

# A User-Centered Design Approaches for Developing Web Information System for Stroke Care (WISS)

Hassan. N. H<sup>1</sup>, A. Bakar. N. A<sup>1</sup>, Md. Nasir M. H. N<sup>2</sup> and Maarop N. A<sup>2</sup>

<sup>1</sup>Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Kuala Lumpur

<sup>2</sup>Faculty of Computer Science and Information Technology, University Malaya, Kuala Lumpur

noorhafizah.kl@utm.my

**Abstract**—Optimizing resources from internet is important because effective stroke care require caregiver have a fruitful of information at increasing efficiency in acute stroke care. With the result shown that stroke becomes the third leading cause of death in world, there is an urge need for the information provided online is reliable. There is still limited information available online to assist in stroke care as well as the right medium to deliver the information to stroke patient. This paper discusses on User-Centered Design (UCD) approaches for designing the prototype for web information system for Stroke Care. The methodology uses are interviews, focus-group discussion and observation, questionnaires and card-sorting activity. This research covers four groups of users: stroke caregivers, two stroke rehab centers, therapists and doctors who handle the structure proposed using UCD approach.

**Keywords**—Stroke Care, User-Centered Design, Human Computer Interaction

## I. INTRODUCTION

Stroke is one of the top five leading causes of death and one of the top 10 causes for as it strikes to everyone without known the age of victims [1]. The problem of stroke has a particularly strong impact, not 64 only because more than half of the world's populations are in Asia, but stroke is the predominant vascular disease in many parts of Asia. From World Health Organization (WHO) reports, it has been estimated that there were 2.5 million people died of stroke worldwide. The burden of stroke is likely to increase substantially in the future because of the aging

population. In [2], it has been suggested that apart from implementing effective stroke prevention programs, identification of factors associated with more severe stroke may help to ease the burden of this coming epidemic.

Besides, it has been agreed that people with stroke may benefit from more rehabilitation compared to the amount of rehabilitation services presently provided. They highlighted the urgent need for the establishment of community-based stroke rehabilitation centers [3]. Therefore, the right medium of information delivery is required to ensure the maximum information from the right stroke community can be reach by stroke caregivers. From research conducted in [4], it discussed on the recommendation for stroke care and highlighted issues on stroke system (in what way it should be reflected) and stroke prevention (how to prevent stroke). Whilst, this paper is focusing on improving stroke care by designing a web information system that provide one stop centers for giving out the information for stroke caregiver. Rehabilitation is a vital component in stroke care. Innovative home-based therapies as an alternative to standard physiotherapy have been studied. However, their feasibility and applicability to the larger affected population remain unknown [5].

A single portal of stroke care information provided from the internet search shows that the information provided on stroke is quite limited for Malaysian compared to Europe and Africa's country. They have their own strong stroke association which exposes them to be aware importance to take care on stroke. However, in Malaysia, there is only one website from independent stroke association known as National Stroke Association of Malaysia

(NASAM) which acts as private rehabilitation centre that provides variety services in stroke care. They promote and deliver the information about their centre and stroke care through their website. However, with the limitation of the information provided by NASAM itself, since they operate independently, they required more information from other resources such as government, public sectors and private hospital. The reason why they need external resources is because hospital is the first place that stroke patients are referred and allocated when they had the first stroke attack. Apart from that, two-way interaction between stroke patients is one of the successfully of sharing idea and information as it still poorly available [6]. Not just that, professional doctors and therapists from Malaysia who are working independently need a place where they can share their experience and communicates with stroke patients.

Therefore, this research describes the requirements needed to design a web information system (WISS) for stroke care using User-Centered Design (UCD) approach from context of human computer interaction. The first section will discuss the overview of UCD, following methods involved in data collection in identifying the requirements. Results and findings later is discussed with proposed future works.

