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An m-health transitional care intervention delivered by nurses improves post-discharged outcomes of caregivers of patients with traumatic brain injury: A randomized controlled trial

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ABSTRACT

Introduction: Caring for patients with traumatic brain injury (TBI) during the transition period from hospital to home can be psychological challenging to caregivers.

Aim: To assess the effectiveness of a novel m-health transitional care intervention to reduce stress and burden of caregivers of patients with TBI and to reduce readmissions.

Methods: A randomized controlled trial with 74 caregivers of adult patients with moderate or severe TBI admitted to a referral hospital in Indonesia. An m-health application for android mobile phones was designed including education and information for caregivers. The application included an online chat feature, with weekly monitoring. The m-health transitional care intervention also included face-to-face education before hospital discharge. Primary outcomes were caregivers' stress and burden. Outcomes were measured at 3-time points; at hospital discharge (T0), two (T1) and four (T2) weeks post-discharge. Random Allocation Software was used to allocate study participants.

Results: Final analysis included data of 37 caregivers in the intervention group and 37 in the control group. Stress within the intervention group decreased over time ($p < 0.001$, MD = 11.05). Between both groups, stress was significantly different at T1 and T2 ($p < 0.001$). The caregiver burden showed similar results (T1 $p < 0.001$ and T2 $p < 0.001$). Only one patient in the control group was readmitted to the hospital.

Conclusion: The m-health transitional care intervention reduced stress and burden of caregivers of patients with moderate or severe TBI. Nurses should consider using m-health technologies to support caregivers from hospital into the community.

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Keywords: Caregiver burden; Caregivers; Telemedicine; Stress; Transitional care; Brain injuries.

INTRODUCTION

Traumatic Brain Injury (TBI) is a significant health concern that might cause disability as well as social and economic challenges among these patients.¹ Worldwide, approximately 69 million people are estimated to experience TBI every year due to various causes and is one of the leading causes of death and disabilities.² The overall incidence of patients with TBI is increasing, even during the COVID-19 pandemic.³ Although the epidemiology of TBI is changing due to more falls in older persons and less head, this is not observed in low- and middle-income countries.⁴ The main cause of TBI in low- and middle-income countries appears to be among male adults involved in road traffic accidents.⁵ Approximately 69 million people are estimated to experience TBI every year, with various causes.³ In 2017, a total of 2,000 people with TBI were admitted to a neurosurgery unit at a referral hospital in Indonesia.⁶ Of these, most people with TBI were male (80.8%) and below 60 years of age.⁶

Patients with moderate to severe TBI require support or other forms of care after hospitalization, even months or years after the injury.⁷ This condition makes the caregiver's role very important in the care of TBI patients at home. Consequences of caring for patients with TBI within a family setting can be challenging.⁸ These challenges include prolonged exposure to stress and tension between the patients with TBI and the caregivers. These tensions can affect social, emotional, and financial functioning within the family and challenges to the caregivers' core values.^{9,10} Problems experienced by caregivers of patients with TBI have a significant relationship with anxiety, and depression which can affect the quality of care they provide to patients with TBI at home after hospital discharge.¹¹ It has been suggested to develop intervention related to problem-solving coaching and education before the discharge of patients with TBI from the hospital, which can reduce the psychological symptoms in caregivers in the future.¹²

During the rehabilitation phase, caregivers of patients with moderate and severe TBI are responsible for fulfilling additional roles and have unique needs. These needs are often related to specific care and informational needs to support their new role in caring for their family member.¹³ Furthermore, additional strain due to the Covid-19 pandemic causes caregivers to face extra challenges. Caregivers living with TBI patients are finding new ways of adapting to the present context, which causes changes in the social and health care conditions.^{14,15}

In Indonesia, caregivers play a central role in care when patients with TBI are admitted to the hospital, up to treatment at home in the transition and rehabilitation phase. Currently, available nursing interventions in hospitals mostly focus on patients with TBI and not their caregivers. Therefore, the aim of this study is to assess the effectiveness of a novel m-health transitional care intervention to improve mental health of caregivers of patients with TBI in Indonesia. The hypothesis of our study was that a m-health transitional care intervention for caregivers of patients with TBI decreases stress and burden of caregivers compared to standard care.

METHODS

Trial Design

This study used a randomized controlled trial (RCT) design with three-timepoint measures. Caregivers of patients with TBI were divided into two groups: the intervention group (who receive the m-health transitional care intervention) and the control group (who receive standard care program) according to standard operating procedures applicable in the hospital. This study was conducted at a single center at Hasan Sadikin Hospital, Bandung, Indonesia, from January to May 2023.

