The impact of a pressure ulcer prevention educational program based on the health belief model for persons with spinal cord injury

Natiara Mohamad Hashim, Julia Patrick Engkasan & Nazirah Hasnan

To cite this article: Natiara Mohamad Hashim, Julia Patrick Engkasan & Nazirah Hasnan (2021): The impact of a pressure ulcer prevention educational program based on the health belief model for persons with spinal cord injury, The Journal of Spinal Cord Medicine, DOI: 10.1080/10790268.2020.1860868

To link to this article: https://doi.org/10.1080/10790268.2020.1860868
Research Article

The impact of a pressure ulcer prevention educational program based on the health belief model for persons with spinal cord injury

Natiara Mohamad Hashim 1, Julia Patrick Engkasan 2, Nazirah Hasnan 2

1Department of Rehabilitation Medicine, Faculty of Medicine, Universiti Teknologi MARA, Selangor, Malaysia, 2Department of Rehabilitation Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

Study design: Pre- and post- trial.

Objectives: To determine the changes of health belief levels after a pressure ulcer (PrU) prevention educational program based on the Health Belief Model (HBM)

Setting: Department of Rehabilitation Medicine, University Medical Centre, Malaysia.

Methods: This study was conducted between May 2016 and May 2018. We created a multidisciplinary structured PrU prevention education program based on the HBM, consisting of didactic lectures, open discussions and a practical session. The content of the program was based on several PrU prevention guidelines. The education program focused on a group of 6–10 participants, and was conducted by a multidisciplinary team; i.e. doctor, physiotherapist, occupational therapist and a nurse. The skin care belief scales (SCBS) questionnaire was administered pre, post and 8-week post intervention, which measured the 9 domains of HBM. The data from the study was analyzed using repeated measures ANOVA to assess the effectiveness of the program.

Results: Thirty spinal cord injured participants who fulfilled the inclusion and exclusion criteria completed this study. The results of the education program show statistically significant effects on Susceptibility; $F(2,58) = 12.53, P < 0.05$, Barriers to Skin Check Belief; $F(2,58) = 5.74, P > 0.05$, Benefits to Wheelchair Pressure Relief Belief; $F(1.65,47.8) = 3.97, P < 0.05$, Barriers to Turning and Positioning Belief; $F(2,58) = 3.92, P < 0.05$ and Self-Efficacy; $F(1.7,49.11) = 4.7, P < 0.05$.

Conclusions: A structured HBM based education program is shown to improve health beliefs level in five SCBS domains. This education program is recommended for PrU prevention within the spinal cord injured population.

Implications: A multidisciplinary structured HBM based education program may improve the current method of PrU prevention education.

Keywords: Spinal cord injury, Pressure ulcer education, Prevention, Health belief model, Rehabilitation

Introduction

Pressure ulcers (PrUs) in spinal cord injury (SCI) are a debilitating condition affecting an individual’s general health condition, psychological status, function and community integration and ultimately could be the cause of mortality secondary to the development of sepsis from infected ulcers. PrU is a common complication following SCI and one of the most common causes of rehospitalisation. Recurrent hospitalization and unemployment due to PrU further contribute to the financial burden associated with PrUs arising from the hospitalization costs. The prevalence of PrU in SCI populations in developing countries is highly variable, ranging from 26.7% to 46.2%. The development rate of PrU in the first 10 years post SCI is between 11.5% and 14.3%. This increases after 15 years post injury to 21%. Prevention of PrU is less costly than the expense of managing the condition itself. A systematic review...
demonstrated that the cost of PrU prevention per patient per day varied between 2.65 € to 87.57 € across all settings compared to the cost of PrU treatment per patient per day, which ranged from 1.71 € to 470.49 € across different settings. Several reports in the literature have emphasized the importance of imparting knowledge regarding PrU prevention by adopting preventive skin care behaviors in order to reduce the PrU occurrence or reduce the severity of PrU. The various modes of education that have been used to educate persons with SCI about PrU included E-learning program, telehealth interventions programs, telephone follow up and behavior contingencies. The E-learning program and video telehealth intervention utilized multimedia to ease the method of education in terms of labor and time saving. However, it requires specialized skills were required. In addition, developing and maintaining the program over a longer period is costly. Access to and literacy in information and multimedia technology is also required in order to enable the persons with SCIs to participate in the education. A study by Garber et al. examining a 4-hour individualized structured educational model and telephone call also has shown a positive outcome. However, this method is not time and cost effective, requiring a number of medical personnel to attend to a large number of SCI patients, which is not feasible or durable in our particular clinical setting. A behavioral contingencies strategy using monetary rewards after successfully preventing a PrU also has demonstrated promising results in reducing PrU occurrence. However, this method involved a large sum of money and is not sustainable in the long run. In a nutshell, education does reduce the risk of pressure ulcer occurrence or severity of PrU, as successfully demonstrated by most of the reviewed studies. Despite their promising outcome, to the best of our knowledge, the theoretical background to the development of their educational program and its applicability to our local clinical settings was not adequately demonstrated.

