown high success rates in tackling problems in the health care domain. Studies such as (Chatterjee et al. 2012) show encouraging results of using persuasive technology to improve the lives of the elderly diabetic patients.

## **Methodology and Research Design**

According to (Simon 1996), design science research is stimulated by the need to solve/improve an existing problem in any given environmental context. In addition, (Hevner and Chatterjee 2010) state that DSR is comprised of three main cycles. Namely, the cycles are the relevance cycle, the rigor cycle, and the design cycle. To effectively design an artifact that addresses any type of problem, a researcher has to carefully consider the relevance and rigor before attempting to design the solution. This study designed and built a persuasive technology package that comprised of i) an awareness video, and ii) a texting application to elevate the level of dietary awareness of participants. Participants pledged to receive one daily text message that contains helpful dietary tips for four days.

The efficacy of this persuasive package was evaluated using repeated measures design, where the participants' awareness level was measured before and after the study. The measures of efficacy were derived from the literature and reviewed by domain experts. The design allowed for establishing a comparison between the "before" level of awareness about healthy diet and the "after" awareness level. This will allow the research team to make a preliminary conclusion that the change in the level of awareness was due to experiencing the persuasive package.

### ***Awareness Video***

As the idea behind this research evolved, it became apparent that the research team needed to develop two artifacts that will eventually compose the solution for this research project. The first artifact that was developed for this project was an awareness triggering tool that was intended to persuade

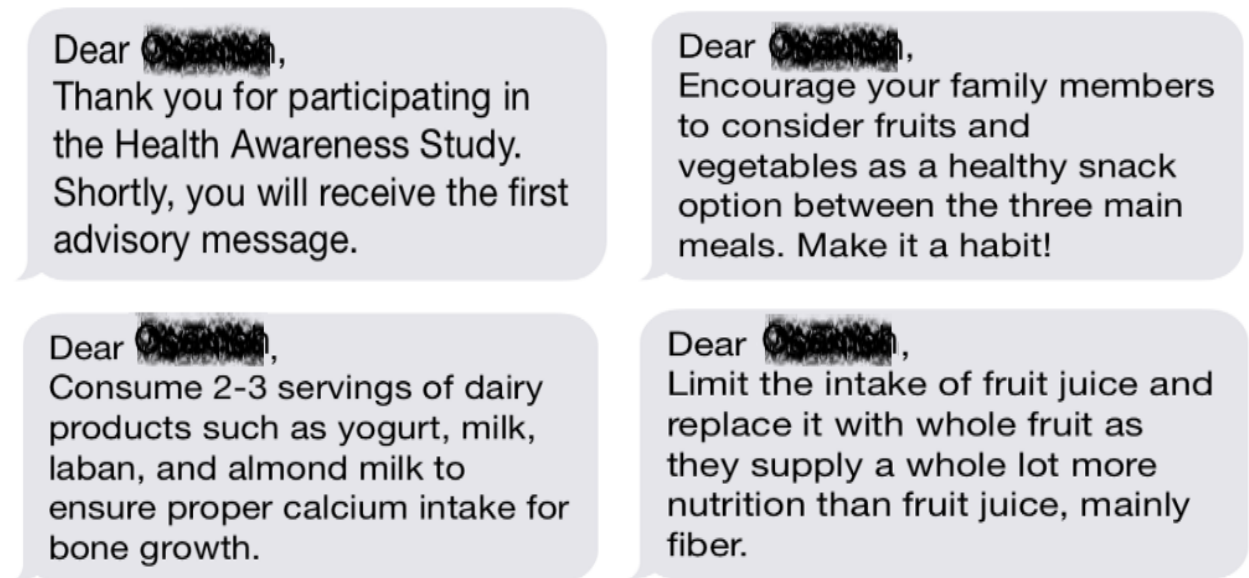
parents/guardians to reflect upon the importance of proper diet for their youth. The awareness triggering tool is composed of an adopted short awareness video (Strong4Life 2013) that will be embedded inside the research webpage. The video (<http://goo.gl/YYKQop>) will serve the purpose of delivering a strong message that is intended to persuade parents/guardians to think about and realize the importance of balanced healthy diet in the early ages of human development. This tool is intended to persuade parents/guardians to participate in the awareness intervention that is also being developed in parallel with this tool (the second artifact).

After participants have been exposed to the awareness video, they will be presented with the option to participate in a short educational program to increase their level of awareness about the important nutrients for their development. If they pledge to participate in this program, their phone number will be entered into our database to receive a daily persuasive text message that is intended to elevate the level of awareness about essential nutrients, in addition to identifying certain health-risk behaviors that are known to cause certain chronic diseases that are known to persist in adulthood.

### **Text Messages**

The second artifact, namely the texting intervention (see Figure 1), is being developed by the research team in collaboration with a dietician specialist in one of the hospitals in the State of Kuwait. The dietician specialist is supplying the research team with essential information about healthy diet that is recommended for the targeted age group. Moreover, the dietician specialist is also helping the research team craft the intervention messages in a compelling and rich manner. In other words, she is assisting the research team in composing short, rich, and strong dietary text messages.