## II. USER-CENTERED DESIGN (UCD)

User-Centered Design (UCD) approach allows user to participate on each of stages throughout all the design process [7]. Thus, the user-centered design (UCD) focusses on user's involvement all-through the planning, design and development of a product [8]. One way to make sure that this is the best practice, WISS will develop based on the UCD approach. Various works have been reported in designing web information system and mobile application using UCD approaches [9] in health-related environment. For example, in [10], the author has proposed the usage of UCD to develop the system in detecting and predicting falls in older adults. Besides, the enhancement of patient portal in a previous study conducted [11] ensure that UCD approach

can ensure that it helps to engage patient in managing their health effectively. The objectives of implementing UCD is to see and practice on how much user plays a role on the structuring the information provided in a web for stroke care. As users become more sophisticated, they expect usability as a key component of information systems when designing complex systems, it is standard systems engineering practice to carefully design the interfaces between subsystems. PACT (People, Activities, Contexts, Technologies) as a useful framework for thinking about a design situation in relation to an interactive system [12]. PACT analysis would be useful for both our analysis and design activities; understanding the current situations, seeing where possible improvements can be made and envisioning future situations and implemented in this study. Besides, UCD approach in interface design involved users which are focus group discussion, usability testing, card sorting, participatory design, questionnaires and interviews [13].

## III. METHOD

This research applies UCD approaches involved interviews, focus-group discussion, card-sorting activity, low-fidelity and high-fidelity prototyping. The research was conducted in two rehabilitation centres in Malaysia. Three group of users involved in this research which are therapist, stroke survivor and stroke caregivers. Figure 1 shows the methodology involved for the proposed Web Information System for Stroke Care (WISS). This study was conducted in two stroke rehabilitation centres in Malaysia.

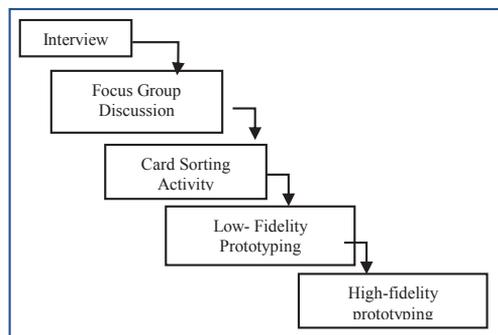


Fig. 1: Research Methodology Approaches

#### IV. RESULT AND DISCUSSION

In this section, we present the results and output from the UCD approaches apply in this study.

##### A. Interview

For unstructured interview session, five respondents participated in this study. The objective of this method is to gather their opinion and feedback on stroke delivery information. Three different groups of users are i) therapist ii) admin in stroke rehabilitation centre iii) stroke caregivers. The questions were asked based on the requirements or information they need to assist them in taking care of stroke patients. From the interview, three main theme were extracted which are i) medium of delivery, ii) information needed and iii) stroke care experience.

TABLE I. UNSTRUCTURED INTERVIEW OUTPUT

Themes	Medium of Delivery	Information needed	Stroke Care Experience
Therapist 1	Web	-Caregiver focus -Information on stroke care	Not mentioned
Therapist 2	Web	-Caregiver focus -Information on stroke care	10years
Therapist 3	Web/Mobile Phone	-Speech Therapy module -Forum with other speech therapist	10 years
Admin in Rehabilitation Centre	Web	-Information on Rehabilitation Centre -Stroke Care Guidelines -A Video/CD for stroke care -pamphlet for public awareness	5 years
Stroke Caregivers	Web	-Educational guidelines -Forum -Emotional Support -Rehabilitation Centre -important information on house renovation for stroke care	<sup>b</sup> years

Table 1 shows the key points that can be highlighted when designing an interface to deliver the information for stroke care. One most important finding that when designing WISS, the design should target and focus more on stroke caregivers and therapist instead of stroke patient, as the patient unable to move their body to search information from the internet.

##### B. Focus Group Discussion

Focus group discussion involved two groups. The session was conducted at stroke

rehabilitation centre within 1 hour for the session. Two groups participated which are i) English group and ii) Mandarin group. The participants are the stroke patient and stroke survivor. Each group has been assigned with one facilitator. Mandarin group is a group of people who can only speak Mandarin which involves eight respondents of stroke patients. The translation process from Mandarin to English is done by one of the stroke caregivers who 80% survives from the stroke. Meanwhile English group is group of people who can only speak English and it involves four respondents of stroke patients. Both group are currently receiving treatments at the rehabilitation centre.

Each group have to answer three questions which are:

1. When you had your first stroke attack?
2. What type of rehabilitation that you did here (NASAM)?
3. What type of information that you need at home?

