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ORIGINAL RESEARCH

Knowledge, Practice and Barriers to Exercise Rehabilitation Among Chinese Patients with Acute Musculoskeletal Injury: A Mixed-Methods Study

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Purpose: This study aimed to identify the current status and barriers to exercise rehabilitation among Chinese patients with acute musculoskeletal injury.

Patients and Methods: This single-center, sequential explanatory mixed-methods evaluation included a quantitative survey and qualitative semi-structured interviews. The quantitative survey was distributed online to patients who had acute musculoskeletal injury within five years. For the qualitative component, patients and their families, as well as physiotherapists, orthopedic surgeons, coaches, and personal trainers were recruited. Interview guides were inductively developed and revised based on data analysis. Thematic analysis was conducted using the Capability, Opportunity, and Motivation Behavior model.

Results: Among 284 participants, only 65.1% visited the hospital, 22.9% sought rehabilitation services, and 6.0% completed training after injury. The most common reasons for not going to the hospital (92.9%) or rehabilitation department (70.1%) was underestimation of the injury severity. However, one year after injury, 65.7% still experienced abnormalities at the injury sites, and 46.9% had changed their sport habits. In total, 23 participants were interviewed. Barriers of exercise rehabilitation included patient's lack of knowledge about the requirement of exercise rehabilitation guidance and instruction from orthopedic surgeons, difficulty with mobility and enough time, insufficient number of qualified physiotherapists or clinics, underestimation of injury severity, low expectation of rehabilitation, and cost reasons.

Conclusion: This study provides novel evidence on systemic and behavioral barriers to exercise rehabilitation in China, supporting efforts in education for both orthopedic providers and patients, expanding the workforce of qualified specialists, and integrated referral and remote-supervision models.

Plain Language Summary: Guidelines recommend exercise rehabilitation guidance in the early stage following acute musculoskeletal injury. However, physiotherapists are insufficient to meet the healthcare needs of the population in China. This was the first mixed methods study focusing on exercise rehabilitation among patients with Chinese acute musculoskeletal injury. The quantitative and qualitative data from participants in different roles demonstrated consistency at multiple points.

Keywords: patient education, orthopedist education, referral system, online remote supervision

Introduction

Numerous guidelines recommend a series of treatments after acute musculoskeletal injury, including rest/immobilization, ice, compression, elevation, anti-inflammatory analgesics, and surgery if necessary.[1] Proper rest/immobilization can

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provide a favorable environment for tissue healing, but it can also lead to reduced bone and muscle volume, reduced strength, and tissue adhesion.[2,3] All these factors can impact patients' motor function. Acute injuries are associated with a potentially low rate of return to general physical activity[4] and a high risk of reinjury.[5] Therefore, guidelines recommend that patients receive exercise rehabilitation guidance in the early stage following injury.[2] However, a significant gap exists in our current healthcare system, as many patients are left to navigate the final stages of their return-to-activity plan without professional guidance, potentially contributing to the negative outcomes reported.[6]

A systematic review[7] reported that most barriers to exercise of people with musculoskeletal conditions were related to intrapersonal factors, including lack of time, pain and health. However, there might be some external factors. A study assessing the current and projected adequacy of the physiotherapist workforce in the United States revealed a substantial national shortfall of 12,070 physiotherapists in 2022, with the shortage expected to persist through 2037.[8] A substantial shortage of physiotherapists also exists in China. In 2019, the incidence of fractures reached 67,850,000.[9] However, according to the China Medical Industry Yearbook 2022,[10] the total number of physiotherapists and sports medicine physicians in 2021 was only 467,005 —clearly insufficient to meet the healthcare needs of the population. Therefore, it is reasonable to speculate that many patients in China do not receive adequate exercise rehabilitation guidance after injury. However, the specific challenges they face remain largely unreported.

Mixed methods research studies,[11] drawing upon the strengths of both quantitative and qualitative approaches and providing an innovative approach for addressing contemporary issues in health services, might be particularly suitable for this topic. Furthermore, COM-B (Capability, Opportunity, Motivation and Behavior) is a behavior change system, which has been used to analyze the qualitative data about behavior determinants, as well as the facilitators and barriers to behavior change.[12–14]

The aim of this study was to identify the current status of exercise rehabilitation among Chinese patients with acute musculoskeletal injury and analyze behavioral barriers by using the COM-B system.

Materials and Methods

This study was a single-center, sequential explanatory mixed-methods evaluation. A quantitative survey was first conducted, followed by qualitative semi-structured interviews to explain the survey results. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the institutional review board of Beijing Sports University (No:2025167H) on 10th April 2025. Written informed consent which included publication of anonymized responses was obtained from all participants. The consents of participants under 18 years of age were signed by their parent or legal guardian.

Quantitative Survey

Data Collection

The quantitative survey was distributed via an online survey tool (https://www.wjx.cn), a widely used social networking application in China. Patients with acute musculoskeletal injury within the past five years were recruited through two complementary channels. (1) Outpatient referrals: Collaborating with the Rehabilitation Department of Beijing Sport University Hospital, we distributed questionnaire to patients during their follow-up visits. (2) Community and online platforms: We posted the survey link on sport medicine-focused social media groups, fitness apps, and regional patient support groups, targeting individuals who may not have sought hospital care. This dual-channel approach aimed to capture both hospital-attending and non-hospital-attending patients, reducing selection bias toward clinical populations. The survey was live from April 10 to 25, 2025. The questionnaire could not be submitted until all the questions were completed, and only one submission was allowed per IP address.

