Development of an Interactive Web Intervention to Promote Healthy Lifestyles among Children and Adolescents

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Life style factors such as low physical activity level and poor eating practices are common contributing factors to the development of obesity and overweight in children and adolescents. The dramatic increase of obesity and overweight is demanding urgent strategies to address this problem. Evidence shows that healthy habits continue into adult life when they are established in early ages. Therefore, educating children and encouraging them to adopt healthy eating and active living practices in their childhood can be an effective strategy in preventing long term excessive weight problems. In the light of technology advancements, the use of web technology is gaining popularity in managing behavioural issues. The aim of the present paper is to describe the development process of an interactive website, which is currently being used in a research study. The research study is a randomized controlled trial with eighty participants, who are school-aged children. The study will assess the effectiveness of the website to improve the knowledge and understanding of the participants in issues relating to healthy life style and their behaviour changes. A number of web components focusing on personal and social factors will be discussed.

Field of Research: E-health and health promotion

1. Introduction

A fast growing overweight and obesity population is a major global concern of public health authorities. Overweight and obesity are related to excessive weight gain resulting from a long-term energy imbalance, where energy consumption exceeds expenditure. Once obesity has developed, it is difficult to manage the weight. Thus, early detection and prevention are considered to be key strategies in this problem (Collins et al., 2006).

Poor eating and low physical activity practices are significant contributing factors to the development of this excessive weight gain problems. Evidence shows that healthy habits continue into adult life when they are established in early ages. Therefore, educating children and encouraging them to adopt healthy eating and active living practices in their childhood can be an effective strategy in preventing long term excessive weight gain problems.

In the light of technology advancements, the use of web technology is gaining popularity in delivering health information and managing the behavioural issues. The objective of the intervention study is to examine the effectiveness of telehealth

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approach using web technologies in promoting healthy living among children. The current paper aims to describe the development process of an interactive website promoting healthy eating and active living among children and adolescences which is currently used in this ongoing research study.

This paper begins with an overview of the global issues of the excessive weight gain. A review of relevant evidence relating to the worldwide problems and technology advancement used in health services delivery is presented in the next section. Research methodology and web-based intervention development of the research study are explained in the following sections.

2. Literature Review

The World Health Organization (2006) has classified obesity as a global epidemic since 1998. According to World Health Organization statistics, there were over 1.6 billion overweight adults (over aged 15), while 400 million people were obese in 2005. The World Health Organization (2006) predicts that there will be approximately 2.3 billion overweight adults and more than 700 million obese by year 2015. It is further forecasted that by 2030, approximately 2.16 billion adults will be overweight and 1.12 billion will be obese (Kelly et al., 2008).

Excessive weight gain among children is also a key feature in this issue. The global rate of childhood obesity is increasing strikingly. For example, rates in Australia have tripled over the last 10 years. According to Australian Bureau of Statistics (2009), the greatest increase in overweight and obesity took place among older children (aged 13-17). It was reported that a higher proportion of older children were overweight (19%) or obese (9%) between 1995 to 2007-08 (Australia Bureau of Statistics, 2009). However, the rate among children aged 5 to 14 remained constant at 17%.

Research shows that overweight and obesity in childhood have a significant impact on their health condition and their psychosocial status (Kelly et al. 2008). Obesity in childhood predisposes an individual to mortality or morbidity that occurs in adulthood (Dietz, 1998). The World Health Organization (2000) reported that obesity is more likely to continue into adulthood when it develops in the late childhood or adolescence. However, Barlow and Dietz (1998) concluded that obese children are not always become obese adults.

Several studies have shown that unhealthy eating patterns and low physical activity are most common contributing factors to the development of overweight and obesity (Ebbeling et al., 2002, Dietz, 1998). Changing people's behaviour and attitude is not that easy, particularly when the behaviour becomes habitual. Evidence shows that healthy habits continue into adult life when they are established in early ages. Therefore, educating children to adopt healthy eating and active living practices in their childhood can be an effective strategy in preventing long term excessive weight problems.

