An Evidence-Based Review of the Safety and Efficacy of Remote Chemotherapy Verification

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In response to the nursing shortage and the emergence of telehealth opportunities, the Oncology Nursing Society used an evidence-based approach to examine current literature and trends for the two-person independent double check of high-risk medications, such as chemotherapy, when one of those two individuals is working remotely. Analysis of available evidence suggests virtual technology for two-person independent double checks is feasible and may be equal to live two-person checks; however, lack of consistency and rigor in the interventions and outcome measures makes a determination on safety or efficacy challenging.

AT A GLANCE

- Innovative solutions for chemotherapy safety checks are needed across the cancer care continuum to respond to the evolving healthcare landscape without sacrificing safety.
- Integrating remote technology into chemotherapy safety checks was not associated with adverse event reports in the literature or practice interviews.
- To determine the safety and efficacy of remote independent verification for high-risk medications, nursing research is recommended.

KEYWORDS
high-risk medication; safety; remote; telehealth; quality; virtual health

Oncology nursing care is complex and requires special training (Oncology Nursing Society, 2020). The consequences of a medication error can be devastating, but when completed properly, an independent double check (IDC) may lessen the chance an error will occur. The IDC of high-risk medications, such as chemotherapy, by two nurses has long been a standard of administration (Neuss et al., 2017). IDCs ensure patients receive medication in the safest way possible and have conventionally occurred with two nurses in the same setting as the patient, independently verifying key components prior to medication administration.

Traditional on-site IDCs can be limiting, more so when there are staffing shortages. The adoption of electronic health records (EHRs) along with the explosion of telehealth opportunities accelerated by the COVID-19 pandemic has given clinicians the ability to be in one location while remotely helping another who may be down the hall or miles away. According to Berlin et al. (2022), the United States will be short an estimated 450,000 nurses by 2025. Because of current and projected nursing shortages, as well as the lack of specialty-trained oncology nurses, trailblazing solutions are necessary to answer the constantly evolving environmental challenges across the care continuum without sacrificing safety.

Implementation of virtual care nurse models, where components of care are delivered via telephone or with two-way communication via video technology, is increasing in a variety of settings (Cloyd & Thompson, 2020). Several core functions of the virtual care nurse include patient education, mentorship, patient monitoring, and admission and discharge care; however, verification of high-risk medications prior to administration is not one of those elements (Cloyd & Thompson, 2020). This article provides an overview of the current literature and clinical practice trends of remote IDC for chemotherapy verification.

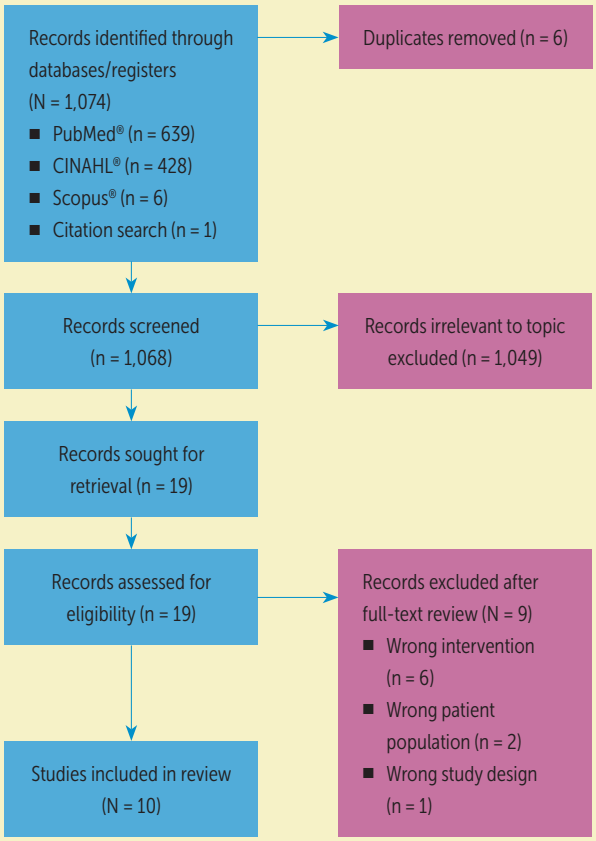
Methods

Synthesis of interventions and outcomes associated with virtual checks of high-risk medications was completed using an evidence-based approach. The PICO (problem, intervention, comparison, outcome) format generated

keywords from the following clinical inquiry: "In patients requiring chemotherapy or high-risk medications (P), how does an in-person double check (I) compared to a virtual second observer double check (C) affect errors (O)?" Figure 1 outlines database utilization and record retrieval. The search initially yielded 1,074 results. After removal of duplicates and irrelevant results, 10 articles were reviewed.

Review of the Oncology Nursing Society's online discussion boards (ONS Communities) revealed additional external evidence and assessed processes in the real working environment from 2019 to 2023. One relevant ONS Communities thread from May 2023 revealed interaction from eight members from four different healthcare organizations.

