INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES

GUIDE TO INFECTION CONTROL IN THE HEALTHCARE SETTING

The Pharmacy

Authors
K.B Lee, Pharm.D
Patricia P Fulco, Pharm.D

Chapter Editor
Michelle Doll, MD, MPH

Topic Outline

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KEY ISSUES

The pharmacy plays a pivotal role in infection prevention and safety in the hospital.

KNOWN FACTS

- Infections occur when pharmacological formulations are contaminated with microbes. This may occur during manufacture, or when medications are improperly prepared, handled, stored, or become outdated.
- Contamination may occur within the pharmacy or in other areas of the hospital when healthcare workers finalize the preparation of medications and administer them.
- Contamination of medications and solutions occurs through 3 routes:
  1. Direct contact.
  2. Use of contaminated ingredients.
  3. Airborne contamination.
- Contamination of intravenous fluids is particularly problematic because of the potential to cause serious illness.
- Inappropriate prescribing of antimicrobials is an important cause of drug resistance. Pharmacists should participate in an antimicrobial stewardship program (ASP) (in coordination with an infectious diseases physician and microbiologist) to optimize antimicrobial usage in the healthcare setting. The goal of an ASP is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use (e.g., minimize toxicities, minimize adverse drug reactions, prevent the emergence of resistance and prevent selection of pathogenic organisms such as *Clostridium difficile*). ASPs are cost effective and have demonstrated a decrease in suboptimal antimicrobial use.

- Optimizing antimicrobial dosing for patient-individualized characteristics (organism, pharmacokinetic/pharmacodynamic parameters and renal/hepatic alterations) is an additional role fulfilled by the clinical pharmacist.
- Many pharmacies now monitor antimicrobial concentrations (e.g., vancomycin) to ensure optimal pharmacotherapy for the correct infectious diseases indication and adjust dosing according to established algorithms.
- Pharmacists often dispense discharge medications to patients. Patient education may ensure that antimicrobials are used properly after discharge.

Controversial Issues

- Although national regulatory agencies and hospital committees have set standards for aseptic practices within the pharmacy, the extent to which asepsis needs to be confirmed is controversial. Should all products that are compounded in the pharmacy be tested by culturing samples? Should products obtained from an outside vendor be tested? Due to the emergence of large companies that supply intravenous solutions to multiple hospitals, infections caused by low-level contamination may be scattered over a large number of hospitals. An individual hospital may see only one infusate or injection medication related infection, which would not normally trigger an investigation within the hospital. Although controversial, a national surveillance system could be developed to monitor bloodstream isolates and, potentially, serve as a means to trace the source of such scattered infections.
- Rational use of antimicrobials has been shown to reduce the emergence of resistance pathogens. The pharmacy, working as a member of an ASP committee, should play a key role in developing institution guidelines for the rational use of antimicrobials to prevent drug resistance, minimize adverse drug events, enhance patient outcomes

and prevent hospital acquired infections. Controversy exists over how much autonomy should be given to the individual provider. In some cases, a short course of therapy is allowed until laboratory results return. In other cases, medications have been made available only for highly selected indications. Controversy usually arises when policies are perceived to impair a prescriber's ability to treat a patient effectively, or when restrictions are perceived as being driven by finances rather than health concerns.

- Recently, in the United States, the Joint Commission (for accreditation and certification of healthcare organizations) has set a standard that institutions establish an ASP. Additionally, the Centers for Medicare and Medicaid Services (CMS) have proposed that institutions establish an ASP as a condition of participation. The Centers for Disease Control and Prevention (CDC) has published Core elements along with a checklist to guide establishment of a robust program. Many institutions do not have the manpower or the financial priority to develop a vigorous ASP and have to stretch the staff available to perform ASP tasks. In resource limited settings susceptibility data are often not available and there is little to no restriction of antimicrobial agents.

