International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Continuous Nursing Care Model Based Health Promotion Program for Orthopedic Patients with Limb Fractures

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Abstract:
With advancements in medical technology and growing healthcare demands, the traditional nursing model increasingly fails to address the continuous care needs of discharged orthopedic patients, who often struggle with managing their health conditions and developing adequate self-care abilities during rehabilitation. The Continuous Nursing Care Model is defined as an integrated approach that ensures seamless, personalized care through coordinated efforts among hospitals, communities, and families, thereby extending support beyond the inpatient setting. This study aims to evaluate the impact of this model on health status and self-care ability, as well as on reducing rehospitalization rates in orthopedic patients with limb fractures. A multi-phased design will be employed, starting with a cross-sectional phase for baseline data collection and intervention program development, followed by a quasi-experimental phase involving pre- and post-intervention assessments. Aged 18 to 59, discharged from three hospitals in Hangzhou between January and March 2025, will be randomly assigned to either an intervention group or a control group. The intervention group will receive comprehensive, personalized care based on the Continuous Nursing Care Model—which includes multidisciplinary team support, targeted health education, psychological counseling, digital health management, and community resource integration—while the control group will receive routine postoperative care. Data will be analyzed using descriptive statistics, independent samples t-tests, chi-square tests, and paired sample analyses after testing for normality to ensure the appropriate use of parametric or non-parametric methods. Rigorous quality assurance measures, such as double data entry and regular data monitoring, will be implemented to ensure data integrity and study validity.

Keywords: Continuous Nursing Care Model; Orthopedic Patients with Limb Fractures; Health Status; Self-care ability; Health Promotion Program

1. Introduction

Traditional medical nursing care has long been the mainstay of inpatient treatment, focusing on short-term interventions and immediate disease management. However, as the complexities of medical science and patient needs have evolved, this conventional model has increasingly fallen short in addressing the comprehensive and long-term requirements of patients after discharge. In contrast, the continuous nursing care model provides a holistic framework that extends professional support from the hospital into the patient's home, ensuring seamless care throughout the treatment and rehabilitation process. This distinction is particularly critical for orthopedic patients diagnosed with fractures of the four limbs or hip, who face not only protracted physical recovery challenges but also significant psychological burdens.

Recent advancements in treatment technology and the broadening disease spectrum have amplified the challenges faced by healthcare providers. Hospitals are now tasked with simultaneously managing acute treatments while also addressing the long-term health needs of discharged patients (Yuan et al., 2024). In orthopedics, this issue is further exacerbated as patients often endure multiple stages of care, including emergency trauma management, surgical interventions, and intensive rehabilitation training. This continuous recovery timeline often results in increased physical strain and emotional distress. Patients with limb fractures or hip fractures, for instance, frequently experience severe pain, diminished muscle strength, and a loss of mobility, which can lead to feelings of isolation and depression. The cumulative burden of these issues can substantially affect their overall quality of life and often result in unforeseen re-hospitalizations, thereby placing additional strain on healthcare systems (Li, 2023; Shuzhen, 2021).

The continuous nursing care model was first introduced by the University of Pennsylvania in the United States and later recognized by the American Medical Association as a core element of primary health care (Stokes et al., 2005). Unlike the traditional model, continuous care ensures that patients receive consistent, professional nursing support during every phase of their recovery—from diagnosis through rehabilitation. This model incorporates key components such as personalized care planning, regular follow-up assessments, home visits, telemedicine consultations, and comprehensive patient education. By integrating these elements, continuous nursing care bridges the gap between hospital discharge and full recovery, providing patients with the tools and support necessary to manage their health effectively.

One of the most significant advantages of the continuous nursing care model is its focus on reducing the burden on patients. Orthopedic patients with limb fractures or hip fractures often face long periods of immobility and discomfort, which contribute to both physical and psychological stress. Continuous care addresses these issues by providing not only medical interventions but also mental health support and social resource integration (Gao et al., 2021). For example, regular nurse-led counseling sessions and support group meetings have been shown to alleviate anxiety and depression, fostering a more positive outlook during the rehabilitation process. This ongoing support is crucial, as it helps patients navigate the challenges of recovery while maintaining motivation to adhere to their rehabilitation protocols.

Furthermore, statistical data from China underscores the effectiveness of the continuous nursing care model in reducing re-hospitalization rates and improving patient outcomes. Recent studies have reported that the implementation of continuous care protocols in Chinese hospitals has led to a reduction in re-admission rates by approximately 25–30% among orthopedic patients. These improvements are attributed to the model's emphasis on early detection of complications and timely intervention, which significantly curtails the progression of post-discharge health issues (Zhang et al., 2019). This statistical evidence not only validates the model's efficacy but also highlights its potential to alleviate the financial and resource burdens on healthcare systems.

Another key aspect of the continuous nursing care model is its emphasis on patient education and empowerment. In traditional models, patients are often discharged with minimal understanding of their post-treatment care requirements. In contrast, continuous care programs provide detailed guidance on wound care, medication adherence, pain management, and rehabilitation exercises. This proactive approach enhances patients' self-care abilities, enabling them to actively participate in their recovery process. Research has demonstrated that orthopedic patients receiving continuous nursing care exhibit marked improvements in self-management, with one study in China noting a 40% increase in self-care competence among patients with limb fractures (Wang, 2022). Such outcomes not only contribute to better

recovery rates but also reduce the incidence of complications, further decreasing the likelihood of re-hospitalization.

The economic burden associated with prolonged rehabilitation and recurring hospital visits is another critical factor that continuous nursing care effectively mitigates. For orthopedic patients, the cost of continuous treatment and post-discharge complications can be substantial. By ensuring continuous monitoring and timely interventions, this model not only improves patient health outcomes but also reduces overall medical expenses (Ge, 2024). Moreover, by decreasing the rate of complications and subsequent re-admissions, continuous care contributes to a more efficient allocation of healthcare resources, ultimately benefiting both patients and providers.