An open and anonymous questionnaire was developed, consisting of 24 single choice, multiple-choice, fill-in-the-blank questions (Supplementary Figure 1). In the introduction, purpose and target audience were stated. Individuals who had experienced an acute musculoskeletal injury within the past five years were invited to answer the questions based on their experience. The questions were divided into three parts. The first part (13 questions) focused on injuries, including sex, age, province, time and site of injury, presence of fractures, surgery, external fixation, sport habits before injury, total recovery, and changes in sport habits. The second part (10 questions) focused on treatment experiences, including

whether the patient visited a hospital or rehabilitation department, the difficulties encountered, and the main medical treatments received. The final part (1 question) was focused on attitudes toward exercise rehabilitation.

Then five experts and revised the questionnaire based on their recommendations were consulted. The expert panel included one orthopedic surgeon, two physiotherapists, one personal trainer, and one epidemiologist. As a final step, a pilot survey was conducted with 10 patients to evaluate the technical usability and functionality of the questionnaire platform. The final version of the survey (Supplementary Figure 1, https://www.wjx.cn/vm/PbRkcWX.aspx) was distributed via the online survey tool.

According to the previous studies,[15] sample size of survey was set to no less than 250.

Data Analysis

Descriptive statistics were calculated. Nominal and ordinal data are presented as numbers (percentages). Continuous variables were expressed as mean ± standard deviation for normally distributed data, and as median (interquartile range) for nonnormally distributed data.

Qualitative Interview

Study Population

A nonprobabilistic, maximum variation sampling strategy was employed to recruit interview participants from May 1 to 10, 2025. Patients who had previously experienced an acute musculoskeletal injury, along with their family members, were included. Additionally, physiotherapists, orthopedic surgeons, coaches, and personal trainers were interviewed. To achieve maximum variation, patients who either actively or passively engaged in exercise rehabilitation, physiotherapists from both public and private hospitals, and coaches from both primary schools and professional sports teams were selected. The patients included in the study varied in age, sex, injury severity and injury location. Recruitment was concluded when additional interviews no longer produced new codes or themes, indicating that data saturation had been reached.[12]

Five interview guides were inductively developed, each containing 4 to 7 opened questions, tailored specifically for patients/family members, physiotherapists, orthopedic surgeons, coaches, and personal trainers, respectively (Supplementary Material 1). The interview questions focused on participants' knowledge, practices and perceived barriers related to implementing exercise rehabilitation for these patients, as well as the challenges and strategies encountered by physiotherapists, orthopedic surgeons, coaches, and personal trainers in delivering patient education on exercise rehabilitation. The interview guides were piloted with a patient, a surgeon, and a physiotherapist, and revisions were made on their feedback. Concurrent with the data analysis, ongoing discussions were held after each interview to refine the questions.

Semi-structured interviews were conducted face-to-face with each participant at their convenience by two researchers: Y.T. (a female student majoring in physical therapy) and Z.Y., PhD (a male associate professor of physical therapy), both of whom worked at Beijing Sports University. An interview topic guide was used to steer the conversation, while allowing participants the freedom to speak as openly and extensively as they wished. All interviews were audio-recorded with written informed consent, and the transcriptions were completed verbatim. To maintain anonymity, participant names were replaced with assigned identification numbers.

Qualitative Data Analysis

The Capability, Opportunity, and Motivation Behavior (COM-B) model from the Behavior Change Wheel[12] was used to analyze the themes of the interview transcripts. The COM-B model is widely recognized as a useful and systemic framework for identifying determinants of behavior, as well as the facilitators and barriers to behavior change. It has been extensively applied in previous studies addressing similar research questions.[13,14] In the context of this study, capability referred to factors that enabled or hindered the ability to engage in exercise rehabilitation; motivation encompassed elements influencing the willingness to participate or the perceived importance of exercise rehabilitation; opportunity included policy or environmental factors that affected its implementation, and behavior referred to the strategies and actions taken to promote exercise rehabilitation.

Two investigators (Y.X. and C.J)., who were not involved in the interview process, independently employed a deductive, line-by-line coding approach to generate initial codes and identify themes by exploring connections among the codes.[13] Meetings were held in which the other two investigators (Y.T. and Z.Y.) reviewed the codes and themes developed by Y.X. and C.J., assessed their interrater reliability, discussed and resolved any discrepancies, and conducted data source triangulation by comparing codes across different participant groups. The finalized themes were then mapped onto the COM-B model.[13,16] The model was continuously refined throughout the study as new data emerged from ongoing interviews. Reflexivity memos were written to help mitigate potential insider bias and enhance the credibility of the analysis.[17] Five participants (a patient, a physiotherapist, an orthopedic surgeon, a coach and a personal trainer) were invited to review the thematic model. Minor revisions were made based on their feedback to enhance clarity and accuracy.

Results

Quantitative Results

A total of 284 patients with acute musculoskeletal injuries completed the questionnaire. Among them, 145 (51.1%) were female and 139 (48.9%) were male. The median age was 40 (28, 50) years. A total of 191 (67.3%) of them came from Beijing. Before the injury, 14 participants (4.9%) were athletes, 147 (51.8%) engaged in regular physical activity, 69 (24.3%) exercised occasionally, and 54 (19.0%) rarely exercised. The types of injuries are detailed in Table 1. As time since injury increased, more patients reported feeling fully recovered. However, even one year after the injury, 65.7% still experienced abnormalities at the injury sites, and 46.9% had changed their sport habits (Table 2).

A total of 185 (65.1%) patients went to the hospital after injury. The most common orders from the first doctor included imaging tests (146, 78.9%), routine treatment suggestions (such as ice, immobilization, medication, or elevation of the injury extremity) (93, 50.3%), physical examinations (76, 41.1%), external fixation (61, 33.0%), functional exercise guidance (48, 25.9%), surgeries (37, 20.0%), and referrals to the rehabilitation department (35, 18.9%).

