



Research article

Readiness for hospital discharge post-initial invasive percutaneous transhepatic biliary drainage: A mixed-methods study

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ABSTRACT

This study explores perceptions regarding hospital discharge readiness among patients with post-first invasive percutaneous transhepatic biliary drainage (PTBD), family caregivers, and healthcare providers who are involved during the discharge period. A convergent mixed-method design was applied. A purposive sample of 30 patients completed a scale measuring readiness for hospital discharge, and 30 participants, including patients, family caregivers, and healthcare providers, participated in in-depth interviews. Descriptive analyses were combined with quantitative data, thematic analyses with qualitative data, and joint displays with mixed analyses. Findings indicate that readiness for hospital discharge was high, the expected support subscale was at the highest possible level, and the personal status subscale was at the lowest level. Three main themes emerged from an analysis of the interview transcripts: improved health conditions, self-care knowledge, and homecare preparedness. Self care knowledge had three sub-themes: taking care of biliary drainage, consuming a suitable diet, and observation of abnormal symptoms. Being ready for hospital discharge contributes to a safer transition from hospital to home. Healthcare providers need to reconsider the criteria for discharge and clarify patients' individual needs. Patients, family caregivers, and healthcare providers need to be prepared for hospital discharge.

1. Introduction

Percutaneous transhepatic biliary drainage (PTBD) is an alternative palliative treatment for malignant obstructive jaundice - a condition comprised of a group of diseases mostly caused by liver and bile duct cancers [1]. In recent years, its prevalence has increased following the rise of these conditions. These cancers were the sixth most diagnosed types globally and the third-leading cause of cancer-related deaths worldwide in 2020, with approximately 906,000 cases and 830,000 deaths [2]. In Thailand, the leading cause of death listed on death certificates was cancer. Among malignant neoplasms in Thailand in 2016 and 2020, liver and bile duct cancers had the highest mortality rates per 100,000 people. These statistics have demonstrated a gradual increase [3].

Malignant obstructive jaundice can lead to hyperbilirubinemia, anorexia, pruritus, cholangitis, septicemia, and liver failure. Generally, surgical resection remains the primary treatment for malignant obstructive jaundice. However, in numerous cases, malignant obstructive jaundice is first detected at an advanced stage. For patients that cannot undergo surgery, urgent treatment is

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required to improve hepatic function and to facilitate the addition of subsequent anti-tumor therapy to a treatment regimen [4]. PTBD is an interventional procedure that locates obstructions and/or inserts a temporary catheter to drain bile. It exhibits good clinical efficacy, few complications, and leads to limited patient suffering. The median progression-free survival duration for such patients is eight months, while the median overall survival is approximately one year [5]. Patients and their caregivers require adequate education regarding the maintenance and management of PTBD for treatment success, defined as reductions in post-PTBD complications [6,7].

Current standards of healthcare service delivery in Thailand and other countries suggest that patients should be discharged 1–2 days after their PTBD insertions [8,9]. This standard, based on the average length of hospital stays, has been implemented to reduce costs [10,11]. However, cost reduction also depends on a reduction in use. Patients with PTBD insertions require adequate educational intervention to develop a sense of mastery in how to maintain and manage the insertions. Otherwise, they may experience severe adverse complications and require subsequent extensive tertiary healthcare service interventions [6,12–14].

Readiness for hospital release includes evaluation of a patient's ability to be discharged to home [15]. The evaluation includes four dimensions: 1) personal status, the physical-emotional state of a patient immediately before discharge; 2) knowledge, the perceived adequacy of information needed to respond to common concerns and problems in a post-hospitalization period; 3) coping ability, the patient's ability to self-manage personal and healthcare needs after discharge; and 4) expected support, the emotional and instrumental assistance available following hospital discharge [16]. Discharge readiness can measure a patient ability to assume responsibility for and to adhere to treatment recommendations at home [14,15,17–20]. There is limited knowledge regarding post-invasive PTBD of liver and bile duct cancers; furthermore, there is no published data on perceptions of patients, caregivers, and healthcare providers regarding patient readiness for discharge. Given the links between reductions in severe post-discharge complications and in utilization of healthcare services/cost, an important first step is to identify perceived readiness for discharge. This study explored perceived readiness for hospital discharge among patients with liver and bile duct cancers post-first invasive PTBD, as well as that of family caregivers and healthcare providers who are involved in the discharge process.