In summary, the continuous nursing care model represents a significant advancement over traditional nursing approaches by addressing the full spectrum of patient needs—from immediate medical treatment to long-term rehabilitation support. For orthopedic patients with fractures of the four limbs or hip, this model offers critical benefits, including reduced physical and psychological burdens, improved self-care capabilities, and lower rates of re-hospitalization. Statistical data from China further supports the effectiveness of continuous care, indicating notable reductions in re-admission rates and enhanced overall patient outcomes. By integrating personalized care plans, regular follow-ups, and comprehensive educational initiatives, continuous nursing care not only bridges the gap left by traditional models but also sets a new standard for post-discharge health management. This study aims to explore the health-promoting effects of the continuous nursing care model on the health status and self-care ability of discharged orthopedic patients, providing essential evidence to support its broader application in the future.

2. Study Objectives

2.1. General Objective

The objective of this study will be to determine of the effectiveness of health promotion program based on continuous nursing care model to improve health status and self-care ability of discharged orthopedic patients with limb fractures

2.2. Specific Objectives

2.2.1 To determine the socio-clinico demographic profile of the study participants as to

a. socio-demographic profile (sex, age, highest educationa; occupation, civil status)-;

b. Clinical factors

2.2.2 To identify the baseline information of the study participants pre-intervention, as to:

a. Health Status;

b. Self-care ability

2.2.3 To determine the health status and self-care abilities of the study participants when grouped according to the socio-clinico demographic profile;

2.2.4 To design and implement a health promotion program based on continuous nursing care model; and

2.2.5 To determine the effectiviness of the health promotion program based on continuous nursing care model as to:

a. Health Status; and

b. Self-care ability

3. Review of Related Literature

3.1 Continuing Nursing Care Model

The continuous nursing care model was first proposed by the University of Pennsylvania in the United States and subsequently included as a core part of primary health care by the American Medical Association (Forest et al., 1947). The core idea of this model is to ensure that patients receive different levels of continuous nursing services from hospital to home and between different departments in the hospital (Carroll & Dowling, 2007). In 2003, the American geriatric society defined continuation of care as designing a series of care actions to ensure collaborative and continuous care in different health care settings (Quinn et al., 2008). This model of care contributes to the patient health status and quality of life by strengthening the cohesion and collaboration between different care services.

Liu & Li (2021) found that the remote care model was effective in improving treatment compliance with colorectal cancer, reducing the rate of rehospitalization, and improving their quality of life. This model provides health monitoring and nursing guidance through the Internet platform, which greatly improves patients' self-management ability and health level. Maoz Hagai et al. (2022) found that the continuous nursing care model helped to improve patient treatment compliance and mental health level and reduced the rate of rehospitalization due to treatment interruption. By establishing effective links between hospital and community care, patients can receive ongoing care support during the treatment and rehabilitation process. Zhou et al. (2024) found that the continuation of nursing mode can significantly improve the rehabilitation effect of patients, shorten the treatment time, and increase patients' compliance with the rehabilitation program. The study points out that continuation care not only guides patients for rehabilitation training but also helps patients to adjust their mentality and manage pain, thus effectively promoting their postoperative recovery.

Liu (2024) analyzed the improvement of continuous nursing care model on the quality of life of elderly patients with type 2 diabetes. Studies have shown that the continuous nursing care model helps patients to better control their condition and improves their quality of life and self-care ability by providing personalized diabetes management programs, regular health education and follow-up assessment. This study shows that the continuation of care has important implications for the long-term management of patients with chronic diseases. Wu et al. (2024) found that breast cancer patients with 4C continuous nursing care model showed higher self-care ability and quality of life during the postoperative recovery process. Through the continuation of care, patients have access to personalized health guidance and care support, reducing the incidence of postoperative complications and improving their overall health status and treatment compliance.

The results of Wu et al. (2024) showed that the continuous nursing care model significantly improved the ability of patients to manage lymphedema and effectively reduced the symptoms of patients. Continuing care improves patients' self-efficacy and health management by enhancing patients' disease awareness, providing targeted rehabilitation guidance and psychological support. Khosravi & Kiani (2024) explored the effects of the continuous nursing care model on oral health, self-efficacy and self-care ability in patients with head and neck cancer. Studies have demonstrated that the implementation of the continuous nursing care model can substantially enhance the oral health status of patients and their self-care abilities. Through remote care and regular follow-up, patients can receive timely health information feedback and professional advice, which in turn can improve self-management and quality of life.

As a new nursing concept, the continuous nursing care model has been widely applied in the treatment and rehabilitation process of different patient groups. By strengthening the cooperation and

communication between hospitals, communities and patients' families, the continuous nursing care model can effectively improve the health management level and quality of life of patients, and provide more comprehensive rehabilitation support for orthopedic patients.

In comparison to recent international studies, this research aligns with findings that continuous nursing care models can enhance patient health outcomes and self-care capabilities. For instance, a study by Smith et al. (2021) demonstrated that continuous nursing interventions significantly improved postoperative recovery and self-management in orthopedic patients. Similarly, Johnson and Lee (2022) found that integrated nursing programs effectively promoted health and self-care among discharged patients. However, this study uniquely focuses on the specific components of health status and self-care abilities, providing a more detailed analysis of these factors. The core goal of this study is to provide theoretical support and practical guidance for the changes of health status and self-care ability before and after the application of continuous nursing care model in orthopaedic patients.

3.2 Orthopedic Patient Care

Orthopedic patient care is a broad and multidimensional field involving pain management, rehabilitation guidance, psychological care, complication prevention and other aspects. With the increasing incidence of orthopedic diseases and the demand of postoperative patients, more and more nursing scholars and clinicians begin to pay attention to the care model and interventions of orthopedic patients, to improve the postoperative recovery process, quality of life and self-care ability of patients. The study of Qin and Liu (2024) shows that the combination of non-drug intervention (such as warm therapy, cold compress, massage, etc.) can effectively reduce the postoperative pain of orthopedic patients, reduce the dependence on drugs, and avoid the occurrence of drug side effects. The study highlights that non-pharmacological care interventions have important clinical value in orthopedic postoperative pain management, especially outstanding in improving patient comfort and rehabilitation outcomes.

