Patient Preference and Adherence

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Implementation of Early Mobilization in Post-CABG Patients: A Constructivist Grounded Theory Study

Meng Xiu[1,2], Fei Yang[1,2], Fangfang Yang[2], Chenwei Wang[1,2], Meijie Zhang[2,3], Weiying Zhang[2]

[1]School of Medicine, Tongji University, Shanghai, People's Republic of China; [2]Department of Nursing, Shanghai East Hospital, School of Medicine, Tongji University, Shanghai, People's Republic of China; [3]School of Nursing, Suzhou Medical College of Soochow University, Suzhou, People's Republic of China

Correspondence: Weiying Zhang, Department of Nursing, Shanghai East Hospital, School of Medicine, Tongji University, No. 150 Jimo Road, Pudong New Area, Shanghai, 200120, People's Republic of China, Email zhangwy_cn@126.com

Purpose: Coronary artery bypass grafting (CABG) is an essential intervention for treating coronary artery disease. However, the effectiveness of postoperative rehabilitation often depends on the implementation of early mobilization by patients. In practice, adherence to early mobilization post-CABG is frequently suboptimal. This study focuses on patients who have successfully implemented early activity post-CABG, exploring the situational factors that facilitate early mobilization.

Patients and Methods: Semi-structured interviews were conducted with 15 post-CABG patients from three hospitals in Shanghai who had successfully implemented early mobilization. Data collection was conducted from October 1, 2024 to December 31, 2024. Utilizing a constructivist grounded theory approach, the interview guide was modified based on emerging themes throughout the study.

Results: Patients who successfully implement early mobilization typically undergo three main stages: intention, initiation, and maintenance. The study identified three main domains influencing these phases: Core Context (including the perception of the importance of exercise rehabilitation, understanding and beliefs about early mobilization, positive personal experiences with physical activity, and observing positive outcomes from others' activities); Essential Conditions (including physical condition, psychological preparedness, knowledge literacy, and initial outcomes); External Factors (including the atmosphere and promotion of early mobilization, the development of an exercise rehabilitation system from pre-surgery to ICU to ward, and social support).

Conclusion: This study provides a new perspective by examining the situational factors associated with the successful implementation of early mobilization after CABG. By focusing on successful cases, healthcare professionals can better understand the implementation process and experiences, enabling them to develop targeted interventions to improve adherence.

Keywords: coronary artery bypass grafting, early mobilization, qualitative research, constructivist grounded theory

Introduction

Cardiovascular diseases are a major public health concern and a leading cause of morbidity and mortality worldwide.[1] In China, the "China Cardiovascular Health and Disease Report 2022" indicates that the prevalence of coronary artery disease (CAD) is steadily increasing, with a rapid rise in mortality rates associated with CAD.[2] Current treatments for CAD include medical therapy, percutaneous coronary intervention (PCI), and surgical interventions.[3] Among these, coronary artery bypass grafting (CABG) is one of the most effective surgical treatments for CAD, aiming to restore myocardial blood flow by bypassing blocked coronary arteries. It is particularly recommended for patients with multivessel disease, severe left main coronary artery disease, or complex coronary artery lesions.[4]

The CABG procedure involves using a blood vessel graft, typically taken from the leg or chest, to bypass blocked or narrowed coronary arteries, thereby restoring blood flow to the myocardium. Studies have demonstrated that CABG is superior to PCI in improving long-term survival and reducing cardiovascular events, especially in patients who cannot achieve adequate revascularization with other treatments.[3,5] However, patients undergoing CABG are still at risk of various complications, including cardiovascular events,[6] infections,[7] and physical dysfunction,[8] which significantly affect recovery

Received: 1 May 2025
Accepted: 12 August 2025
Published: 30 August 2025

and quality of life. Early cardiac rehabilitation, recognized globally as a class I-A recommendation,[9–11] is crucial for enhancing functional recovery and reducing postoperative complications in CABG patients. Early mobilization is a core component of in-hospital cardiac rehabilitation, which includes activities such as sitting at the bedside, standing, or walking.[11]

Early mobilization, defined as physical activity initiated as soon as possible postoperatively, plays a vital role in enhancing cardiovascular recovery, preventing postoperative complications, and reducing hospital stay duration.[12] Currently, there is no standardized timing for initiating early mobilization. Different studies have defined it variably as starting within 24 hours post-surgery,[13] after 48 hours of mechanical ventilation,[14] within 72 hours post-surgery,[15] or within 2 to 5 days in the ICU.[16] Additionally, adherence to early mobilization varies significantly across different countries. Studies have shown that the adherence rates in intensive care units (ICUs) in Western countries are typically around 40%-60%.[17,18] In contrast, in China, due to a shortage of specialized rehabilitation therapists and a high patient-to-staff ratio, rehabilitation often relies on patients themselves, resulting in lower adherence rates compared to international standards.[19] This disparity highlights the need for in-depth research within the unique context of cardiac rehabilitation in China. It reveals the gap between the theoretical benefits of early mobilization and its practical implementation in postoperative care for CABG patients.

Most existing research on early mobilization after CABG focuses on identifying barriers to patient participation, such as physical limitations,[20] pain,[21] fear of movement,[22] and lack of motivation.[23] However, studies exploring the intrinsic motivations and cognitive processes of patients who actively participate and adhere to early mobilization programs are relatively limited. It is important to note that the barriers to not acting and the reasons for engaging in action involve distinct psychological and behavioral mechanisms, suggesting that the original causes of action and inaction should be separately explored.[24] Constructivist Grounded Theory (CGT) is a qualitative methodology that emphasizes understanding how individuals construct meaning from their experiences within specific contexts.[25] It has been successfully applied among diverse patient populations, such as ICU survivors[26] and individuals undergoing rehabilitation,[27] to explore complex processes including recovery experiences, motivation, and behavior change.

