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Impact of Unit Dose Medication Distribution Systems on Medication Safety, Nursing Efficiency, and Pharmacy Workflow in Hospital Settings: A Narrative Review

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ABSTRACT: **Background**: Medication distribution is an essential part of hospital practice, yet it remains a source of preventable medication errors and operational difficulties. Nurses and pharmacists share responsibility for ensuring that prescribed medications reach patients safely and on time. Unit dose medication distribution systems have been introduced in many hospitals to improve medication handling, strengthen pharmacy oversight, and reduce unnecessary preparation activities in nursing units.

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Objective: This narrative review explores the contribution of unit dose medication distribution systems to medication safety, nursing efficiency, and pharmacy workflow, with particular attention to the practical relationship between nursing and pharmacy departments.

Methods: This narrative review draws on published literature and professional guidance related to hospital medication distribution, medication administration errors, pharmacy automation, and nursing practice. The available evidence is discussed thematically, focusing on the advantages, limitations, and practical implications of unit dose systems. The review does not attempt a systematic synthesis or quantitative estimation of intervention effects.

Discussion: Unit dose distribution changes how medications move through the hospital and how responsibilities are shared between pharmacists and nurses. Pharmacy involvement in medication verification and dose preparation may reduce opportunities for medication selection and preparation errors. Nurses may benefit from more organized medication supplies and reduced handling of bulk medication stock. However, these advantages depend on timely dispensing, clear communication, adequate staffing, and reliable information systems. Centralized distribution may also create new challenges, particularly when medications are urgently needed or orders change frequently.

Conclusion: Unit dose medication distribution can contribute to safer and more organized hospital medication practices. Its success depends not only on the distribution model itself but also on effective collaboration between nurses and pharmacists, appropriate technology, and continuous evaluation of daily clinical workflows

1. INTRODUCTION

Medication administration is one of the most frequent clinical activities performed in hospitals. Every day, nurses administer medications to patients with different diagnoses, treatment plans, and levels of clinical complexity. Before these medications reach the bedside, pharmacists are involved in reviewing prescriptions, evaluating medication appropriateness, and ensuring that the correct products are available for administration. Although these responsibilities are closely connected, medication distribution is not always straightforward.

In a busy hospital, medication orders may change several times during a patient's admission. A physician may adjust a dose after reviewing laboratory results, discontinue a medication because of an adverse reaction, or prescribe a new treatment that must be administered without delay. Such changes require timely communication between pharmacy and nursing departments. When communication is delayed or medication supplies are poorly organized, the risk of missed doses, administration delays, and medication errors may increase.

Medication errors remain a major concern in healthcare. The World Health Organization has highlighted the importance of reducing avoidable medication-related harm through safer medication practices and stronger healthcare systems 1. Although medication errors can occur at any stage of the medication-use process, the distribution and administration stages deserve particular attention because they involve several professional groups and multiple opportunities for human error.

Traditionally, many hospitals have relied on ward-stock medication distribution, where commonly used medications are stored in nursing units. Nurses select the prescribed medication from available stock and prepare the required dose before administration. This arrangement offers convenient access to medications, particularly in clinical areas where immediate treatment is frequently required. However, it also places considerable responsibility on nurses for medication selection, stock management, and preparation.

Unit dose medication distribution offers a different approach. Instead of supplying medications primarily in bulk quantities, the pharmacy provides individually packaged doses, usually organized according to patient-specific medication requirements. This

allows pharmacists to maintain greater oversight of medication distribution while reducing some of the preparation activities performed in nursing units.

The concept is not entirely new, but its relevance has increased as hospitals have introduced electronic prescribing, automated medication packaging, barcode verification, and electronic medication administration records. These technologies can support unit dose distribution, although they do not replace the need for professional judgment and careful medication administration.

An important consideration is that unit dose distribution affects both nursing and pharmacy practice. A change that simplifies one department's work may increase responsibilities in another. For example, reducing medication preparation at the nursing station may require additional pharmacy packaging activities and more frequent medication deliveries.

Understanding these practical relationships is important when evaluating whether unit dose distribution improves hospital performance.