PrU education usually takes place at the beginning of the rehabilitation process, when patients are still accepting and adjusting to their injury. Their psychological state at that point of time may hinder complete comprehension of the importance and impact of these preventive measures. Once patients are discharged from the hospital, adherence to the program changes according to the patients’ environment and activities, which ultimately leads to a higher risk of developing PrU.

A qualitative study among SCI individuals to explore the gaps in PrU preventive education found that patients preferred to discuss the topic face to face with peers and healthcare professionals, rather than having to read about it from available materials. The timing of this education is also important. In the early years post injury, patients are most focused on figuring out how to integrate back into the community and to live with minimal and/or no assistance from others. This is when they pay the least attention to PrU prevention. Hence, it is important to regularly emphasize the prevention methods. The researchers proposed that the PrU education session/program should include SCI peers sharing their experiences with the patients. Listening to people who are going through the same things has a stronger impact on the patients. They valued their peers’ experiences; as well as the challenges, barriers and solutions in managing PrU throughout their life.

It should be acknowledged that individuals with SCI who were informed of and trained in PrU prevention measures failed to routinely perform them once they returned to their community, despite being able to perform them independently. This implies that other factors exist which influence the adherence to the skin care behavior. Health belief has been found to be one of the predictors of PrUs status 3 years post injury. A qualitative study has shown that the perception or belief towards susceptibility and severity of PrU correlates with the compliance to skin care behavior. These studies illustrate the significant role of health beliefs in influencing PrU occurrence and adherence levels towards the preventive method. However, the studies failed to explore how health beliefs should be adopted and applied in PrU preventive intervention by manipulating the modifying factors domain in the Health Belief Model (HBM) that may contribute to the increase of adherence levels.

The health belief model (HBM) is used to predict adherence to self-care regimens in chronic conditions. The model was first proposed by Rosenstock in 1974. The model describes that the adherence to a health regimen is motivated by beliefs regarding susceptibility and severity of the condition. The belief yields a behavior that overcomes barriers to achieve the desired outcome. Dai and Catanzaro pioneered the use of the HBM in the SCI population to examine factors predicting adherence to PrU prevention behaviors. This is a cross-sectional observational study that utilized self-constructed questionnaires covering the domains of HBM aiming to measure specifically the health beliefs level toward PrU preventive methods. This study has found that perceived severity and efficacy correlated significantly with adherence level. They proposed that education for PrU prevention should emphasize information about severity, specific knowledge and
techniques of skin care that may increase compliance towards the behavior. Several interventional studies utilizing HBM based education have demonstrated some promising results in improving not only the level of beliefs but also their compliance level towards preventive method in cardiovascular disease, breast cancer prevention and haemorrhagic fevers, to name a few.\textsuperscript{17-19}

In our current practice, education is largely confined to the bed-side during active rehabilitation, is delivered by the medical personnel and rarely involves peers. In addition, the existing educational materials are mainly in the English Language, which may not be easily understood by many locals. Furthermore, with the diversity of the Malaysian population, the existing materials poorly exhibit relatable real-life scenarios, and information sometimes fails to focus on pertinent issues.\textsuperscript{20,21} Hence, it is important to develop education that fits best with the local population using familiar and comprehensible local languages, includes open discussion with other peers and medical personnel, and is cost- and time-effective. Most importantly, the education should be based on a proven theoretical background, namely HBM, in order to promote adherence towards the routine. Utilizing peers to participate in the preventive education is a practical way to address all domains of HBM, namely belief in susceptibility, severity, barriers towards the preventive behavior and self-efficacy. However, the education should be navigated by medical personnel to ensure that the recommendations of the peers are in alignment with PrU preventive guidelines.