Research ethics

This study was approved by The Research Ethics Committee of Center for Social and Behavioral Science IRB (Document Number: 2022-St-Nur-St-35), and The Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung (Document Number: LB.02.01/X.6.5/459/2022). The ethical principles in this study include (a) obtaining informed consent from potential research participants, (b) minimizing the risk of harm to participants; (c) protect anonymity and confidentiality; (d) avoiding using deceptive practices; and (e) give participants the right to withdraw from this research. The head nurse in the ward introduced the researcher to the potential subjects. The researcher explained the objectives of the study, the procedure, and the possible benefits and risks of the study participants. The participants received the information that they had the right to choose whether to participate in the program or withdraw at any time without any negative consequences. The participants verbally agree to participate in the program and completed the consent form. The researcher provided contact information for future reference, including a telephone number and address. The CONSORT statement guideline is used to report this study (Figure 1).¹⁶

Participants

The population in this study was caregivers of patients with moderate or severe TBI. All caregivers of these patients who were going to be discharge at Hasan Sadikin Hospital were recruited using the following the inclusion criteria: (a) Age 18 or older; (b) Family members who identifies self-identify as a responsible person in caring for patients with TBI at home or a main caregiver who has been assigned by other family members in caring for patients; (c) Caregivers who provide care of patients with moderate or severe TBI; (d) Able to communicate, read, write and speak Indonesian well; (e) Have an android phone and can operate it well; and (f) Have a measurement score of The Preparedness for Caregiving Scale (PCS) <16. The PCS is a caregiver self-rated instrument that consists of eight items that asks

caregivers how well prepared they are. Responses are rated on a 5-point scale with scores ranging from 0 (not at all prepared) to 4 (very well prepared). The scale is scored by calculating the mean of all items answered with a score range of 0 to 4. A total score of less than 16 indicates that the caregiver is not well prepared for hospital discharge.

The exclusion criteria in this study were caregivers for patients with TBI with comorbidities (heart disorders, kidney disorders, and diabetes mellitus). In addition, caregivers for TBI patients who will move locations outside of West Java Province after hospitalization or were sick at hospital were also not included in this study.

Development of intervention

The development of this program consisted of five stages, including: (1) searching the literature regarding the problems and caregiver needs in caring of TBI patients during the transition from hospital to home and interventions that can be provided; (2) developing the program, which includes educational modules and m-health applications adapted to caregiver conditions; (3) test the program content and educational modules by three experts (2 experts from Indonesia and one expert from Thailand); (4) refinement of modules and programs according to suggestions from experts; and (5) test the feasibility of applications.

Intervention

The m-health program application prototype concept was designed to assist the need for intervention in providing patient care during the transition of patients with TBI from hospital to home (Figure 2). This program begins with education and face-to-face information meetings with caregivers using flipcharts and demonstration of caring skills. The m-health application provided an overview of interventions carried out by caregivers of patients with TBI while at home. This application provided education and information for caregivers

regarding (a) how to treat patients with TBI at home, which includes craniotomy wound care of and how to provide nutrition, (b) recognize signs of infection in wounds of craniotomy, (c) recognize emergencies in cases of TBI patients at home, (d) stress management, and (e) how to arrange a schedule for the care of patients with TBI at home. This program complements routine care, which consists of education about physical health and TBI medical problems, and how to treat patients with TBI at home.

When patients with TBI was still being treated at the hospital, researchers would provide face-to-faced education to the caregivers about the components contained in m-health. The m-health application was a caregiver-assisting tool for remembered educational materials supplied by researchers while in the hospital so that the caregivers could access educational materials quickly and easily, accompanied by educational videos that could made treated patients with TBI at home more accessible. An online chat service within the m-health application allowed chat communication between nurses and caregivers at home. A feature also provided a contact numbered when the caregiver had problems or needed assistance in cared for patients at home.

The m-health programmed was also accompanied by monitoring and follow-up telephoned conversations to support the caregivers of patients with TBI and assist in solved caregivers' problems during the transition from hospital to home. The m-health application used an android-based operating system. Application development on the android platform used the Framework fluttered programming language. In addition, Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver models. The kernel also acted as an abstraction layer between the hardware and the rested of the software stack (Figure 4).

Outcomes

The primary outcomes were stress transition and caregiver burden. The secondary outcome was readmission of patients with TBI.

The stress transition was measured using the previously published Caregiver Stress Self-Assessment, a modified version containing a list of 20 statements that reflect how people feel when taking care of another person.¹⁷ After each statement, the answer option scale is Never = 0, Rarely = 1, Sometimes = 2, Quite Frequently = 3 Nearly always = 4. Total scores were the sum of all 20 items: min 0 to max 80.