Table 1 General Description of Injuries

		N	%
Injury time	<3 months	63	22.2
	3 to 6 months	40	14.1
	6 to 12 months	38	13.4
	>1 year	143	50.4
Site of injury	Low extremity	177	62.3
	Upper extremity	70	24.6
	Torso	31	10.9
	Others	6	2.1
Fracture	No	233	82.0
	Yes	51	18.0
Surgery	No	253	89.1
	Yes	31	10.9
External fixation	No	145	51.4
	Yes	139	48.6

Table 2 Recovery From Injuries

Injury Time		<3 Months	3 to 6 Months	6 to 12 Months	>1 Year
Feeling of injury site [N, (%)]	Normal Abnormal	10(15.9) 53(84.1)	8(20.2) 32(79.8)	11(28.9) 27(71.1)	49(34.3) 94(65.7)
Preinjury sport habit [N, (%)]	Unchanged Changed	16(25.4) 47(74.6)	15(37.5) 25(62.5)	17(44.7) 21(55.3)	76(53.1) 67(46.9)

In the survey on the importance of exercise rehabilitation, 254 patients (89.5%) considered it either very important or important. However, only 65 (22.9%) patients went to the department of rehabilitation, 37 (13.0%) patients received exercise rehabilitation guidance, and 28 (9.9%) patients received physiotherapy and/or manual therapy. Ultimately, only 17 (6.0%) completed the training plan. The reasons of not going to the hospital, not seeking rehabilitation treatment, or not completing the training plans are shown in Figures 1–3.

Qualitative Results

A total of 23 participants were interviewed, including 12 patients, 2 patients' family members, 2 physiotherapists, 2 orthopedic surgeons, 2 coaches, and 3 personal trainers. The sex, age, and other characteristics of the participants are provided in Supplementary Table 1. The interviews lasted between 15 to 32 minutes. Overall, 14 subthemes were identified and mapped to the COM-B model (Figure 4). Supplementary Table 2 provides quotations for each subtheme, demonstrating consistency in the data across participants with different roles.

Capacity

Consistent with the quantitative data, many patients and their family members were unaware of the need for exercise rehabilitation guidance after the injury: "No one advised me/my family member to visit the rehabilitation unit after the injury" (participants 1, 2, 3, 5, 7, 8, 10, 13, 14, 19, and 20, patient; participants 4, 18, patient' family member). Some orthopedic surgeons do not encourage their patients to do exercise rehabilitation at the early stage of injury: "I usually recommend 4–6 weeks of immobilization to patients who do not need surgery" (participant 21, Orthopedic surgeon);

> Patients are usually unaware of the necessity of exercise rehabilitation, because both the orthopedic surgeon and the physiotherapist assume that simply returning to normal life is sufficient. (participant 12, football coach)

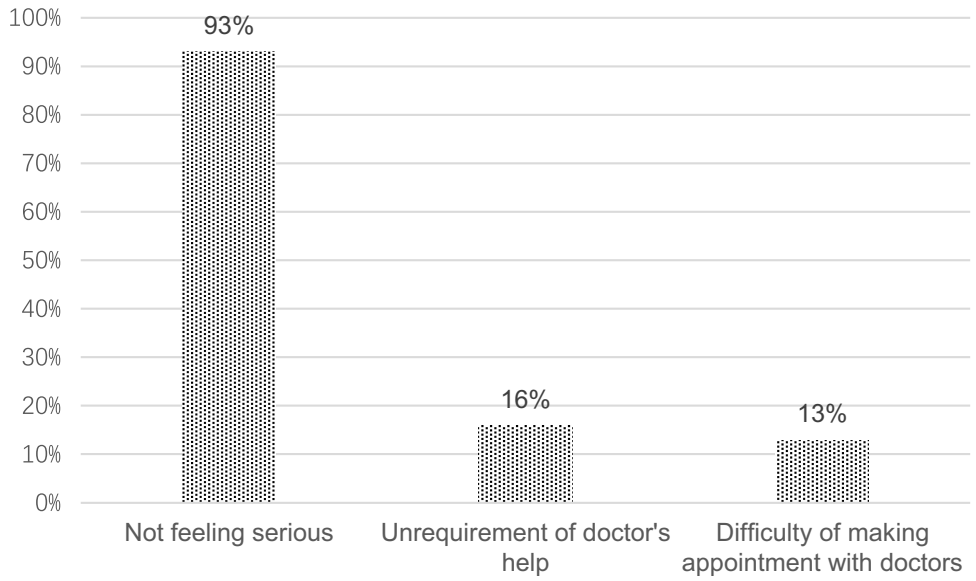

Figure 1 Reasons for not going to the hospital (n=99).

