Journal of Clinical and Nursing Research, 2026, Volume 10, Issue 3
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

# Research Progress on Risk Perception of Skeletal-Related Events in Patients with Solid Tumors

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**Abstract:** Skeletal-related events are common complications in patients with advanced solid tumors and bone metastases, significantly affecting their quality of life and survival prognosis. Risk perception refers to an individual's recognition, judgment, and understanding of risky matters, which holds great significance in promoting healthy behaviors and improving preventive actions among patients. Understanding the level of risk perception for bone-related events in patients with solid tumors is a crucial approach to enhancing their subjective initiative and compliance in bone health management behaviors. This article provides a comprehensive review of the current status, measurement tools, influencing factors, and intervention strategies related to the risk perception of bone-related events in patients with solid tumors. The aim is to enhance the awareness of bone-related events among patients with solid tumors and clinical practitioners, providing references for promoting bone health management behaviors and improving patients' quality of life.

**Keywords:** Solid tumor; Skeletal-related events; Risk perception; Review; Nursing

**Online publication:** Apr 21, 2026

## 1. Introduction

Skeletal Related Events (SREs) refer to clinical complications primarily manifested as pathological fractures, bone pain, and spinal cord compression in patients with advanced solid tumors, resulting from bone metastases and/or cancer treatment-induced bone loss [1]. During disease progression, 30% to 60% of solid tumor patients experience SREs, with over 30% suffering from multiple SREs, severely impacting their quality of life and survival prognosis [2,3]. Currently, although prevention guidelines for SREs in solid tumor patients are relatively well-established, insufficient attention to SRE risks among healthcare providers, patients, and caregivers leads to

poor adherence to preventive behaviors, inadvertently increasing the risk of SREs and creating a vicious cycle. Risk perception refers to patients' cognition, judgment, and understanding of risky situations [4]. Enhancing disease risk perception can promote improvements in health behaviors and strengthen treatment adherence [5]. Therefore, understanding the level of SRE risk perception among solid tumor patients represents an important approach to improving their adherence to preventive behaviors and subjective initiative. This article reviews the current status, measurement tools, influencing factors, and intervention strategies of SRE risk perception in solid tumor patients, aiming to enhance this population's awareness of SREs, thereby improving their adherence to bone health management behaviors and quality of life.

## 2. Current status of risk perception for SREs

The concept of SREs risk perception originates from the cognition of SREs-related knowledge. Studies have found that both nurses and patients have deficiencies or gaps in their understanding of SREs [6,7]. To improve the management of SREs in patients with solid tumors, several international expert consensuses on SREs management have been published, covering lung cancer and breast cancer, among others [8,9]. Multiple international surveys on the awareness of SREs among solid tumor patients have shown that over half (58%) of patients receive insufficient or no information about SREs, patients have limited awareness of their potential SREs risks during treatment, 60% of patients have not received bone-protecting agent therapy, and 62% of patients are not completely satisfied with the bone health education they receive [5,10]. Domestic researchers have primarily conducted SREs awareness surveys among nurses, revealing that although over half of oncology nurses have extensive work experience, they lack adequate knowledge in bone health prevention and identification of SREs risk factors, and more than two-thirds of nurses lack confidence in managing bone health in solid tumor patients. Due to insufficient SREs-related knowledge, the risk perception level of SREs across different groups is generally poor, which to some extent diminishes the effectiveness of health education and nursing interventions provided by healthcare professionals. This can easily lead to issues such as poor patient compliance and inadequate implementation of preventive measures, thereby increasing the risk of SREs occurrence.

## 3. Research tools for risk perception of SREs

Overseas research on the perception of SREs risk began relatively early. Fang Lei et al. used a self-developed chronic disease patient risk perception questionnaire to investigate awareness of SREs among 125 patients with solid tumors (lung cancer, breast cancer, prostate cancer) and multiple myeloma [11]. The questionnaire comprised five modules: demographics, clinical characteristics, BTA use, bone health awareness, and educational experience, and included two open-ended questions. The study showed that awareness of SREs among solid tumor patients was at a low-to-moderate level, and there was a significant gap in bone health education between those who had experienced SREs and those who had not [12]. Subsequently, they conducted a special survey targeting 200 breast cancer patients with bone metastases. The results were not optimistic, revealing a clear information deficit in bone health education, with patients expressing a strong need for diverse, repeatable information formats. Regarding the investigation of nursing staff awareness, some scholars used a self-developed "Cancer Patient Bone Health Management Questionnaire" to survey 283 oncology nurses [13]. The survey covered multiple aspects including work environment, nursing experience, confidence in managing patients with bone metastases, bone

health knowledge, and the use of bone-protecting agents. The survey found that oncology nurses generally had insufficient awareness of SREs and inadequate management practices, lacking training, funding, knowledge, or professional development opportunities.