Caregiver burden was measured using the Short- Zarit Burden Interview (ZBI), which gives a complete evaluation of each goal and subjective burden. It is one of the most customarily used burden measures and verified in many culturally and ethnically diverse populations.¹⁸ The Short- Zarit Burden Interview (ZBI) is a 12-item instrument for measuring the caregiver's perceived burden of providing family care. The 12 items are assessed on a 5-factor Likert scale. Items one to ten have positive statements with values ranging from 0 = 'never' to 4 = 'nearly continually.' While items number 11 and 12 have negative questions, with values ranging from 0 = 'nearly continually' to 4 = 'never. ' Item ratings introduced to gave a completed rating, ranging from 0 to 48, with higher scores indicating extra burden.

The readmission rate of patients with TBI monitor through the hospital's medical record database. All instruments used the back translation technique from English to Bahasa Indonesia. Item validity was carried out with 30 caregivers of patients treated at Hasan Sadikin Hospital before commencing the study. The item validity test was analyzed using IBM-SPSS version 26.0. The range of the corrected item-total correlation of the instruments were from 0.69 to 0.95. The Cronbach's alpha values were 0.88 to 0.91.

Sample size estimation

A power of 0.80 at an alpha level of 0.05 requires an adequate approximation of the n as given by the two groups' mean formulas.¹⁹ Powell, et al.'s study (2016)²⁰ findings were used to determine the effect size. This randomized controlled trial investigated the effectiveness of telehealth in improving self-management of the caregivers of patients with TBI. Using Cohen's formula, the effect size (d) was 0.20 ($p < 0.05$). Subsequently, we used the formula from Cohen to estimate the sample size by considering the given significant criterion of $\alpha = 0.05$, power = 0.80, where $\mu_1 = 42.1$, $\mu_2 = 49.9$, $SD_1 = 11$, and $SD_2 = 11.3$), and desired effect size was (d)=0.20, indicating the minimum required sample size of 31 participants per group. In addition, 20% more participants were added per group to overcome an anticipatory dropout, yielding a sample size of 37 study participants per group.

Random assignment

The Random Allocation software version 2.01 program was used to randomize participants into the intervention group or the control group. Random Allocation software has been produced to support the first type of randomization. The software is free to download and provides an output in the allocation order based on the selected blocking type. The research assistant carried out the randomization process, to which the principal researcher was blinded.

Threats to internal validity

Maturation: the strategy to overcome this problem in this study is to have a parallel control group to equally consider the effect of maturation for both groups. In the control group, at the end of the study, the researcher asked about the caregiver's activities that can be related to the research outcomes, for example, attending a seminar or workshop regarding the care of patients with TBI at home.

Statistical regression: In this study, random assignment of participants to each group can help eliminate this problem. Also, the coding process and statistical analysis was carried out by third parties (statisticians) to reduce bias in the results and conflicts of interest.

Selection bias: We used randomized sampling process used to avoid this study's threat. In addition, the chi-square test, Fisher's exact test, and independent t-test were used to confirm the homogeneity of background characteristics and mean scores of hospital discharge readiness, stress transition, and caregiver burden at baseline in both groups.

Mortality: in this study, a small payment of one hundred thousand rupiahs to each participant helped with the cost of the android data package. Furthermore, the researcher ensured consistent participation throughout the study. In addition, researchers also conducted monitoring through Online Chat and telephones as monitoring and follow-up methods.

Diffusion or imitation: the researcher used the account and password to access the program so that the control group could not access the program. Also, the researcher just used one participant in one room.

Statistical Methods

The numerical data types, namely age, patient length of hospital stays, income, and readiness of hospital discharge, are presented in the form of mean, median, standard deviation, minimum value, and maximum value. The categorical data, namely gender relationship with patients, education level, stress transition, caregiver burden, and the incidence of readmission of the patients are presented in percentages/proportions. The chi-square test, Fisher exact test, and likelihood ratio tested the equivalence of the proportion of demographic data between the control group and intervention group.

The researcher tested the assumption of the normality and homogeneity of variance of data sets. Assumptions of dependent variables: readiness of hospital discharge, stress transition, and caregiver burden as measured by the intervention and control groups are continuous data. This study examined the effect of the m-health intervention over time during program implementation. One-way repeated-measures analysis of variance (one-way RM-ANOVA) compared the difference across the three-timepoints.