2. Materials and methods

A convergent parallel mixed-methods design was used, in which both qualitative and quantitative data were collected in parallel, analyzed separately, and then merged [21]. The quantitative strand comprised patient scores regarding levels of readiness for hospital discharge. The qualitative strand clarified the readiness for hospital discharge from the perspectives of patients, family caregivers, and healthcare providers.

2.1. Sample and setting

This study was conducted in a university teaching hospital with a capacity of 1,800 beds and a tertiary referral status. Two wards from the surgical department collaborated on this study.

Thirty patients participated in the quantitative study. Patients eligible for inclusion in the survey had been diagnosed with liver or bile duct cancers from Aug. 1, 2019–Dec. 31, 2020; had received PTBD as a treatment course; were 18 years or older; could clearly communicate in the Thai language; were willing to participate; and had received approval from their healthcare providers. Patients with cognitive impairments were excluded.

Thirty individuals involved in a hospital discharge were invited to participate in the qualitative study, of whom 10 had been diagnosed with and treated for liver cancer or bile duct cancer, 10 were healthcare professionals, and 10 were family caregivers. Healthcare providers were eligible if they were physicians or nursing professionals directly involved in providing healthcare services to patients diagnosed with hepatocellular carcinoma or cholangiocarcinoma, able to clearly communicate in the Thai language, and willing to participate in this study. Eligible caregivers included family members who would provide direct patient homecare, were able to clearly communicate in the Thai language, and were willing to participate.

2.2. Research instruments

2.2.1. Questionnaires

The main instrument was a Thai version of the Readiness for Hospital Discharge Scale (RHDS). The original English version of the RHDS, containing 23 items in two parts, was developed by Weiss et al. Weiss & Piacentine [15,16] and translated into Thai by Sriprasong et al. [22]. First, a dichotomous yes/no question asked whether a patient was perceived as being ready for discharge. The remaining 22 items were divided into four subscales: personal status (7), knowledge (8), coping ability (3), and expected support (4). Responses were rated on a scale that ranged from 0 (*never*) to 10 (*always*). Readiness for discharge scores included: *very high* (9–10), *high* (8–8.9), *medium* (7–7.9), and *low* (<7). Thai version reliability was evaluated in a pilot study with 10 patients within the same hospital who had health conditions similar to those of the participants. Cronbach's alpha was 0.8, indicating acceptable internal consistency. Further sections were included to obtain sociodemographic information and other basic characteristics paralleling treatment details.

2.2.2. Semi-structured interviews

Semi-structured in-depth interview guides were developed based on a literature review [15,16,23]. They were evaluated by three experts and tested on two patients with bile duct cancer who had undergone invasive PTBD. Further sections were included to obtain

Table 1
Sociodemographic and clinical characteristics of primary liver cancer (N = 30).

Characteristics	n	%
Sex		
Men	21	70
Women	9	30
Age (years, range = 46–80, \bar{X} = 62.93, SD = 9.34)		
41–50	4	13.3
51–60	7	23.3
61–70	13	43.3
71–80	5	16.7
81–90	1	3.3
Education level		
Unlettered	1	3.3
Primary school	3	10.0
Secondary school	25	83.3
Bachelor	1	3.3
Marital status		
Single	3	10
Married	23	76.7
Widow/divorce/split up	4	13.3
Religion		
Buddhist	29	96.7
Islam	1	3.3
Current occupation		
No occupation	11	36.7
Merchant	3	10
Farmer gardener	10	33.3
Freelance	5	16.7
Miscellaneous	1	3.3
Family income/month		
Less than 5,000 Baht	14	46.7
5001–10,000 Baht	8	26.7
10,001–20,000 Baht	4	13.3
20,001–30,000 Baht	3	10
30,001–40,000 Baht	1	3.3
Sufficient income		
Yes	14	46.7
No	16	53.3
Source of income		
Occupation	17	56.7
Pension	1	3.3
Savings	1	3.3
Allowance	11	36.7
Source of support for medical expenses		
Gold privilege	23	76.7
Civil servant welfare	3	10
Social security scheme	4	13.3
Living arrangement		
Live alone	3	10
Living with spouse	4	13.3
Living with spouse and descendant	18	60
Living with descendant and relative	5	16.7
Caregiver after discharge		
Spouse	13	43.3
Descendant	13	43.3
Relative	2	6.7
Neighbor	1	3.3
Miscellaneous	1	3.3
Length of diagnosis with illness (\bar{X} = 62.97, SD = 48.63)		
1–90 days	26	86.7
91–120 days	2	6.7
121–365 days	2	6.7
Planned to get treatment?		
Yes	22	73.3
No	8	26.7
Length of hospitalization		
Less than 15 days	26	86.7
For 16–30 days	4	13.3

Abbreviations: SD, standard deviation; n, number.

sociodemographic information and other relevant data.