This narrative review examines the influence of unit dose medication distribution systems on medication safety, nursing efficiency, and pharmacy workflow. It also considers the challenges of implementation and the importance of cooperation between pharmacists and nurses.

2. METHODOLOGY

This article was developed as a narrative review of literature addressing medication distribution and medication safety in hospital settings. The discussion draws on published research, medication safety recommendations, and professional guidance concerning hospital pharmacy practice, nursing medication administration, barcode verification, and automated medication distribution.

The literature was considered in relation to three main areas: medication safety, nursing workflow, and pharmacy operations. Additional attention was given to communication between healthcare professionals and the organizational challenges associated with changing medication distribution practices.

A narrative approach was selected because the topic involves several interconnected clinical and operational issues. Medication distribution systems cannot be evaluated solely by counting medication errors. Their influence on nursing workload, pharmacy responsibilities, medication availability, and communication between departments must also be considered.

The review therefore emphasizes interpretation and practical implications rather than statistical comparison.

This manuscript does not represent a systematic review. No exhaustive database search, formal study selection process, or risk-of-bias assessment was performed. Accordingly, the discussion should be interpreted as a critical overview of relevant literature rather than a comprehensive assessment of all available evidence.

3. UNIT DOSE MEDICATION DISTRIBUTION IN HOSPITAL PRACTICE

The basic principle of unit dose medication distribution is that medications are supplied in quantities suitable for a single administration. In many hospitals, these doses are packaged and organized according to the medication orders of individual patients.

A typical process begins when a physician enters a medication order. The pharmacist reviews the prescription and considers factors such as dose, route, frequency, potential interactions, allergies, and the patient's clinical condition. Once the order has been verified, the required medication is prepared or selected for dispensing.

The medication is then supplied to the nursing unit, where the nurse confirms the patient's identity, checks the medication against the active order, administers the dose, and documents the administration.

Although the process appears straightforward, its practical operation requires coordination. Medication orders must be updated accurately, doses must be delivered at the appropriate time, and discontinued medications must be removed from active use.

One advantage of unit dose distribution is that medications can be identified and controlled more consistently. Individually packaged medications generally carry information about the product, strength, and other relevant details. When integrated with electronic systems, they may also support barcode verification and more reliable medication tracking.

However, the unit dose package itself does not guarantee that a medication will be administered correctly. Nurses must still confirm the correct patient, medication, dose, route, and time while considering the patient's current clinical status.

Similarly, pharmacist verification cannot eliminate every possible error. Incorrect patient information, incomplete medication histories, communication failures, and system-related problems may still affect medication safety.

Unit dose distribution should therefore be understood as one component of a broader medication safety process rather than a complete solution.

4. MEDICATION SAFETY AND THE PREVENTION OF MEDICATION ERRORS

Medication errors may occur for several reasons, including unclear prescriptions, similar medication names, incorrect dose calculations, interruptions during preparation, and communication failures.

In traditional ward-stock systems, nurses may be required to select medications from shelves or storage cabinets containing several strengths and formulations. Under demanding working conditions, particularly during busy medication rounds, this creates opportunities for selection errors.

Unit dose distribution may reduce some of these risks by transferring routine medication selection and packaging responsibilities to the pharmacy department.

This arrangement allows pharmacists to review prescriptions before routine doses are dispensed. It may also reduce the number of occasions on which nurses need to prepare doses from multidose containers.

The potential safety benefits are particularly relevant when patients receive numerous medications or when dose adjustments are common. Nevertheless, certain medications still require bedside preparation, dilution, or special handling, regardless of the distribution model.

Barker and colleagues reported medication administration errors across multiple healthcare facilities, illustrating the continuing need for effective safeguards in medication administration 2. Their findings are relevant to understanding the broader problem of administration errors, although the study should not be interpreted as direct evidence that unit dose distribution alone prevents them.

Technological systems may provide additional protection. Poon and colleagues demonstrated that barcode-supported medication administration was associated with reductions in medication administration errors and potential adverse drug events 3.

Barcode administration is especially valuable when medication packaging, electronic medication records, and patient identification systems are properly integrated. Nevertheless, its effectiveness depends on consistent use. Workarounds, damaged barcodes, and inaccurate electronic records can undermine the intended safeguards.