The dietician lives in close proximity to our targeted population, which makes her well-aware of the dietary issues that are prevalent in the adolescent population. In addition, the dietician specialist is well-immersed in the culture of our targeted population, hence, providing the research team with the most relevant and optimal content that should be delivered through the designed intervention solution. In summary, the dietician's involvement with the research team will help in focusing the efforts to target the most relevant health-risk dietary behaviors that are prevalent within our target population.



**Figure 1. Text Messages**

### **Pre-Exposure Awareness Level**

Finally, the research team decided to conduct pre- and post- surveys in order to assess the efficacy of the designed intervention solution. The pre-survey is intended to measure the participants' current level of awareness about the importance of healthy diet in raising healthier generations. For instance, the

participants will be asked questions about their awareness of the relationship between diet (including specific dietary components such as trans fats) and specific diseases (e.g., cancer, heart disease, high blood pressure), especially those that are known to persist in adulthood. This will supply the research team with preliminary data to determine the type of persuasive text messages to be sent. In other words, this will enable the researchers to tailor the text messages specifically to the needs of each participant, thereby, increasing its utility. By doing so, the research team is hoping to achieve high utility rates for the designed artifact.

The post-survey will be conducted after completing the full course of the texting experiment to measure the level of change by comparing the pre and post survey data.

## ***Participants***

The pre-survey link was sent to participants using snowball sampling method, resulting in the recruitment of 90 participants. Out of our sample, only 34 responses were usable; the majority of whom were Saudi Arabian nationals (94%). The remaining number (56 respondents) did not provide their contact information and so were deemed unusable for this study as this information was critical for study proceedings. The total participants in this research study were 34 individuals, 13 females and 21 males, with an age range of 18–37.

The majority of participants have children under their care, with an average of about two children per participant. The average annual household income of participants is \$35,000. The recruitment of participants was done using two methods. First, the research team used convenience sampling, which is characterized by selecting subjects based on their availability and proximity to the research team. Second, the research team utilized Facebook to recruit more subjects, in order to get a more representative sample. The sample size will provide the research team with preliminary evidence on the efficacy of the persuasive intervention package.

## ***Procedures***

Participants were initially recruited using convenience sampling through social media applications such as WhatsApp and Facebook. The research team posted an initial recruitment message on a Facebook page that has an overwhelming number of Saudi subscribers (Saudis in USA). The message contained brief information about the purpose behind this study, along with the hyperlink to the research webpage. After participants land in the research webpage, they were prompted to view an adopted health awareness video (Strong4Life 2013). Upon completing the video, participants were given the option to pledge and participate in the second phase of the research study, namely, the awareness text message intervention. By pledging, participants are agreeing to receive one text message per day for four days. After pledging, the participants were automatically directed to the pre-survey webpage.

The pre-survey aims to assess the current level of awareness of our participants in order to compare it with the post-survey results. Upon completion of the pre-survey, participants were asked to provide their phone number and first name, in order to be added to the texting application to receive the daily text messages. Finally, after receiving the text messages for four days in a row, a text message was sent to each participant to thank them for their participation and provide them with the hyperlink for the post-survey.

## **Results**

Based on the results of the pre-survey, most participants indicated that they lacked some important dietary information. This was clearly visible in the responses of the pre-survey, as nearly half of the participants answered “No” to a question that measured their current level of awareness about any diseases that are known to persist in adulthood that are caused by health-risk diet in the early ages. Furthermore, participants also illustrated a lack of awareness when answering pre-survey questions that were aimed to measure their awareness about certain food products that adolescents need to have or avoid. Nearly two third of all participants reported that they were not likely to read the food labels when making their regular grocery shopping. Moreover, nearly half of the respondents indicated they were not aware of specific nutrients that are essential in the early ages of human development.

Item	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
The web-page was easy to navigate	66.67%	30.77%	2.56%	0.00%	0.00%
The awareness video that I watched at the beginning motivated me to subscribe to the awareness text messages	42.11%	55.26%	2.63%	0.00%	0.00%
The video made me reflect on the dietary habits of my children or people under my care	27.03%	59.46%	8.11%	2.70%	2.70%
The text messages have elevated my awareness regarding certain changes that I can make to improve my children's daily diet	43.59%	41.03%	12.82%	2.56%	0.00%
The text messages were easy to understand	68.42%	26.32%	2.63%	2.63%	0.00%
After participating in this study, I feel that it has influenced my perception about the importance of proper diet for the long-term health.	43.59%	48.72%	2.56%	2.56%	2.56%

**Table 1. Post-Survey Results**

Item	All of them	3	2	1	None
Out of the four messages that you have received, how many messages have you acted upon?	33.33%	22.22%	30.56%	11.11%	2.78%
Out of the four messages that you have received, how many messages have you considered acting upon?	44.12%	20.59%	23.53%	11.76%	0.00%

**Table 2. Message Consideration**

The post-survey results (see Table 1) show that more than 90% of respondents stated that the designed webpage, where the awareness video is embedded, was fairly easy to navigate. Furthermore, post-survey responses also recorded high agreement with the efficacy of the persuasive video. Nearly 42% of participants indicated that they “Strongly Agree” that the adopted video motivated them to participate in this study, while 55% of respondents indicated that they “Agree.”

