Web-Based Nutrition Education for Patients with Hypertension: A Conceptual Framework

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Abstract. Nutrition education is important for patients with hypertension to reduce the adverse outcomes of the disease. A web-based approach has the potential for improving the quality of nutrition education. This paper describes a conceptual framework for the development of a web-based nutrition education system for patients with hypertension, also known as the Web-based Approach on the dietary management and physical activity to control hypertension (W.A.T.C.H) in Malaysia. The website aims to improve the nutrition knowledge and promote behavioural changes among patients. The Theory of Planned Behaviour, Self-Determination theory and Cognitive Load Theory will be used in the development of the website. The website will (1) serve as a portable resource for patients on nutritional education for blood pressure control; (2) supplement the hypertension clinical care by providing an online educational tool for patient. This paper illustrates how learning and multimedia theories can be used in the development of the website.

1. Introduction
Hypertension (HTN) is a non-communicable disease that has become a public health challenge [1–3]. It is a significant risk factor for cardiovascular diseases, stroke, and kidney diseases [4,5]. HTN is the most common risk factor for death and the leading cause of disabilities worldwide [1,6,7]. Hypertension is indicated by an elevated blood pressure (BP) above the normal range [8]. BP of an individual should be categorised as normal, elevated, or stage 1 or 2 to prevent and treat high BP.

According to the World Health Organization (WHO), hypertension can be controlled by involving patients in their self-care surveillance [9,10]. Many studies have reported self-care behaviours as one of the main factors for controlling high blood pressure [9,11–14]. Self-care is defined as the capability of people, families, and communities to take part in health promotion and protection, disease prevention, and dealing with illness and disability either with or without the support of a health care provider [15].

Currently, the Ministry of Health has taken the lead in formulating the National Strategic Plan for Non-Communicable Diseases 2016–2025 (NSP-NCD 2016–2025) to prevent and control hypertension in Malaysia. The NSPNCD 2016–2025 was an initiative from the Eleventh Malaysia Plan (2016–2020). There are seven action plans and initiatives within the NSPNCD which include Tobacco Control, Obesity Control, Salt Reduction Strategy, Active Living, Alcohol Control, Cancer Control and Strengthening Chronic Disease Management at Primary Care Level through the Enhanced Primary
Health Care (EnPHC) Initiative. In 2018, the Ministry of Health had developed the Salt Reduction Strategy to Prevent and Control NCD for Malaysia 2015 to 2020, in line with the Global Action Plan by WHO 2013 to 2025. Three M-A-P (M-Monitoring, A-Awareness, and P-Product) strategies were outlined to achieve the objective. This strategy is targeting the general population to reduce salt intake by 30% from the current salt intake level.

Many modalities can be used to conduct nutrition intervention such as using technology and Internet for nutrition education via discussion forums, blogs, quizzes, hyperlinks, chats and wikis [16]. The use of the Internet to deliver Web-based interventions (WBI) or web-based learning (WBL) to patients is increasing rapidly and, therefore, has become a significant component of health care with important implications for the future of the health care system [17].

Web-based learning (WBL), also known as electronic learning (e-learning), refers to Internet technologies used to deliver a broad array of solutions that enhance the instructional process. WBL combines online and knowledge management attributes [18]. The introduction of the Internet into clinical practice as an information-sharing medium has brought opportunities for innovative interventions for individuals with chronic illnesses and their care providers. These interventions are often designed to address deficiencies in patient’s knowledge and chronic illness self-management skills [19]. Apart from that, the emergence of web-based resources in electronic health initiatives offers cost-effective and fast delivery of health services [20,21]. Furthermore, the web-based nutrition and physical activity education could lead to favourable and equivalent nutrition-related changes when compared with in-person delivery. In addition, it is also able to provide efficient, interactive, and tailored content to the user [22].

Patients will sometimes be provided with traditional educational materials such as pamphlets or brochures to support the effectiveness of the dietary advice. The written information is better remembered and leads to better treatment adherence [23] but written instructions can cause difficulties to patients with low education or literacy and non-native speakers [24]. Although adopting a better diet requires an understanding of how to make healthier dietary changes [25], most of the educational materials were insufficient and poorly developed [26,27].

The web-based nutrition and physical activity education could lead to favourable (20) and equivalent nutrition-related changes when compared with in-person delivery as well as provide efficient, interactive, and tailored content to the user [17]. At present, the Ministry of Health of Malaysia has developed a website called Myhealth in 2011 [28]. The portal is useful in providing information and updates for those who are healthy and those with diseases. However, the portal is void of several elements such as multidisciplinary collaborations from fields like human-computer interaction and patient-centered design [29]. The information provided is simple and, therefore, unable to convey a full understanding to the users on how to construct a healthy diet [25]. The website also has minimal features used to engage with users even though it provides media elements such as videos, illustration, animations, and audio [28]. In addition, the broad targeted users reduce the health promotion effects as it does not focus on the characteristics of the population such as age, gender and culture [30]. Another critical component missing on the website is how this website motivates users for behavioural changes. Motivation is generally considered to be the impetus for change and is derived from the knowledge, understanding, and attitude following the emerging situation of the person [30,31].