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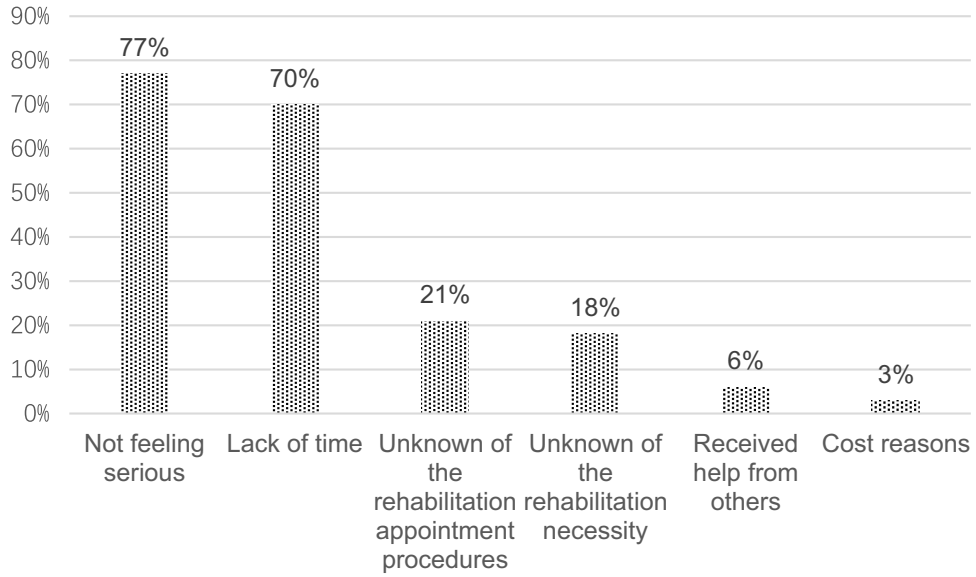

Figure 2 Reasons for not seeking rehabilitation treatment (n=219).

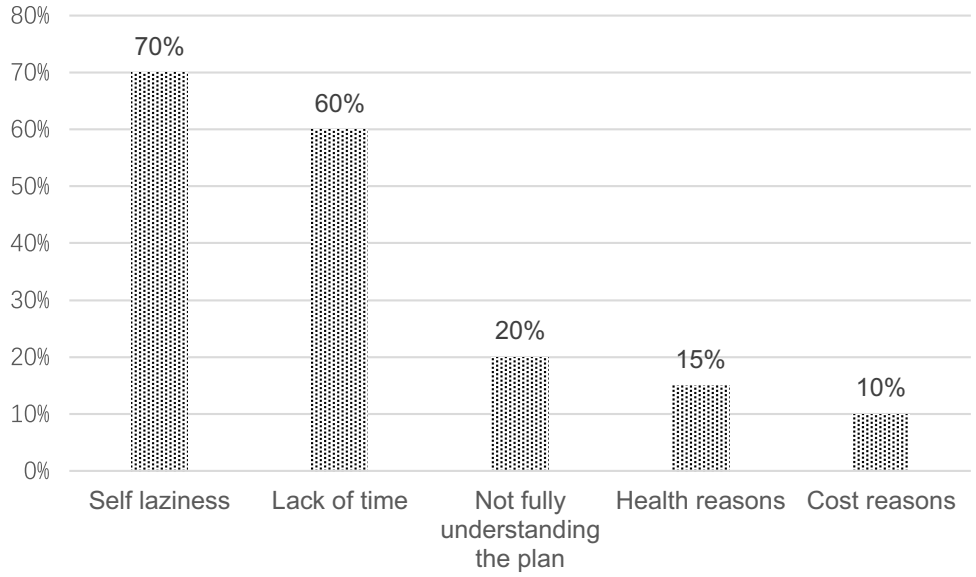

Figure 3 Reasons for not completing the training plans (n=20).

Compared with rehabilitation, more attention was paid to the surgery: " At the beginning of injury, I only cared about the surgery, but not rehabilitation" (participant 8, patient, footballer).

Difficulty with mobility by injury was one of the barriers to exercise rehabilitation:

> I had difficulty walking after the injury, and every time I went to the rehabilitation department, I worried about inconveniencing others. This was one of the reasons why I did not visit the rehabilitation department. (participants 2, 20, patient)

Some patients did not have enough time to complete the training: "I could manage to attend in-person exercise rehabilitation sessions no more than once a week" (participants 2, 13, patient); "Attending exercise rehabilitation sessions 3–4 times a week was difficult to manage unless it was during the summer holidays." (participant 8, patient, footballer).

