ISMP Guidelines for Safe Use of Automated Dispensing Cabinets in Hospitals

South Carolina Society of Health-System Pharmacists
2nd Annual Pharmacy Automation and Technology Conference
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Introduction
Unit Dose System introduced 1920's
• 1943 Penicillin $20/dose
• 1946 Penicillin 55¢/dose
Medication Nurse emerged 2005
72% ADC Use
Primary cart Fill Distribution

Hospital Drug Distribution Systems
• Pre-1960s - floor stock system
  – Locked narcotic safes/boxes (keys) with manual counts
• 1960s – individual patient prescriptions; 3-5 day supply, nurses “poured” own meds
• 1970s – unit dose distribution; IV admixtures
  – Drug cart fills (bin fill by Rx tech and checks by RPh); nurse servers; locked mechanical cabinets or carts for controlled drug storage (keys)
  – Usually 24 hour supply of scheduled and “prn” medications
  – Updated throughout the day – pneumatic tube; pharmacy delivery; nurse gets from pharmacy; borrows from other patient or “stash”

ADC Improvements
• 1990s – automated dispensing as primary method evolving
  – “Profile system” to require pharmacist order review prior to dispensing
  – Computerized alerts
  – Decrease order turn around
• 1990s – 2000s – “Pockets” vs. matrix drawers; lidded containers
• 2000’s – Bar code systems
  – For stock replenishment and drug selection
  – Bedside scanning
  – Telepharmacy applications after pharmacy hours

Milestones in Nursing Care & Drug Distribution Systems

• Total Patient Care
• Functional Care
• Team Nursing
• Primary Nursing

Hospital Drug Distribution Systems
• Late 1980s – Early 1990s. Cabinets with tracking for narcotics; some floor stock items
  – Charge capture
  – Improved security
  – Improved inventory control
• Early 1990s – Automated dispensing for first dose (no RPh screening); allergy checks

ISMP ADC Survey 1999 vs. 2007
• 453 respondent
• 75% utilizing ADCs
• 20% as the primary means of drug distribution
• Features that promote safety lacking.
• Practitioner safety precautions not established

• 800+ respondents
• 94% utilizing ADCs
• 56% as the primary means of drug distribution
• More safeguards in place than in 1999
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**ISMP ADC Survey**

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**Checking Process**

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- Pharmacists checking ADC stock medication before leaving the pharmacy
- Verification after stocking the ADC
- Double check after a nurse overrides the ADC

**Pharmacist Review**

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<td>28%</td>
<td>64%</td>
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- Pharmacist must review orders before removing medication from the ADC
- Nursing perception – front line staff
- Pharmacist perception
- Reported that all ADCs are capable of being profiled

**Cabinet Design**

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- Can only remove requested drug from ADC vs. multiple drugs available in a matrix setting

**Multidisciplinary Requirements**

- Pharmacists
- Pharmacy technicians
- Nurses

**Gaps in the Safe Use of ADCs**

- New trends with increased use of ADCs
  - Bypassing pharmacy profile functionality
  - Difficulty managing override usage patterns
  - More ADC transactions
    - Lines at the cabinet
    - At-risk practices with drug selection
    - Variable processes for transporting drugs to bedside
  - Increased density of drug storage
    - High-alert medications in matrix drawers
    - Selection errors common

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Creating the ADC Forum
- ISMP convened a Steering Committee with 5 ADC vendors
- Steering Committee concluded... “There was very little formalized guidance to direct healthcare facilities on the safe use of ADCs”
- Steering Committee proposed a project to identify core processes when using ADCs that would challenge both hospitals and vendors to improve the safety/safe use of ADCs

ADC Forum
- Industry Sponsors
  - Cardinal Health
  - McKesson
  - Omnicell

ADC Forum – March 2007
- Stakeholders
  - 13 hospitals (large, small, general, specialty)
  - Pharmacist and nurse from each facility
  - Members of the ISMP staff
  - Developed “Core Processes” (independent of hospital size, pharmacy hours, or specialty)

ADC Project Scope
- Draft guidelines appeared for public comment on the ISMP website through December 31, 2007
- Final guidelines posted March 2008
- ADC self assessment posted August 2009 and available nationally

ADC Core Processes
- Provide ideal environmental conditions for the use of ADCs
- Ensure ADC system security
- Use pharmacy-profiled ADCs
- Identify information that should appear on the ADC screen
- Select and maintain proper ADC inventory
- Select appropriate ADC configuration
### ISMP Guidelines for Safe Use of Automated Dispensing Cabinets in Hospitals

#### ADC Core Processes
- Define safe ADC restocking processes
- Develop procedures to ensure the accurate withdrawal of medications from the ADC
- Establish criteria for ADC system overrides
- Standardize processes for transporting medications from the ADC to the patient's bedside
- Eliminate the process for returning medications directly to their original ADC location
- Provide staff education and competency validation

#### Provide ideal environmental conditions for the use of ADCs
- **Ensure a sufficient number of readily accessible cabinets**
  - Consider drug distribution model and patient population
  - Monitor for practitioner accessibility issues