In this study, CGT is adopted to explore the situational factors, meaning, pathways, and rehabilitation experiences of early mobilization from the perspective of CABG patients who actively participate in early postoperative activities. By focusing on patients who successfully engage in and adhere to early mobilization programs, this study aims to provide a deeper understanding of the factors that promote participation, ultimately offering theoretical guidance to improve participation rates and adherence in CABG postoperative rehabilitation programs.

Materials and Methods

Study Design

This study adopted Constructivist Grounded Theory as proposed by Charmaz (2006)[25] as the primary methodological approach. CGT was chosen over other forms of grounded theory due to its unique focus on capturing both the individual and contextual elements shaping post-CABG patients' experiences with early mobilization. Unlike traditional grounded theory approaches, CGT emphasizes the interpretive role of researchers, acknowledging that their perspectives and interactions with participants actively shape the data collection and analysis process. This alignment allows researchers to engage deeply with participants, adjust questions and analytical directions flexibly, and thus reveal the nuanced personal experiences, motivations, and meanings that drive patients' behaviors.

Participants

Participants were recruited using purposive and theoretical sampling methods[28] from three tertiary hospitals in Shanghai. The study considered various situational factors such as age, occupation, and education level that might influence patients' participation in early mobilization. Based on the distribution of these factors and the categories developed during the study, patients with different dimensions were selectively included in interviews. Inclusion criteria were: (1) age $\geq$ 18 years; (2) patients in the ward who had completed early mobilization. (The criteria for early mobilization following CABG surgery in this study are as follows: After CABG, patients begin passive and active bed activities (such as passive or active joint movement exercises or passive in-bed cycling training) within

three days, once vital signs are stabilized in the ICU and the patient has been evaluated by a physician. These initial bed activities in the ICU start at 5 minutes per session and are gradually increased as the patient's tolerance improves. Upon transfer from the ICU to a general ward, bedside activities (such as sitting up and standing) and out-of-bed activities (such as walking training) are continued within three days, with the exercise intensity carefully controlled to remain within 2–4 metabolic equivalents (METs). The entire process is primarily nurse-led, with active involvement from physicians, rehabilitation therapists, and the patient's families). (3) willingness and active participation in postoperative rehabilitation; (4) voluntarily participate in the study. Exclusion criteria were: (1) cognitive impairment or a history of mental illness;The sample size was determined by data saturation, resulting in the inclusion of 15 patients. General information about the participants is provided in Table 1.

Data Collection

Data collection was conducted from October 1, 2024 to December 31, 2024 by the first author (M.X), a clinically experienced master's student who is currently interning in a cardiac surgery ward and possesses substantial theoretical knowledge related to CABG. This study was conducted in three tertiary general hospitals in Shanghai, China, each with a total of 2,000 beds, all of which are recognized for their excellence in CABG surgery and cardiac rehabilitation. These hospitals have well-structured protocols for early exercise rehabilitation after CABG, which cover the preoperative, ICU, and postoperative stages. These comprehensive cardiac rehabilitation programs include early mobilization, tailored exercise regimens, and a multidisciplinary approach, ensuring high standards in postoperative recovery and patient outcomes.

Guided by CGT, data collection emphasized flexibility and adaptability, allowing interview questions to be refined as new insights emerged. The interview guide was initially developed based on the study objectives and a literature review, incorporating the Behavioral Event Interview[29] structured around Situation, Task, Action, and Result (STAR). The interview guide used in this study is presented in Box 1. Semi-structured interviews were conducted at the bedside with 15 postoperative patients who met the inclusion criteria. To ensure a quiet environment, interviews were scheduled after the completion of patients' treatment tasks. Each interview lasted 30 to 50 minutes, with follow-up questions adaptively crafted to explore emerging themes identified from prior interviews. This iterative process enabled real-time adjustments to the interview approach, facilitating the exploration of unanticipated yet relevant themes and enriching data comprehension. Throughout the interview process, the interviewer actively engaged with participants, drawing on their own interpretations and professional experience to collaboratively construct and refine the understanding of past experiences. Additionally, non-verbal cues, such as facial expressions and gestures, were also observed and recorded. The sample size was determined according to the principle of data saturation. Specifically, after at least 10 interviews, if no new themes or information emerged from three consecutive interviews, recruitment was terminated.[30] No repeated interviews were conducted.

Data Analysis

Within 24 hours after each interview, the audio recordings were transcribed verbatim, and reflective memos were written. Two researchers independently reviewed transcripts and initial codes for accuracy, resolving discrepancies through discussion or consulting a third researcher when needed. Data collection and analysis were conducted simultaneously, with the text data imported into NVivo 11 software for assisted coding and analysis. The data analysis followed the constructivist grounded theory approach, including open coding, selective coding, and theoretical coding.

During open coding, text segments were labeled with descriptive codes that captured both participants' expressions and the researcher's interpretations. Constant comparative methods were applied to identify emerging patterns, similarities, and discrepancies. Selective coding then focused on core categories closely related to the research topic, while reflective memos documented evolving interpretations and potential researcher biases to ensure transparency in the co-construction of meaning. Finally, theoretical coding identified relationships among the core categories, and the model was refined through team discussions to reflect the implementation process of early mobilization in post-CABG patients.