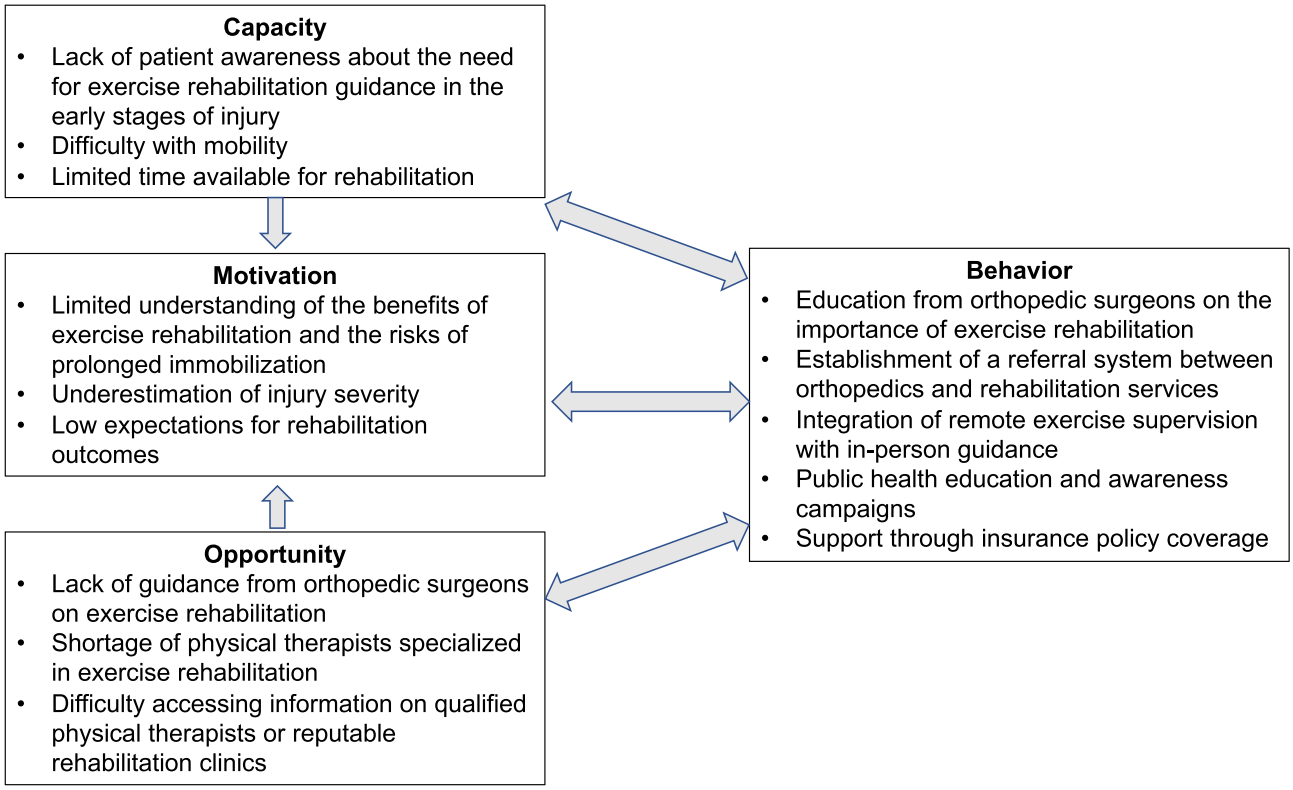

Figure 4 Capacity, opportunity, Motivation-behavior model of the facilitators and barriers to exercise rehabilitation after injury.

Opportunity

Patients typically consulted an orthopedic surgeon after an injury. However, in this study, very few received any exercise rehabilitation advice from them:

> In addition to having X-rays taken, I/my family member was instructed by the orthopedic surgeon to apply ice and compression, elevate the limb and immobilize it, rest and manage pain— but exercise rehabilitation was not mentioned (participants 1, 2, 3, 5, 7, 8, 10, 13, 14, 15, 19, 20, patient; participants 4, 18, patient's family member);

"I rarely tell patients how to maintain moderate physical activity or how to move the uninjured parts of the body during immobilization" (participant 23, orthopedic surgeon);

> Generally, orthopedic surgeons focus on performing surgeries effectively and minimizing the risk of complications. They do not have time to address exercise rehabilitation in detail. Spending more than 40 minutes providing rehabilitation guidance during an outpatient visit is considered a luxury. (participant 16, physiotherapist)

The shortness of physiotherapists well-trained in exercise rehabilitation was noted: "The number of physiotherapists is insufficient to meet the need of injured patients" (participant 21, orthopedic surgeon). Not all the physiotherapists were experienced in exercise rehabilitation:

> I don't recommend others visit the rehabilitation department of a general hospital because the therapists there often lack expertise in exercise-based rehabilitation (participant 8, patient, footballer);

> Orthopedic or rehabilitation specialists without a background in sports medicine often believe that helping patients return to normal daily life is sufficient. They typically pay little attention to whether patients can resume their pre-injury sports activities. (participant 12, coach of football)

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Some injured patients sought functional training in gyms to aid their recovery, but personal trainers were not the rehabilitation specialists: "Personal trainers in gyms often focus solely on training. Their knowledge is not sufficient to provide exercise rehabilitation guidance for their clients" (participant 17, personal trainer). The wide variation in physiotherapists' skill levels made it difficult for patients to identify a qualified one:

> Finding a qualified physiotherapist is far more important than choosing a particular clinic. Unfortunately, it is very difficult for patients to make that determination (participant 6, personal trainer);

> I used to be an athlete and retired from the professional team, so I know some excellent physiotherapists who have worked for professional teams. I often refer my injured team members to them for exercise rehabilitation. However, these highly skilled physiotherapists are often not accessible to the general publics (participant 12, football coach).

Motivation

Almost all the patients were not aware of the benefits of exercise rehabilitation or the harms of immobilization: "I don't know what happened to my body during immobilization. But I don't like to stay in bed and want to get back to work as soon as possible" (participant 1, patient); "I know muscle loss can occur due to immobilization, but I'm not sure when rehabilitation should actually begin." (participants 3, 5, 7, 13, patient). Awareness of both the benefits of exercise rehabilitation and the risks of neglecting it may encourage patients to seek appropriate guidance:

> Before developing plans, it is necessary to inform patients about the potential consequences of skipping exercise rehabilitation and how long it may take to see the effects of training. (participant 10, patient)

Two other barriers to exercise rehabilitation are the underestimation of injury severity and low expectations of rehabilitation. Consistent with the quantitative findings, many patients believed that their injury was mild: "Initially, I did not recognize the severity of the injury and only had the wound treated in the emergency room" (participant 5, patient); "I didn't visit the hospital at first because I believed minor injuries would heal on their own" (paticipant7, 10, 13, patient). Some patients were reluctant to invest too much time and effort in enhanced recovery, saying things like, "I'm not a professional athlete, so I don't need a structured exercise rehabilitation program." (participant 3, 13, patient);

> Exercise rehabilitation is often considered more suitable to young people who are more physically active and expect faster recovery, while old patients might not need it. (paticipant7, patient)

Behavior

Orthopedic surgeons' knowledge of exercise rehabilitation needs improvement:

> Orthopedic surgeons tend to give conservative advice. They usually emphasize immobilization but rarely stress the importance of maintaining moderate physical activity (participant 1, patient);

> I often help my injured clients to perform functional training. Most of them came to me after the acute phase. I think it's a little bit late. During the acute phase, doctors were overly conservative and focused primarily on immobilization, offering little guidance on how patients could maintain moderate physical activity. (participant 11, personal trainer)

Additionally, patients need some key information:

> I need to know how much exercise rehabilitation costs, what the expected training effects are, how long it takes to achieve these effects, and ultimately, what the difference is between undergoing training and not doing any at all (participant 5, patient);

> Pain or discomfort is often unavoidable during rehabilitation. Training can make patients fearful of worsening the injury. Therefore, it is essential to educate the patients what level of pain is normal and expected. Without this understanding, they are unlikely to complete the rehabilitation plan. (participant 20, patient)

Popular health education could help patients gain this important information.