2.3. Data collection

After approvals were obtained from the Human Subjects Ethics Committee and the Department of Surgical Specialty, qualitative and quantitative data were collected simultaneously. At the time of discharge, nurses provided discharge education, including diet guidance, catheter care, instructions on bathing, how to change dressings, and permissible activities. Patients were also advised on abnormal conditions, medications, resources for consulting, and follow-up dates. The researchers identified eligible patients based on suggestions from nurses in a surgical ward. The researchers asked potential participants about their willingness to participate in this study. After receiving informed oral consent, participants were required to complete questionnaires and informed that they could withdraw from the study at any time. Questionnaires had a 30 min time limit and were completed by 30 patients. The researcher checked each questionnaire for completeness to avoid missing data. After submission of the questionnaires, 10 interested patients were asked to also take part in an interview.

Ten healthcare providers and 10 family caregivers participated in interviews. Researchers conducted in-person interviews of family caregivers at the time of patient discharge while healthcare providers were interviewed at their convenience. The researchers explained the objectives and scope of the study to patients before obtaining written consent forms. Following an interview guide, interviewers asked open-ended questions to explore participants' perception of readiness for hospital discharge. Questions included: are you (patient)/client/relative ready to go home and how?; how will the patient care for themselves (patient)/client/relative when staying at home?; have you received enough information to care for yourself (patient)/client/relative at home?; and, how have you obtained enough support to care for yourself (patient)/client/relative at home? Each interview was privately conducted and lasted 30–50 min, or until data saturation was reached.

2.4. Ethical considerations

This study was approved by the Institutional Review Board of the Faculty of Nursing, Chiang Mai University (no. 090/2019). The study procedure was explained to all participants, and they were informed of their right to withdraw at any time, and ensured that their choices would not affect their medical treatment. All participants provided informed written consent and were compensated with travel fees or payments. All data were recorded anonymously and kept confidential.

2.5. Data analysis

2.5.1. Quantitative data analysis

Quantitative data were analyzed using descriptive statistical analysis, including frequencies, means, and percentages of readiness for hospital discharge.

2.5.2. Qualitative data analysis

The qualitative data were analyzed using thematic analysis, consistent with a method used by Ryan [24]. The interview tapes were transcribed, and the researcher read the texts multiple times to identify and analyze the main themes. The sub themes were also identified.

2.6. Integration

After both quantitative and qualitative data were analyzed, preliminary results were presented to and discussed by the co-authors. Comparative themes and sub-themes identified in the qualitative data analysis were merged with the quantitative results. Hence, it was possible to explore the consistency, explanations, and any divergences between quantitative and qualitative data [21].

Table 2
Scores for RHDS and subscales (N = 30).

RHDS	n	(%)	Mean	SD
No	1	3.3		
Yes	29	96.7	8.02	1.12
Sub-scale			Mean	SD
Personal status			6.74	0.75
Knowledge			7.78	1.67
Coping ability			8.42	1.74
Expected support			8.89	1.21

Abbreviations: SD, standard deviation; n, number; RHDS, Readiness for Hospital Discharge Scale.

3. Results

3.1. Quantitative results

3.1.1. Patient characteristics

This study included 30 patients: 21 men (70%) and nine women (30%). The mean age of the respondents was 62.93 years. Most participants (86.6%) planned to be cared for post-discharge by their spouses and/or descendants. The mean length of illness was 62.97 days. The mean length of hospitalization until discharge was 11.47 days. Other information is presented in [Table 1](#).

3.1.2. Scores for perceived readiness for hospital discharge

As shown in [Table 2](#), 96.7% (n = 29) of respondents answered yes to the question, "Are you ready for hospital discharge?". The overall readiness for hospital discharge was high ($\bar{X} = 8.02$, $SD = 1.12$). Expected support received the highest mean score of the four dimensions ($\bar{X} = 8.89$, $SD = 1.21$), followed by coping ability ($\bar{X} = 8.42$, $SD = 1.74$), knowledge ($\bar{X} = 7.78$, $SD = 1.67$), and personal status ($\bar{X} = 6.74$, $SD = 0.75$).