Xu (2021) found that comprehensive nursing intervention can significantly reduce the postoperative pain of orthopedic patients and reduce the incidence of complications. Through the comprehensive use of drug therapy, psychological nursing, physical therapy and other means, the overall recovery speed of patients has accelerated, and the incidence of postoperative complications (such as infection, thrombosis, etc.) has been effectively controlled. Muhamad et al. (2022) highlighted that discharge planning plays a pivotal role in ensuring the successful postoperative recovery of orthopedic patients. Through comprehensive communication with patients and their families, healthcare professionals can offer personalized discharge guidance and follow-up care recommendations, thereby effectively reducing the patient rehospitalization rate and enhancing their postoperative rehabilitation outcomes. Research emphasize that discharge planning should consider patient specific needs and ensure that patients receive adequate care support after discharge. Kumar et al. (2023) found that the implementation of epidemic prevention and control measures affected the admission, treatment, and surgical scheduling of orthopedic patients, leading to delays in their rehabilitation process. During the pandemic, the limited resources of nursing staff and the nursing needs of patients increased, resulting in the unsatisfactory recovery effect of patients. The study proposed that the nursing service and resource allocation of orthopedic patients should be strengthened after the outbreak to better meet the rehabilitation needs of patients.

Moreover, Anieche et al. (2022) found that nursing audits and feedback mechanisms can enhance the quality of care for orthopedic patients and reduce nursing errors. Through regular nursing quality inspection and feedback, nursing staff can timely adjust nursing measures and improve nursing strategies, so as to improve the overall rehabilitation effect of patients. The study underscored the significance of

ensuring the quality of care in the field of orthopedic medicine. Li and Yang (2024) analyzed the treatment effect of cluster nursing combined with traditional Chinese medicine nursing intervention on abdominal distension and constipation in orthopedic bedridden patients. It was found that the combined intervention of cluster care and TCM care could effectively relieve abdominal distension and constipation symptoms in patients with orthopedic bed rest. Traditional Chinese medicine nursing improves the intestinal function of patients through massage, acupuncture and other ways, while cluster nursing strengthens patients physical support and emotional regulation through holistic nursing management. The combination of the two improves the overall rehabilitation effect of patients.

Zhou and Lu (2023) found that the application of pain interventions (such as pain assessment, analgesic drugs, psychological support, etc.) can significantly reduce the pain level of postoperative orthopedic patients and improve the sleep quality of patients. Studies believe that the effective management of postoperative pain can not only help to improve patient comfort but also can accelerate their rehabilitation process and reduce the occurrence of complications. NCPD Tests (2023) showed that the comprehensive use of multimodal pain management strategies (such as medication, physical therapy, psychological support, etc.) can significantly improve the pain experience of elderly orthopedic trauma patients and reduce the impact of pain on patients' quality of life. This study shows that pain management in elderly patients should adopt an individualized and multi-dimensional intervention to ensure optimal care outcomes. The study of Jiang Man (2023) shows that psychological nursing can effectively reduce patients' anxiety, depression and other negative emotions, and help patients better adapt to the physical changes after surgery. By establishing a good communication relationship with patients, psychological care can improve patients' compliance and promote their postoperative rehabilitation. The study highlights the indispensable role of psychological care in the postoperative recovery of orthopedic patients. Zhu Yan et al.'s (2023) study revealed that cluster care intervention can substantially decrease the occurrence of pressure ulcers in orthopedic patients, particularly during surgery for patients with prolonged bed rest. The study points out that the combined use of regular turning over, skin care, nutritional support and other measures can effectively prevent the formation of pressure ulcers and improve the quality of patient care. It can be seen from the above studies that the care of orthopedic patients not only focuses on the relief of postoperative pain, but also involves the nursing intervention of abdominal distension, constipation, pressure ulcers and psychological fluctuations. The combined use of various nursing measures can not only improve the postoperative rehabilitation effect of patients, but also effectively reduce complications and improve the quality of life of patients. Nursing intervention for orthopedic patients requires a comprehensive consideration, including pain management, psychological counseling, complication prevention, and continuous nursing support after discharge.

3.3 Health Promotion of Orthopedic Patients

3.3.1 Health Status

The health status of orthopedic patients is one of the key factors affecting their rehabilitation process and quality of life. Health promotion is not only the disease treatment for patients, but also involves the patients' psychological, physical function, social adaptation and other multi-dimensional health conditions. Jonas et al. (2023) assert that the health behavior intentions of orthopedic patients are substantially influenced by the environmental design, particularly the spatial layout, color usage, natural light, and other factors. These factors can significantly enhance patients' exercise intentions and participation in rehabilitation. Health behavior intention is closely related to the patients' physical function

recovery, mental health, and other aspects.

Pang et al. (2022) investigated the effects of WeChat-based health education combined with postoperative rehabilitation model on motor function and complications in orthopedic patients. The study found that providing personalized postoperative health education and guidance through the WeChat platform, combined with the enhanced postoperative recovery model, can effectively improve the motor function of orthopedic patients and reduce postoperative complications. Health education promotes patients' cognition and participation in the rehabilitation process, thus contributing to improve overall health status and recovery outcomes. The study proposed by Zhang (2017) designed a hospital-community integration continuous nursing care model for orthopedic discharged patients, aiming to promote the improvement of long-term health status of patients. This study shows that the continuous nursing care model effectively promoted the health management of patients through the hospital-community collaboration, especially in postoperative rehabilitation and health education. The study found that the continuous nursing care model can improve the self-care ability, health awareness and quality of life of orthopedic patients, and significantly improve their health status.

