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Comprehensive Chemotherapy Safety Protection Network: From Traditional Care to Intelligent Innovation

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Introduction

Chemotherapy drugs are highly toxic and require careful management to ensure the safety of patients, healthcare staff, and the environment. To address these risks, we developed the "Comprehensive Chemotherapy Safety Protection Network", a system that integrates digital technology with innovative safety measures. This framework transforms traditional services into a tech-driven model, enhancing drug management, occupational safety, and overall protection. It also provides a scalable solution for global healthcare systems.

Methods

Our safety network is structured into three key domains: patient safety, medication safety, and personnel safety, each with specific strategies:


Dedicated structured chemotherapy order entry system


Authorization procedure


Consensus-based chemotherapy prescription selection and verification mechanism

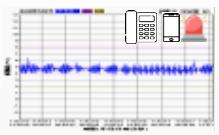

Intelligent chemotherapy prescription verification system
20 advisory alert + 18 hard stop check


Smart Chemotherapy Compounding and Management System (SCCMS)


Barcode-assisted workflow
9 advisory alert + 15 hard stop check


AI pump verification system


Medication box location alert system


24-Hour refrigerator temperature monitoring with dual alert system


Regular Health Screening Program


AR360 training program


Smart Clip


Real-time medication stability alert


Notification mechanism for refrigerated medications

Results:

Patient Safety

- **Prescription error rate** is maintained at 0.01–0.03% (international benchmark: 0.1-24.6%) [1,4,5].
- **Chemotherapy compounding errors** were reduced from **4 to 0** after SCCMS implementation.
- **Infusion pump rate setting errors** were eliminated (International benchmark: 0.6-3.8%)[2,3]; and **administration time** was reduced from **8 minutes to 2.8 minutes** (65% reduction).

Medication Safety

- **Zero temperature-related drug disposal incidents** occurred due to effective refrigerator monitoring and alert system.
- **Medication box location alert system** prevented chemotherapy drug wastage and **reduced disposal costs** from **$6,000 to $0**.
- Chemotherapy infusions **exceeding stability limits** were reduced from **2.9% to 0.13%** (International benchmark: 0.5-7.5%)[2,3].

Personnel Safety

- **No abnormalities** were found in the health examinations of chemotherapy staff.
- **Workflow efficiency** was improved: SCCMS reduced **53.5% of preparation steps** and shortened **prescription preparation time by 27%** (890 → 650 seconds).
- **IV connector disconnection incidents** were eliminated from **8 to 0** after Smart Clip implementation.
- **AR360 training** reduced **teaching stress** (62%) and **interference**(51.9%), and improved learning **effectiveness** (4.3/5).

Conclusion:

Our "Comprehensive Chemotherapy Safety Protection Network" enhances chemotherapy treatment safety and efficacy for patients while fully protecting chemotherapy staff from drug exposure risks. It streamlines medication management, ensuring accuracy at every step. The goal is to provide high-quality chemotherapy services and a safe working environment for healthcare professionals. This model offers a scalable, intelligent approach to chemotherapy safety that can be applied globally. Future efforts will focus on cross-institutional validation and international collaboration to establish global best practices for chemotherapy safety standards.

References:

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