Other than that, most education websites lack credential and evidence-based website education [32,33]. A shortage of teaching principles in e-learning and unclear of the theoretical model contract are also among the problems in the current educational website [33,34]. The designing culturally-suited personalized interventions is essential to sustain patients’ involvement in their treatment and encourage patients to take an active role in their health [35]. The research question in this study is “what are the theories, design, and elements of a website for hypertensive patients?” Therefore, this study aims to design and develop a website that utilises learning and multimedia theories or models and adapt the persuasive element in the website to be used by hypertensive patients.

2. Conceptual framework for developing web-based nutrition education
Figure 1 shows the proposed conceptual framework to develop the web-based nutrition education for patients with hypertension.

2.1. The use of theories in nutrition intervention

The use of theory in the design of web-based nutrition and physical activity education is important to ensure the effectiveness of the intervention [20, 36]. Many studies have proven that the effectiveness of nutrition and physical activity education can be improved if it articulates the use of learning theories [37–40]. Theories are series of interrelated concepts that present a systematic view of events by specifying relations among variables to explain and predict event. Theories help to describe and explain the relationship of certain events or phenomena [41] and explain or predict events by illustrating the relationships among a set of variables [42].

A meta-analysis on the application of the Internet to promote health behaviour change showed that more extensive use of theory was associated with increased positive outcomes in the interventions and substantial effects on behaviour [43]. Of the importance of using theory to develop nutrition and physical activity education programs, several studies indicated a combination of theories provides the best approach for web education [44, 45]. The use of instructional design and multimedia learning, coupled with learning theories in the online delivery of the nutrition and physical activity education programs are the fundamental principles to foster learning among users [46].

2.2. Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) was developed by Fishbein in 1967 to better understand relationships between attitudes, intentions and behaviours. Intentions are assumed to capture the motivational factors that influence behaviour and to indicate how hard people are willing to try or how much effort they would exert to perform the behaviour [47]. According to this model, behavioural intention is influenced by 1) whether the person is in favour of doing the behaviour (attitudes), 2) how much the person feels social pressure to do it (subjective norms), and 3) whether the person feels in control of the action in question (perceived behavioural control). Table 1 describes the concept in TPB.

Table 1. Major of concepts of Theory of Planned Behaviour.
| Construct of Theory/ Potential Mediator of Behaviour Change | Definition |
|-------------------------------------------------------------|-------------|
| Behavioural intentions                                      | Perceived likelihood of taking a given action. |
| Attitudes                                                   | Favourable or unfavourable judgments about a given behaviour. |
| Outcome expectations (basis of cognitive attitudes)        | Beliefs about the outcomes of performing the behaviour. |
| Affective attitudes (experiential attitudes)                | Emotional response to the idea of performing the behaviour. |
| Subjective norms (injunctive norms)                        | Beliefs that people who are important to the group either approve or disapprove of them performing the behaviour. |
| Descriptive norms                                           | Beliefs about other people’s attitudes or behaviours with regards to the behaviours. |
| Perceived behavioural control                               | Perceptions of how much control people have over the behaviour, whether there are environmental barriers to action. |

This theory is very useful for understanding food choice and dietary behaviours. The theory assumes that people make decisions in a reasonable manner, i.e. it states that people are likely to take action if they expect the action will lead to outcomes they desire, thus improving their attitudes; if other people they value think it is a good idea; and if they feel they have some control over taking action.

2.3. **Self-Determination Theory**

Self-Determination Theory (SDT) is an approach to human motivation and personality that uses traditional empirical methods to investigate people’s inherent growth tendencies and innate psychological needs that are the basis for their self-motivation and personality integration as well as for the conditions that foster those positive processes [48]. SDT identifies the need for competence, relatedness, and autonomy as essential needs for facilitating optimal growth, integration, constructive social development, and personal well-being [49]. Motivation concerns energy, direction, and persistence, which are all aspects of activation and intention; this makes it a good fit to complement TPB and Social Cognitive Theory (SCT). The issue of whether people stand behind a behaviour out of their interests and values or do it for reasons external to the self is a matter of significance in every culture and represents a basic dimension by which people make sense of their own and other’s behaviour [48].