Findings from this study could greatly impact the way PrU education is delivered to persons with SCI. The study has potential to add new knowledge to the issue of addressing the development and testing of an educational program. Hence, our objective is to create a structured education program by integrating the conceptual framework of HBM and test its applicability and effectiveness in improving health beliefs level pertaining to PrU preventive behavior.

\textbf{Methods}

\textbf{Ethical consideration}

The study was approved by the institution’s Medical Research Ethics Committee (20164–2377). Each participant received and read the patient’s information sheet, and written consent was obtained prior to the intervention.

\textbf{Study design and setting}

This is a pre- and post-trial conducted between 2016 and 2018 in the University Medical Centre, a 1000-bed teaching hospital.

\textbf{Participants}

A total of thirty-four persons with SCI who were undergoing inpatient rehabilitation and attending outpatient SCI rehabilitation clinic, and who fulfilled inclusion and exclusion criteria were recruited. In this study, we employed a non-probability convenience sampling technique. The decision for utilizing this sampling technique was based on two considerations; (1) the small population that limits the availability of patients who met the inclusion and exclusion criteria, and (2) funding limitations.\textsuperscript{22} The inclusion criteria includes: (1) aged 18 years and above, (2) inability to walk except for therapeutic purposes, (3) traumatic and non-traumatic etiologies of SCI, (4) ability to manage skin regime independently determined by Spinal Cord Independence Measure (SCIM) score of 6 in the domain of mobility in bed and action to prevent PrU, (5) proficient in either Bahasa Malaysia or English, and (6) at least 3 months post injury. The exclusion criteria are (1) concomitant brain injury with the presence of cognitive impairment as determined by the Mini Mental State Examination (MMSE) score of 24 or less, which were available from patients’ clinical notes, (2) completely dependent for caregiver assistance (3) resident of nursing homes, (4) non-traumatic etiology of SCI that is progressive in nature, such as metastatic diseases or HIV associated myelopathy, and (5) signs and symptoms of depression based on Patient Health Questionnaire – 9 score of 5 or more.

\textbf{Intervention framework of structured PrU prevention educational program based on HBM}

In this study, we created a structured PrU prevention education program based on the Health Belief Model domains. This education program consists of three parts which include a didactic lecture, followed by open discussion with peers and finally a practical session with therapists and nurse. Figure 1 (supplemental) depicts the integration of HBM into the framework of the education intervention.

\textbf{Didactic lecture}

The didactic lecture reflects the HBM domains of perceived susceptibility and severity. A qualitative study by Schubart et al.\textsuperscript{12} has emphasized that people living with SCI prefer to discuss the preventive topic face-to-face with peers or health care professionals compared to reading materials.\textsuperscript{12} This didactic lecture aimed to summarize and simplify the theoretical knowledge from the existing PrU preventive guidelines to allow in-depth understanding, provide necessary
knowledge pertaining to the topic of interest and to avoid information overload. It was presented using a PowerPoint presentation to a group of 6–10 participants and conveyed in national language by a rehabilitation physician who worked closely with the SCI population. The main content of the lecture included the risks of developing PrU, severity of PrU, and early detection and prevention of its occurrence. The source of information is several documented and published clinical practice guidelines. The duration of the lecture was approximately 45 min. Before the lecture, a brochure containing pertinent and important information related to PrU was given to each participant.

**Semi-structured open discussion**
This open and sharing discussion was held with SCI peers and moderated by the researcher, who was a medical officer experienced in managing patients with SCI. The researcher used a discussion guide to ensure that the topic discussed was centered and directed towards the experience of dealing with PrU according to the HBM Domains of belief in benefits and barriers, susceptibility and severity. The objective of this session to allow crossover of knowledge and instilling the perception severity of PrU by sharing their experiences relating to the complications, challenges, barriers and solutions in managing PrU throughout their lives. The duration of this session was almost 1 h. The sharing sessions were audiotaped to allow reflection and evaluation of the whole sessions.