SUGGESTED PRACTICE

- The pharmacy should implement and follow procedures from the United States Pharmacopeia, Chapter 797, to prevent compounded sterile products (CSPs) from the following:
  1. Microbial contamination.
  2. Exposure to excessive bacterial endotoxins.
  3. Variability in the intended strength of correct ingredients.
  4. Unintended chemical and physical contaminants.
  5. Ingredients of inappropriate quality

- Employees should be trained in aseptic technique before making preparations or administering medications.
- Limit the activities of staff members who exhibit symptoms of infection.
- Single-dose vials should be used within one and six hours, respectively, if compounded outside or inside a laminar airflow workbench (ISO Class 5 environment). Multiple-dose vials may be discarded after 28 days from initial use. All vials should be labeled with beyond-use dates (date or time after which a CSP may not be stored or transported and is calculated from the date or time of compounding).
- For products that are reconstituted, only sterile diluents should be used. Utmost care should be taken not to introduce contaminants from the outside of containers into the interior. If liquid is to be injected through a vial membrane, the membrane should be disinfected before being pierced.
- Syringes that are used to inject medications or liquids into the container should be sterile and preferably single-use and disposable.
- Recommend proper labeling, dating, and storage of sterile products.
- A tracking system should be devised in case of a product recall. The tracking system should allow identification of patients who received potentially contaminated medications.
- Pharmacy areas should be kept clean. Food should not be consumed in areas where CSPs are handled. Clean rooms, where CSPs are prepared, should be free of visible dust, and access should be limited. Detailed policies should be maintained for the activities allowed in the clean room.
- Personnel preparing sterile medications should wear clean clothing covers and gloves along with completing annual competencies to ensure proper aseptic technique. Hands should be washed before and after CSPs are prepared. Employees should not prepare sterile products if they have rashes, sunburn, weeping sores, broken skin, conjunctivitis, or respiratory infections. When preparing sterile or potentially toxic

solutions such as chemotherapies, laminar airflow workbenches (ISO Class 5 environment) are strongly recommended.

- The pharmacy should ensure that medications are appropriately handled and stored throughout the institution. Medications should be stored according to manufacturers' instructions. All CSPs should have an appropriate beyond-use-date printed on the outside of the container. Environmental conditions should be checked periodically, including the daily temperature log of refrigerators and the competency of laminar airflow workbenches.
- Establish ASP strategies for minimizing the development of resistant strains of microorganisms as well as for optimizing therapeutic outcomes in individual patients. The two major strategies are **formulary restriction/preauthorization** and **prospective audit** with intervention and feedback. Individual physicians or departments should be involved in the development and implementation of policies that affect them. The ASP should develop guidelines for infectious syndromes based on institution susceptibility patterns and antimicrobial formulary.
- The pharmacy should educate providers to help minimize medication side effects and avoid drug interactions.
- The infection control committee should include representation from the pharmacy.
- An ASP pharmacist ideally would have specialty training in infectious diseases or certification in antimicrobial stewardship.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

- Pharmacy: There is a paucity of published literature looking at the optimal role of the hospital in preventing infections in low- and middle-income countries (LMICs). In light of this, there is growing interest in training pharmacists to practice pharmacy in this setting. The Commonwealth Pharmacists Association (CPA –

http://commonwealthpharmacy.org) and the Tropical Health Education Trust (THET – https://www.thet.org) have joined forces to encourage pharmacists to share their skills in LMICs.

- Investing in lab capacity to test for antibiotic resistance is crucial and needs to be a priority at the national level.
- Antibiotics should not be given out without a prescription.
- Access to new antibiotics should be restricted and their use ideally would be directed by susceptibility testing.
- ASP: In institutions where there are limited resources, there are many potential interventions that can be initiated. These include, but are not limited to: switching patients from IV to PO (and therefore facilitate discharge), therapeutic substitution, batching IV antimicrobials to decrease waste, and formulary restriction.

SUMMARY

The pharmacy plays various roles in infection prevention and safety. The pharmacy should ensure that medications and solutions are not contaminated. Policies should address training and annual performance evaluation of employees, and they should be reviewed annually to ensure they reflect current best practices. Employees with acute respiratory, gastrointestinal, or skin infections should not be permitted to handle medications. To promote rational use of antimicrobials, pharmacists should work closely with hospital committees and physicians, encourage multi-disciplinary collaboration within the health system and evaluate compliance with policies. It is becoming more urgent that an ASP be initiated in the healthcare setting to pass Joint Commission mandates. Importantly, pharmacists often have an opportunity to counsel patients about medication adherence, proper storage and handling of medications/devices, and medical waste disposal. In all of these areas, the

pharmacy may have a major impact on the success of an infection control program.