Sheng (2019) found that orthopedic trauma patients generally have psychological problems such as anxiety and depression, especially in the early postoperative period. Factors affecting the mental health of patients include the severity of the condition, pain experience during treatment and social support. The study suggests that the mental health assessment of orthopedic patients should be an important part of the health management to improve the overall health level and rehabilitation effect of the patients. Anieche et al. (2022) found out that implementing care review and feedback mechanisms can significantly enhance patient health outcomes, particularly in the areas of health status monitoring and symptom management. Regular nursing audits and feedback not only enhance the quality of nursing but also enable timely detection of changes in patients' health status. This allows for prompt adjustments in nursing measures, thereby facilitating patient recovery. Mir Hassan and David's (2022) study showed that the mental health status of orthopedic trauma patients seriously affects their overall health status and rehabilitation process. Emotional problems such as psychological stress, anxiety, and depression are the main obstacles affecting the recovery of patients. The research suggests that psychological care interventions can relieve negative emotions and significantly improve their health, especially for those experiencing major trauma or surgery. Forsberg (2020) explored the relationship between American Society of Anesthesiologists Physical Status Classification System (ASA) grade, patient self-estimated physical health, psychological well-being, and anxiety symptoms. Studies have shown that the physical health status of orthopedic patients is closely related to their psychological well-being and anxiety symptoms. Higher ASA grade was significantly associated with poorer physical health and higher anxiety symptoms. The study suggests that attention should be paid to the patients' physical health assessment, combined with mental health interventions to improve their overall health status, especially during the postoperative recovery period. Matteo (2021) study proposed HEPAS (healthy diet, physical activity, and sleep hygiene), and concluded that the health status of orthopedic patients is closely related to these three. Studies have shown that the overall health and rehabilitation process of orthopedic patients can be significantly promoted by improving their dietary structure, increasing physical activity and improving sleep quality, especially during the postoperative recovery stage.

The research results of Zhou et al. (2022) show that the health awareness of orthopedic patients after the health management intervention with TCM characteristics has been significantly improved. Through the combination of TCM theory and practice, patients' cognition of the disease and self-care ability are

enhanced, and their health status has also been improved. The study emphasizes that TCM characteristic health management plays a unique role in the health promotion of orthopedic patients, especially in improving patients health self-management ability. Bernstein et al. (2022) investigated the effects of social health determinants (Social Determinants of Health, SDH) on the physical function and mental health of newly admitted orthopedic patients. It was found that socioeconomic factors, educational background, and living environment have significant effects on the physical function and mental health of orthopedic patients. Low socioeconomic status is strongly associated with poorer physical function and higher mental health problems (e. g., depression and anxiety).

3.3.2 Self-Protection Ability

Self-care ability refers to the ability of patients to self-manage health and prevent and control disease. For orthopedic patients, the postoperative self-care ability is particularly critical, because it directly affects the rehabilitation process and quality of life. The study of Yi, Kou, and Wei Mei (2020) found that the tripartite collaborative care model with the participation of medical staff, patients and their families in the early postoperative stage can effectively improve the self-care ability of orthopedic patients, especially in the early postoperative stage. The improvement of self-care ability is significantly related with the reduced incidence of postoperative complications and the acceleration of recovery, which proves the promotion effect of this model on postoperative rehabilitation.

Xiong (2010) highlighted that guiding patients to conduct pressure ulcer prevention through self-care theory can significantly improve patients self-care ability, especially in terms of bed care, body position change, and skin care. After receiving education on self-care theory, patients have a deeper understanding and practice of the prevention of pressure ulcers, thus effectively reducing the incidence of pressure ulcers. Koo and Kim (2011) analyzed the effects of anxiety and self-care compliance through CD-ROM. Structured educational procedures were found to be effective in reducing patients' anxiety levels and improving their self-care compliance. The education includes postoperative care, activity management, and complication prevention, which enhance patients' self-care awareness and self-care ability. Liu et al. (2020) found that the self-care ability of orthopedic diabetes patients significantly improved through personalized motivational interview nursing intervention. Especially in self-glucose monitoring, diet control, and exercise management, patients demonstrated higher self-management ability. The study emphasizes that motivational interviewing can effectively improve patients' self-management behaviors and enhance their self-care ability.

Ward et al. (2011) found that good self-care ability in orthopedic patients significantly improved treatment compliance with deep vein thrombosis prophylaxis. The improvement of self-care ability has a strong correlation with variables such as patients' emphasis to health management, lifestyle change, and treatment compliance, indicating that self-care ability is of great importance for disease prevention. Zhang (2017) found that the continuous nursing care model helps to improve patients self-care ability, especially in the long-term health management process after discharge. With the help of continuous care, patients can better perform postoperative care, medication management and lifestyle adjustment, to effectively improve their self-care ability and reduce the incidence of postoperative complications. Li, Liu, and Liao (2023) highlighted that the hospital-community-family integration continuous nursing care model significantly improved patients self-care awareness and ability, especially in postoperative rehabilitation, drug management and lifestyle adjustment. The improvement of self-care ability is closely related to variables such as the recovery of physical function and quality of life, indicating that the continuous nursing care model has a positive role in promoting self-care ability.

Zhu et al. (2019) demonstrated that pain management care not only alleviates postoperative pain but also significantly enhances patients' self-efficacy. Patients show higher awareness of self-care in pain management and can better cope with pain, thus improving their postoperative rehabilitation effect and self-care ability. The results of Huang et al. (2020) show that internet continuation care significantly improves the self-efficacy and daily living ability of orthopedic patients by providing online health education and real-time monitoring. Patients can better master the self-care knowledge, enhance the confidence in the disease management, promote the change of health behavior, and thus improve the overall self-care ability of patients.