Feasibility study

Before starting this research, the researcher conducted a pilot study on 7 caregivers to determine the feasibility of the proposed study intervention to improve the later study quality and efficiency. The pilot study was performed on seven caregivers of patients with TBI who have the same characteristics as the research inclusion criteria. The initial findings showed that all subjects experienced a decrease of stress transition and caregiver burden at two weeks and one-month post-discharge follow-up. High satisfaction scores on mHealth were also reported and no patient was readmitted.²¹

RESULTS

The study included 74 caregivers who met the inclusion criteria. The participants were divided into two groups: the intervention group (n=37) and the control group (n=37) (Figure 1). The distribution based on the characteristics of the patients with moderate and severe TBI are presented in Table 1. No differences were observed between both groups of patients. The data showed that in both the control and intervention groups, before discharge, all patients had craniotomy wounds and experienced pain, and most of them had a nasogastric tube. Some patients use urinary catheters and tracheostomies, had difficulty moving and experience visual disturbances. At a follow-up visit one month after discharge, the surgical wound was

dry, and most patients no longer used a nasogastric tube, urinary catheter, or tracheostomy, especially in patients with a severe head injury. General complaints of pain in both groups decreased, and some patients still experienced mobility and visual disturbances.

Table 2 presents the characteristics of the caregivers in the intervention group, the mean caregiver age was 43.4 ± 9.1 years. The mean days of caregivers caring of patients was 4.16 ± 1.2 days. In the control group, the mean age of caregivers was 44.1 (SD 8.4) years. The mean days of caregivers caring of patients was 4.27 (SD 1.1) days. In the intervention group, most caregivers were female (89.2%), who had a spousal relationship (48.6%) and had moderate education (54.1%). In the control group, most caregivers were female (78.9%) who had a spouse relationship (51.4%) and had moderate education (51.4%).

In the intervention group, before discharge, the mean stress transition score was 28.59 (SD 5.4), while two weeks after discharge, the score decreased to 22.84 (SD 3.1) and decreased further to 17.49 (SD 2.1) at one month after discharge. Over time across the three timepoints the difference of the mean stress transition score was significantly less ($p < 0.001$). The mean stress transition scores across time in the control group was not significant ($p = 0.054$) (Table 3).

At discharge, the difference of the mean stress transition scores between two groups was not significant ($p = 0.112$). However, we observed significant difference of the mean stress transition scores between both groups at two weeks after discharge ($p < 0.001$) and one month after discharge ($p < 0.001$) (Table 3).

In the intervention group, before discharge, the mean caregiver burden score was 19.78 (SD 3.5), while two weeks after discharge, the score decreased to 15.03 (SD 2.1) and decreased further to 11.62 (SD 1.5) at one month after discharge. Over time across the three timepoints the difference of the mean caregiver burden scores was significantly decreased ($p < 0.001$). The mean caregiver burden scores across time in the control group was not

significant ($p=0.056$) (Table 4).

At discharge, the difference of the mean caregiver burden scores between two groups was not significant ($p=0.072$). The difference of the mean caregiver burden scores between both groups at two weeks after discharge was significant ($p<0.001$) as well as at one month after discharge ($p<0.001$) (Table 4).

The secondary outcome was the patient readmission; one patient experienced readmission in the control group, whereas no patient underwent intervention in the experiment group.

DISCUSSION

The aim of our study was to investigate the effects of a new m-health supportive care transition program on response patterns (stress transition and burden of caregiving) among caregivers of patients with TBI as well as patients' readmission rate at one month after hospital discharge. The main results of our study showed the m-health application combined with verbal information and education to caregivers of patients with TB resulted in less stress and burden compared to the caregivers in the control group.

Providing information in several sessions can increase caregiver's knowledge and competence in caring for patients with TBI at home. A recent study identified that providing education combined with a network of healthcare professionals, caregivers were better prepared to care for patients with TBI.²² The provision of education in our study was carried out through a combination of face-to-face and a bespoke m-health application. Teaching skills through demonstration to caregivers to better support patients after hospital admission can improve quality of life and independence and reduce the burden of distraction for patients and caregivers.²³ With education and training with bespoke materials, caregivers can try to

perform the expected skills, and nurses can quickly evaluate the skills of caregivers before the patient returns home.

In our study, caregivers in both groups had a high mean stress transition scores during discharge, although the intervention group had a lower score than the control group. Similarly in another study, the caregivers demonstrated increase pressure of caring for patients with TBI at pre-discharge (45%), one month after discharge (48%), and three-month post discharge (27%).²⁴ In the two groups of our study, we observed a decrease in mean stress transition scores at two weeks and one month after discharge. However, the statistical analysis showed that only the intervention group had a decrease in the mean stress transition scores at two weeks and one month after discharge.