**Practical session**
The objective of this practical session was to promote self-management by improving self-efficacy in performing PrU preventive behavior as recommended by Canadian Best Practice Guidelines for the Prevention and Management of Pressure Ulcers in People with SCI. This session aimed to help them learn, consistently apply, and incorporate appropriate PrU prevention strategies into their activities of daily living. The length of the practical session was also about 1 h. This session was jointly conducted by a nurse, occupational therapist and physiotherapist. This practical session comprised of skin care techniques, wheelchair pressure relief, turning and sitting and equipment (wheelchair and cushion) maintenance. To ensure a uniform dissemination of information and to avoid any missed information, a representative of each group was given a checklist of information that should be taught by the health care professionals. The group representative was asked to tick off the information covered in the session, ensuring that all of the necessary information was taught. In this session, participants were divided into three groups and assigned to each of the stations led by the health professionals. Every participant’s prior prevention technique was assessed, and proper technique was taught to each participant. Problems could be identified and addressed if any of the participants were unable to master the correct technique. The session reflects the HBM domains of self-efficacy.

**Research instruments**
Demographics data and participants’ characteristics which were relevant to this study were gathered through a checklist-type questionnaire. Skin Care Beliefs Scale (SCBS) was utilized in this study to measure the effectiveness of the intervention, assessing before the program started, immediately after it ended, and at the 8th week post program. This assessment tool looks specifically into the behavior related to belief regarding barriers and benefits of PrU preventive measures. A total of 82 items were investigated, comprising the nine domains of the SCBS, which consist of two general domains of belief in susceptibility and self-efficacy, six specific domains of belief in benefits and barriers; and three specific skin care behaviors, namely wheelchair pressure relief, skin care and turning and positioning. A Likert five-point response scale (strongly disagree, disagree, neutral, agree and strongly agree) was used. In the severity, susceptibility and belief in benefits domains; the higher the the response score, the stronger the belief in the importance of the accompanying domain. However, in the domains of belief of barriers; a higher response score indicates a lower belief that the accompanying barrier is still a barrier.

**Data collection procedure**
The SCBS was evaluated through an interview at three occasions: just before the structured education program began, immediately upon completion and at 8 weeks post completion. The interview was performed through telephone calls or meeting the participants personally for the 8th-week assessment.

**Analysis**
SPSS 23 for Windows was used for the statistical analysis. Descriptive analysis was performed to analyse the demographic data. Repeated analysis of variance (ANOVA) was used to measure the effectiveness of the structured education program by analysing the significant mean difference of SCBS scale between pre-intervention, immediate post-intervention and at 8
weeks post intervention. Mann Whitney and Kruskal Wallis tests were performed to examine the relationship between the independent variables and significant values of SCBS domains.

**Results**
A total of 30 out of 34 participants completed this study; four participants did not complete the SCBS questionnaire at 8 weeks post intervention. Table 1 shows the demographics of the participants. More than half of them have received previous education addressing PrU prevention (66.7%). The majority have had a history of developing PrU with 23.3% in less than 6 months, while 16.7% developed PrU after 6 months to 1 year; 40% after 1 year, and 20% of them had no history of PrU before the date of education.

**Effectiveness of HBM based structured PrU prevention education program**
Table 2 shows the results of ANOVA of the differences between pre, immediate-post and 8 weeks post intervention. Five SCBS domains showed significant statistical change; beliefs in susceptibility \(F(2, 58) = 6.89, P < 0.05\), belief in barriers to skin check \(F(2,58) = 5.74, P < 0.05\), belief in benefits to wheelchair pressure relief \(F(1.65,47.84) = 3.97, P < 0.05\), belief in barriers to turning and positioning \(F(2, 58) = 3.92, P < 0.05\) and belief in self-efficacy \(F(1.7, 49.1) = 4.7, P < 0.05\).