3.4 Future Research Perspectives

Future research in continuous nursing care for orthopedic patients should focus on addressing several key areas that remain insufficiently explored. Current studies predominantly concentrate on demonstrating the effectiveness of continuous care models in improving treatment compliance, reducing rehospitalization rates, and enhancing patient quality of life across various populations, such as the elderly and chronic disease sufferers. However, there is a notable gap in research specifically targeting orthopedic patients with limb fractures, particularly regarding how socio-clinico demographic factors influence both health status and self-care ability post-discharge. Although several investigations have highlighted the benefits of continuous nursing care in reducing postoperative complications and accelerating recovery, many of these studies lack a comprehensive analysis of the integrated health promotion programs that not only focus on physical rehabilitation but also on empowering patients to actively manage their health at home. Moreover, existing literature often overlooks the individual differences in patient backgrounds, including their educational level, occupational status, and family support systems, which are crucial for tailoring effective interventions. In light of these gaps, the current study aims to design and implement a health promotion program based on an continuous nursing care model specifically for orthopedic patients with limb fractures. By systematically evaluating baseline conditions and measuring changes in health status and self-care capabilities, this research intends to provide a more nuanced understanding of how continuous nursing interventions can be optimized to meet the unique needs of this patient group, ultimately improving long-term outcomes and enhancing overall quality of care.

3.5 Theoretical Framework

Holistic Nursing Theory: Guided by the holistic nursing theory and framed within the biopsychosocial model, this approach emphasizes systematic nursing interventions. The human body is viewed as an integrated whole composed of biological, psychological, and social factors, which collectively influence health and disease. Therefore, to maintain and promote health and to treat illness, it is imperative not only to focus on biological factors but also to consider psychological and social factors. This necessitates the practice of holistic nursing—conducting comprehensive assessments of the biological, psychological, and social aspects of the human body, and then implementing targeted nursing measures to facilitate complete recovery. This study constructs its continuous nursing care model based on this concept.

Omaha System: The Omaha System comprises three components: the Problem Classification Scheme, the Intervention Scheme, and the Outcome Evaluation Scale. The Problem Classification Scheme covers four domains-environment, psychosocial, physiological, and health-related behaviors-encompassing a total of 42 health problems. The Intervention Scheme categorizes nursing interventions into four major areas: health education, guidance and counseling; treatments and procedures; case management; and surveillance.

The Outcome Evaluation Scale measures outcomes on a five-level scale based on cognition, behavior, and status of the problems. This study uses the Omaha System as its framework.

Maslow's Hierarchy of Needs Theory: Proposed by the American psychologist Abraham Maslow, this theory posits that human basic needs are arranged in a hierarchical order from low to high: physiological needs, safety needs, love and belonging needs, esteem needs, and self-actualization needs. Human needs are progressively hierarchical, meaning that higher-level needs are only activated when the lower-level needs are sufficiently met. In assessing the continuous nursing care needs and nursing issues of discharged orthopedic patients, this study applies Maslow's theory in conjunction with the patients' specific conditions to determine the priority order for addressing their continuous nursing care issues.

3.6 Conceptual Framework

The conceptual framework illustrated above highlights the relationship between the socio-clinico demographic profile of the study participants, the Health Promotion Program grounded in a continuous nursing care model, and the resulting effectiveness measured by health status and self-care ability. The socio-clinico demographic profile encompasses variables such as sex, age, educational attainment, occupation, civil status, and relevant clinical factors, all of which shape each participant's baseline conditions. These attributes are crucial for understanding individual differences in physical, psychological, and social circumstances, ultimately influencing patient engagement and responsiveness to health interventions. By acknowledging these variations, the program can be tailored to address diverse needs, thereby ensuring that the intervention is more precise, equitable, and effective. This customization is especially critical for orthopedic patients with limb fractures, who often require sustained rehabilitation support and multifaceted care to regain functional independence and maintain overall well-being. Moreover, this comprehensive perspective underscores the critical role of personalized interventions that account for each patient's unique socio-clinical circumstances and rehabilitation needs.

At the core of this conceptual framework is the Health Promotion Program, which integrates the principles of a continuous nursing care model to provide personalized and ongoing support for discharged orthopedic patients. This intervention focuses on promoting recovery through structured activities such as patient education, regular follow-ups, telemedicine consultations, and community-based resources, all aiming to enhance physical recovery and psychosocial adjustment. By systematically evaluating changes in health status and self-care ability, the study assesses the program's effectiveness in bridging the gap between hospital-based treatment and long-term rehabilitation. Moreover, the framework implies a cyclical process, wherein insights gained from monitoring patient outcomes can be fed back into refining and optimizing the intervention. In doing so, practitioners can ensure that the care provided remains relevant and adaptive throughout the recovery journey. Ultimately, the successful implementation of this program is expected to reduce complications, improve patients' functional outcomes, and foster greater autonomy in managing daily activities. Through this comprehensive approach, the framework provides a robust basis for designing and evaluating interventions that respond to the unique challenges faced by orthopedic patients with limb fractures.

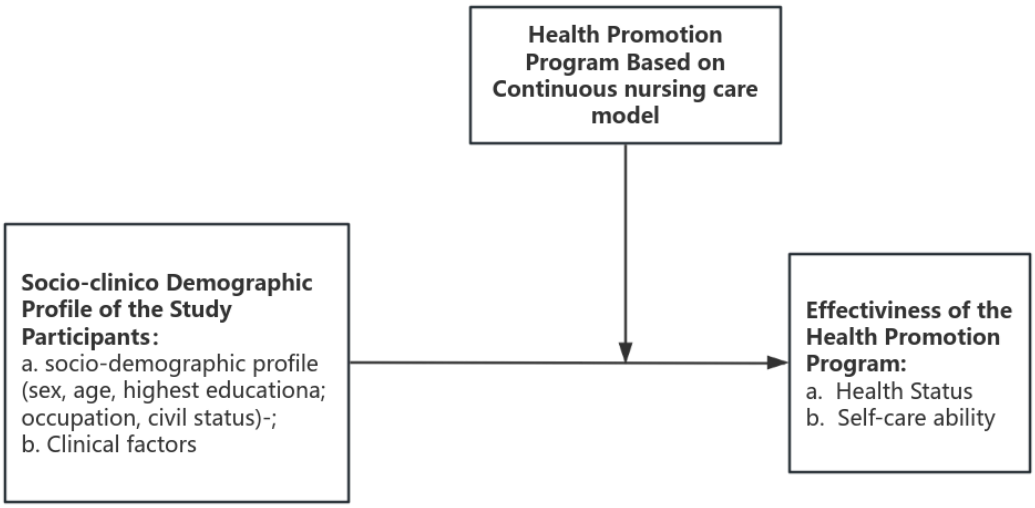

Figure 1 Conceptual Framework

4. Methods

This section will include sample selection, research tools, ethical considerations, and specific operating procedures to ensure the scientific nature and ethical compliance of the study. This section details the design framework of the study, the participant selection criteria, the use of the study tools, and the ethical considerations, and specific steps in the implementation process.