https://doi.org/10.2147/PPA.S537861

Table 1 Characteristics of Participants

ID	Gender	Age	Occupation	Education	Caregiver	Euroscore	Number of Bypass Grafts	ICU Stay Duration (days)	Postoperative length of stay (days)	Implementation of Early Exercise Rehabilitation	
										Time to First Active in-Bed Mobilization	Time to First out-of-Bed Mobilization
A	Male	75	Freelancer	College	Spouse	4	2	2	7	POD 1	POD 3
B	Male	59	Freelancer	Middle school	Spouse	3	2	2	6	POD 1	POD 3
C	Male	59	Freelancer	Middle school	Spouse	3	2	3	7	POD 1	POD 4
D	Female	71	Farmer	Elementary school	Spouse	4	3	3	8	POD 1	POD 5
E	Male	74	Farmer	Elementary school	Children	3	2	2	7	POD 2	POD 3
F	Male	74	Freelancer	High school	Spouse	3	2	3	8	POD 1	POD 5
G	Male	57	Worker	High school	Children	3	2	2	6	POD 1	POD 2
H	Male	76	Freelancer	Middle school	Spouse	4	2	3	7	POD 1	POD 4
I	Male	57	Manager	Master's degree	Self	3	2	3	7	POD 1	POD 4
J	Male	67	Freelancer	Elementary school	Spouse	3	3	3	7	POD 2	POD 4
K	Male	53	Doctor	Elementary school	Children	2	2	2	6	POD 1	POD 3
L	Male	76	Manager	College	Spouse	4	3	4	8	POD 2	POD 6
M	Male	75	Worker	Middle school	Spouse	4	2	4	8	POD 1	POD 6
N	Female	70	Freelancer	Elementary school	Children	4	2	2	7	POD 1	POD 4
O	Male	58	Freelancer	High school	Spouse	6	3	5	10	POD 2	POD 6

Abbreviations: POD, postoperative days; Euroscore is a risk assessment tool that comprises three dimensions; patient-related, cardiac-related, and operation-related factors, with higher scores indicating increased predicted operative mortality.

Box 1 The interview guide

Opening
1. Introduction.
2. Consent confirmed.
Questions
1. When did you start exercising after your surgery? How did you do it? Can you describe it in detail?
1. In what context did your post-surgery exercise rehabilitation occur? How did you feel about it?
1. Why did you participate in exercise rehabilitation? What made you willing to engage in this rehabilitation program?
1. What outcomes did you perceive from early postoperative exercise rehabilitation? How do you feel about these outcomes?
1. Did you encounter any difficulties or barriers during the process of early mobilization? How did you address them?
1. If you met a fellow patient (after CABG surgery) who was reluctant to start early mobilization, how would you encourage them?
Closing
9. Do you have any additional information you would like to add?
10. Do you have any questions?
End

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki for the protection of human subjects. Ethical approval was obtained from the Medical Ethics Committee of Shanghai East Hospital (IRB NO. 2023019), dated 21 March 2023. Before the interviews, the study's purpose and confidentiality principles were explained to the patients, and informed consent was obtained from all participants, including the publication of anonymized responses. Ethical guidelines were strictly followed throughout the research to ensure participant privacy and data confidentiality.

Results

Characteristics of Participants

A total of 15 patients were included in the study, comprising 3 females and 12 males. Among them, 14 underwent off-pump CABG, and only one patient received on-pump CABG with a cardiopulmonary bypass (CPB) time of 123 minutes. The characteristics and relationships of the participants are shown in Table 1.

Theoretical Model for the Implementation of Early Mobilization After CABG Surgery

We developed a theoretical model for early mobilization after CABG surgery, categorizing early mobilization into three phases: the intention phase, the initiation phase, and the maintenance phase. The study identified three primary domains influencing early mobilization in post-CABG patients: core context, essential conditions, and external factors. These domains respectively impact different stages of early mobilization in post-CABG patients (see Figure 1).

Core Context

Perception of the Importance of Exercise Rehabilitation

Recognizing the crucial role of exercise rehabilitation in their recovery often forms the foundational motivation for patients actively participating in early mobilization. Many patients expressed a deep understanding of the benefits of exercise rehabilitation and acknowledged that it not only aided in their recovery but also significantly improved overall postoperative health outcomes. Through external knowledge gathering, they gradually realized that exercise rehabilitation is not merely a step in the recovery process but a core element directly related to their long-term health and quality of life.

> C: I know that exercising after surgery will help me recover better. The doctors emphasized the importance of exercise rehabilitation for my postoperative recovery. Exercise is definitely beneficial for wound healing. If I do not exercise, I might face a longer recovery time and more complications.