The central issue is that medication safety depends on several layers of protection. Unit dose distribution can improve medication organization, but it works best when supported by pharmacist verification, nursing assessment, reliable documentation, and a culture that encourages reporting and learning from errors.

5. THE INFLUENCE OF UNIT DOSE DISTRIBUTION ON NURSING EFFICIENCY

Nursing workload is often discussed in relation to direct patient care, but a considerable part of a nurse's working day is devoted to medication-related activities.

These activities include reviewing medication orders, locating medications, preparing doses, confirming patient identity, administering treatment, documenting administration, and monitoring patient responses.

In wards that rely heavily on bulk medication supplies, nurses may also spend time managing stock and requesting replacements for unavailable medications.

Unit dose distribution may simplify some of these activities by providing medications in a more organized form.

For example, when medications are already packaged in the required strength, nurses may spend less time selecting tablets from multidose containers or preparing routine oral medications. This may be particularly useful in medical and surgical wards where several patients receive medications at similar administration times.

However, reduced preparation does not necessarily mean that the total time required for medication administration will decrease.

Nurses must continue to review orders, assess patients, perform required checks, and document treatment. In some hospitals, barcode scanning and electronic documentation may introduce additional steps, even though these steps support medication safety.

Missing medications are another important concern. When a scheduled dose has not arrived from the pharmacy, the nurse may need to contact pharmacy staff, request an urgent supply, or rearrange medication administration activities.

These interruptions can offset some of the time saved through unit dose packaging.

The relationship between unit dose distribution and nursing efficiency is therefore influenced by the reliability of the entire medication supply process.

A well-functioning system may reduce unnecessary medication handling and improve workflow organization. A poorly coordinated system may instead create delays and frustration.

For this reason, hospitals should evaluate nursing efficiency through practical indicators such as medication preparation time, missing-dose frequency, administration delays, and interruptions during medication rounds.

6. PHARMACY WORKFLOW AND MEDICATION DISTRIBUTION RESPONSIBILITIES

Introducing unit dose distribution also changes how pharmacy departments organize their daily work.

In a conventional ward-stock system, the pharmacy may supply medications in larger quantities, with nursing units maintaining their own stock of commonly used products.

Under a patient-specific unit dose model, pharmacy staff become more directly involved in preparing, organizing, and distributing individual doses.

This creates opportunities for improved medication control, but it also introduces additional operational responsibilities.

Pharmacists and pharmacy technicians may need to manage packaging equipment, verify medication labels, prepare medication carts, process returns, and respond to frequent changes in medication orders.

In hospitals with large inpatient populations, these activities can become substantial.

Automation may help manage the workload. Automated packaging and dispensing technologies can support repetitive tasks and improve consistency when properly configured and maintained.

However, automation does not remove the need for quality assurance. Equipment may malfunction, medications may be loaded into incorrect locations, and packaging information may be inaccurate.

Professional guidance on automated dispensing systems emphasizes the importance of appropriate configuration, security, medication selection controls, and ongoing monitoring 4.

Another operational consideration is the balance between centralized medication control and timely medication availability.

Centralized distribution can improve accountability, but nursing units must still have access to urgently required medications. Hospitals therefore need clear procedures for emergency medications, approved override processes, and medication delivery outside routine schedules.

The success of unit dose distribution ultimately depends on whether pharmacy services can provide accurate medication supplies without creating avoidable delays in patient treatment.

7. COLLABORATION BETWEEN NURSING AND PHARMACY DEPARTMENTS

One of the most important aspects of unit dose medication distribution is the relationship between pharmacists and nurses.

Although the two professions have different responsibilities, they participate in the same medication-use process. Their work is closely connected, and difficulties in one department can directly affect the other.

For example, a pharmacist may verify and dispense the correct medication, but the intended treatment may still be delayed if the dose does not reach the nursing unit on time.

Similarly, a nurse may identify a discrepancy in the medication order, but the problem cannot always be resolved without communication with the pharmacist or prescriber.

Effective collaboration requires more than simply assigning responsibilities.

Both departments need a shared understanding of how medication orders are processed, how urgent doses are requested, and how medication discrepancies should be handled.