Rehabilitation relies on the collaboration between orthopedic surgeons and physiotherapists. The referral system enables patients to access rehabilitation treatment early in the course of their injury:

> My child won't have hurt his ankle repeatedly if exercise rehabilitation had been implemented at the early stage. Direct referral to physiotherapists by orthopedic surgeons is preferred (participant 4, patient's family member);

> Orthopedic surgeons often lack the time to address rehabilitation needs. Therefore, a referral system is necessary to involve physiotherapists early in the recovery process and ensure patients receive timely rehabilitation support. (participant 15, patient)

Consistent with the quantitative data, patients encountered difficulties in completing the training. Both face-to-face guidance and online remote supervision have their own advantages and disadvantages. A combined approach is likely to be the most effective:

> Online guidance can help address the inconvenience of hospital visits for patients, but it cannot fully replace in-person assessment and instruction. The ideal model is the combination of online instruction and supervision with in-person follow-up (participant 16, physiotherapist);

> I believe face-to-face guidance is more appropriate in the beginning. The physiotherapist can demonstrate the exercises to me, and then I can continue practicing at home. Later, follow-up evaluations and additional in-person guidance can be provided as needed. (paticipant3, patient)

Financial difficulties also affect the implementation of exercise rehabilitation: "The cost is one of the reasons my child cannot attend in-person trainings twice a week" (participant 18, patient's family member). Support from insurance policies might help address this issue:

> Under the current health insurance policy, rehabilitation after an injury is not covered unless a surgery is performed. As a result, financial concerns may discourage patients from choosing exercise rehabilitation. (participant 23, orthopedic surgeon)

Discussion

This mixed-methods study revealed an inadequate implementation of exercise rehabilitation among patients with acute musculoskeletal injuries. Barriers included patients' lack of awareness of the benefits of exercise rehabilitation and the risks of immobilization, underestimation of injury severity, low expectations regarding rehabilitation outcomes, mobility limitations, time constraints, lack of instruction from orthopedic surgeons, a shortage of qualified physiotherapists, difficulty accessing reliable information about skilled physiotherapists or reputable rehabilitation clinics, and cost reasons.

In this quantitative study, although most patients considered exercise rehabilitation as very important or important, only 22.9% of them visited the rehabilitation department, and even less patients (6.0%) completed the training. This contradiction can be explained by findings from both the quantitative and qualitative data. Patients often underestimate the severity of their injuries and the potential long-term impact, which reduces their motivation to engage in exercise rehabilitation. In this study, 65.7% of patients continued to experience abnormal sensations at the injury site, and 46.9% reported changes in their pre-injury exercise habits one year after injury. Previous studies have also reported a high rate of reinjury,[5,18–20] a low rate of return to general physical fitness activities,[4] and a high incidence of post-traumatic osteoarthritis[21–23] following various musculoskeletal conditions such as ankle sprains, hamstring strains, and knee ligamentous injuries. Given the long-lasting adverse outcomes, both standard rehabilitation guidance and extended follow-up care are recommended.[6]

These results indicate that insufficient education from orthopedic providers may contribute to suboptimal exercise rehabilitation practices. This finding aligns with previous studies conducted in lung transplantation recipients or preoperative patients.[14,24] A lack of knowledge, time, and energy poses significant challenges for orthopedic surgeons in providing adequate education on exercise rehabilitation, highlighting the need for support from physiotherapists. Although rehabilitation physicians and therapists are the best qualified to deliver specific guidance, patients often remain unaware of the need to visit the rehabilitation department unless explicitly recommended or referred by their orthopedic providers. Unfortunately, many of the orthopedic surgeons in this study missed valuable opportunities to emphasize the importance of exercise rehabilitation, highlighting the need for improved education and training within the field.

Furthermore, efforts should be made to streamline the referral process, making access to exercise rehabilitation less time-consuming and more convenient, as suggested by participants in this study.

Rehabilitation barriers exist in all kinds of people, such as old adults with frailty,[25] patients with lung cancer,[26] and young adults with knee injury.[27] Barriers included a series of physical and psychosocial disease-related conditions. In this study, patients with acute musculoskeletal injury often have difficulties in visiting the clinic several times a week. Consistent with previous findings, participants in this study recommended implementing remote exercise instruction and supervision through online platforms.[28–32] Online platforms should provide personalized plans tailored to local settings, video demonstrations, adherence tracking, and direct communication with physiotherapists. However face-to-face physical examinations and demonstrations remain essential—especially for patients without prior exercise habits, who may face greater challenges in carrying out exercise plans. Participants recommended a hybrid approach that combines online guidance and supervision with timely in-person follow-up. But this might encounter some difficulties in rural or underserved areas due to impact of digital health tools.