Each group 's gives their own opinion based on the question asked. The objective of the focus group discussion is to identify main requirements they need that can be accessible when designing the website. All the results for the focus group activity are discussed below. The first group gives different opinion on stroke. The first group has three stroke patients accompanied by three stroke caregivers. Basically, the first group consisted of stroke patients who had major stroke attack. The group discussion is distracted with another issue as stroke caregivers use the opportunity to share the information with stroke patients they are taking care of. Besides, they could not answer directly the three questions asked, but they discuss on how hard their life to deal and manage with the emotional feeling with stroke patients. The stroke caregivers need some encouragement to manage stroke patients. Most of the time when the focus group is conducted, they just share their feeling towards stroke patients.

The second group consists of eight participants of stroke who have had their first stroke attack. Basically all eight stroke

patients could not speak in English and only can speak Mandarin. In this case, a translator who can understand both languages translate the discussion conversation. This person also is a stroke caregiver. Most of them are being accompanied by their caregivers, maid, son or daughter. Most of them had the first attack and had received physiotherapy from rehabilitation centres. The stroke patients need a caregiver at home to accompany them all the time. This focus group discussion also strengthens the point that stroke patients will not be the main person who needs the information. Instead, stroke caregivers are the person who handles everything and guides stroke patients. All the requirements needed is analysed and being recorded to be part of key words that can be used for designing WISS.

- |  |
|--|
| <ol style="list-style-type: none"><li>1. General Information on stroke</li><li>2. Emergency and education for patients</li><li>3. Videos</li><li>3. Life after stroke<ul style="list-style-type: none"><li>• Rehab and regaining independence</li><li>• Therapies</li><li>• Effect</li><li>• Warning signs of stroke</li><li>• Media</li><li>• Statistics</li><li>• Media stroke news</li><li>• Preparation of home renovation for patient</li><li>• How to avoid another stroke</li><li>• Exercise and fitness</li><li>• Diet plan</li><li>• Improving patient care</li></ul></li><li>4. Information from professional</li><li>5. Connecting others</li><li>6. Caregivers</li><li>7. Research findings</li><li>8. Program provided</li><li>9. Downloadable information</li><li>10. Contact<ul style="list-style-type: none"><li>• Links to government hospitals and rehab centers</li><li>• List of Donor</li><li>• Directory of nursing home</li><li>• Directory of volunteers</li></ul></li></ol> |
|--|

Fig. 2 : Results of card Sorting Activity

### C. Card Sorting Activity

Card sorting activity is a popular method to understand users 'opinion on the information, navigation and labelling within the site [14]. Card sorting activity is a knowledge-elicitation technique often used by information architects, interaction designers and usability professionals to establish or assess the navigation hierarchy of a Website. Card sorting is the activity where it involves a few people to select the card on what they really think that is necessary for them. The content of these card sorting comes from interview and the focus group discussion that have been conducted before. The total of card that was created is 120 cards that written the content of information extracted from the previous session conducted. Three respondents involved stroke caregivers and one stroke patients involved in this card sorting activity. The selection background of respondents is considered when they did the card sorting activity to ensure that the outcome of activity provides different perspectives. Figure 1 shows the summary and output of the main part of web navigation structure used for card sorting activity.

For the first participants, he does the card sorting activity within 15 minutes only. The first respondent just sorts the card according to what he understands from the written information on the card. The second respondent who is Chinese participants for card sorting activities understands the objectives of the card. She tries to sort according to what she wants WISS going to be. But some of the classified things such as video and images, she did not put all together. Meanwhile, third respondents who is stroke caregivers partially understand the words, sometimes he referred to the card coordinator to see the meaning of the card since he did not understand English so much. The fourth respondents who has a background of computer science is a stroke survivor student from local university. She able to complete the card within the timeframe given and shows the logic on arranging the card.

In order to find the best match and potential card to apply in WISS, there are certain things to consider in quickly derive easily-read, quantitative results from a card-sort activity, it can be done by entering data into a spread sheet template that is adaptable to any set of cards and categories provided. But this is only applicable if the card sorting respondent is more than 30. Since only four respondents involved in

WISS for the card sorting activity, the important criteria to be consider are 1) respondent background, 2) logical 3) similarity [15]. The fourth respondent is the most suitable criteria to be referred in terms of three criteria identified. Some similarity from the cards sorts by the respondents are also taken into consideration.

#### D. Prototyping

High fidelity prototyping is chosen as it is quite similar with the final products that allow user and developer to test the real functionality of the system developed. Four stages of prototyping involved in the design process involved three respondents from the same respondents of card sorting activity. They review the sketch of interface and provide feedback on the best design they prefer. Figure 2 shows prototyping of the sketch design for the main page. This will be the final product or user interface design that will be tested and verified with end user at the later stage.