Advancement of technology is increasingly becoming alternative and convenient tools in delivering health information and managing some diseases and health-related behaviour problems. In particular, the technology of Web has initially been

used as a medium of delivering health information. The access to health information online is considered to be convenient and quick. Gradually, web technologies have been used for more than accessing information; this includes activities such as information sharing and social networking. For example, the use of interactive tools such as chat rooms, email, hyperlinks, interactive multimedia and online discussion boards have become popular features in health-related online activities (Stout et al., 2001, Tate et al., 2001).

A number of studies have utilised web technologies as a tool to improve knowledge, manage diseases and modify behaviour in various health and medical fields, including managing asthma, diabetes, smoking cessation and excessive weight problems (Homer et al., 2000, Jackson et al., 2006, Jackson and Warren, 2000, Krishna et al., 2003, Oenema et al., 2001, Cook et al., 2007, Jago et al., 2006, Long and Stevens, 2004, Rothert et al., 2006). Most of those studies have reported promising outcomes.

Studies concerning asthma reported decreased morbidity and reduced use of emergency room services by the participants. Krishna and colleagues (2003) found that the use of an Internet-enabled interactive multimedia asthma education program is a feasible addition to clinic visits. Yet, a study of managing asthma undertaken by Homer and colleagues (2000) showed no significant differences in the outcomes for both intervention and control groups. In a study of smoking cessation, Lenert et.al (2003) reported that automated email messaging system had increased the rate of early successful quit efforts in participants. A review of diabetes care studies conducted by Jackson et al (2006) investigated the use of information technology (IT) to enhance care for adults with type 2 diabetes. The study focused on three categories of information technology: Internet, telephone and computer-assisted integration of clinical information. The study reported that IT-based interventions improved health care utilization, behaviours, attitudes, knowledge and skills. However, internet technology was reported did not provide positive impact on health care utilization and clinical outcomes.

Further, there have been several studies on the use of online technologies to promote physical activity and healthy eating among children and adolescents (Jago et al., 2006, Mangunkusumo et al., 2007, Norman et al., 2007, Patrick et al., 2006, Williamson et al., 2006). These studies have concluded that there is a need to undertake more research to determine the effectiveness of this tool. The studies have suggested that the technologies must be further evaluated in order to determine the potential of online applications. Therefore, the design of an online intervention (website) plays a significant role in achieving set goals of the study. While there are some studies involving adult populations to examine the effectiveness of telehealth, the number of studies involving children is significantly low.

3. Research Methodology

The research study is a randomized controlled trial assessing the effectiveness of web technologies to promote healthy lifestyles relating to physical activity and healthy eating patterns. After participants recruited at outpatient clinics in Royal

Children's Hospital Brisbane (Australia), the participants are randomized to either receiving access to website-delivered program (intervention group) or receiving no treatment (control group).

The minimum sample size was calculated based on published evidence (Abbott et al., 2007). It has been assumed that the mean (standard deviation) of the number of portion of fruits and vegetables consumed daily by primary school children is 4(1.5). Then, in order to observe an increase of 1 portion per day with a *power = 0.08*, and *an alpha level = 0.05*, the minimum sample is calculated 36 participants per group would be required to ensure adequate power to the proposed research study. Assuming 10% dropout, it is required to enroll a total of 80 children into the research study.

Participants will be included in the study if they meet the following inclusion criteria: (a) aged 8 to 14 years, (b) able to read and write, (c) have access to and are familiar with computers and the Internet, (d) have no primary nutritional problem and (e) receive no prescribed supplemental food treatment. Participants are not eligible to take part in the study if they are (a) receive treatment for weight problem and eating disorders prior to baseline measure and (b) insufficient English Language proficiency.

The research study has received ethical approvals from Human Research Ethics Committee of the University of Queensland and Royal Children's Hospital (RCH), Brisbane, (Australia) and Institutional Approval from the RCH Executive Committee. Voluntary written parental consent and assent of their children are required, since the children are young participants (age <18 years).