Research on SREs risk perception in China started later, with studies primarily focusing on nurses. Researchers mainly used a self-developed "SREs Cognition and Management Questionnaire", covering nurses' roles and responsibilities, cognition of SREs and CTIBL, and understanding and confidence in bone health management, comprising 23 items. The questionnaire had a content validity of 0.95. Research findings were similar to those from overseas studies, indicating significant room for improvement in the management of SREs in solid tumor patients in China. In recent years, with increasing attention to cancer symptom management, researchers have developed a series of risk perception assessment tools, which can be categorized as either universal or specific. Universal scales include the Chronic Disease Patient Risk Perception Questionnaire, Fall Risk Perception Questionnaire, etc [14]. Specific scales include tools for measuring lymphedema risk perception after breast cancer surgery, venous thromboembolism risk perception in hospitalized patients, etc. However, a complete and targeted tool for assessing SREs risk perception in solid tumor patients remains lacking.

## 4. Factors influencing risk perception of SREs

The risk perception of solid tumor patients towards SREs plays a crucial supportive role in their preventive behaviors. Numerous factors influence this perception, primarily encompassing the following aspects.

### 4.1. Demographic factors

Research indicates that factors such as age, occupation, education level, and family support are the main influences on SREs risk perception. Patients with solid tumors undergo long treatment cycles, and studies have shown that strong family support can alleviate the psychological stress caused by the illness, helping patients proactively pay attention to disease risks, thereby enhancing the comprehensiveness of their risk awareness. Conversely, Lobchuk et al. pointed out that if caregivers experience "role strain" (such as excessive care burden or emotional exhaustion), the quality of communication with the patient declines [15]. This may delay the patient's recognition of important health signals, reduce their willingness to seek medical attention, and indirectly weaken their risk perception.

### 4.2. Disease and treatment factors

Disease characteristics (such as tumor pathological type and bone metastasis status) and treatment-related factors (such as treatment side effects and accessibility of examinations) constitute the "objective basis" influencing SREs risk perception [16]. Patients with advanced solid tumors are more prone to focus on complication risks. SREs have an insidious onset, and some patients often underestimate the risk of SREs due to the "absence of significant early discomfort". Moreover, local pain caused by chemotherapy and radiotherapy is frequently confused with early symptoms of SREs (such as bone pain). During the use of medications such as bisphosphonates and denosumab, some patients exhibit cognitive biases (e.g., believing that "the risk of drug side effects is higher than that of SREs themselves" or developing an "excessive sense of security" regarding the medication), thereby reducing the accuracy of risk perception or neglecting the prevention of SREs, ultimately leading to an increased risk of SREs occurrence [17].

### 4.3. Health literacy

Health literacy, defined as an individual's ability to access, understand, evaluate, and apply health information is a core intrinsic factor influencing SREs risk perception. Patients with high health literacy can translate SREs-related knowledge provided by healthcare professionals into proactive risk assessment awareness, whereas those with low health literacy are prone to "information transformation barriers", leading to biased judgments regarding the "benefit-cost ratio of preventive measures". This results in a "fragmented" perception of risk and indirectly diminishes the importance attributed to SREs risk [18].

### 4.4. Trust relationship among doctors, nurses, and patients

The trust relationship among physicians, nurses, and patients is a key influencing factor in medical interactions. Surveys indicate that patients with high trust in healthcare providers are more receptive to disease risk notifications and more proactive in adopting preventive measures. In contrast, patients with low trust tend to perceive physicians or nurses as "exaggerating risks" and avoid consultations, leading to blind spots in risk perception. As the primary implementers of bone health education, nurses serve as intermediaries between physicians and patients. Their professional competence and communication skills are crucial for establishing effective physician-patient communication and nurse-patient trust [19]. If healthcare providers can enhance their professional competence, prioritize risk management and communication regarding SREs, and improve their risk communication skills, they can not only increase patients' awareness of SREs risks but also promote active patient cooperation in treatment and preventive measures, thereby playing a positive role in improving patient prognosis.

### 4.5. Cancer self-efficacy

Cancer self-efficacy refers to the confidence and belief of cancer patients in their ability to cope with cancer and related issues, playing a significant role in the perception of SREs risk among solid tumor patients. Patients with higher self-efficacy are more likely to proactively seek knowledge about SREs, have a more acute perception of SREs risk, and are more willing to accept health education and guidance provided by healthcare professionals, adopting effective preventive measures to reduce the risk of SREs occurrence [20]. Conversely, patients with lower self-efficacy often lack confidence in their ability to cope with the disease, which can easily lead to anxiety and fear. These negative emotions can interfere with their accurate judgment of SREs risk, resulting in insufficient risk perception or even neglect of the existence of risks. They may also be skeptical of nursing interventions and unwilling to cooperate, thereby increasing the difficulty of nursing care and hindering effective management of SREs risk by nurses. When facing difficulties and challenges during treatment, patients with low self-efficacy are more likely to give up, thus increasing the likelihood of SREs occurrence. Healthcare professionals can help patients enhance their self-efficacy by providing personalized health education and encouraging patient participation in self-management, thereby better coping with SREs risk.