M-health can provide information to the caregivers' needs while caring for patients, including how to manage stress. They can easily repeat information by consulting the application on their mobile phones. The literature concluded that information could improve knowledge and recommend active education strategies that include participant's involvement including repeated educational episodes for reinforcement and clarification.²⁵ In our study we also conducted monitoring and follow-up via telephone in the experiment group, and caregivers were allowed to consult through the Online Chat feature in the m-health transitional care program. This component was also allegedly able to influence the decrease in the stress transition score in the experiment group at two weeks and one month after discharge. Based on the research results, caregivers of patients with TBI with easier access to communicate and consulting with healthcare workers have better psychological outcomes than caregivers who live in villages and have difficult access to health services.²⁶ These benefits can be drawn from implementing an Android-based program in this study. Other literature suggests that attractiveness of rehabilitation technology in adults with TBI, their caregivers, and healthcare experts are useful for improving patient outcomes.²⁷

Similar to stress transition, the caregiver burden might increase when limited support is provided to caregivers and they will be challenged by increased physical and mental health burdens.²⁸ Providing information about patients with TBI will help reduce the caregiver burden in caring for these patients.²⁹ It has been identified that caregivers who experience higher burden scores are caregivers with patients whose conditions do not significantly improve, such as patients with Glasgow Coma Scale values that do not increase and immobile mobilization abilities, so that caregivers must spend a lot of time and energy a lot in treating patients.³⁰

Limitations

There are several study limitations to address. The blinding of intervention and patients was only possible in the data analysis where the researcher was blinded to the data of the study participants. Another limitation is the generalizability of our study findings because of our small group size and single centre. A limitation of our study is also related to the m-health technology and its content. The application included only the main education materials. However, we have designed the content with a sample of caregivers who reviewed the content before using the application in our study. Another limitation is related to the confounding factors which have not been explored in-depth including the economic impact of caring for a patient with moderate or severe TBI at home. Finally, our timeframe included up to 4 weeks post hospital discharge. Long-term follow-up is needed to understand the impact of caring for patients with TBI over a longer period.

CONCLUSION

Our study demonstrated that the m-health transition care program reduces the transition stress and caregivers' burden of caregivers caring for patients with moderate and severe TBI. The implication for nursing practice relates to the opportunities and benefits of using m-health technologies in clinical settings as well as in community settings, particularly in low- and middle-income countries where transitional care has limited support in the community. Developing a bespoke m-health transitional care program for chronically ill patients with dependent care needs, co-designed with patients, carers, and nurses, might improve the quality of care and reduce burden of carers in the community.

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CONFLICT OF INTEREST

All authors stated that there was no conflict of interest in this study.

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Table 1. The demographic of patients with moderate or severe TBI in both group (N= 74)

Variables	Intervention group (n=37)	Control group (n= 37)	Homogeneity of test (p-value)
Age (year)			0.501
Mean (SD)	35.2 (13.9)	38.9± (6.6)	
Min-max	18-69	18-75	
<hr/>			
Glasgow Coma Scale			
Pre-discharge			0.675
Mean (SD)	12.7 (0.52)	12.8 (0.69)	
Min-max	11-13	11-13	
One-month after discharge			0.544
Mean (SD)	14.3 (0.84)	14.4 (0.67)	
Min-max	12-15	12-15	
<hr/>			
Gender			0.633
Male: n (%)	29 (78.4)	27 (73)	
Female: n (%)	8 (21.6)	10 (27)	
<hr/>			
Diagnosis			0.255
Moderate: n (%)	30 (81.1)	31 (83.8)	
Severe: n (%)	7 (18.9)	6 (16.2)	
<hr/>			
Patient's condition			
Pre-discharge			
Craniotomy wound: n (%)	37 (100)	37 (100)	
Nasogastric Tube: n (%)	21 (56.7)	22 (59.4)	
Dower Catheter: n (%)	10 (27)	8 (21.6)	
Tracheostomy: n (%)	3 (8.1)	2 (5.4)	
Pain: n (%)	37 (100)	37 (100)	

Disability to move: n (%)	12 (32.4)	14 (37.8)
Vision loss: n (%)	4 (10.8)	4 (10.8)
One-month after discharge		
Craniotomy wound: n (%)	37 (100)	37 (100)
Nasogastric Tube: n (%)	8 (21.6)	10 (27)
Dower Catheter: n (%)	5 (13.5)	3 (8.1)
Tracheostomy: n (%)	0 (0)	1 (2.7)
Pain: n (%)	6 (16.2)	8 (21.6)
Disability to move: n (%)	8 (21.6)	9 (24.3)
Vision loss: n (%)	4 (10.8)	4 (10.8)