3.2. Qualitative findings

Thirty participants, including 10 patients, 10 family caregivers (one spouse, five offspring, four relatives), and 10 healthcare providers (one doctor, six registered nurses, and three practical nurses), were interviewed to understand readiness for hospital discharge ([Table 3](#)). Three main themes emerged from the analysis, including improved health condition, self-care knowledge and preparedness for homecare.

3.2.1. Improved health condition

The main concern about hospital discharge readiness involved patients' health status. Ensuring that patients could manage self-care at home required physical stability, stable vital signs, adequate laboratory results, adequate intake and output, minimal bleeding, pain

Table 3
Sociodemographic and clinical characteristics of participants (N = 30).

Characteristics	Type of participant		
	Patient n (%)	Caregiver n (%)	Healthcare provider n (%)
Sex			
Men	6 (60%)		1 (10%)
Women	4 (40%)	10 (10%)	9 (90%)
Age (years)			
21–40			
41–60	4 (40%)	4 (40%)	2 (20%)
61–80	6 (60%)	6 (60%)	8 (80%)
Religion			
Buddhist	10 (100%)		
Islam			
Occupation			
Non-occupation	5 (50%)	2 (20%)	
Agriculture	3 (30%)	1 (10%)	
Employee	2 (20%)	3 (30%)	
Private company employee		2 (20%)	
Miscellaneous		2 (20%)	
Physician			1 (60%)
Nurse			6 (30%)
Practical nurse			3 (30%)
Level of education			
Non-education	1 (10%)		
Primary school	8 (80%)	3 (30%)	
Secondary school		3 (30%)	
High school		1 (10%)	
Diploma		3 (30%)	2 (20%)
Bachelor	1 (10%)		6 (60%)
Higher than bachelor			2 (2%)
Relationship with patient			
Spouse		1 (10%)	
Offspring		5 (50%)	
Relative		4 (40%)	
Outsourcing patient care			
Provide treatment			1 (10%)
Provide care			9 (90%)

Abbreviation: n, number.

control, and absence of nausea or vomiting. Respondents stated:

There are no postoperative complications that we're worried about ... (except for) bilirubin levels ... For example, can you (patient) eat enough of the right foods because nutrition before and after surgery is quite important. (Doctor 1)

Post-PTBD, the patient received antibiotics for three days and did not have a fever. This meant that there were no complications, and that they could take care of themselves. (Nurse 2)

My health has improved. Before I could not breathe; I felt tightness in my abdomen. Now there is no tightness. I feel strong and have more energy. (Patient 5)

Previously, he suffered a lot. However, he appears better now. He started eating again. There is less itchiness. (Caregiver 4)

However, one patient conveyed the importance of confirming health status before discharge.

I am not ready. I must be treated here until I feel stronger. I am still in pain where they cut me, at the wound in my belly. They have not taken out the tumor there. I have abdominal pain, bloating, and sometimes I faint. (Patient 7)

3.2.2. Self-care knowledge

This theme focused on the information needed to respond to common worries and problems during a post-hospitalization stage, and three sub-themes arose.

3.2.2.1. Taking care of biliary drainage. This involved the first time that a tube was inserted into a patient for a prolonged duration. All participants, patients, caregivers, and nurses paid attention to the care tubes, including dressing the devices, preventing infection, and using security methods to prevent catheter dislodgement, breaking, or twisting.

I am afraid of wound infections. I have to clean the tube very well. I wipe it with alcohol every time. I also go to the local community clinic for wound care. (Patient 2)

I have to be careful. I ensure that everything is clean. When I empty a bag, I make sure to clean the tube and bag. I protect myself and the patient. Everything must be free of infection. If we maintain cleanliness and pay attention, there will be no complications. (Caregiver 5)

When I give him a shower, I cover the wound with this thin plastic. I am afraid of water getting in and causing an infection. Every three days, we change the dressing. (Caregiver 9)

The bag must be kept below the waist to prevent bile from returning. I make sure that the tube is not folded because it will block the drain. (Patient 5)

When I drain the bile, I prepare a container. I have a small can, and I clean it with a disinfectant. I keep the tube here. Wound care is performed by the local community clinic every three days. We must ensure that the tube does not come off. (Caregiver 4)