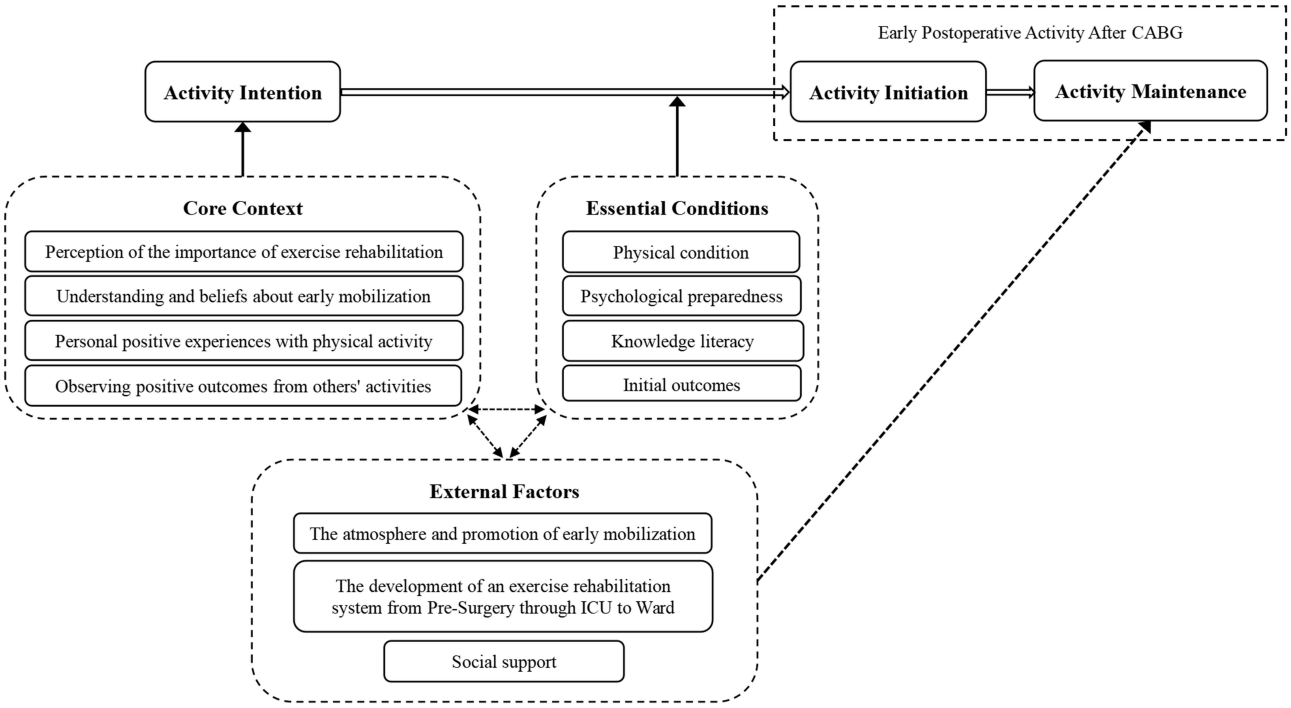

Figure 1 Theoretical model for the successful early implementation of post-CABG patient mobilization.

I: I think that since I have had heart surgery, my heart needs direct improvement, and exercise clearly helps with that. Secondly, it is about restoring physical function…Usually, after surgery, you lose weight, and your muscles may shrink. I lost 15 kilograms, which certainly means muscle loss, so I believe exercise rehabilitation is very important and should be taken seriously.

Understanding and Beliefs about Early Mobilization

Due to postoperative physical weakness and fear of the unknown, patients initially often had doubts or even fears about early mobilization. Some patients mentioned feeling resistant when first informed about the need for early mobilization, fearing it might worsen their condition or lead to postoperative complications. However, information from various sources, such as guidance from healthcare providers, preoperative education, and a sense of responsibility for their health, gradually changed their perceptions. A correct understanding of early activity fosters a belief in its importance.

B: The doctor said I should start some mild activities as soon as possible, but I was really worried at the time, afraid that moving would worsen my wound. Later, a nurse explained why early mobilization is necessary, saying it not only helps me regain strength but also reduces the risk of postoperative blood clots. That made me realize that early mobilization is actually meant to protect me.

O: I want to recover as quickly as possible, so not exercising is not an option, right?

Personal Positive Experiences with Physical Activity

Patients who had positive experiences with exercise in the past or were aware of its health benefits felt more confident and proactive in managing their postoperative rehabilitation tasks. During interviews, some patients noted that they had established good exercise habits before surgery and recognized the many benefits of regular physical activity.

K: I have always had a habit of exercising. We are used to going to bed early, getting up early, and taking walks every day. So, after the surgery, even if the doctor did not tell me to, I would still get up and walk around. I know that exercise makes me feel better, sleep better, and reduce stress. I also believe it helps me recover faster.

For patients who have undergone similar surgeries or interventions before, their previous rehabilitation experiences also build confidence for early mobilization this time around.

A: After my previous heart stent surgery, I recovered quickly through exercise, so after this surgery, I am even more convinced that early activity will help me recover again.

Observing Positive Outcomes From Others' activities

Postoperatively, patients often interacted with others who were at various stages of recovery. Witnessing fellow patients who had started early mobilization gradually regained their independence, reduced pain, or improved cardiopulmonary function could be a powerful source of motivation. These firsthand observations served as a strong incentive for patients to engage in early mobilization themselves.

A: I saw a patient next to my bed start moving around just a few days after surgery, and within a few days, he was walking independently. I was really impressed. It made me believe that if I start moving early, my recovery will also go smoothly.

Such successful examples made it easier for patients to overcome initial fears or doubts about exercising.

O: Seeing how others have recovered so well through early mobilization, my concerns disappeared immediately. I felt that I could not fall behind, and I needed to start exercising as soon as possible to recover just like them.

Essential Conditions

Physical Condition

Post-CABG patients were highly attentive to their surgical outcomes and postoperative physical responses. They considered engaging in early mobilization only when their vital signs were stable to ensure that activities do not exacerbate fatigue or worsen their condition.

E: Yesterday, they said my incision looked great.I always monitor my heart rate and blood pressure. Before they were stable, I did not dare to move around. However, once I felt these indicators were normal, I started trying some simple activities, and I felt better day by day.After all, this is about heart bypass surgery, so we have to take everything seriously.

Postoperative pain and fatigue are common challenges for patients following CABG. Moreover, many patients may still have tubes (such as chest or urinary catheters) in place. Once pain is effectively managed and issues with the tubes are properly addressed (fixed or removed), patients become more willing to adapt and begin early mobilization. Recognizing their lack of physical strength post-surgery, patients may actively use assistive devices, such as walkers, to help them stand and walk.

I: Pain might affect my early activities, but after taking a few steps, the pain subsides. When I feel the pain, I rest for a while and gradually increase the activity.

L: After the surgery, I had tubes in me, so I did not want to get out of bed. However, once the doctor helped remove them, I immediately wanted to get up and walk.

B: After the surgery, I felt very weak, so I started my rehabilitation exercises with a walker, slowly pushing myself without needing anyone to help me. It felt great.

Psychological Preparedness

Self-efficacy in exercise rehabilitation refers to a patient's confidence and belief in their ability to perform rehabilitation exercises and benefit from them successfully. During the postoperative recovery process, patients often believe that successful recovery relies mainly on their willpower and effort. They self-monitor and actively participate in rehabilitation exercises. A successful surgery gives patients hope, and those with a positive mindset exhibit greater enthusiasm and motivation during rehabilitation, hoping to recover quickly and return to normal life through continuous exercise. Additionally, this study found that, compared to women, men typically exhibit higher self-efficacy when facing early activity.