#### Provide ideal environmental conditions for the use of ADCs
- **Location, Location, Location**
  - Avoid distractions
  - Allow sufficient exterior space around the ADC
  - Provide adequate lighting and comfortable temperature
  - Close to refrigerated supplies and other medications
  - Close to necessary resources

#### Ensure ADC System Security
- **Establish a clear process on how passwords are assigned**
- **Update the system database daily**
  - Remove passwords that should no longer be active
  - Update new passwords issued
- **Utilize biometric identification or change passwords quarterly**

#### System Security
- **Document the destruction of medication waste at the time of removal**
- **Routinely review/reconcile the documented medication waste**
- **Define user privileges**
- **Provide a remote locking mechanism for refrigerated storage associated with the ADC**

#### Use Pharmacy-Profiled ADCs
- **All ADCs should have the capacity to be profiled by the pharmacy, including outpatient areas**
- **ADCs without “profiling” capability should be used for a limited variety and quantity of medications**
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ISMP ADC Survey 2007

- Pharmacist Review
  - 1999 2007
  - Pharmacist must review orders before removing medication from the ADC: 28% 64%
  - Nursing perception:
    - Pharmacist perception: N/A 56%
    - N/A 72%

Select and Maintain Proper ADC Inventory

- Oversight by the Pharmacy and Therapeutics (P&T) Committee of drug availability in the ADC
- Establish criteria for including or excluding medications in the inventory
- Establish maximum par levels to prevent multifold overdosing

Error Adverted

- Order for: “calcium gluconate 1 gram IV.”
- Nurse believed that each 10 mL vial contained only 98 mg.
- A ten-fold overdose was avoided because the drug cabinet contained only six vials of calcium gluconate.
- Error was detected when nurse contacted pharmacist at home to obtain more vials.

Select Appropriate ADC Configuration

- Limit the use of matrix drawers
  - Avoid use for high-alert medications, reversal agents, and drugs prone to diversion
- Avoid placing non-medications, (e.g., keys, cameras, patient belongings) in ADCs at the expense of storing additional medications

Select Appropriate ADC Configuration

- Can only remove requested drug from ADC vs. multiple drugs available in a matrix setting

ISMP ADC Survey 2007

- Cabinet Design
  - 1999 2007
  - Can only remove requested drug from ADC vs. multiple drugs available in a matrix setting: 30% 50%
Safe ADC Restocking Processes
- Encompasses a number of sub-processes that can involve both pharmacy and nursing staff
- Include redundancies to assure that the correct medication is placed in the appropriate location within the ADC

Stocking Errors with ADCs
- Wrong drug concentration
- Wrong location (drawer/bin)
- Restocking or return to inventory
- Par level too high/bin overflow

Stocking Errors: Look-alike names
- A nurse noted HYDROmorphine 4 mg injections had been stocked in the morphine 4 mg compartment in the ADC
- Pharmacy was notified and it was found that two patients may have received the wrong drug

Stocking Error: Look-alike packaging
- Patient in a cardiac cath lab had an order for heparinized saline, concentration of 2 units/mL (1,000 units in 500 mL NS)
- A bag of heparin was selected from the ADC and 1-2 mLs were infused
- The bag of heparin selected had a concentration of 50 units/mL (25,000 units in 500 mL D_5W)
Safe Restocking Process - Pharmacy

- Create a sequestered location in the pharmacy for all stock designated for ADC distribution
- Minimize distractions/interruptions
- Designate specific staff for this work

Safe Restocking Process - Delivery

- Segregate and secure all medications designated for an individual ADC
- Plan delivery time in conjunction with the workflow; avoid restocking during scheduled medication times

ISMP ADC Survey 2007

Checking Process
- Pharmacists checking ADC stock medication before leaving the pharmacy 1999 2007
  65% 75%
- Verification after stocking the ADC
  18% 18%
- Double check after a nurse overrides the ADC
  10% 29%

ADC Stock
- Multiple concentrations available 1999 2007
  35% 35%
- Ready to use medications available
  95% 87%
- Non-medication stored in the ADC
  15% 23%
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Identify Information that Should Appear on the ADC Screen

- Demographic Information
- Medication Display
  - Drug name, dose, and route
  - Instructions for preparation
  - Location of the medication
  - Warnings/alerts
  - Time of last removal

Identify Information that Should Appear on the ADC Screen

- Supplemental information
  - An ICON to indicate profiling is “online”
  - Drug information ICON with direct link
  - Flag to indicate “new” order
  - Summary page to indicate what has been selected

Lack of Information on the ADC Screen

- Wrong patient selection from a pick list
- Medications administered to patients known to be allergic
- Extended release medications crushed
- Wrong dose or route errors

Develop Procedures for the Accurate Withdrawal of Medications from the ADC

- The contents (concentrations, variety and volume) and configuration of the ADC play a large role in the practitioner’s ability to safely select and remove medications from the ADC