Therefore, when they ambulate, they have to carry the tube below their waist. If they have to move the tube higher, they must fold the tube to prevent the bile from being reversed. This should be emphasized. The bag is drained every morning. (Nurse 5)

Be careful, it will be slippery. Do not let a kid get so close, be afraid if it steps off, it becomes a big deal. The doctor will have to revise again. (Patient 8)

3.2.2.2. Consumption of a suitable diet. Although PTBD is an interventional procedure used to promote bile drainage and relieve jaundice, appropriate food consumption is still required. Participants, such as patients, caregivers, and nurses, were concerned about the suitability of patient food. For example, getting fat in their diets could be difficult. Hence, supplements should be taken to boost calorie intake, and fatty foods should be avoided to maintain liver and bile duct function.

Eat small portions often for relief of abdominal distension; drinking water will reduce jaundice. (Patient 7)

They should avoid eating a fatty diet. My father can eat food items like steamed rice and sticky rice, as they are okay. (Caregiver 4)

They should eat nutritious food. Fruits and vegetables contain vitamins, especially vitamin C, which increases appetite. (Nurse 3)

3.2.2.3. Observation to detect abnormal symptoms. PTBD has been recognized as an effective technique for obtaining biliary access and relieving jaundice. However, post-PTBD complications may occur. Participants were concerned about infections, occlusions, dislocation, drain leakage, and cholangitis.

I have to check the wound to ensure that it is not dirty. I have to watch for any abnormal signs. For instance, bile may leak into the wound. If there are any problems with the wound, I contact the consulting nurses at the hospital immediately. (Patient 5)

They explained that if the area around the blue tube gets infected, it will turn white. If the area around the tube is white, I have to take the patient to the hospital immediately. (Caregiver 2)

If the tube comes off or the wound becomes infected, I have to bring my mom back to the hospital. The hospital has her medical history. I will start there. (Caregiver 3)

If there is abdominal pain, or the tube comes off, or the stitches separate, they have to see a doctor right away. They should not wait because bile will leak into the abdominal cavity, leading to complications. (Nurse 9)

If the wound starts oozing or is obstructed, it will cause a fever. This means there are some abnormal symptoms. (Nurse 7)

3.2.3. Preparedness for homecare

The last theme of perceived readiness for hospital discharge involves preparation for home care. Patients and caregivers discussed how they prepared to take care of themselves and the patients when they are back home. They prepared materials for safety and convenience and assigned someone to provide care.

He used to sleep on the second floor. I will have him sleep on the main floor so it is convenient for him to go to the bathroom. (Caregiver 3)

I am preparing a bed for my father. His old mattress does not have springs so he can lie down more comfortably, and the drainage tube (of PTBD) will be at the right level down here. (Caregiver 4)

Make sure it is clean, not dirty. If it is dirty, the infection will be in this area (pointing at the PTBD). My daughter-in-law will do all this [wound care] at home. (Patient 7)

4. Discussion

The quantitative findings showed high average scores, indicating general readiness for hospital discharge. Qualitative data revealed that this readiness was the result of improved health conditions, self care knowledge, and preparedness for home care. Transitioning from a hospital to home care is challenging for both patients and their caregivers. A successful discharge means that a patient is ready to continue being cared for at home. Readiness includes preparing patients, caregivers, and the community to support continuation of care at home. The goals include continuity of care with provision of a good quality of life for patients at home or at a local community clinic. A successful discharge is not defined as readiness for a quick hospital discharge. It rather implies readiness to transition from hospital care to community care while maintaining patient satisfaction, a good quality of life, and a positive health outcome [25,26]. Current results were similar to previous studies [15,27–29], showing that readiness for hospital discharge was high.

Although scores for overall average readiness in the current study were high, those in the sub-category of health status were the lowest among the four dimensions of RHDS. Qualitative analysis showed that patients, caregivers, and healthcare providers thought that patients' health conditions had improved enough for discharge. The results of the quantitative and qualitative studies had a slight congruence. This meant that patients could have hidden their real feelings from the researchers. Additionally, since most participants were men (70%), they might have maintained a strong facade and presented themselves as ready to be discharged. However, some patients were not in good condition and were not ready to be discharged. Our results were consistent with prior studies [30,31] that showed that the RHDS in the health status dimension was low since some patients did not get well; however, their family roles and responsibilities forced them to maintain that they were ready for discharge even if this was not true based on their physical state. Therefore, it is suggested that healthcare providers reconsider discharge criteria, paying close attention to individual patient needs and identifying readmission risks. These actions will contribute to timely, safe discharge planning and prevent rehospitalization.