4.1. Study Design and Local of the Study

This study will adopt a multi-phased approach to investigate the effectiveness of a continuous nursing care model in promoting health among orthopedic patients with limb fractures.

In Phase 1, the study will screen participants who meet the criteria.

In Phase 2, the researchers will employ a cross-sectional design to gather baseline information and develop the health promotion program. This phase will involve collecting demographic and clinical data from orthopedic patients to identify their most pressing needs, as well as examining existing hospital protocols and community resources. These findings will inform the design of the continuous nursing care model, ensuring that it aligns with patients' unique socio-clinical profiles and addresses the gaps in current orthopedic care practices.

In Phase 3, the study will proceed with a quasi-experimental design, characterized by a pre- and post-intervention assessment of patient health status and self-care ability. Although there will be an active intervention in the form of a newly developed health promotion program, randomization and the use of a strict control group may not be fully feasible due to institutional constraints and ethical considerations. This limited ability to randomly assign participants or maintain strict control conditions underscores the quasi-experimental nature of the study.

In phase 4, the study will implement a continuing care model intervention for the participants. According to the design, the intervention was implemented step by step for the study participants.

In phase 5, the study will conduct post-intervention data collection and collation. Despite these constraints, the researchers will implement standardized procedures to collect data before and after the intervention, allowing for a systematic comparison of outcomes. The design will also feature monitoring and follow-up to gauge the sustainability of improvements. Through this two-phase structure, the study will generate

comprehensive insights into both the development of a targeted health promotion program and its effectiveness in a real-world clinical environment.

The research will be conducted in three major hospitals, including Hangzhou First Peoples Hospital, the Affiliated Hospital of Hangzhou Normal University, and Hangzhou Hospital of Traditional Chinese Medicine. Three hospitals located in a metropolitan area with well-established orthopedic services. These institutions are recognized for providing a range of orthopedic interventions and rehabilitation support, including post-discharge follow-ups and limited home-care services. Each hospital will offer a distinct context for implementing and evaluating the continuous nursing care model, as they maintain different patient volumes, staffing patterns, and community outreach programs. By involving multiple hospitals with diverse patient populations and organizational structures, the study will aim to capture a broader spectrum of patient needs and thereby enhance the generalizability of the findings.

4.2. Study Participants

4.2.1. Sample size

In this study, the researchers will recruit orthopedic patients from three major hospitals in Hangzhou, including Hangzhou First Peoples Hospital, the Affiliated Hospital of Hangzhou Normal University, and Hangzhou Hospital of Traditional Chinese Medicine, between January 2025 and March 2025. Eligible participants will be adults aged 18 to 59 who have been diagnosed with fractures of the four limbs or hip, and they will be enrolled in the intervention prior to discharge. Ethical clearance will be obtained before the recruitment process commences, ensuring that all participants voluntarily consent to join the study. The primary outcome measure for sample size estimation will be the SF-36 health status questionnaire, and the calculation will incorporate a 10% attrition rate to account for potential dropouts. The final sample size will be determined using the formula for comparing two means, aiming to secure a sufficient number of participants to rigorously assess the impact of the continuous nursing care model on patient health outcomes.

$$N_1 = N_2 = \frac{2\sigma^2(t_{\alpha/2}+t_\beta)^2}{x_{1-2}{}^2} .$$

4.2.2. Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for this study are as follows:

The inclusion and exclusion criteria for this study will be determined based on specific factors related to orthopedic patients. Inclusion will be for orthopedic patients with limb fractures and patients aged 18-59 years old. Only those who will voluntarily participate, along with their families, and will sign the informed consent form will be considered. Furthermore, patients who will have undergone relevant orthopedic surgical treatment and will meet the basic requirements of postoperative rehabilitation care will be included.

Conversely, certain exclusion criteria will be applied. Patients with other serious diseases, such as malignant tumors or severe heart, liver, or renal failure, will be excluded. Those with cognitive impairment, including a history of language communication and comprehension disorders, mental illness, or conditions preventing effective participation in the study, will not be eligible. Patients who will voluntarily withdraw during the study period or will be rehospitalized for other diseases will also be excluded. Furthermore, individuals who will be unable to complete the questionnaire or participate in follow-up visits for any reason will not be include.

4.3. Research Instruments

1. General Data and Clinical Data

This questionnaire will be designed by the investigator to identify the demographic data and diseases of orthopedic patients. It will include basic information such as sex, age, highest educationa; occupation, civil status. Additionally, it will capture clinical factors, including fracture, fracture type, history of diseases, and other chronic diseases.

2. The Health Status Questionnaire

The data will be collected using the Health Status Questionnaire (The Short Form-36 Health Survey, SF-36) (Ware et al., 1993). It will comprehensively summarize physiological and psychological functions, as well as subjective feelings, through 36 questions divided into eight dimensions: overall health, physiological function, physical pain, vitality, social function, emotional function, and mental health. During the scoring process, each item will first be processed in a positive manner, then scored individually, with the initial score converted into a standardized 0–100 percentage scale. Higher scores will indicate a better quality of life. A score above 60 will indicate basic self-care in daily life; scores between 40 and 60 will indicate the need for assistance; scores between 20 and 40 will suggest significant dependence; and scores below 20 will indicate complete dependence. The questionnaire's reliability and validity with Cronbach's coefficient od 0.910. The specific contents and scoring criteria of the questionnaire in this study are shown in Appendix C.