Communication is particularly important when patients are transferred between units, when medications are discontinued, or when treatment plans change unexpectedly.

A patient transferred from an intensive care unit to a general ward, for instance, may have several medication orders modified within a short period. If the pharmacy distribution record and nursing medication administration record are not synchronized, medications may be delayed, duplicated, or supplied unnecessarily.

Regular communication between pharmacy and nursing teams can help identify these problems before they affect patients.

Joint training may also improve understanding of each department's challenges. Nurses benefit from knowing how medication orders are verified and processed, while pharmacists benefit from understanding the practical demands of medication administration at the bedside.

This shared perspective is particularly valuable when hospitals introduce new distribution systems or technologies.

8. COMPARISON BETWEEN TRADITIONAL WARD-STOCK AND UNIT DOSE MEDICATION DISTRIBUTION SYSTEMS

The differences between ward-stock and unit dose distribution extend beyond medication packaging. They influence responsibility, workflow, inventory management, and the way medications are made available to patients.

Table 1. Practical comparison of traditional ward-stock and unit dose medication distribution systems

Aspect	Traditional ward-stock system	Unit dose distribution system
Medication availability	Medications are stored in nursing units	Patient-specific doses are commonly supplied by pharmacy
Nursing responsibilities	More routine stock selection and dose preparation	Less handling of bulk supplies for eligible medications
Pharmacy responsibilities	Greater emphasis on bulk stock supply	Greater involvement in dose verification, packaging, and distribution
Medication safety	Depends heavily on ward-level controls	Adds pharmacy-level dispensing safeguards

Aspect	Traditional ward-stock system	Unit dose distribution system
Inventory control	Stock distributed across clinical units	Potential for more centralized tracking
Medication waste	Excess ward stock may contribute to waste	Patient-specific supply may reduce some unused stock
Urgent medication access	Commonly available from ward stock	Requires reliable emergency supply arrangements
Operational challenges	Stock management and selection errors	Packaging workload, delivery delays, and missing doses

The differences presented are general operational characteristics. Actual outcomes depend on the design of the system and the resources available within each hospital.

9. CHALLENGES ASSOCIATED WITH IMPLEMENTATION

Although unit dose distribution offers several potential advantages, implementation can be difficult, especially in hospitals with limited staffing or outdated information systems.

One of the first challenges is the financial investment required.

Hospitals may need medication packaging equipment, suitable storage areas, medication carts, electronic systems, and additional pharmacy personnel. These expenses may be significant during the early stages of implementation.

A second challenge involves changes in professional responsibilities.

Nurses who are accustomed to selecting medications directly from ward stock may initially experience difficulties adapting to scheduled pharmacy deliveries. Pharmacy staff may also face increased workload as more medication preparation activities are transferred to their department.

Staff involvement during planning can help reduce these difficulties.

Another concern is the management of medication orders that change frequently.

In intensive care units, emergency departments, and other high-acuity settings, treatment plans may change rapidly. A distribution model designed primarily around scheduled doses may not adequately support these environments unless urgent supply procedures are available.

Information technology also plays an important role.

If pharmacy and nursing systems are not properly integrated, discrepancies may occur between prescribed medications, dispensed doses, and administration records.

Such problems can affect medication availability and create uncertainty among healthcare professionals.

Finally, not all medications are suitable for conventional unit dose packaging. Certain injectable medications, hazardous medications, refrigerated products, and medications requiring immediate preparation need specialized handling procedures.

Hospitals should therefore adapt the distribution model to clinical requirements rather than expecting every medication to follow the same process.

10. DISCUSSION

The introduction of unit dose medication distribution is often described as a medication safety improvement, but its practical effects are broader.

It changes how medications are prepared, how information is exchanged, and how responsibility is shared between pharmacy and nursing departments.

From a medication safety perspective, one of its main strengths is the opportunity to standardize medication handling before administration. Pharmacist verification and individual dose packaging can reduce certain risks associated with medication selection and preparation.

However, the available evidence must be interpreted carefully. Studies examining barcode administration, electronic prescribing, and automated dispensing provide important information about medication safety, but their findings cannot always be attributed specifically to unit dose distribution.