Therefore, to evaluate the difference in means for these five SCBS domains, post-hoc testing using repeated measures ANOVA (Bonferroni) was applied to compare the mean scores across the three time-point, which is summarized in Table 3. The 8 weeks post intervention for SCBS domain of belief in susceptibility, belief in benefits of wheelchair pressure relief and belief in self-efficacy remain higher compared to the baseline. Mean score at 8 weeks post intervention for SCBS domains of belief in barrier of skin check and turning and positioning remain lower than the baseline score.

Of the remaining four SCBS domains, Table 2 shows non-significant improvement of mean scores across the three time-point measurement by the SCBS scale.

**The relationship between the changes of beliefs (differences between pre-, post intervention and 8 weeks post intervention) with demographic characteristics.**
A Kruskal–Wallis H test yielded statistically significant means score difference in belief in benefits of wheelchair pressure relief at pre- and immediate post intervention between the different duration of injury, \( \chi^2 = 6.81, P < 0.05\) (Table 4), with a mean rank difference score of 18.0 for duration < six months, 20.6 for duration of one year to ten years and 11.7 for duration of > ten years. The belief in barrier of skin care (Table 4) shows statistically significant means score difference at pre- and immediate post intervention between the different past duration of PrU history, \( \chi^2 = 10.7, \)
P < 0.05, with a mean rank score difference of 16.7 for duration of < six months, 13.8 for duration of six months to one year, 10.8 for > 1 year and 25 for absence of previous history of PrU.

There are no statistically significant mean score differences across groups for all independent variables between pre and 8 weeks post intervention as indicated by Kruskal- Wallis H test and Mann–Whitney U test (Table 4).

**Discussion**

This study highlights how an HBM-based PrU prevention education program increased the level of health beliefs which could promote adherence to the preventive methods for PrU. The current study also illustrates the feasibility of using the SCBS to measure the effectiveness of the education by measuring the domains of HBM specifically pertaining to PrU prevention.

**Effectiveness of HBM based PrU prevention education**

The education program was effective in improving five out of nine investigated domains of HBM; belief in susceptibility, belief in barriers of skin check, belief in benefits of wheelchair pressure relief, belief in barriers of turning and positioning and belief in self- efficacy. Several factors may have contributed to such results by observing and reflecting the whole education process and evaluating the content of the recorded sharing sessions. The lecture highly emphasized the increasing risk of developing PrU over time, especially in individuals with chronic SCI. Sharing sessions among participants with SCI allowed cross-over of knowledge, provided exposure to real-life experience, and further portrayed the actual risk, thereby impacting on the participants’ beliefs regarding the risks of PrU occurrence. The participants also shared their successful strategies in overcoming and tackling obstacles specifically with regard to performing skin checks and turning and positioning, which are unique to every individual. Furthermore, the experienced peers actively provided personal tips and techniques. They also had the chance to assess and correct other participants’ techniques during the practical session, supplementing the information provided by health care professionals and filling in the gaps which were lacking in existing education materials.

We believe that the motivation, drive and support shared between the participants reinforced positive thinking and re-directed them to practise the preventive behavior in a more vigilant manner. Competency in detecting early occurrence of PrU was overcome.
during the practical and theory session. In this session, the basic knowledge was accentuated, and technique was assessed and refined. Accordingly, the perception that PrU prevention can solely be conducted efficiently by medical personnel, was overcome. There was also real-time visual feedback of pressure distribution provided by performing pressure mapping while the participants performed the pressure relief act. Therefore, a real depiction of pressure prone area was provided during sitting by displaying pressure distribution. This reinforced the importance of wheelchair pressure relief.

Significant changes were sustained up to 8 weeks post intervention. From this study, however, we are unable to ascertain the duration of observed changes in beliefs, and at which point in time changes start to dissipate. If we knew this crucial information, we could gauge the time at which the program needed to be iterated to the participants.