FIGURE 1.
PRISMA FLOW DIAGRAM



PRISMA—Preferred Reporting Items for Systematic Reviews and Meta-Analyses
Note. Of the 10 articles reviewed, 1 article was a position statement that did not address how the second nurse for independent double checks is accessed, and 5 articles were focused on pharmacy services and practices. Although these practices are now considered equivalent, 4 of the 5 articles had no discussion of a remote double check, and 1 discussed remote compounding. The remaining 4 articles had heterogeneity in the outcome measures and intervention procedures.

A review of the National Cancer Institute–designated cancer center nursing leadership Listserv provided additional practice details regarding remote IDCs. Practice interviews with individuals identified through the online discussion boards and Listserv were conducted using standardized questions via video virtual technology. Overall themes were established and recommendations for consideration were formulated after synthesizing the literature and practice interviews.

"Evidence suggests virtual technology for two-person IDCs is feasible and may be equal to live two-person checks."

Review of the Literature

Four articles were appropriate for synthesis of interventions and outcomes (see Table 1). Identified themes included the use of (a) video virtual (remote) technology and (b) technology-assisted workflow systems.

Video Virtual (Remote) Technology

Use of remote verification technology was common, with audio (telephone) and audiovisual methods described as the primary interventions. Kok et al. (2019) implemented the remote check process for chemotherapy administration in the home via video call, where a second practitioner completed the IDC prior to every administration. Czmielewski et al. (2022) addressed the number and severity of errors found while using remote verification for radiation treatment planning. Sterile compounding has also been supported using remote verification within the pharmacy setting. There were no associated errors in documentation or safety when a remote pharmacist, in addition to a second verifier on site, completed the IDC (Jean et al., 2020). Despite these reports, barriers still existed with remote verification and inspection of the infusion pump and drug label. Omission of infusion rate check, confirmation of drug label accuracy, and visual inspection of the product to be administered were potential safety risks posed by audio-only (telephone) verification (Neuss et al., 2017).

Technology-Assisted Workflow Systems

The type of technology leveraged to accomplish verification of high-risk settings varied. Jean et al. (2020) described the technology-assisted workflow system using barcoding and photography for each step of pharmacy sterile compounding.

Pharmacists also added gravimetric verification via an electronic balance to confirm volume and density accuracy (Jean et al., 2020).

In a virtual clinical pharmacy service program, participating rural-based organizations designated videoconferencing carts for delivery of virtual services (Chambers et al., 2022). Virtual pharmacists completed medication reconciliation, safety checks, and patient education using high-definition webcam and videoconferencing programs with noise-canceling headphones and dual screens. Templates to document services ensured standardization and capture of all relevant information (Chambers et al., 2022).

Audiovisual conferencing for second verification using mobile devices occurred in the pediatric homecare setting (Kok et al., 2019), and physicists relied on the virtual desktop to review setup images and perform plan checks for radiation treatment planning (Czmielewski et al., 2022). Among these novel approaches to verification in high-risk settings, there was no decrease in safety reported. The integration of technology was equivalent in the majority of articles reviewed, with one article reporting improvements in safety (Chambers et al., 2022).

Practice Interviews

The online discussion boards and Listserv yielded nine nursing leaders; however, only six completed interviews. Individuals reported seven different technology interventions for the second-person IDC. Comparative details from the interviews are further discussed in Table 2.

Two interventions were directly related to the IDC process for chemotherapy; however, as with the literature review, there was significant heterogeneity in the outcome measures and intervention procedures. One site implemented the remote check process for chemotherapy administration in the home via telephone where the second verification was completed by either a nurse or pharmacist (site 4, personal communication, July 17, 2023). Another used videoconferencing technology to complete the double-check process for patients admitted to the hospital on a non-oncology unit. This institution followed the same steps of the policy for double check, including label visualization and pump checks, using the videoconferencing technology. However, complications arose regarding the remote nurse cosigning the chemotherapy in the EHR in a remote capacity, which halted implementation (site 3, personal communication, July 17, 2023). One institution used barcode technology for blood administration, not chemotherapy (site 1, personal communication, July 11, 2023), and the final institution implemented remote verification for apheresis verification procedures (site 2, personal communication, July 11, 2023).

Practice site outcome measures focused primarily on feasibility, as opposed to safety and patient adoption. Feasibility challenges included device availability, screen control, reception, and dedicated telephone lines, all of which led to barriers with remote IDC implementation. The need for alternative downtime workflows, cosigning functionality between two separate locations, availability of mobile devices, and substantial reliance on information technology teams to implement these interventions were additional barriers.

Remote processes still posed issues, despite their initiation to relieve staffing pressures. Sometimes there were not enough nurses trained in the remote check process to support needs on every shift, leading to prolonged wait times for an available remote verifier. All sites reported positive nurse adoption of technology-assisted IDCs, despite these barriers. To the knowledge of those interviewed, the interventions described in the practice interviews were not associated with any adverse events; however, this is largely anecdotal because safety was not a primary outcome measure.

Implications for Practice

Although a few innovative institutions are exploring the integration of technology into the nursing verification process, many more individuals interviewed verbalized interest in this intervention. This is likely a reflection of nursing workforce challenges coupled with the rising volume of patients with cancer and non-oncology indications for oncology drugs nationally.