4. Study Intervention

The key objective of the research study is to investigate the effectiveness of a website to improve knowledge and to promote healthy behaviour in eating and physical activity. A website for the purpose of this research study has been developed. The website is called "Eat Smart…Stay Active…A Healthy Me!" A combination of store-and-forward communication and synchronous interactive elements has been employed in the website.

Eligible participants will be randomised either to control or intervention group. Participants in intervention group will be granted the access to this website. They use the website to retrieve information and take part in a number of activities. The information and activities provided in the website are related to healthy diet and physical activity. Participants in the control group will not receive the access to the website. They will go on with their usual daily life. However, the participants in the control group will be offered access to the website upon completion of the follow-up process.

In the following section, we will describe the process of the development of each component in the website.

4.1 Development of the Website

In line with the objective of the research study, the primary goal of the website is to provide the study participants access to the relevant information in healthy eating and active life-styles, engage them in activities that promote interest in these areas, and improve social support.   Table 1 specifies the objectives of the current website promoting health lifestyle.

Table 1. Objectives of the website

1	Deliver health-related messages and information
2	Promote Encourage self-efficacy and self-management skills
3	Promote social support among website users

The design process of the website can be divided into four phases: (i) information gathering (ii) web design (iii) Implementation plan (iv) use and delivery of the website. Figure 1 outlines stepwise process in the website development.

Figure 1. Processes in Web Intervention Site Development
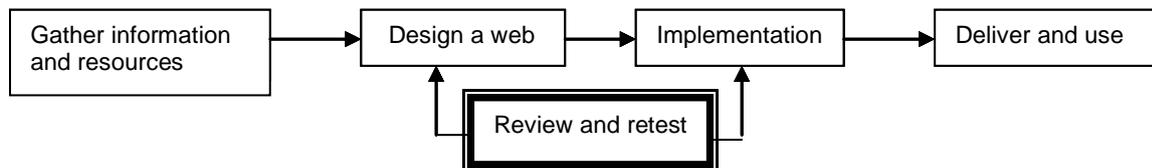
4.1.1. Information and Resources Gathering

The first task was to gather relevant information on healthy eating and active living for children that can be included in the website. The content of the website is based on a validated health education program developed and evaluated at the Harvard School of Public Health, United States (Carter et al., 2007). In making the website relevant to the Australian context, the content is modified in accordance to the Australian Guide to Healthy Eating and Physical Activity recommendations (Department of Health and Ageing, 2008). In addition, a number of other relevant websites were researched and related themes were collected. While selecting information from those websites, we were particularly careful to ensure the quality of health information. Therefore, we only selected web links published by accredited and official organizations. To engage participants in web activities, we also included a number of online games and quizzes as part of the web content. These games and quizzes are closely related to healthy eating and physical activity themes.

4.1.2. Web Design

The 'look' and 'feel' (graphical user interface) are important features of a website (Sklar, 2006). This comprises elements such as colour, shapes, layout, typefaces and behavior of dynamic elements such as navigation buttons and menus. For instance, "the look" can be described when users read texts, view graphics and "the feel" relates to experience of using the website such as when users make associations with links and feel funky, serious or warm when visiting a website. The "look and feel" is affected by the mixture aspects of information design, navigation,

interface cues, style of writing to present the content, layout, font styles and sizes, colours, page loading, icons, graphics and animations.

Preparation of contents for a website (hyper-documents) is different from written text (Sklar, 2006). Studies relating to how the Web users read found that they scan the contents on web (Morkes and Nielsen, 1997). Studies on web usability concluded that users scan the web pages, users do not like long scrolling pages and users prefer factual information. Experts suggested that writing for online content must be brief, concise, simple, informal style and clear (Sklar, 2006, Nielsen, 1998). Considering these factors, we categorized the content into two primary topics with short and concise messages. Table 2 provides key messages as the primary topic for the web content.