C: I feel like recovery is about self-discipline, relying on myself. Others can encourage you, but it ultimately comes down to you. Only you can feel what's happening with your body and know that you are getting better. Sometimes lying in bed for too long gets uncomfortable, and I see it as just part of the recovery process.

I: Having a successful surgery gave me much hope. Plus, I believe that life is about staying active. The key is to have the determination to keep going. If someone forces you, it never feels natural. Also, I feel like as a man. sometimes you have to tough it out and overcome the pain.

Knowledge Literacy

During this interview, patients who successfully implement early mobilization post-CABG often have a higher level of knowledge literacy, which provides a foundation for successful early rehabilitation. Knowledge literacy refers to a patient's understanding of the methods and techniques of early mobilization and postoperative rehabilitation knowledge. These patients proactively learn and understand relevant information to participate in early rehabilitation activities more scientifically. Patients with a better understanding of rehabilitation's importance and methods are more motivated to participate in rehabilitation training actively.

I: I used my phone to gather information about postoperative exercise rehabilitation, and based on this knowledge, I created a detailed exercise plan for myself. The doctor also helped refine the plan… This plan includes two parts: exercises on the bed and off the bed. On the bed, I start with head movements, followed by facial muscle activities and massages, then abdominal massages and pelvic floor exercises, as well as simple leg lifts. Off the bed, I set a daily walking goal, gradually increasing the steps.

Initial Outcomes

During early exercise rehabilitation, patients recognized the benefits of early activity for cardiac recovery. This positive feedback created a virtuous cycle, encouraging patients to be more willing to cooperate in the exercise rehabilitation process.

G: I feel stronger and stronger. Compared to those who do not exercise, I feel like my recovery is much faster. The doctor mentioned that because of my early activity, my lungs have re-expanded well post-surgery, which is a specific benefit I have noticed.

A: At first, I could only walk a few steps and felt very weak, but later, I could walk farther and farther. I think exercise is effective, so I am willing to keep going.

External Factors

The Atmosphere and Promotion of Early Mobilization

Patients who successfully implemented early mobilization post-CABG benefited from access to resources and time, which provided critical support for their recovery. Resource accessibility was evident through health education from healthcare professionals, personalized activity goals and supervision, and abundant rehabilitation materials in the ward environment, all of which helped patients acquire the necessary knowledge and motivation. Additionally, the hospital's careful scheduling of activity times ensured that patients could engage in early mobilization during optimal periods when their physical condition allowed, effectively promoting the rehabilitation process. This combination of well-managed resources and time created a positive and supportive environment for early recovery.

D: The doctors and nurses monitored my early activities daily. When I returned to the ward from the ICU, the doctor told me to get out of bed as early as possible and gave me detailed instructions on how to do breathing exercises and walking. I often saw posters on the walls in the corridors while moving around, and the nurses tailored my daily activity plan based on my condition —how many steps to take today, how many each day, and so on. I felt valued, which made me more willing to cooperate.

L: The hospital has a fixed activity time every day, which gives me the chance to recover at my own pace without worrying about conflicting with other treatments.

The Development of an Exercise Rehabilitation System from Pre-surgery Through ICU to Ward

The exercise rehabilitation system, which spans from pre-surgery to the ICU and then to the ward, encompasses the entire rehabilitation process for patients. Our interviewed patients also emphasized that this comprehensive procedural system played an essential role in their postoperative recovery, helping them to regain health more efficiently.

> E: Before the surgery, I received a lot of rehabilitation education, so I knew what to do postoperatively. In the ICU, someone would help me turn over and move my body. After moving to the ward, the doctors and nurses developed a more specific activity plan for me, and I was making progress every day. I feel like I am getting closer and closer to full recovery.

Social Support

Social support mainly includes care and encouragement from family members, fellow patients, friends, and colleagues. The family is the most critical support system in the patient's rehabilitation process. The company and care of family members and friends provided psychological support during early mobilization, enhancing their confidence in recovery.

> G: After surgery, my friends and colleagues called to encourage me, helping me feel at ease and willing to cooperate with the rehabilitation.… My spouse and my son took turns taking care of me, always supporting and encouraging me during my rehabilitation exercises…My son would come straight to see me after work. Sometimes, I feel really bad about it… He has to work and still come to take care of me, so I want to recover quickly and go home so my family does not have to worry about me anymore.

Additionally, support from fellow patients is also a significant source of social support for patients. Communicating and sharing experiences with other surgical patients fosters empathy and motivation, while seeing others in the same ward engaging in activities can also be encouraging.

> B: Before the surgery, we cheered each other up, saying it would all be over after a nap. After the surgery, we kept sharing our experiences. If I had any problems with my exercises, I would ask them since they had also gone through surgery.

> A: When I saw them getting out of bed and moving around, it motivated me to do the same.

The social support system offered patients additional psychological comfort and emotional strength, helping them feel more warmth and encouragement during their recovery process.

Discussion

The theoretical model developed in this study reveals the situational factors influencing early mobilization after coronary artery bypass grafting (CABG). It examines these factors through three perspectives: core context, essential conditions, and external factors, providing an in-depth analysis of how these elements affect the initiation, intention, and maintenance of patient activity. The synergistic interaction of these three elements creates a feedback mechanism that continuously reinforces each other, promoting the persistence and effectiveness of early mobilization. Therefore, understanding and optimizing the relationships between these factors are crucial for enhancing the effectiveness of early rehabilitation interventions.