Several other barriers exist. There was a gap between the increasing demand for exercise rehabilitation and the availability of physiotherapists, which may be influenced by the overall number of physiotherapists and sports medicine physicians in China.[10,33] High rehabilitation needs pose a major challenge to Chinese health systems. In China, the primary care settings mainly provide basic clinical treatment and public healthcare.[34] However, rehabilitation is often marginalized as a natural process of recovery, rather than an essential resolution to deal with body disabilities.[35] In addition, information about qualified specialists and clinics was not easily accessible. Finally, financial concerns may also discourage patients from choosing exercise rehabilitation.

This study had several strengths. First, to our knowledge, this was the first mixed methods study focusing on exercise rehabilitation among patients with acute musculoskeletal injury. The quantitative and qualitative data from participants in different roles demonstrated consistency at multiple points, indicating the robustness of the findings. Second, all the related persons were recruited, including patients, patients' family members, orthopedic surgeons, physiotherapists, coaches, and personal trainers for the qualitative study, enabling us to provide a comprehensive picture of the barriers and potential solutions, some of which have never been identified in previous studies. Finally, COM-B model was used to analyze the qualitative data. This model helped to identify all the potential intervention functions and policy categories and prevent policy makers and intervention designers from neglecting important options.

This study has several limitations. First, the single-center design and geographic concentration of participants in Beijing may limit generalizability to the broader Chinese population. Second, the online survey format may introduce selection bias toward younger or more digitally literate participants. Finally, potential recall bias exists because participants were asked to recall injury experiences within the past five years. A multicenter cross-sectional survey or intervention trials assessing the effectiveness of integrated referral systems and combination of online guidance with timely in-person follow-up needs to be conducted in the future.

Conclusion

This study highlights the need for systemic improvement in the current practice of exercise rehabilitation among patients with acute musculoskeletal injuries. To overcome the identified barriers, efforts should focus on improving education for both orthopedic providers and patients, public health and rehabilitation policy (such as national workforce development, streamlining referral system and reimbursement reform), and integrating online remote supervision with in-person follow-up. Evaluating the effectiveness of hybrid rehabilitation programs or large-scale multicenter validation might be studied in the future.