## 5. Intervention strategies

### 5.1. Factors related to medical institutions and healthcare professionals

Bone health management in patients with solid tumors is often regarded as an adjunct to cancer treatment and tends to be marginalized. It presents a highly challenging task. Studies have shown that there remains significant room for improvement among nurses in China regarding their knowledge of SREs, as well as in the management

and guidance of bone protection strategies. The specialized setup for bone metastases in China is incomplete, the implementation of standardized treatment is suboptimal, and the disciplinary configuration, treatment concepts, and approaches in this subspecialty urgently need updating. There is a severe resource imbalance in bone health management for cancer patients. In contrast, foreign countries have established relatively mature nurse-led bone health management models. Through the involvement of multidisciplinary teams, they have achieved comprehensive, multi-faceted management throughout the entire course of SREs. This process has also clarified the role of oncology nurses in the bone health management of patients with solid tumors. Enhancing the awareness and management capabilities of healthcare institutions and professionals regarding SREs will effectively improve bone health outcomes and quality of life for patients with solid tumors. This model provides a practical foundation for China to construct intervention programs for SREs risk perception in solid tumor patients. Simultaneously, the state and relevant departments need to provide strong support and coordination in terms of funding investment and policy guidance. By establishing a sound institutional framework and promoting the coordinated development of various disciplines, the management of SREs can be advanced towards standardization and high-quality development.

### 5.2. Patient-related factors

The lack of knowledge about SREs among solid tumor patients often leads to a low level of risk perception regarding SREs, which in turn affects patients' bone health management behaviors. Previous studies have shown that solid tumor patients' understanding of SRE-related knowledge is not optimistic, and their information acquisition primarily relies on healthcare professionals. It is recommended to implement improvements in three aspects: the timing, content, and format of education. The management of SREs should be integrated throughout the entire process of diagnosis and treatment. Referring to relevant guidelines for bone metastases in solid tumors, SRE risk assessment and health education should be conducted when solid tumor patients are at high risk of bone metastases or are diagnosed with bone metastases, before initiating bone-modifying agents, during the use of bone-modifying agents (especially before the first administration), when SRE-related symptoms appear, and when imaging examinations indicate abnormalities. This should be accompanied by continuous dynamic health education.

The educational content should be comprehensive and systematic, and the formats should be diversified. Methods such as oral explanations, printed or video-based educational materials, establishing WeChat platforms, medication reminders and follow-up notifications, and setting up "Bone Health Mini-Class" group education sessions should be employed to encourage and guide patients to actively participate in the prevention and treatment of SREs. This is of great significance for delaying the occurrence of SREs and maintaining bone-related quality of life. Simultaneously, emphasis should be placed on stratified education (based on education level, age, disease course, etc.) and synchronous education for caregivers, forming a "patient-caregiver-medical staff" three-dimensional risk closed-loop. This will comprehensively enhance patients' risk perception of SREs and their compliance with bone health management.

## 6. Conclusion

SREs have an insidious onset, and patients face significant "financial toxicity" after onset. Standardized prevention and treatment are crucial for reducing the incidence of SREs and improving symptom experiences. Prevention,

identification, diagnosis, and treatment based on guidelines have been validated in clinical practice; however, numerous influencing factors still result in suboptimal risk management of SREs in clinical settings, with patient-related factors being a significant contributor. Low patient adherence and poor health literacy undermine nurses' confidence in conducting SREs health education, significantly affecting their work enthusiasm. Currently, domestic research on SREs risk perception primarily focuses on nursing staff, with limited studies on SREs perception, preventive behaviors, adherence, and preventive outcomes among solid tumor patients. No assessment tools related to SREs risk perception in solid tumor patients have been developed domestically, nor have foreign-developed scales been localized and translated. In the future, assessment tools with good reliability and validity could be developed or translated, and theory-based intervention measures for SREs risk perception in solid tumor patients could be actively explored to promote changes in bone health behaviors among these patients, improve their prognoses, and drive in-depth development in the field of cancer prevention and nursing in China.

## Funding

2026 Yunnan Provincial Department of Education Scientific Research Fund Project (Project No.: 2026 J0350)

## Disclosure statement

The authors declare no conflict of interest.

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