Core context serves as the starting point for forming behavioral intentions, which, when sufficiently strengthened, naturally lead to action. Patients' understanding and beliefs about early mobilization are crucial in fostering behavioral intentions. These findings are consistent with Englert's study,[31] which showed that patients generally believe early mobilization can accelerate recovery and reduce complications, thereby enhancing their willingness to participate in rehabilitation. Additionally, previous positive exercise experiences and observing others' successful cases significantly increase patients' motivation to engage in early mobilization. This aligns with the social learning theory emphasized in the literature,[32] which suggests that people learn not only through direct experience but also by observing others and the outcomes of their behaviors. That is, patients learn directly from their experiences and by observing and mimicking the behaviors and results of others. Therefore, in clinical practice, healthcare professionals should actively showcase successful rehabilitation cases, create a supportive environment, and provide the necessary education to help patients develop positive intentions and motivations for early mobilization, thereby promoting better rehabilitation outcomes.

The patient's physical condition, psychological readiness, knowledge literacy, and initial outcomes are crucial "essential conditions" for successfully initiating early mobilization. Effective pain management and proper handling of surgical drains

significantly influence a patient's readiness to begin mobilization. A study[33] found that when pain is well-controlled and drains are properly managed, patients' ability to mobilize improves significantly, enabling them to engage in early mobilization more safely. Our research also indicates that patients need adequate preparation in terms of physical condition, psychological readiness, knowledge, and experience to participate in early mobilization. Taking a comprehensive approach to assessing these preparedness states and providing necessary education and support can improve the initiation rate of early mobilization. This aligns with existing literature on the critical role of individual readiness in behavior change.[34] However, our study further expands these findings by demonstrating that individual readiness is an indispensable condition for the practical implementation of early mobilization. This indicates that merely having the intention to engage in an activity is not sufficient; patients must be thoroughly prepared across multiple domains. Our study also found that fewer women, compared to men, met the inclusion criteria and successfully implemented early mobilization. This discrepancy may be associated with differences in psychological readiness for postoperative rehabilitation.[35] Some researches have highlighted that female cardiac patients often face greater emotional burden,[36] lower confidence in engaging in physical activity,[37] and a stronger reliance on external support,[38] which may hinder timely participation in early mobilization.[39] In contrast, male patients are more likely to report higher confidence and a greater sense of control in their recovery process, potentially facilitating adherence to mobilization routines.[35,40] This finding aligns with Frank's results,[41] indicating the importance of providing targeted psychological support for female patients to enhance their participation in early mobilization programs.

External factors can collectively promote early mobilization behavior in post-CABG patients. A positive rehabilitation atmosphere and effective promotion can significantly encourage patients to participate in early mobilization. Our study found that the daily medical schedules included specific time slots for physical activity, during which no medical or nursing procedures were conducted. Patients generally reported that this dedicated time for exercise improved their participation in physical activities and enhanced their rehabilitation outcomes. Additionally, having patients from the same ward engage in activities simultaneously during these periods further increased the effect of peer support. Thaler's dual-system theory model[42] divides human decision-making into two systems: System 1 (intuitive and automatic) and System 2 (deliberate and analytical). In System 1, intuitive and automatic responses are influenced by environmental and social factors. Our findings suggest that social support from family members, peers, and friends can enhance patients' motivation for mobilization through both direct and emotional encouragement. Meanwhile, System 2 involves a deliberate process in which patients rationally assess the benefits of early mobilization. Research indicates[33] that professional support from healthcare providers, along with a conducive rehabilitation atmosphere, provides essential information and education, helping patients understand the importance of early mobilization and motivating them to engage in rehabilitation exercises. Our study corroborates this perspective. Therefore, we propose designing an intuitive and easily accessible activity environment (such as clear signage to guide walking) and visual cues, alongside the involvement of family members, peer support, and healthcare providers' guidance, to create a comprehensive support system that effectively promotes early mobilization in post-CABG patients, improving their adherence and rehabilitation outcomes.

In this study, we propose that the rehabilitation process for post-CABG patients is a multi-stage, continuous process that spans from preoperative education through the ICU to the ward phase. However, there is currently no integrated system in China that encompasses all these stages. The absence of a standardized process can result in information asymmetry, where healthcare providers lack a comprehensive understanding of the patient's rehabilitation status at different stages. This can affect the coherence of rehabilitation planning and potentially lead to delays or interruptions in rehabilitation, preventing the provision of personalized treatment plans and diminishing the effectiveness of rehabilitation and patient confidence. Therefore, establishing a systematic, multi-stage rehabilitation framework is crucial to ensure continuous, personalized care and support throughout the entire rehabilitation process.

Strength and Limitations

This study is the first to use qualitative methods to explore situational factors promoting successful early mobilization in post-CABG patients. However, there are several limitations. First, the study only included three female participants, which may lead to a lack of gender representation, especially given that male patients are more predominant, potentially introducing sample bias. Additionally, a potential bias arises from the selection of the three hospitals, all of which are recognized for their excellence in cardiac rehabilitation. These hospitals likely have better resources and more structured protocols for early

mobilization, which may not be representative of hospitals with less developed cardiac rehabilitation practices. Thus, the findings may not be fully generalizable to other settings. It is also noteworthy that this study was conducted in China, where cultural factors may influence patients' rehabilitation attitudes and behaviors. Therefore, the findings may not be directly applicable to regions with different cultural backgrounds. Finally, as only a single-session interview was conducted, the study may not fully capture the dynamic changes in patients' perceptions and experiences over time.

Conclusion

This study proposes a theoretical model for the successful implementation of early mobilization in post-CABG patients, which includes core context, essential conditions, and external factors, revealing the key elements that promote early mobilization. Compared to previous studies, this research explores the situational factors of early mobilization in post-CABG patients from a new perspective, offering a more comprehensive and in-depth understanding of the various situational factors influencing patient behavior. This approach offers more precise and personalized guidance for optimizing early mobilization interventions, aiming to help healthcare professionals draw lessons from successful cases by emphasizing peer role modeling, fostering structured rehabilitation environments, and reinforcing multidisciplinary collaboration.