Table 2. The characteristics of caregivers of patients with moderate or severe TBI (N= 74)

Variables	Intervention group (n=37)	Control group (n= 37)	Homogeneity of test
Age (year)			0.435
Mean (SD)	43.4 (9.1)	44.1 (8.4)	
Min-max	24-60	23-60	
Length of patient care			0.419
Mean (SD)	4.16 (1.2)	4.27 (1.1)	
Min-max	2-7	2-7	
Total income per month			0.815
Mean (SD)	3.450.000 (534.4)	3.250.000 (654.4)	
Min-max	2.100.000-5.600.000	2.000.000-6.000.000	
Gender			0.640
Male: n (%)	4 (10.8)	8 (21.6)	
Female: n (%)	33 (89.2)	29 (78.4)	
Relationship with patient			0.537
Spouse: n (%)	18 (48.6)	19 (51.4)	
Parent- child: n (%)	15 (40.6)	16 (43.2)	
Sibling: n (%)	4 (10.8)	2 (5.4)	
Education			
Low: n (%)	15 (40.5)	15 (40.5)	
Moderate: n (%)	20 (54.1)	19 (51.4)	
High: n (%)	2 (5.4)	3 (8.1)	

Table 3. Comparison of the stress transition at discharge, two weeks after discharge, and one month after discharge between and within two groups (n=74)

Stress transition	n	T ₀	T ₁	T ₂	p-value
		Mean (SD)	Mean (SD)	Mean (SD)	
Control	37	29.38 (4.5)	26.18 (4.5)	23.24 (6.3)	0.054
Intervention	37	28.59 (5.4)	22.84 (3.1)	17.49 (2.1)	<0.001
p-value		0.112	<0.001	<0.001	

T0=discharge; T1=two weeks after discharge; T2=one month after discharge.

Table 4. Comparison of the caregiver burden at discharge, two weeks after discharge, and one month after discharge between and within two groups (n=74)

Caregiver burden	n	T ₀	T ₁	T ₂	p-value
		Mean (SD)	Mean (SD)	Mean (SD)	
Control	37	22.11 (3.0)	22.62 (2.9)	21.59 (3.1)	0.056
Intervention	37	19.78 (3.5)	15.03 (2.1)	11.62 (1.5)	<0.001
p-value		0.072	<0.001	<0.001	

T0=discharge; T1=two weeks after discharge; T2=one month after discharge.