Table 2. Key health messages of the website

Themes	Healthy eating (Eat smart)	Physical activity (Stay active)
Health Messages	Eat a variety of food	Stay 60 active minutes
	Eat more fruits and vegetables	Enjoy 120 screen minutes
	Eat less fat, food and sugar in food	

The website is designed in a cluster structure. It is similar to hierarchical approach with the top page intended to allow access to other every page except every topic area has a group of information.

This approach encourages users to explore the information within topic areas. Both website flowchart and storyboarding techniques were used to plan navigation of the site. Planning of navigation structure is an important aspect of the easy use of a website to travel through. Good navigation is when users travel easily and efficiently throughout a website (Morkes and Nielsen, 1997). Figure 2 illustrates the cluster structure used by the current website to present the content. A site map is also used to give a broad view of the node-link structure for users by displaying the entire node-link structure. Chen and Rada (1996) strongly support the use of site maps. Their research concerning on comparing and synthesizing 23 experimental studies of hypertext concluded that site map can be described as "graphical maps that visualize the organization of hypertext have significant impact on the usefulness of a hypertext system".

Figure 2. Cluster structure
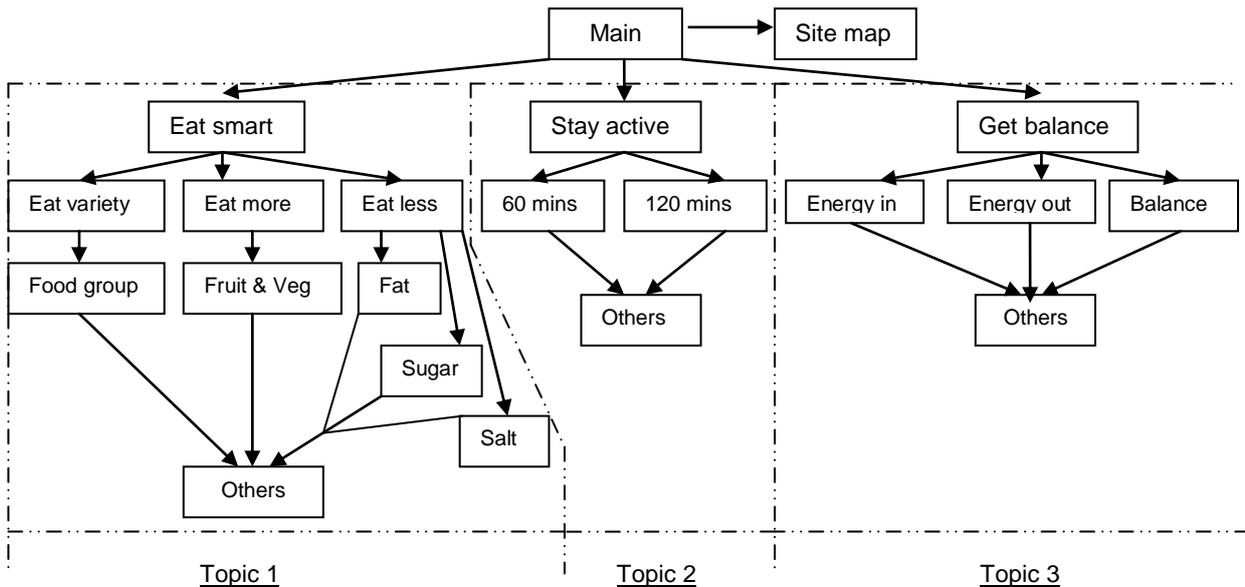
The navigation structure of current website has assisted to development of page layout. We use style "combination of top and left bar", which divided into two logical grouping (Burrell and Sodan, 2006). Figure 3 shows the development of web page layout. The top horizontal list of navigation bars provide hyperlinks to knowledge and information; eat smart, stay active, get balance and other web links. The vertical list of navigation-link menus direct to communication platform and short quizzes; e-discussion, e-talk, email and test your knowledge.