Ethics Approval

Approval for the study was obtained from the Medical Ethics Committee of Shanghai East Hospital (IRB NO.2023019), dated 21 March 2023.

Acknowledgments

We are deeply grateful to the patients who participated in this study for sharing their experiences.

Funding

The studies are supported by Important Weak Subject Construction Project of Shanghai Pudong New Area Health Commission (Grant No. PWZbr2022-04); Key Discipline Projects in the Three-Year Action Plan for Discipline Construction at Tongji University School of Medicine (Grant No.JS2210103); Research project of the Specialized Committee on Nursing Management, Shanghai Hospital Association (Grant No. HLGL202510) and Shanghai East Hospital Talent Program (DFRC2017017)

Disclosure

The authors report no conflicts of interest in this work.

References

1. Townsend N, Kazakiewicz D, Lucy Wright F, et al. Epidemiology of cardiovascular disease in Europe. *Nat Rev Cardiol*. 2022;19(2):133–143. doi:10.1038/s41569-021-00607-3
2. Hu -S-S. Heart failure in China: epidemiology and current management. *J Geriatric Cardiol*. 2024;21(6):631–641. doi:10.26599/1671-5411.2024.06.008
3. Persson J, Yan J, Angerås O, et al. PCI or CABG for left main coronary artery disease: the SWEDEHEART registry. *Eur Heart J*. 2023;44(30):2833–2842. doi:10.1093/eurheartj/ehad369
4. Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: executive summary: a report of the American college of cardiology/American heart association joint committee on clinical practice guidelines. *Circulation*. 2022;145(3):e4–e17. doi:10.1161/CIR.0000000000001039
5. Dimeling G, Bakaeen L, Khatri J, Bakaeen FG. CABG: when, why, and how? *Cleve Clin J Med*. 2021;88(5):295–303. doi:10.3949/ccjm.88a.20115
6. Garganeeva A, Kuzheleva E, Tukish O, et al. Predictors of adverse cardiovascular events after CABG in patients with previous heart failure. *Life*. 2025;15(3). doi:10.3390/life15030387
7. Zukowska A, Kaczmarczyk M, Listewnik M, Zukowski M. Impact of post-operative infection after CABG on long-term survival. *J Clin Med*. 2023;12(9). doi:10.3390/jcm12093125
8. Gallo M, Trivedi JR, Monreal G, Ganzel BL, Slaughter MS. Risk factors and outcomes in redo coronary artery bypass grafting. *Heart Lung Circulation*. 2020;29(3):384–389. doi:10.1016/j.hlc.2019.02.008
9. Kim C, Sung J, Lee JH, et al. Clinical practice guideline for cardiac rehabilitation in korea. department of rehabilitation medicine, inje university school of medicine, Sanggye Paik hospital, Seoul, Korea division of cardiology, department of medicine, Sungkyunkwan university school of medicine-heart vascular st. *Ann Rehabil Med*. 2023;47(5):355–443.