For example, the improvements reported by Poon and colleagues were associated with barcode technology 3. Such findings support the value of technology-assisted medication administration, but they do not establish that unit dose packaging alone produces the same results.

The effect on nursing efficiency also deserves careful consideration.

Reducing medication preparation activities may allow nurses to organize medication rounds more effectively, but this benefit can disappear when medication deliveries are unreliable or communication with the pharmacy is difficult.

In practice, nurses are likely to judge the success of the system partly by whether the correct medication is available when needed.

Pharmacy departments, meanwhile, may experience greater responsibility for dispensing accuracy and medication logistics. These responsibilities can support improved medication control, but they require adequate staffing, training, and operational resources.

This creates an important management consideration: improving nursing workflow should not simply transfer an unsustainable workload to pharmacy personnel.

A successful system must achieve a reasonable balance between patient safety, medication availability, nursing efficiency, and pharmacy capacity.

The relationship between these outcomes is especially relevant in hospitals seeking to improve medication management standards and strengthen their quality and patient safety programs.

Hospitals should avoid evaluating unit dose distribution solely on the basis of implementation completion. Installing packaging equipment or introducing patient-specific medication drawers does not necessarily mean that medication distribution has become safer.

Meaningful evaluation requires monitoring what happens during routine clinical practice.

Measures such as medication administration errors, missing-dose requests, dispensing discrepancies, medication waste, and administration delays can provide useful information about system performance.

Feedback from nurses and pharmacists should also be considered because operational problems may not always be reflected in formal incident reports.

Overall, the literature supports a broader understanding of medication safety in which distribution systems, technology, professional responsibilities, and organizational culture are closely connected.

11. PRACTICAL IMPLICATIONS FOR HOSPITAL MANAGEMENT

Hospital administrators considering unit dose distribution should begin by examining their existing medication-use processes.

Understanding how medications currently move from the pharmacy to nursing units can help identify unnecessary steps, frequent delays, and areas where errors are more likely to occur.

A multidisciplinary team should then determine which medications and clinical areas are suitable for unit dose distribution.

General medical and surgical wards may offer opportunities for structured implementation, while emergency and critical care settings may require additional arrangements for rapid medication access.

Training should be provided to both pharmacy and nursing personnel before the system becomes operational.

Particular attention should be given to medication order changes, missing doses, medication returns, barcode verification, and the management of urgent medications.

Hospitals should also establish clear performance indicators and review them regularly.

Importantly, implementation should be treated as an ongoing quality-improvement process rather than a one-time operational change.

As staff become familiar with the system, their experiences can help identify opportunities to improve medication delivery schedules, packaging procedures, and communication between departments.

12. LIMITATIONS OF THE REVIEW

Several limitations should be acknowledged.

First, this article is a narrative review and does not use a systematic search strategy. Relevant studies may therefore have been omitted.

Second, the literature discussed includes studies of medication administration technologies and broader medication safety interventions, not exclusively investigations of unit dose distribution.

Third, differences in hospital size, staffing, technology, and medication management practices may limit the generalizability of findings across healthcare institutions.

Finally, improvements in medication safety and workflow cannot always be attributed to one intervention because hospitals frequently introduce several changes simultaneously.

These limitations highlight the need for additional research comparing medication distribution models using clearly defined clinical and operational outcomes.

13. Conclusion

Unit dose medication distribution can improve the organization of hospital medication services and provide additional safeguards during medication dispensing and administration.

For nurses, it may reduce some routine preparation activities and make medication supplies easier to manage. For pharmacists, it creates opportunities for closer medication oversight and more structured distribution processes.

However, these advantages are not automatic. Delayed medication deliveries, insufficient staffing, poor communication, and unreliable information systems can limit the effectiveness of the system.

The most important consideration is how well the distribution model supports the daily work of healthcare professionals while maintaining timely and safe patient care.

Rather than viewing unit dose distribution as a stand-alone solution, hospitals should consider it part of a wider medication safety strategy involving pharmacists, nurses, prescribers, information systems, and hospital leadership.

Further research examining medication errors, nursing workload, pharmacy productivity, and cost-effectiveness would help clarify the circumstances in which unit dose distribution provides the greatest benefit.

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