Several limitations were noted during this evidence-based review. First, many of the articles reviewed discussed interventions implemented during the early stages of the COVID-19 pandemic, which may have affected staffing, onboarding, instruction and training, or incident reporting. Similar studies to

TABLE 1.
SYNTHESIS OF ARTICLE INTERVENTIONS AND SAFETY OUTCOMES (N = 4)

	INTERVENTION	
STUDY AND FOCUS	VIDEO VIRTUAL (REMOTE) TECHNOLOGY	TECHNOLOGY-ASSISTED WORKFLOW SYSTEMS[a]
Chambers et al., 2022; pharmacy check	Improved safety	N/A
Czmielewski et al., 2022; radiation oncology	No difference in safety	N/A
Jean et al., 2020; pharmacy check	N/A	No difference in safety
Kok et al., 2019; chemotherapy in the home	No difference in safety	N/A

[a] Includes use of barcode technology and digital photography
N/A—not included or used

validate the results in the setting of postpandemic recovery are warranted. Second, small sample sizes, outcome measure heterogeneity, and lack of rigorous implementation designs pose further challenges to generalizability or direct application to clinical practice and patient care workflows. Practice interventions may not be inclusive of initiatives occurring through the United States because individuals discussed the practices of only four sites during interviews.

Despite these limitations, themes emerged from the literature review and the practice interviews that can guide future research and clinical practice. There are implications for technology companies that design and maintain EHRs to consider the integration of remote workflows that support the evolving needs of the healthcare environment, particularly systems that are designed with fail-safes to prevent functionality errors or interruptions in connectivity. Institutions can challenge historical IDC practices and design an infrastructure that supports technology-assisted workflows. The voice of the frontline nurse is essential at decision-making tables within their organization and externally with companies designing products for healthcare organizations. Consideration of the nursing perspective and nurses' perceived challenges can better inform the adoption of technology, policies, and workflows needed to support remote IDC in clinical practice.

Additional nursing research on the efficacy, safety, and feasibility of technology-based IDCs is encouraged. In testing these novel innovations, it is critical that the core components of IDC are not sacrificed when integrating technology solutions. Given the high volume of interest and substantial need for rigorous research in this area, a multisite collaboration could be an efficient way to explore this issue. Exploration of this innovation, with particular focus on safety, equity, patient satisfaction, clinician satisfaction, and return on investment in alignment with the quintuple aim, is encouraged. Publication of this work, regardless of the findings, can continue to build the body of evidence around this area of practice.

TABLE 2.
PRACTICE INTERVIEW VARIABLE COMPARISONS BY SITE

	PRACTICE INTERVIEW SITE			
VARIABLE	1	2	3	4
Documentation	Single-nurse sign-off in Oracle Cerner EHR	Single-nurse telephone call annotation in EHR	Co-signature for chemotherapy in Epic EHR	Single-nurse telephone call annotation in Epic EHR using smart phrases
Independent double check process modifications	No second-person visualization of blood product label or identification band; the nurse scans barcodes instead.	Second checker does not visualize label or pump.	No modifications; nurses use video to visualize identification band and drug labels.	Second checker does not visualize label or pump.
Process	Use of barcode technology verification to replace second RN for checking blood products	Remote apheresis kit checks for inpatients; implemented dual read-back of components with 1 remote RN	Piloted for inpatient off-service chemotherapy treatments; 1 RN goes off unit and second RN completes check virtually; pilot completed over 3 weeks (about 10 patients)	Home infusion implementation of a double check with 1 RN in the patient home and second check completed via telephone with RN or pharmacist in the office confirming the label order
Site-identified barriers	System downtime requires reverting to prior 2-RN process.	Device availability for staff, number of trained staff, mobile telephone reception for video calls, coordinating technology team support	Double signing the order requires that RNs are in the same location; needed to create a workaround for screen control to have remote RN sign order	Needed to set up a dedicated telephone line for these calls to the office to prevent long holds
Treatment types	Blood transfusions	Apheresis only	Chemotherapy and immunotherapy	Any infusion with a dose change, new drug, or new start of high-risk class of drugs
Virtual check platform	Cerner Bridge	Telephone (audio only)	Zoom embedded in Epic	Telephone (audio only)

EHR—electronic health record
Note. Of the 7 interventions identified via practice interview, 3 were focused on pharmacy verification of high-risk medications. Implementation was successful and replaced the need for 2 pharmacists physically located in the same area; however, the practices were not directly translatable to the nursing double-check procedure.

Conclusion

Traditional standards that guide the safe administration of chemotherapy and other high-risk medications must evolve with the changing healthcare landscape. Evidence suggests virtual technology for two-person IDCs is feasible and may be equal to live two-person checks; however, lack of consistency and rigor in the interventions and outcome measures prevents determining safety or efficacy at this time. These findings can guide future standards of administration, ensure safe high-risk medication verification by trained nurses, increase access to care, and maximize use of telehealth interventions, but well-designed nursing research is required to support the adoption of virtual technology for two-person IDCs into clinical practice.

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