REFERENCES

1. American Society of Health-System Pharmacists. ASHP Statement on the Pharmacist's Role in Infection Control. Am J Health-Syst Pharm 1998; 55(16):1724–6.

2. American Society of Health-System Pharmacists. ASHP Statement on the Pharmacist's Role in Antimicrobial Stewardship and Infection Prevention and Control. Am J Health-Syst Pharm 2010; 67(7):575–7.

3. Barlam RF, Cosgrove SE, Abbo LM, et al. Implementing an Antibiotic Stewardship Program: Guidelines by the Infectious Disease Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis 2016; 62(10):e51–77. doi: 10.1093/cid/ciw118.

4. Chiller TM, Roy M, Nguyen D, et al. Clinical Findings for Fungal Infections Caused by Methylprednisolone Injections. N Engl J Med 2013; 369(17):1610–9. doi: 10.1056/NEJMoa1304879.

5. Climo MW, Israel DS, Wong ES, et al. Hospital-Wide Restriction of Clindamycin: Effect on the Incidence of *Clostridium difficile*-Associated Diarrhea and Cost. Ann Int Med 1998; 128(12 Pt 1):989–95.

6. Dellit TH, Owens RC, McGowan JE Jr, et al. Infectious Diseases Society of America and the Society of Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to

Enhance Antimicrobial Stewardship. Clin Infect Dis 2007; 44(2):159–77.

7. Goff DA, Bauer KA, Reed EE, et al. Is the Low Hanging Fruit Worth Picking for Antimicrobial Stewardship Programs? Clin Infect Dis 2012; 55(4):587–92. doi: 10.1093/cid/cis494.

8. Joint Commission. Approved: New Antimicrobial Stewardship Standard. Jt Comm Perspect 2016; 36(7): 1, 3-4, 8.

9. Kastango ES. American Society of Health-System Pharmacists (ASHP). Blueprint for Implementing USP Chapter 797 for Compounding Sterile Preparations. Am J Health-Syst Pharm 2005; 62(12):1271–88.

10. Mattner F, Gastmeier P. Bacterial Contamination of Multiple-Dose Vials: a Prevalence Study. Am J Infect Control 2004; 32(1):12–6.

11. Pedersen CA, Schneider PJ, Scheckelhoff DJ. ASHP National Survey of Pharmacy Practice in Hospital Settings: Monitoring and Patient Education — 2015. Am J Health-Syst Pharm 2016; 73(17): 1307–30.

12. Rybak M, Lomaestro B, Rotschafer JC, et al. Therapeutic Monitoring of Vancomycin in Adult Patients: a Consensus Review of the American Society of Health-System Pharmacists, the Infectious Diseases Society of America, and the Society of Infectious Diseases Pharmacists. Am J Health-Syst Pharm 2009; 66(1):82–98. doi: 10.2146/ajhp080434.

13. Schwartzberg E, Rubinovich S, Hassin D, et al. Developing and Implementing a Model for Changing Physicians' Prescribing Habits —

the Role of Clinical Pharmacy in Leading the Change. J Clin Pharm Ther 2006; 31(2):179–85.

14. Smith F. Private Local Pharmacies in Low and Middle Income Countries: a Review of Interventions to Enhance Their Role in Public Health. Trop Med Int Health. 2009; 14(3): 362–72. doi: 10.1111/j.1365-3156.2009.02232.x.

15. Smith RM, Schaefer MK, Kainer MA, et al. Fungal Infections Associated with Contaminated Methylprednisolone Injections. N Engl J Med 2013; 369(17):1598–609. doi: 10.1056/NEJMoa1213978.

16. United States Pharmacopeia, Pharmaceutical Compounding — Sterile Preparations, 2012. Chapter 797. 1–38.

17. Centers for Disease Control and Prevention. Core Elements of Hospital Antibiotic Stewardship Programs; available at https://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html (accessed 10/11/17).