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Disclosure

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References

1. Baoge L, Van Den Steen E, Rimbaut S, et al. Treatment of skeletal muscle injury: a review. *ISRN Orthopedics*. 2012;2012:689012. doi:10.5402/2012/689012
2. Zheng XQ, Huang J, Lin JL, Song CL. Pathophysiological mechanism of acute bone loss after fracture. *J Adv Res*. 2023;49:63–80. doi:10.1016/j.jare.2022.08.019
3. Graham ZA, Lavin KM, O'Bryan SM, et al. Mechanisms of exercise as a preventative measure to muscle wasting. *Am J Physiol Cell Physiol*. 2021;321(1):C40–C57. doi:10.1152/ajpcell.00056.2021
4. Ezzat AM, Brussoni M, Whittaker JL, Emery CA. A qualitative investigation of the attitudes and beliefs about physical activity and post-traumatic osteoarthritis in young adults 3-10 years after an intra-articular knee injury. *Phys Ther Sport*. 2018;32:98–108. doi:10.1016/j.ptsp.2018.05.001
5. Shalaj I, Gjaka M, Bachl N, Wessner B, Tschan H, Tishukaj F. Potential prognostic factors for hamstring muscle injury in elite male soccer players: a prospective study. *PLoS One*. 2020;15(11):e0241127. doi:10.1371/journal.pone.0241127
6. Paterno MV, Fitzgerald GK. Booster visits in the management of the acute musculoskeletal injuries: transforming care to improve outcomes-A perspective review. *J Orthop Res*. 2024;42(6):1151–1158. doi:10.1002/jor.25852
7. de Amorim H, de Noronha M, Hunter J, et al. Barriers and facilitators to exercise-based rehabilitation in people with musculoskeletal conditions: a systematic review. *Musculoskelet Sci Pract*. 2025;77:103279. doi:10.1016/j.msksp.2025.103279
8. Zarek P, Ruttinger C, Armstrong D, et al. Current and projected future supply and demand for physical therapists from 2022 to 2037: a new approach using microsimulation. *Phys Ther*. 2025;105(3):zaf014. doi:10.1093/ptj/pzaf014
9. Zhu Z, Zhang T, Shen Y, Shan PF. The burden of fracture in China from 1990 to 2019. *Arch Osteoporos*. 2023;19(1):1. doi:10.1007/s11657-023-01353-4
10. China Medical Industry Yearbook 2022. Available from: http://www.nhc.gov.cn/mohwsbwstjxxzx/tjtjnj/202305/6ef68aac6bd14c1eb9375e01a0faa1fb/files/b05b3d958fc546d98261d165cea4adba.pdf. Accessed February 11, 2026.
11. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs-principles and practices. *Health Serv Res*. 2013;48(6):2134–2156. (). doi:10.1111/1475-6773.12117
12. Jowsey T, Deng C, Weller J. General-purpose thematic analysis: a useful qualitative method for anaesthesia research. *BJA Educ*. 2021;21(12):472–478. doi:10.1016/j.bjae.2021.07.006
13. Michie S, van Stralen MM, West R. The behavior change wheel: a new method for characterizing and designing behavior change interventions. *Implement Sci*. 2011;6:42. doi:10.1186/1748-5908-6-42
14. Yang H, Liu S, Chen J, et al. Perceptions of barriers to and facilitators of exercise rehabilitation in adults with lung transplantation: a qualitative study in China. *BMC Pulm Med*. 2024;24(1):65. doi:10.1186/s12890-024-02882-5
15. Bennell KL, van Ginckel A, Kean CO, et al. Patient knowledge and beliefs about knee osteoarthritis after anterior cruciate ligament injury and reconstruction. *Arthritis Care Res*. 2016;68(8):1180–1185. doi:10.1002/acr.22794
16. Patton MQ. *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. Los Angeles, CA, USA: Sage Publications; 2014.
17. Blythe S, Wilkes L, Jackson D, Halcomb E. The challenges of being an insider in storytelling research. *Nurse Res*. 2013;21(1):8–12. doi:10.7748/nr2013.09.21.1.8.e333
18. Paterno MV, Rauh MJ, Schmitt LC, Ford KR, Hewett TE. Incidence of second ACL injuries 2 years after primary ACL reconstruction and return to sport. *Am J Sports Med*. 2014;42(7):1567–1573. doi:10.1177/0363546514530088
19. Schneider GA, Bigelow C, Amoroso PJ. Evaluating risk of re-injury among 1214 army airborne soldiers using a stratified survival model. *Am J Prev Med*. 2000;18(3 Suppl):156–163. doi:10.1016/S0749-3797(99)00177-4
20. Lipscomb HJ, Cameron W, Silverstein B. Incident and recurrent back injuries among union carpenters. *Occup Environ Med*. 2008;65(12):827–834. doi:10.1136/oem.2008.039222
21. Castano Betancourt MC, Maia CR, Munhoz M, Morais CL, Machado EG. A review of risk factors for post-traumatic Hip and knee osteoarthritis following musculoskeletal injuries other than anterior cruciate ligament rupture. *Orthop Rev*. 2022;14(4):38747. doi:10.52965/001c.38747
22. MOON Knee Group, Jones MH, Oak SR, Andrish JT, et al. Predictors of radiographic osteoarthritis 2 to 3 years after anterior cruciate ligament reconstruction: data from the MOON on-site nested cohort. *Orthop J Sports Med*. 2019;7(8):2325967119867085. doi:10.1177/2325967119S00348
23. Claes S, Hermie L, Verdonk R, Bellemans J, Verdonk P. Is osteoarthritis an inevitable consequence of anterior cruciate ligament reconstruction? A meta-analysis. *Knee Surg Sports Traumatol Arthrosc*. 2013;21(9):1967–1976. doi:10.1007/s00167-012-2251-8
24. Fuchs TI, Pfab C, Kiselev J, Schaller SJ, Spies C, Rombey T. Barriers and facilitators to the implementation of prehabilitation for elderly frail patients prior to elective surgery: a qualitative study with healthcare professionals. *BMC Health Serv Res*. 2024;24(1):536. doi:10.1186/s12913-024-10993-2
25. Barnes K, Hladkowicz E, Dorrance K, et al. Barriers and facilitators to participation in exercise prehabilitation before cancer surgery for older adults with frailty: a qualitative study. *BMC Geriatr*. 2023;23(1):356. doi:10.1186/s12877-023-03990-3
26. Avancini A, Sartori G, Gkountakos A, et al. Physical activity and exercise in lung cancer care: will promises be fulfilled? *Oncologist*. 2020;25(3):e555–e569. doi:10.1634/theoncologist.2019-0463
27. Watkins R, Young G, Western M, Stokes K, McKay C. Nobody says to you "come back in six months and we'll see how you're doing": a qualitative interview study exploring young adults' experiences of sport-related knee injury. *BMC Musculoskelet Disord*. 2020;21(1):419. doi:10.1186/s12891-020-03428-6
28. Kerstiens S, Gleason LJ, Huisingh-Scheetz M, et al. Barriers and facilitators to smartwatch-based prehabilitation participation among frail surgery patients: a qualitative study. *BMC Geriatr*. 2024;24(1):129. doi:10.1186/s12877-024-04743-6
29. Kimura CS, Bidwell S, Gurland B, Morris A, Shelton A, Kin C. Association of an online home-based prehabilitation program with outcomes after colorectal surgery. *JAMA Surg*. 2023;158(1):100–102. doi:10.1001/jamasurg.2022.4485
30. Shelton E, Barreto NB, Bidwell S, et al. Engagement and adherence with a web-based prehabilitation program for patients awaiting abdominal colorectal surgery. *J Gastrointest Surg*. 2021;25(12):3198–3207. doi:10.1007/s11605-021-05171-2
31. Kerstiens S, Bender EM, MG R Jr, et al. Technology-assisted behavioral intervention to encourage prehabilitation in frail older adults undergoing surgery: development and design of the BeFitMe™ apple watch app. *Digit Health*. 2023;9:20552076231203957. doi:10.1177/20552076231203957

32. Blumenau Pedersen M, Saxton J, Birch S, Rasmussen Villumsen B, Bjerggaard Jensen J. The use of digital technologies to support home-based prehabilitation prior to major surgery: a systematic review. *Surgeon*. 2023;21(6):e305–e315. doi:10.1016/j.surge.2023.05.006
33. Chen N, Fong DYT, Wong JYH. Trends in musculoskeletal rehabilitation needs in China from 1990 to 2030: a bayesian age-period-cohort modeling study. *Front Public Health*. 2022;10:869239. doi:10.3389/fpubh.2022.869239
34. Li X, Lu J, Hu S, et al. The primary health-care system in China. *Lancet*. 2017;390(2584):94. doi:10.1016/S0140-6736(17)33109-4
35. Xiao Y, Zhao K, Ma ZX, Li X, Qiu YP. Integrated medical rehabilitation delivery in China. *Chronic Dis Transl Med*. 2017;3(2):75–81. doi:10.1016/j.cdtm.2017.02.003