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Review Article

Use of Clinical Decision Support Systems by Oncology Nurses in Monitoring High-Risk Cancer Medications

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- CDSSs; Oncology Nurses; Monitoring High-Risk; Cancer Medications

Abstract

Clinical Decision Support Systems (CDSSs) have emerged as vital instruments in oncology settings, particularly for nursing professionals managing high-risk cancer medications. As cancer incidence continues to rise globally, the complexity and toxicity of anticancer therapies necessitate robust mechanisms to ensure patient safety. This review explores the use of CDSSs by oncology nurses to monitor high-risk medications, focusing on their role in identifying dosage errors, contraindications, and potential toxicity. A narrative literature review was conducted using key databases, targeting studies from the last decade that examined CDSSs applications in oncology nursing. The analysis identified recurring themes related to medication safety, user experience, integration into clinical workflow, and educational implications. While CDSSs significantly contribute to error reduction and improved clinical judgment, challenges such as system interoperability, alert fatigue, and limited nurse-specific customization were noted. The findings emphasize the need for continuous development and tailored implementation of CDSSs to optimize their utility in oncology nursing practice. Clinical implications include enhanced patient safety, improved nurse confidence in medication management, and the potential for data-driven nursing education. Future directions suggest more comprehensive integration of artificial intelligence and machine learning algorithms into CDSSs, increased interdisciplinary collaboration in tool design, and further research on long-term clinical outcomes. This review underscores the importance of digital support tools in enhancing oncology nursing practice, ultimately contributing to better patient outcomes..

INTRODUCTION

Cancer is a leading cause of morbidity and mortality worldwide, with increasing incidence rates placing a substantial burden on healthcare systems. According to the World Health Organization, global cancer cases are projected to reach 27.5 million annually by 2040 [1]. This surge is driven by various factors including aging populations, increased exposure to environmental carcinogens, unhealthy lifestyles, and advances in early detection and diagnosis [2]. With the rising number of patients undergoing complex and aggressive cancer therapies, there is an urgent need to ensure safe and effective medication management [3].

High-risk cancer medications, including chemotherapeutic agents, targeted therapies, and immunotherapies, possess narrow therapeutic indices and are associated with severe adverse effects. These treatments require precise dosing, continuous monitoring, and prompt intervention in case of toxicity [4]. Oncology nurses are central to this process, as they administer medications, observe and report side effects, educate patients, and coordinate care across multidisciplinary teams [5].

Clinical Decision Support Systems (CDSSs) are digital platforms created to aid healthcare professionals in making well-informed choices regarding patient treatment. It provides timely and relevant information, often at the point of care, to help clinicians with various aspects of their decision-making process, such as diagnosis, treatment, and medication and making informed decisions by integrating evidence-based knowledge with patient-specific data. These systems seek to enhance the delivery of healthcare by improving medical decision-making through the application of specialized clinical knowledge, individualized patient data, and additional pertinent information. The CDSSs typically work by matching patient characteristics to a computerized knowledge base, then presenting the clinician with patient-specific assessments, recommendations, or alerts. CDSSs examples are tools that may encompass computerized alerts, reminders, clinical guidelines, order sets, diagnostic support, and documentation templates. Numerous CDSSs are incorporated into electronic health records (EHR) and

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Table 1: Advantages and considerations on the use of CDSSs in oncology nursing practice

Advantages	Considerations
Improved Patient Safety: Reduces medication errors, especially with high-risk cancer drugs.	Alert Fatigue: Frequent, non-specific alerts can overwhelm nurses.
Early Detection of Adverse Events: Assists in identifying toxicity and contraindications early.	Workflow Disruption: Poorly integrated systems can interrupt clinical routines.
Standardized Care: Promotes evidence-based, consistent decision-making.	Dependence on Technology: May reduce critical thinking if over-relied upon.
Enhanced Efficiency: Streamlines documentation and monitoring tasks.	Training Requirements: Requires time and resources for proper nurse training.
Enhanced Decision-Making: Access to a vast array of information, encompassing patient records, medical literature, and optimal practices,	
Support for Complex Regimens: Helps manage multi-drug protocols and interactions.	

in perceived utility and trust, and cognitive overload during the early phases of CDSS use. Nurses report that systems not tailored to their workflows can lead to frustration and inefficiency [8,17,41,47-49].

Qualitative findings suggest that alert fatigue is a significant concern. Nurses reported feelings of cognitive overload during the initial phases of CDSS implementation and expressed frustration with excessive alerts, contributing to alert fatigue. Repetitive or non-specific alerts lead to desensitization, reducing the likelihood that critical warnings will be heeded.

In contrast, nurses expressed greater trust and engagement with CDSSs when they were involved in system design or customization, resulting in improved alignment with clinical workflows [50-53].

Despite their potential, implementing CDSSs presents economic challenges. Start-up costs include hardware procurement, software licensing, and comprehensive training programs. For resource-limited hospitals, additional barriers such as weak technology infrastructure, inconsistent internet access, and limited staff capacity further complicate adoption [54]. Nonetheless, studies suggest that CDSSs can offer cost savings by reducing medication errors [55], preventing hospital readmissions [56], and streamlining workflow [13]. To mitigate financial barriers, the use of open-source platforms and cloud-based solutions may offer more feasible alternatives. These platforms reduce the need for local hardware investment and facilitate remote technical support.

The review also highlights the critical role of education and training. Without adequate instruction, nurses may underutilize or misuse CDSS features. Continuous professional development and involvement of nursing staff in system design can help overcome these barriers [8]. Finally, this is a narrative review, the absence of formal search and quality assessment of the included literature is a limitation of this work.

CONCLUSIONS

CDSSs are increasingly essential in oncology nursing for the safe and effective monitoring of high-risk cancer medications. They support clinical decision-making, enhance patient safety, and improve workflow efficiency. Despite challenges such as alert fatigue and implementation barriers, the evidence supports their continued and expanded use.

Future efforts should focus on tailoring CDSSs to nursing workflows, enhancing interoperability with other systems, and incorporating advanced technologies like artificial intelligence for predictive analytics. Examples include artificial intelligence models to predict immune-related or chemotherapy-induced adverse events or patient stratification tools that support personalized treatment regimens based on risk profiles. These may be random forest algorithms, support vector machines, and deep learning neural networks. Nevertheless, these uses although helpful and promising have the risk of algorithmic bias due to unbalanced training data, and the need to preserve human oversight in CDSS-enabled care. Thus transparency is of major importance in AI decision-making

Following, interdisciplinary collaboration is vital to ensure that CDSSs are user-friendly and clinically relevant. Further research should aim to evaluate long-term patient outcomes, cost-effectiveness, and adoption in diverse healthcare settings. As the landscape of cancer care evolves, so too must the tools that support it. CDSSs offer a promising pathway toward safer, more personalized, and efficient oncology nursing practice.

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