Both vertical and horizontal navigation-link menus are graphic-based. In planning a successful user experience, it is important to consider such details like appropriate icons, animations, placement of navigation buttons, balance of texts and graphics, choice of colour, font size and style; limitation of texts in a page to avoid of too much scrolling task and hypertext linking.

Consistency is the key factor while designing the layout for every page of the website. Interactive features aiming to promote self-management skill, social influence, social supports and social motivation are also included. Those features including discussion board, real-time chat session, and email have been embedded into the website system. Details of the use of each feature will be discussed in the following sections.

Figure 3. Web page layouts
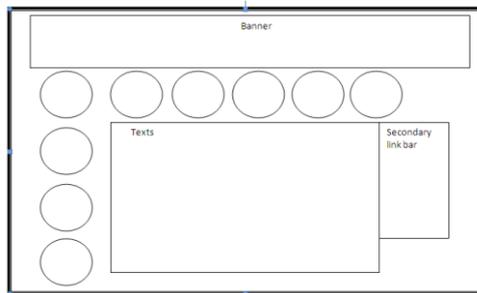
| Rough draft | Final draft (web screen) |

4.1.3. Implementation Plan

At this phase, a prototype on computer medium is developed. We published the website by uploading to server system for the purpose of testing exercise. The website was pilot-tested to four children who were aged 8 – 14 years. Web usability is the main concern during the testing exercise. It includes understanding of the web content, finding information, information feedback, visual clarity, compatibility and consistency. The website has been modified according to feedback and comments received. Revising and retesting tasks were taken place at this stage.

4.1.4. Use of Website

At the beginning of the intervention study, each participant of intervention group will receive the web address, a unique username and password to enable them access the website for eight weeks. They will be allowed to explore the website at their own time pace. They are advised to spend no more than 30 minutes a day for surfing the website. Weekly emails reminding participants to access the website frequently will be sent.

Participants are invited to participate in several online activities including goal-setting exercise, discussion forum and real-time chat sessions. These activities promote both personal and social factors. Table 3 describes overview of web participation. Weekly basis goal-setting activities are divided into food diary, activity log and sedentary activity. These activities are targeted to improve eating and exercise behaviour; and cut down sedentary activities. Social support has been identified as an important tool in managing behavioural changes (Jackson and Warren, 2000, Bandura, 2004). In the current project, the website provides discussion forum and chat session to share experience and opinions among the participants. The discussion forum aims to provide participants a social networking opportunity through which motivation, peer influences and encouragement in behaviour change is focused.

Table 3. Activity levels on the website

Level	Individual	Group
Activities	Web exploration	Discussion forum
	Food diary	Chat session
	Activity log	
	Power down screen time	
	Games and quizzes	

Participants are given opportunity to share their topics with others. However, the principal investigator will moderate and monitor the discussion forum regularly to ensure the forum at all times in relation to the basic themes; healthy eating and active living. The principal investigator will have contact with the intervention group several times each week through emails, the online discussion board and chat sessions. The chat session is conducted in pre-arranged time.

Participants in the control group will receive no access to the website. They will go on with their usual daily life without any treatment given. However, the web-based program will be offered to the control group at the conclusion of the two month follow-up.

5. Conclusion

An interactive website has been designed for the randomized controlled trial to investigate the effectiveness of web intervention for the prevention of overweight and obesity in children and adolescence. This article described the development of the interactive web-based intervention to promote healthy eating and active living among children and adolescents. Findings from the research study will add significant evidence to the growing literature regarding prevention of obesity and overweight research. The study will also offer alternative ways in delivering healthcare principally employing e-health techniques for promoting healthy eating and exercise habits particularly in children and adolescence.

However, our study has several limitations regarding the web-based intervention need to be considered. First, length of time are given to participants in the intervention group to access the website is minimal. Participants in intervention group are given 8 weeks to access the website with weekly email reminder. The other limitation is the website offers a general health-related content across all ages. In other words, the website has been designed without considering age segmentation.

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