Types of Removal Errors with ADCs

- Wrong drug from a pick list
- Wrong drug from the drawers
  - Look-alike names
  - Look-alike packaging
  - Wrong concentration/strength
- Workarounds
- Overrides

Wrong Medication From Pick List

- Sorted by brand name, the antiarrhythmic BREVI\text{\textipa{BLOC}} (esmolol) and the anesthetic BREVI\text{\textipa{TAL}} (methohexital) appeared directly next to one another on an ADC screen
- Nurse accidentally removed Brevibloc instead of Brevital and placed the wrong medication at the patient’s bedside
- Fortunately, another nurse and the physician caught the error during the “time out” period immediately before the procedure

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Look-alike Packaging
- Physician asked for ephedrine, but a nurse selected epinephrine from the ADC, drew up the medication into a syringe, and handed it to the primary nurse.
- The patient suffered a period of hypertension and chest pain but eventually recovered.

Look-alike Names
- Hespan ordered for a patient who became hypotensive after a B/L hip replacement.
  - Nurse inadvertently took a bag of heparin 25,000 units from ADC stock and infused it over an hour.
  - Hespan and heparin share the characters "H-E," "P-A" and "N" in the same order.
  - Also, both products are in premixed bags and they are often stored near one another due to their similar spelling.

Removing Wrong Concentration
- **Roxanol**® (morphine) 20 mg/mL was kept in the ADC along with morphine elixir 10 mg/5 mL.
  - When a physician ordered "morphine elixir 15 mL," a nurse withdrew the concentrate by mistake.
  - Fortunately, the patient's only reaction to the 300 mg dose was to sleep the entire day.

Develop Procedures for the Accurate Withdrawal of Medications from the ADC
- To limit the risk of wrong drug selection:
  - Pharmacy-profiled mode
  - Validate patient information on the screen
  - One patient/one administration at a time
  - Orientation/annual competency update

Develop Procedures for the Accurate Withdrawal of Medications from the ADC
- Visual validation of withdrawal: Matched against the MAR
- Provide patient-specific doses: Limit practitioner manipulation of the drug after removal
- Return only to secure, designated bin

Develop Procedures for the Accurate Withdrawal of Medications from the ADC
- Only medications that are available for administration should initially appear on the active profile.
- Profile appearance:
  - Separate scheduled/PRNs
  - Indicate location of drug
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<td>Nurses remove more than one patient’s medication during one session</td>
<td>N/A</td>
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48% Nurses (2007):
“ADCs not located in areas free from distractions”

Establish Criteria for ADC System Overrides

- Use of ADC overrides should be situationally dependent.
- Emergency access should be available in circumstances in which waiting for a pharmacist to review the order before accessing the medication could adversely impact the patient’s condition.

Errors Associated with ADC System Overrides

- Duplicate therapy
- Drugs given too early or too late
- Wrong patient, drug, dose, route

Establish Criteria for ADC System Overrides

- Reduce the risk of error when an override is used:
  - Limit the quantity and number of drug concentrations available
  - Minimize use of multi-dose containers
  - Provide a process where the drug and dose are checked against the patient’s allergies, weight, and other appropriate information

Establish Criteria for ADC System Overrides

- Provide override rationale
- Require an independent double-check for high-alert drugs or hospital specific
- Perform competency assessment
- Review overrides regularly to determine
  - Accuracy of medication delivered against the order
  - Trends/barriers to pharmacy profiling
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ISMP ADC Survey 2007

- Checking Process 1999 2007
  - A double check is performed after a nurse overrides the ADC

Standardize Processes for Transporting Medications to the Patient’s Bedside

- Distribution model selected
- Availability and placement of ADCs related to the physical environment of the unit
- Standardized methods used to secure medications during transportation

Errors Associated with Transportation from the ADC

- Medications taken to the wrong bedside for administration
- Medications delayed or omitted (left in uniform pockets)
- Potential errors and diversion issues related to unsecured medications

Use of Automated Dispensing Cabinets: ISMP Surveys

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Standardize Processes for Transporting Medications to the Patient’s Bedside

- Availability and placement of ADCs to prevent workarounds
- Secure Transport
  - Medications remain in their original unit-dose package as much as possible

Standardize Processes for Transporting Medications to the Patient’s Bedside

- Secure transport:
  - Hand-carry a single patient’s medication for one administration time directly to the patient’s bedside
  - Use computers on wheels (COWs), mobile carts, or workstations on wheels (WOWs) with labeled, patient-specific drawers that have the ability to lock

Standardize Processes for Transporting Medications to the Patient’s Bedside

- Have the MAR available at the bedside to support patient ID and safe drug administration
- Open packages at the patient’s bedside
  - Only exception—medications that need to be crushed, measured, or wasted

Eliminate the Process of Returning Medications Directly to their Original ADC Location

- All medications should be returned to a common secure one-way return bin that is maintained by pharmacy and not to an individual pocket or bin within the ADC

Provide Staff Education and Competency Validation

- Informed of the risks associated with drug selection
- At-risk behaviors/expectations for practice
- Lessons learned from the regular review and discussion of ADC-related medication errors and near misses reports