Several challenges were encountered during the delivery of PrU prevention education which might influence the results; firstly, the theoretical sessions placed greater emphasis on the medical implications of PrU, while the SCBS items were more focused on psychosocial consequences. Secondly since different individuals have different experiences and degrees of severity of PrU implications, it was difficult to maintain and control the homogeneity of information shared and obtained during the sharing session, as the four sessions were held at different times with different participants. Thus, the impact differed among the four sessions. Some of the questions that were asked in the domain of severity were less related to current real-life situations; and given that the degree of consequences and coping mechanisms differed between the participants may have created bias. Secondly, 66% of the participants had received prior PrU prevention education, which possibly did not contain additional information; hence, the education became less impactful, leading to lack of individualization in the content of the education in addressing certain aspects of the unchanged domain. The items asked in the specific domain of belief in barriers in wheelchair pressure relief did not specifically target the situation that the participants perceived as barriers, such as reduction in endurance, shoulder pain, poor truncal problem and spasm, which may have had some effect on the results.

Limitations and future recommendation specific to education intervention
As a summary, based on the earlier discussion and aforementioned pitfalls, the education program lacked individualization in addressing problems unique to every participant. The duration of the education sessions was not sufficient to delve thoroughly into specific barriers especially during the sharing and practical sessions. As discussed above, there was difficulty maintaining homogeneity of information during the sharing session, as the 4 sessions were conducted separately with different participants present. While we also acknowledged the role of peers in delivering education, there was lack of standardization of peer-led support groups to ensure that the information aligned with the general medical consensus. Chronic SCI participants often adapted behaviors which conformed to and fulfilled their needs and lifestyles. Nonetheless, these methods may not follow or agree with conventional medical advice.

For future recommendations, the duration of the education sessions should be extended to up to one hour and thirty minutes for each session. In addition,
a study should be conducted among persons with SCI, to explore the common barriers and issues that they face in their everyday lives. Subsequently, every important issue might be addressed effectively and individually during the next iteration of the program. Persons selected to lead the peer-sharing sessions must also be trained before conducting educational sessions. Individuals must be able to recommend ‘real-life’ based problem-solving experience while leaving out information that has little scientific basis in order to prevent confusion and maladaptive behaviors.

A further limitation factor that reduced the power of the study was the study design; it being a one-arm single centered study and with a small sample size. Even though pre–post trial study design is not the best study design to study effectiveness of an intervention due to lack of control over the factors that may simultaneously influence the intervention implementation, such influence was minimised by administering the outcome tools immediately after the completion of the intervention. Blinding is not feasible in a complex and rapidly changing healthcare and its organisation, as pointed by Guihan et al. while conducting research into prevention of PrU.26 The researcher also pointed out the impracticality of controlling every variable that might influence the study’s outcome. For our study, we adopted a pre- and post- trial study design based on the following justifications; (1) to minimize the heterogeneity of the population, the comparison was made with the participants served as their own control group, (2) small population size with limited availability of participants that met the inclusion and exclusion criteria, and (3) restricted funding. With a greater sample size, the effect size might be increased, allowing the deployment of more robust parametric testing to measure factors that influence the outcome. The dominance of chronic SCI participants in the studies, who may have sound theoretical knowledge might have affected some of the results; should the demographic have consisted of more acute or subacute SCI participants, the results might have been influenced accordingly. The study also does not actually address whether the provision of prevention education reduces the incidence of PrUs. Hence, this paper warrants further research studying the rate of PrU incidence and compliance level towards the preventive method.

Conclusion
From this study, we can conclude that this structured HBM theoretical based PrU prevention education program may play an integral role in improving beliefs towards PrU prevention behavior in five domains of the SCBS. This study has not only allowed us to measure the health beliefs level towards PrU preventive interventions, but has also allowed us to test the applicability and practicability of the HBM based education in our local clinical setting and also identify specifically which areas of HBM beliefs are lacking in the education and need to be addressed. Our results have contributed to the improvement of future PrU prevention education delivery.

Acknowledgements
1. Sa’adah Binti Muhamad Amin, Occupational Therapist
2. Atika Suhada Mistee, Physiotherapist
3. Chua Siew Chin, Rehabilitation Nurse

Disclaimer statements
Contributors None.

Funding The University of Malaya funded this study under the University of Malaya Research Grant (PO019-2016A).

Conflicts of interest All authors have no conflict of interest to declare.

ORCID
Natiara Mohamad Hashim @ https://orcid.org/0000-0002-6466-2551
Julia Patrick Engkasan @ http://orcid.org/0000-0003-0599-4908

References