Apart from personal status, readiness for hospital discharge depends on acquisition of the knowledge needed to properly care for patients at home. In this study, a moderate readiness score occurred when caregivers and patients had confidence in how to provide home care. In the qualitative results, the theme "self care knowledge" explained how patients and caregivers cared for drainage tubes, provided a suitable diet, did wound care, recognized abnormal symptoms, and provided follow-up care. As 86.7% of our participants spent from 1 to 90 days being diagnosed and treated at a hospital, they understood the treatment plan and were taught about the illness and its management (73.3%). In addition, the fact that many participants were older adults (43.3%) and Buddhists (96.7%) contributed to greater acceptance of their illness. Buddhists believe that a past life's karma affects a current life situation, and that impermanence is a noble truth. These beliefs helped participants accept their illnesses and treatment, encouraging them to follow the treatment plans and performing self-care to maintain their lives as long as possible [32]. This finding was consistent with studies [18, 20], in which the knowledge dimension in readiness for hospital discharge was moderate, implying that patients had not yet mastered sufficient disease-related knowledge. Generally, discharge teaching in Thailand is delivered by nurses on the day of discharge. It is difficult for nurses to provide all necessary information when patients and caregivers are distracted, focused on completing payments, receiving medicines, and returning home. It is better to conduct discharge teaching gradually rather than comprehensively at the end of a hospital stay.

While quantitative results showed a high ability to cope with problems, no qualitative finding supported this dimension. The durations of treatments and illnesses increased the patients' readiness for hospital discharge. Of the participants, 86.7% were diagnosed and treated in the hospital for 1–3 months. A total of 73.3% of patients received a treatment plan for PTBD for the first time. Therefore, they did not experience any complications. They were independent and could perform self-care and learn from healthcare providers, which made them confident that they could care for themselves when they were discharged. These findings were similar to prior studies [28,33], which found that coping ability received the highest mean score in the RHDS subscales. Greater knowledge regarding self-care was the same as a greater ability to handle care demands at home [30].

The levels of expected support also greatly affected participants' readiness for hospital discharge. The theme "preparedness for home care" in the qualitative analysis showed that family support affects patient readiness. Family is an important structure in Thai culture, as elsewhere. Family members are always expected to support each other. The family moves through each stage of life together and faces changes in environments, society, individuals, and situations. Family is a key part of the system needed to maintain balance. The familial system includes family members who may have different work or social statuses, expectations, and relationships with society, and changes can affect a family system at both individual and group levels. Hence, adjustments to change must occur at both levels to achieve equilibrium. If nurses understand and consider family information when planning hospital discharge, they can help patients and their families be ready and well-prepared for transitions to home care [34].

The current results were similar to those of studies [18,20,28,31] that found that when there is social support at home, readiness for hospital discharge is high. This indicates that participants have adequate resources for support when they go home.

5. Limitations

The number of participants available for this study was limited. During the data collection period, coronavirus disease 2019 pandemic was at its peak. This affected the number of participants available for a quantitative study. The researchers often had to reschedule appointments and many participants did not keep their appointments. Some targeted patients died owing to difficulties they faced commuting across provinces, making it challenging for patients and their relatives to reach their appointments. These limitations affected the target number of participants.

6. Conclusions

The current results can be used as foundational information when determining readiness for hospital discharge in patients with primary liver cancer post-PTBD. In addition, nurses can further accurately assess readiness by involving both patients and their relatives when preparing for hospital discharge. Follow-up studies of the post-discharge phase should be conducted to understand the adjustment of patients to home. Understanding the difficulties of adjustment to home care after discharge can help healthcare providers develop more effective ways to prepare patients with PTBD for discharge.

Author contribution statement

Kanittha Rattanakanlaya, Ph.D.; Dr. Lalida Noppakun, Ph.D.: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper. Dr. Nuttamon Vuttanon, Ph.D.: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper. Mrs. Wantanee Sangwattana, M.N.S.; Miss Nongnuch Boonyue, M. Ed. (Health promoting): Performed the experiments. Lecturer Srisuda Iamruksa, M.N.S.: Conceived and designed the experiments.

Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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