3. Self-care ability questionnaire

The data will be evaluated using the Self-Care Capacity Measurement Scale (the Exercise of Self-Care Agency Scale, ESCA) (Kearny & Fleischer, 1979), which will be based on Orem's self-care theory and originally developed by Kearny and Fleischer in 1979. Translated by Chinese scholars (Deloitte Li, 2022), it primarily includes four dimensions: self-care skills, self-care responsibility, self-concept, and health knowledge level, comprising a total of 43 items with a maximum score of 172 points. Based on the total score and the scores of individual dimensions, higher scores will indicate better self-care ability. The questionnaire's reliability and validity with Cronbach's coefficient od 0.96. The specific contents and scoring criteria of the questionnaire in this study are shown in Appendix C.

4.4. Specific Procedures Based on Study Objectives

This study will be conducted in five distinct phases that systematically evaluate the impact of the continuous nursing care model on the health promotion of orthopedic patients with limb fractures. The procedures will be implemented in future tense and will align with the approved study objectives. A detailed Gantt chart will be developed to schedule and monitor the progress of each phase, ensuring that milestones and deliverables are met according to the study timeline. Throughout the study, quality assurance and quality control measures will be integrated to maintain data integrity, ensure adherence to the intervention protocol, and guarantee that the study outcomes are reliable and valid.

4.4.1. Phase 1: Screening of Participants and Research Team and Capacity Building

In the screening phase, orthopedic patients will be selected from three hospitals in Hangzhou between January 2025 and March 2025. Patients will be eligible if they are diagnosed with fractures of the four limbs or hip and fall within the age range of 18 to 59 years. A random sampling method will be used to identify patients who meet the inclusion and exclusion criteria from the orthopedic discharges. All potential participants will be provided with detailed information regarding the study, and their eligibility will be confirmed through initial medical record reviews and preliminary interviews. Quality control

procedures will be applied during this phase to ensure that the sample is representative and that the attrition rate does not exceed 10%. This phase will also include the establishment of a secure database where all participant screening data will be recorded.

The research team will consist of approximately 15 professionals with diverse expertise, including orthopedic nursing specialists, community health nurses, psychological counselors, nutritionists, and data analysts. Each member will receive specialized training on the study protocol, data collection methods, and quality control procedures. Capacity-building activities, such as regular workshops, team-building sessions, and periodic review meetings, will be organized to enhance the team's effectiveness and maintain high standards of practice throughout the study. The research team will be directly involved in all aspects of the intervention, from the initial screening of participants and pre-intervention data collection to the implementation of the care model and post-intervention assessments. Their combined expertise and coordinated efforts will ensure the accurate execution of the intervention and the reliability of the study outcomes. The team's role in the intervention is critical for achieving the study objectives and providing insights into the continuous nursing care model's impact on the health promotion of orthopedic patients.

4.4.2 Phase 2: Pre-intervention Measurement

After completing the screening process, baseline data will be collected during the pre-intervention measurement phase. Standardized questionnaires with verified reliability and validity will be used to assess clinical demographic profiles—including gender, age, education, marital status, and occupation—as well as key health status indicators. These indicators will cover overall health perception, physical function, physical pain, vitality, social function, emotional function, and mental health. In addition, self-care ability will be evaluated based on dimensions such as self-care responsibility, self-concept, self-care skills, and health knowledge. All data will be captured electronically using a secure system, and rigorous quality assurance measures will be implemented to check for data completeness and accuracy.

4.4.3 Phase 3: Design of the Intervention Protocol

In this phase, the intervention protocol will be designed based on the continuous nursing care model. The intervention frame will integrate multidisciplinary team support, personalized care planning, comprehensive health education, psychological support, digital health management, and community resource integration. The protocol will outline detailed procedures for each intervention component, including the modalities of health education (face-to-face sessions, health lectures, written materials, and digital platforms like WeChat and mobile applications), and the schedule for personalized psychological counseling and rehabilitation training. A specific framework will be provided that describes how the intervention is delivered, including timelines and responsibilities. Quality assurance measures, such as regular team meetings and protocol audits, will be established to ensure fidelity to the intervention design. The intervention protocol will be documented and included as an appendix to the study documentation.

4.4.4 Phase IV: Implementation of the Intervention Program

The implementation phase will involve executing the intervention program over a three-month period. Participants will be randomly allocated into two groups: an intervention group and a control group. The control group will receive routine postoperative care, which includes basic wound care, pain management, prevention of deep vein thrombosis, standard rehabilitation guidance, discharge instructions, and regular follow-up through telephone or outpatient visits. The intervention group will receive the routine care plus additional interventions derived from the continuous nursing care model. These additional interventions will involve active multidisciplinary team support, individualized care plans, enhanced health education and training sessions, structured psychological support, digital health management via mobile applications

and WeChat, and community resource integration. Quality assurance during this phase will be maintained by continuous monitoring of intervention delivery, adherence to the prescribed protocol, and regular data collection to document any deviations. The research team will conduct periodic reviews and adjust the intervention as necessary to ensure that it meets the intended objectives (see Appendix A).

4.4.5 Stage 5: Post-intervention measures

Upon completion of the three-month intervention period, post-intervention measurements will be conducted to evaluate the impact of the continuous nursing care model. The same standardized instruments used in the pre-intervention phase will be administered to assess changes in health status and self-care ability. In addition, a satisfaction survey will be conducted to gauge participants' perceptions of the nursing services, including aspects such as the professionalism of the nursing staff, the effectiveness of the intervention, and the overall quality of the care environment. Data regarding any instances of rehospitalization and postoperative complications during the follow-up period will also be recorded. These outcomes will be compared with baseline data to determine the efficacy of the intervention. All collected data will undergo rigorous quality control procedures and statistical analysis to verify the intervention's effect on patient outcomes.

4.5 Ethical Considerations

Ethical Approval: This study will obtain ethical approval from the Clinical Trial Ethics Committee of the Red Cross Hospital of Hangzhou, China. The committee will review the study protocol, design, and all associated procedures to ensure that the research meets national and international ethical standards. The approval process will involve a thorough examination of the study's aims, methodologies, and potential risks. The research team will submit all required documents, and any modifications requested by the committee will be promptly addressed. Once approval is granted, the study will proceed in full compliance with the established ethical guidelines, ensuring respect and protection for all participants.