Figure 1. CONSORT Flow Diagram

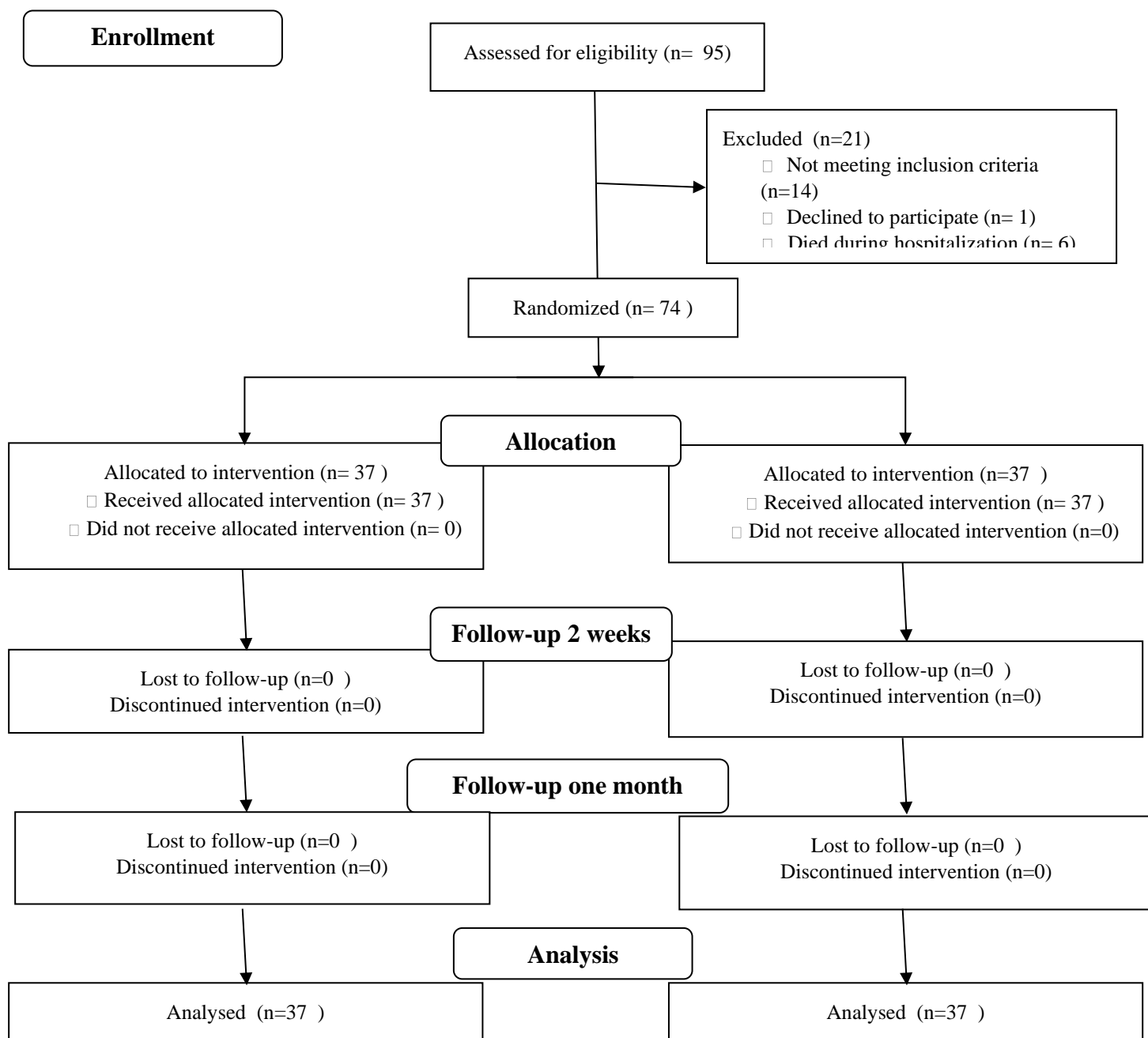


Figure 2. Scheme of intervention

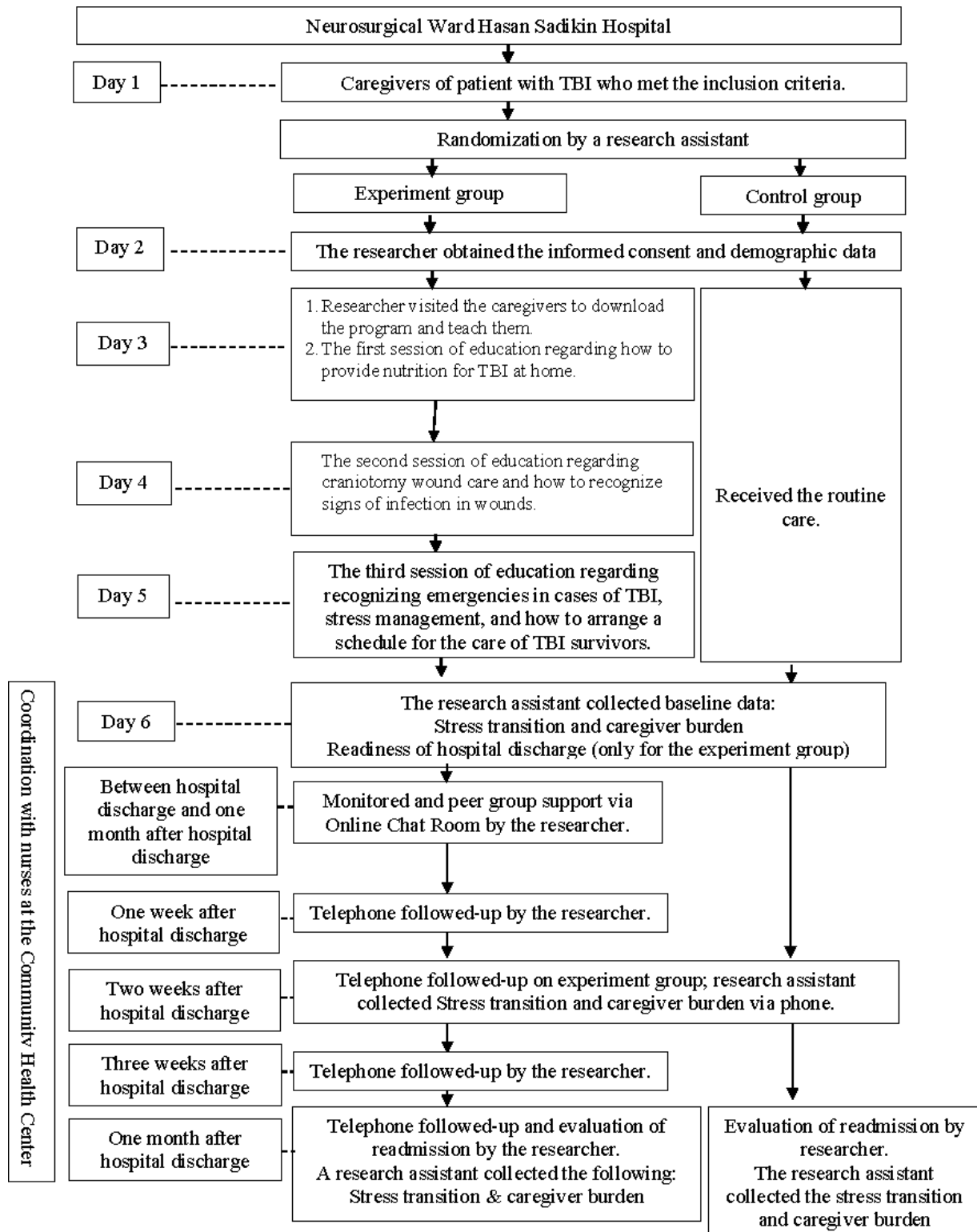