Figure 3: Prototyping of final-product

### V. CONCLUSION

The study revealed that the respondents could not find any information system that provides information on stroke care is currently available at one portal in Malaysia. They hope that they can access information on stroke care through one single portal in Malaysia. Besides, the study presented web navigation structure for WISS that will be further evaluated with end-user. Hence, detail study is conducted to ensure that users are involved in each development process. UCD techniques implemented in the design process to ensure that each requirement

identified that involving users is implemented. The results of each activity conducted such as interviews, focus group, card sorting activities are documented throughout the whole process. There are some limitations on this study such as the wide involvement from different type of users could lead to more effective design. However, as a start, WISS will become a good start for portal development on stroke care in Malaysia applying UCD approaches.

### REFERENCES

- [1] Loo, K. W., & Gan, S. H. (2012). Burden of stroke in Malaysia. *International Journal of Stroke*, 7(2), 165-167.
- [2] Thammaroj, J., Subramaniam, V., & Bhattacharya, J. J. (2005). Stroke in Asia. *Neuroimaging Clinics of North America*, 15(2), 273-282.
- [3] Nordin, N. A. M., Aziz, N. A. A., Aziz, A. F. A., Singh, D. K. A., Othman, N. A. O., Sulong, S., & Aljunied, S. M. (2014). Exploring views on long term rehabilitation for people with stroke in a developing country: findings from focus group discussions. *BMC health services research*, 14(1), 118.
- [4] Schwamm, J. (2005). The evolving role of acute stroke imaging in intravenous thrombolytic therapy: patient selection and outcomes assessment. *Neuroimaging Clinic*; 15 (2): 421-440.
- [5] Cheah, W. K., Hor, C. P., Zariah, A. A., & Looi, I. (2016). A Review of Stroke Research in Malaysia from 2000-2014. *The Medical journal of Malaysia*, 71(Suppl 1), 58-69.
- [6] Walsh, M. E., Galvin, R., Loughnane, C., Macey, C., & Horgan, N. F. (2015). Community re-integration and long-term need in the first five years after stroke: results from a national survey. *Disability and rehabilitation*, 37(20), 1834-1838.
- [7] Fox, D., Sillito, J., & Maurer, F. (2008, August). Agile methods and user-centered design: How these two methodologies are being successfully integrated in industry. In *Agile, 2008. AGILE'08. Conference* (pp. 63-72). IEEE.
- [8] Uma, V., & Suseela, V. J. (2015). UCD Approach for the Management of User Services in University Libraries. *International Journal of Advanced Library and Information Science*, 3(1), pp-274.

- [9] Gkatzidou, V., Hone, K., Sutcliffe, L., Gibbs, J., Sadiq, S.T., Szczepura, A., Sonnenberg, P. and Estcourt, C., (2015). User interface design for mobile-based sexual health interventions for young people: design recommendations from a qualitative study on an online Chlamydia clinical care pathway. *BMC Medical Informatics and Decision Making*, 15(1), p.72.
- [10] Harte, R., Glynn, L., Rodríguez-Molinero, A., Baker, P.M., Scharf, T., Quinlan, L.R. and ÓLaighin, G., (2017). A human-centered design methodology to enhance the usability, human factors, and user experience of connected health systems: a three-phase methodology. *JMIR Human Factors*, 4(1).
- [11] Nazi, K.M., Turvey, C.L., Klein, D.M. and Hogan, T.P., (2018). A Decade of Veteran Voices: Examining Patient Portal Enhancements Through the Lens of User-Centered Design. *Journal of Medical Internet Research*, 20(7).
- [12] Benyon, D., Turner, P. & Turner, S. (2005). *Designing Interactive Systems: People, Activities, Contexts, Technologies(PACT)*. Addison-Wesley.
- [13] Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. Bainbridge, W. *Encyclopedia of Human-Computer Interaction*. Thousand Oaks: Sage Publications, 37(4), 445-456.
- [14] White, H., Wright, T. & Chawner, B. (2006). Usability evaluation of library online catalogues, *ACM 7<sup>th</sup> Australasian User Interface Conference*, Hobart, Australia, 50, 69 – 72.
- [15] Hudson, W. (2005). Playing your cards right: getting the most from card sorting for navigation design. *Interactions - HCI & Higher Education*, 12(5), 56-58.