Informed Consent Process: All eligible orthopedic patients will be provided with a detailed informed consent form prior to participation. The research team will explain the study purpose, procedures, potential risks, and benefits through face-to-face discussions, supplemented by written materials and verbal explanations. Participants will be informed that their involvement is entirely voluntary and that they may ask questions at any time. The informed consent process will ensure that each participant fully understands the study requirements and their rights, including the freedom to decline or withdraw without any adverse consequences. This process will be documented to maintain transparency and uphold ethical standards throughout the study.

Duration of Participation: The duration of participation for each enrolled patient will be clearly defined and communicated during the informed consent process. Participants will be involved in the study from the point of enrollment, which occurs prior to hospital discharge, until the conclusion of the follow-up evaluation phase, anticipated to last for three months. During this period, participants will undergo the continuous nursing care intervention and periodic assessments. The study design will ensure that the duration is sufficient to observe meaningful changes in health status and self-care ability, while also being considerate of the patients' recovery timeline. Regular updates and scheduling will be provided to maintain clear communication with participants.

Privacy Protection: The study will strictly protect the privacy and confidentiality of all participants' personal and clinical information. Data will be collected using anonymous codes rather than names, and all records will be securely stored in password-protected systems accessible only to authorized research

team members. Measures will be implemented to ensure that any published results or shared data do not reveal individual identities. The research team will comply with relevant data protection regulations and guidelines, ensuring that the handling, storage, and dissemination of information are conducted with the highest standards of security and confidentiality. Participants will be reassured that their privacy will be safeguarded throughout the study.

Participant Emotional Distress Management Protocol: Recognizing that participation in the study may evoke emotional distress, particularly among orthopedic patients coping with recovery challenges, the research team will establish a comprehensive emotional distress management protocol. This protocol will include regular monitoring of participants' emotional well-being through standardized assessments and direct interactions during follow-up sessions. In the event that a participant exhibits signs of significant stress, anxiety, or depression, immediate support will be provided through counseling services or referrals to mental health professionals. The protocol will also include guidelines for managing any emotional responses during the informed consent process and intervention sessions, ensuring that each participant receives prompt and compassionate care.

Risk and Inconvenience: The potential risks and inconveniences associated with this study will be clearly communicated to all participants during the informed consent process. Expected risks may include mild psychological stress from regular assessments and the possibility of information privacy concerns. The research team will implement strategies to minimize these risks, such as regular monitoring of participants' well-being and strict adherence to data security protocols. Although participation may require some additional time for assessments and follow-ups, the inconvenience will be kept to a minimum. The research team will ensure that any risks are promptly addressed, and participants will be informed of their right to withdraw at any stage without any impact on their future medical care.

Benefits of the Study: Participants in this study will potentially benefit from an enhanced continuous nursing care model that aims to improve their overall health status and self-care ability following orthopedic treatment. The intervention is designed to provide comprehensive support that extends beyond the hospital, including personalized health education and ongoing follow-up. These measures will likely contribute to reduced postoperative complications, improved recovery outcomes, and enhanced quality of life. Additionally, the study's findings will offer valuable insights into the effectiveness of continuous nursing care, which may benefit future patients and contribute to improvements in orthopedic care practices. Participants will be informed of these potential benefits during the consent process.

Data Management and Security: Data management will be rigorously maintained throughout the study to ensure accuracy, integrity, and security. All clinical and questionnaire data will be collected in standardized formats and entered into a secure database with restricted access. Regular audits and data verification procedures will be conducted to maintain data quality. The research team will ensure that all electronic records are encrypted and that physical documents are stored in locked facilities. Data will be retained only for the duration necessary to complete the study and will be destroyed securely afterward, in accordance with ethical guidelines and legal requirements. These measures will guarantee that participants' information is handled with the utmost care and confidentiality.

Conflict of Interest: The research team will declare any potential conflicts of interest prior to the commencement of the study. All team members will explicitly state that they have no financial or personal interests that could influence the study's design, conduct, or outcomes. This declaration will be included in the study documentation and communicated to the ethics committee as part of the approval process. The team will adhere to strict policies regarding impartiality and objectivity, ensuring that all findings are

reported transparently and without bias. In cases where any potential conflict of interest is identified during the course of the study, appropriate measures will be taken to mitigate its impact, thereby upholding the integrity and credibility of the research.

5. Statistical Analysis of Data

The statistical analysis of data in this study will be carried out using a variety of tools and tests tailored to each specific objective. Data will be entered and curated using SPSS 25.0.

For the first specific objective—determining the socio-clinico demographic profile of the study participants—the clinical and demographic data (such as gender, age, education, marital status, and occupation) will be described using descriptive statistics (mean, standard deviation, median, and interquartile range, as appropriate).

For the second objective, which is to identify the baseline information of participants pre-intervention concerning health status and self-care ability, standardized questionnaires will be employed. Descriptive analyses will be used to establish baseline means and variability. Normality testing (Shapiro-Wilk) will determine the subsequent use of either paired sample t-tests (F-tests) for normally distributed data or the Wilcoxon signed-rank test for non-normally distributed data during pre- and post-intervention comparisons.

To address the third objective, which involves comparing health status and self-care abilities when grouped according to the socio-clinico demographic profile, independent samples t-tests will be used for normally distributed continuous variables, while the Mann-Whitney U test will be used for non-parametric data. Categorical variables will be analyzed using the chi-square test or Fisher's exact test, ensuring that the baseline balance between the groups is maintained.

For the fifth objective, the effectiveness of the program will be evaluated. The intervention's impact will be assessed by comparing changes in health status and self-care ability using paired sample t-tests (F-tests) for normally distributed data or Wilcoxon signed-rank tests for non-parametric data. In addition, effect sizes will be calculated to quantify the magnitude of change.

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