Figure 3. The prototype of m-health transitional care program

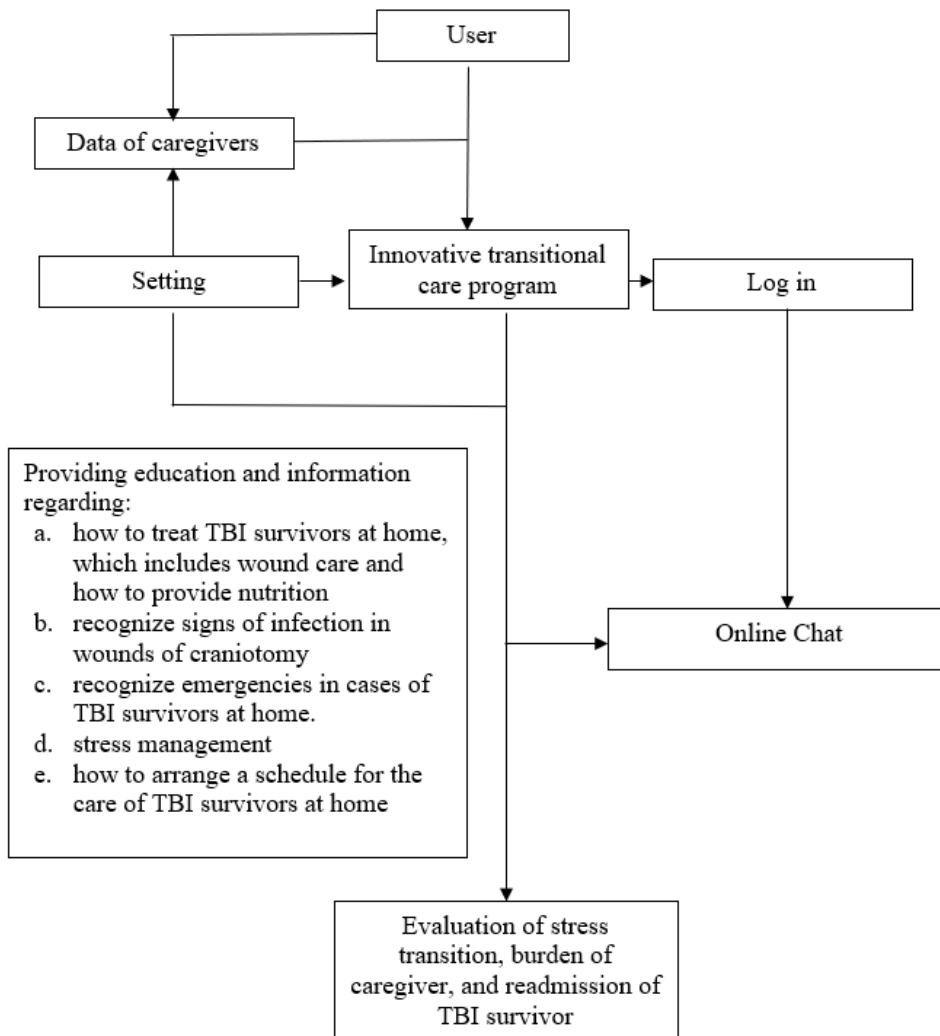


Figure 4. M-health transition care program application