10. Woodruffe S, Neubeck L, Clark RA, et al. Australian cardiovascular health and rehabilitation association (ACRA) core components of cardiovascular disease secondary prevention and cardiac rehabilitation 2014. *Heart Lung Circulation*. 2015;24(5):430–441. doi:10.1016/j.hlc.2014.12.008
11. Niebauer J. Cardiac rehabilitation in Austria. *Wiener medizinische Wochenschrift*. 2018;168(1–2):46–49. doi:10.1007/s10354-017-0607-x
12. Anderson L, Oldridge N, Thompson DR, et al. Exercise-based cardiac rehabilitation for coronary heart disease: cochrane systematic review and meta-analysis. *J Am Coll Cardiol*. 2016;67(1):1–12. doi:10.1016/j.jacc.2015.10.044
13. Hickmann CE, Castanares-Zapatero D, Bialais E, et al. Teamwork enables high level of early mobilization in critically ill patients. *Ann Intens Care*. 2016;680.
14. Jolley SE, Regan-Baggs J, Dickson RP, Hough CL. Medical intensive care unit clinician attitudes and perceived barriers towards early mobilization of critically ill patients: a cross-sectional survey study. *BMC Anesthesiol*. 2014;14(1):84. doi:10.1186/1471-2253-14-84
15. McWilliams D, Weblin J, Atkins G, et al. Enhancing rehabilitation of mechanically ventilated patients in the intensive care unit: a quality improvement project. *J Crit Care*. 2015;30(1):13–18. doi:10.1016/j.jcrc.2014.09.018
16. Hodgson C, Needham D, Haines K, et al. Feasibility and inter-rater reliability of the ICU Mobility Scale. *Heart Lung*. 2014;43(1):19–24. doi:10.1016/j.hrtlng.2013.11.003
17. Højskov IE, Thygesen LC, Moons P, Egerod I, Olsen PS, Berg SK. The challenge of non-adherence to early rehabilitation after coronary artery bypass surgery: secondary results from the SheppHeartCABG trial. *Eur J Cardiovasc Nurs*. 2020;19(3):238–247. doi:10.1177/1474515119883454
18. Hodgson CL, Capell E, Tipping CJ. Early mobilization of patients in intensive care: organization, communication and safety factors that influence translation into clinical practice. *Crit Care*. 2018;22(1):77. doi:10.1186/s13054-018-1998-9
19. Liu H, Tian Y, Jiang B, Song Y, Du A, Ji S. Early mobilisation practice in intensive care units: a large-scale cross-sectional survey in China. *Nurs Crit Care*. 2023;28(4):510–518. doi:10.1111/nicc.12896
20. Bourke A, Niranjan V, O'Connor R, Woods C. Barriers to and motives for engagement in an exercise-based cardiac rehabilitation programme in Ireland: a qualitative study. *Bmc Primary Care*. 2022;23(1):28. doi:10.1186/s12875-022-01637-7
21. Salenger R, Holmes SD, Rea A, et al. Cardiac enhanced recovery after surgery: early outcomes in a community setting. *Ann Thorac Surg*. 2022;113(6):2008–2017. doi:10.1016/j.athoracsur.2021.06.072
22. Bäck M, Cider Å, Herlitz J, Lundberg M, Jansson B. Kinesiophobia mediates the influences on attendance at exercise-based cardiac rehabilitation in patients with coronary artery disease. *Physiother Theory Pract*. 2016;32(8):571–580. doi:10.1080/09593985.2016.1229828
23. Gray E, Dasanayake S, Sangelaji B, Hale L, Skinner M. Factors influencing physical activity engagement following coronary artery bypass graft surgery: a mixed methods systematic review. *Heart Lung*. 2021;50(5):589–598. doi:10.1016/j.hrtlng.2021.04.006
24. Yue P, Zhu ZY, Wang YL, et al. Determining the motivations of family members to undertake cardiopulmonary resuscitation training through grounded theory. *J Adv Nurs*. 2019;75(4):834–849. doi:10.1111/jan.13923
25. Charmaz K. Constructing grounded theory: a practical guide through qualitative analysis International Journal of Qualitative Studies on Health and Well-Being. 2006;1(3):118–192. doi:10.1080/17482620600881144
26. Corner EJ, Murray EJ, Brett SJ. Qualitative, grounded theory exploration of patients' experience of early mobilisation, rehabilitation and recovery after critical illness. *BMJ Open*. 2019;9(2):e026348. doi:10.1136/bmjopen-2018-026348
27. King R, Downer T, Lord B, Flanagan B, Oprescu F. A practical example of how to apply constructivist grounded theory methodology: exploring patient experiences during paramedic led healthcare. *Res Nurs Health*. 2025;48(4):508–521. doi:10.1002/nur.22468
28. Clarissa C, Salisbury L, Rodgers S, Kean S. A constructivist grounded theory of staff experiences relating to early mobilisation of mechanically ventilated patients in intensive care. *Glob Qual Nurs Res*. 2022;9:23333936221074990. doi:10.1177/23333936221074990
29. Zhang X, Li Y, Gong X, Zhang X, Yu X. Study on competency characteristics of rural general practitioners based on behavioral event interview. *Rev Chin J Gene Prac*. 2023;22(10):1025–1031.
30. Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res*. 2016;26(13):1753–1760. doi:10.1177/1049732315617444
31. Englert C, Rebar A, Rhodes RE, Pfeffer I. Editorial: new developments in the intention-behavior gap for physical activity - recent trends, controversies, and a critical outlook. *Front Psychol*. 2023;14:141119973.
32. Lee LS, Banks L, Oh PI, Brooks D, Colella TJF. Capturing the perspectives of women with coronary artery disease regarding interval training or continuous exercise in cardiac rehabilitation. *Disability Rehabil*. 2022;44(1):68–78. doi:10.1080/09638288.2020.1756469
33. Jacob P, Gupta P, Shiju S, et al. Multidisciplinary, early mobility approach to enhance functional Independence in patients admitted to a cardiothoracic intensive care unit: a quality improvement programme. *BMJ Open Quality*. 2021;10(3):e001256. doi:10.1136/bmjoq-2020-001256
34. Beasley L, Grace S, Horstmanshof L. Assessing individual readiness for change in healthcare: a review of measurement scales. *J Health Organiz Manage*. 2021;35(8):1062–1079. doi:10.1108/JHOM-10-2020-0414
35. Claes J, Goetschalckx K, Schepers D, Florequin F, Van Opstal H, Cornelissen V. Gender differences in response to center-based cardiac rehabilitation: a retrospective study. *Euro J Prev Cardiol*. 2024;31(Supplement_1). doi:10.1093/eurjpc/zwae175.216
36. Marzolini S, Brooks D, Oh PI. Sex differences in completion of a 12-month cardiac rehabilitation programme: an analysis of 5922 women and men. *Eur J Cardiovasc Prev Rehabil*. 2008;15(6):698–703. doi:10.1097/HJR.0b013e32830c1ce3
37. Koh Y, Stehli J, Martin C, et al. Does sex predict quality of life after acute coronary syndromes: an Australian, state-wide, multicentre prospective cohort study. *BMJ Open*. 2019;9(12):e034034. doi:10.1136/bmjopen-2019-034034
38. Wieslander I, Baigi A, Turesson C, Fridlund B. Women's social support and social network after their first myocardial infarction; a 4-year follow-up with focus on cardiac rehabilitation. *Eur J Cardiovasc Nurs*. 2005;4(4):278–285. doi:10.1016/j.ejcnurse.2005.06.004
39. Firoozabadi MG, Mirzaei M, Grace SL, et al. Sex differences in cardiac rehabilitation barriers among non-enrollees in the context of lower gender equality: a cross-sectional study. *BMC Cardiovasc Disord*. 2023;23(1):329. doi:10.1186/s12872-023-03331-7
40. Smith JR, Thomas RJ, Bonikowske AR, Hammer SM, Olson TP. Sex differences in cardiac rehabilitation outcomes. *Circ Res*. 2022;130(4):552–565. doi:10.1161/CIRCRESAHA.121.319894
41. Halfwerk FR, Wielens N, Hulskotte S, Brusse-Keizer M, Grandjean JG. A mobilization poster stimulates early in-hospital rehabilitation after cardiac surgery: a prospective sequential-group study. *J Cardiothorac Surg*. 2023;18(1):83. doi:10.1186/s13019-023-02173-w
42. Biswal D. Nudge: improving decisions about health, wealth, and happinessRichard H.Thaler & Cass R.SunsteinLondon, UK: penguin2009, ISBN: 978-0-141-04001-1. *J Public Affairs*. 2020;20(3):e2075. doi:10.1002/pa.2075