Even though a larger number of participants watched the video and answered the pre-survey questions, few have not completed the pledge to participate in this study. In general, post-survey respondents indicated that the awareness video made them reflect on the dietary habits of persons under their care with 59.46% indicating “Agree” and 27% “Strongly Agree.” Moreover, respondents indicated that the persuasive messages were fairly easy to comprehend, with 68.42% of respondents indicating that they

“Strongly Agree” and 26.32% indicating they “Agree.” Only 2.63% of respondents indicated that they “Disagree” with the clarity of the persuasive messages. Furthermore, participants responded positively when asked about the how likely they are to act upon or even consider the persuasive text messages (see Table 2).

## **Discussion**

The pre- and post- survey data showed that males were more willing to participate and provide their feedback than females. Out of our sample, 63% are males and 37% are females. Overall, the survey results, pre and post, show success in achieving the goal of this study. The pre-survey results indicated that our sample pool was lacking awareness about the importance of diet for adolescents. Nearly half of respondents indicated that they were not aware of certain diseases that are known to persist in adulthood that are attributed to food products adolescent eat or drink. Since the purpose of this study is to examine the efficacy of a persuasive technology package to elevate the awareness level of parents/guardians about the importance of a balanced-diet, it was deemed necessary by the research team to use a repeated measures design to assess results of the campaign. In fact, the pre-survey data also helped the research team devise the persuasive messages.

Post-survey results showed that there was a noticeable change in the level of awareness of participants. The majority of post-survey respondents indicated that this campaign helped in making them more aware of the importance of a balanced healthy diet for the long-term health of adolescents. Furthermore, nearly 85% of post-survey respondents indicated that the text messages they received throughout this study elevated their awareness regarding certain changes that they can make to improve the dietary habits of people under their care.

## **Contribution**

The novelty of our design stems from the fact that such a persuasive technology package has not been tested in Saudi Arabia. To the best of our knowledge, there have been no such studies done in Saudi Arabia that examine the efficacy of combining an awareness video and text messaging campaign. Moreover, the use of persuasive technology to promote healthy lifestyle is still nascent in this region. As time progresses, we will see an increased utilization of persuasive technology to promote behavioral changes. There have been numerous studies published recently that use persuasive technology to carry out its intervention plans. Ranging from counteracting health-risk behaviors such as smoking to promoting physical activity, these studies have shown great utility of persuasive technology to carry out different goals (Sohn and Lee 2007; Khalil and Abdallah 2013; Purpura et al. 2011). In this present study, the vast majority of participants were Saudi Arabian nationals, which provide a preliminary indication that similar interventions can be successful, in areas of similar culture and dietary behavior.

Finally, our work would fall into the lower-right quadrant of the (Gregor and Hevner 2014) 2x2 grid of knowledge contribution framework: "Exaptation." The main reason why it is classified as such is because the research extends known solutions to different problems. According to (Gregor and Hevner 2014), "effective artifacts may exist in related problem areas that may be adapted or, more accurately, exapted to the new problem context." In our case, we extend a known solution, persuasive technology in this context, to a new problem, which elevates dietary awareness about health-risk behaviors of adolescents in Saudi Arabia to prevent the onset of diseases that are known to persist in adulthood.

## **Conclusion**

In this study, we aimed to examine the efficacy of using a persuasive technology package to elevate the level of awareness about the importance of balanced-diet for adolescents. This research experiment targets Saudi Arabian parents/guardians. Combining the awareness video and texting campaign in a single persuasive package was successful in elevating the level of awareness about the importance of diet for the long-term health of the adolescent population. While our present study focuses on Saudi Arabian nationals, we believe that our solution can be utilized in any Middle Eastern country as the same dietary problems exist throughout this region. Future studies may include larger sample sizes to achieve more

generalizability. This study was aimed at examining preliminary conclusions regarding the efficacy of similar solutions that aim to target public health crises globally.

Participants of this study indicated that the persuasive package as whole was effective in making them more aware about the health problems that poor diet may cause to adolescents in their adulthood. The pre-survey data illustrates that nearly half of participants did not have any knowledge that certain health-risk dietary behaviors can cause diseases that are known to persist in adulthood. The video was a powerful reminder to participants to reflect upon the dietary habits of children or people under their care. As post-survey data illustrates, the vast majority of participants thought that the text messages were a great reminder to parents about small aspects that they can change in order to improve the dietary behaviors of their children. In fact, this study illustrated the potential of utilizing persuasive technology to improve the overall health of future generations.

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