2.4. **Cognitive Load Theory**

Cognitive Load Theory (CLT) was introduced in 1985 to better understand how people learn. Cognitive Load Theory (CLT) is a conceptual framework relevant to activities that involve performing tasks by focusing on the management of working memory during learning. The fundamental of CLT is learners have a subset of the memory system called working memory, where the thinking and learning occurs. The learning process has very limited capacity when processing new information and, if not rehearsed, the new information will be lost within 15 to 30 seconds. The CLT framework explains the three aspects of cognitive load: intrinsic, extraneous, and germane. The intrinsic load is related to the task difficulty and the learner’s level of expertise. The extraneous load is related to how the task is presented and to elements that are unconnected to the goals of the task and not essential for learning. The germane load is related to the learner’s level of concentration, which is important to long-term storage of new information [50–52]. It is hypothesized that a high extraneous load may jeopardise both intrinsic and germane loads on the working memory, hindering opportunities for effective learning [50,51]. So, an efficient instructional design should aim to minimise extraneous load, to manage intrinsic load, and to optimise germane load [50–52].
The extraneous load may be minimised by reducing the ineffective load by eliminating the effect of the environment on learning. The different pedagogic approaches can also reduce the extraneous load, such as splitting the main task into partial ones which students can complete by themselves (problem completion), providing worked examples, and maintaining one integrated source of information [51,53]. The intrinsic load should be managed through the selection of tasks that match learner’s level of expertise [54]. The germane load could be improved with activities that provide schemata construction and automation [50,51,53]. The total cognitive load have been measured with self-rating evaluation of learner’s mental effort, response time to secondary tasks, and psychophysiological measures [50,52]. Instruments such as the Paas Cognitive Load Scale [55] and the NASA Task Load Index [56] have been used as measures of total cognitive load [51].

2.5. Instructional Design
The delivery of content requires proper instruction to ensure the learning process takes place. The instruction can be seen as the deliberate arrangement of events in the individual’s environment to make learning happen and to make it effective. Gagne’s theory of instruction has been widely used to design instruction using a variety of media (website) for a variety of audiences [44]. In general, the sequence of learning or events of instruction (EoI) is described as in table 2.

| Sequence of events of instruction | Theory-based nutrition and physical activity education strategies |
|----------------------------------|---------------------------------------------------------------|
| Gain attention (A)               | • Use attention-getter that is personally relevant for audience about behavioural goal. |
| Present stimulus or new material (S) | • Tailor messages to audience’s prior knowledge and values.  
• Outcome expectations or perceived benefits: Demonstrate effectiveness of the desired behaviour.  
• Affective attitudes: Increase reflection on affect/feelings about taking action.  
• Barriers/ self-efficacy: Make desired action easy to understand and do. |
| Provide guidance and practice (G) | • Provide food- and nutrition-related knowledge and cognitive skills to engage in actions.  
• Use credible social model |
| Apply and close (C)              | • Enhance application  
• Goal setting and action plans  
• Provide social supports |

2.6. Content
The content and principles of the website will be based on the several established guidelines. The website is proposed to have 9 modules as presented in table 3.

| Content / Module | Topic |
|------------------|-------|
| Module 1         | Understanding yourself |
| Module 2         | Hypertension – Facts and Myths |
| Module 3         | Back to basic – Understanding food |
| Module 4         | DASH diet |
| Module 5         | Minerals |
| Module 6         | Grocery shopping |
| Module 7         | Eating out |
Module 8  Healthy cooking  
Module 9  Physical Activity  

The content will be presented in the form of infographic posters or notes and videos. The methods and development multimedia for learning will be used as guidance in developing the content of the module [57]. Upon completion of the content development, a validation process by using a standard questionnaire will be used [57].

2.7. Incorporating theories into the content

The contents of the website will be incorporated to fit with the learning theories. Table 4 shows several learning outcomes tailored with the theories.

| Theory                                  | Construct                        | At the end of the program, users should be able to: |
|-----------------------------------------|----------------------------------|--------------------------------------------------|
| Theory of Planned Behaviour (TPB)       | Behavioural intention            | 1. analyse the pros and cons of choices either to remain unhealthy eating habit or shifted to a diet that is recommended for patient with hypertension. |
|                                         |                                  | 2. resolve any barriers that prevent from practising a healthy diet. |
|                                         |                                  | 3. identify the adverse outcomes of not controlling their diet. |
| Awareness                               | • self-analysed dietary intake either bad, good or improving by comparing with the recommendation. |
| Outcomes expectation                    | • have the information on the positive outcomes of practising a healthier diet. |
| Perceived benefits                      | • belief that dietary changes will make their blood pressure under control improve quality of life. |
| Perceive barriers / self-efficacy       | • reduce the barriers from practicing the recommended diet. |
|                                         | • apply a variety of strategies to eat according to the recommendation. |
| Self-Determination Theory (SDT)         | Relatedness                      | • connects with peers who can motivate them to continue eating healthily. |

3. Conclusion

The web-based nutrition education for patients with hypertension will serve as a portable resource to supplement the hypertension education and permit patients to have continued access to materials and resources that would be useful even beyond the counselling session. The use of learning and multimedia theories and instructional design will help patients to have a better understanding and compliance towards the management of hypertension. In addition, W.A.t.C.H will be useful to provide broad access to validated and reliable nutrition information. It will also serve as a catalyst in the health system that fit and complement the health system goal. Ultimately, this website will contribute to the improvement in the healthcare delivery system.

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