A pharmacy residency is “organized, directed, postgraduate training in a defined area of pharmacy practice.” Training focuses on sharpening the judgment necessary for competence in the provision of direct patient care, as well as, in the case of many specialized residency programs, on caring for a particular type of patient. The American Society of Health-System Pharmacists (ASHP) accreditation standards require that pharmacy practice residents become competent in patient care. Residents must gain exposure to and participate in an effective and safe medication-use process. Such exposure is deemed a service commitment by ASHP. To be effective, service commitments should be met in an integrated and systematic manner. Residents must be responsible for caring for a wide variety of patients and developing drug information skills.

Service commitments are often met in the form of rotations or blocks devoted to a practice area or patient population. Some residency programs may meet this requirement through longitudinal patient care experiences. This design is commonly used in the primary care setting, where the focus is on managing chronic diseases and promoting continuity of care. These same models often hold true for pharmacy practitioners with direct patient care responsibilities. However, many pharmacy departments, particularly in the acute care setting, struggle to provide a high level of care directly to each patient around the clock.

We report our experience with a pharmacy residency on-call program designed to contribute to residents' competencies in patient care and to extend the functions of the pharmacy department.

The program, which was begun at the University of Kentucky Chandler Medical Center in 1984, offers a supportive environment in which the resident is held accountable for pursuing optimal outcomes of drug therapy. The program provides opportunities for the resident to engage in independent decision-making, care for a wide variety of patients, and manage acute illness. On-call services are provided in single 24-hour shifts beginning at 0800 each day. Residents assess and respond to supratherapeutic serum drug concentrations, perform pharmacokinetic monitoring, provide drug information, evaluate patients for specific drug therapy, obtain medication histories for HIV-seropositive patients, and participate in emergency patient management. Residents provide services in the absence of the primary pharmacist on nights, weekends, and holidays and devote a four-hour period to drug distribution. Each pharmacy resident participates in the on-call program, regardless of the chief focus of his or her residency. Residents' activities are documented electronically, and preceptors give feedback via e-mail. The program and its activities have evolved over the years to reflect changes in pharmacy practice.

An on-call program for pharmacy residents provides a valuable learning experience while enhancing patient care.

Index terms: Decision making; Education, pharmaceutical; Patient care; Pharmaceutical services

Abstract: A pharmacy residency on-call program designed to contribute to residents’ competence in patient care and to extend the functions of the pharmacy department is described.

The program, which was begun at the University of Kentucky Chandler Medical Center in 1984, offers a supportive environment in which the resident is held accountable for pursuing optimal outcomes of drug therapy. The program provides opportunities for the resident to engage in independent decision-making, care for a wide variety of patients, and manage acute illness. On-call services are provided in single 24-hour shifts beginning at 0800 each day. Residents assess and respond to supratherapeutic serum drug concentrations, perform pharmacokinetic monitoring, provide drug information, evaluate patients for specific drug therapy, obtain medication histories for HIV-seropositive patients, and participate in emergency patient management. Residents provide services in the absence of the primary pharmacist on nights, weekends, and holidays and devote a four-hour period to drug distribution. Each pharmacy resident participates in the on-call program, regardless of the chief focus of his or her residency. Residents' activities are documented electronically, and preceptors give feedback via e-mail. The program and its activities have evolved over the years to reflect changes in pharmacy practice.

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competence in patient care and to extend the functions of the pharmacy department.

Setting

Pharmacy residency training at the University of Kentucky (UK) Chandler Medical Center is jointly supported by the UK Hospital and the College of Pharmacy, both of which fund a total of 14 residents. These positions include ASHP-accredited pharmacy practice, critical care, oncology, and pediatric residencies. Most training, particularly in direct patient care, occurs at the 473-bed tertiary care hospital, the UK Children’s Hospital, the Markey Cancer Center, and the Kentucky Clinic.

Pharmaceutical services are provided from a combination of satellite and centralized pharmacies supported by automated dispensing technology and unit pharmacists, who provide day-shift services on weekdays. Distributive activities continue from oncology and pediatric satellite pharmacies each evening, with all distributive functions routed to the central pharmacy during the late evening and night shifts. Clinical staff pharmacists, clinical specialists, clinical faculty, residents, and pharmacy students provide direct patient care in this service, teaching, and research environment by participating in patient care rounds six days a week. Pharmacists, residents, and students also routinely respond to drug information requests. An additional service is provided by the drug information center, which responds to patient-specific medication inquiries from health care professionals throughout Kentucky from 0800 through 1700 on weekdays.

A variety of drug policy tools, including therapeutic interchange and intravenous-to-oral conversion programs, are in place. The antimicrobial management team works to ensure safe, appropriate, cost-effective antimicrobial use for UK Hospital patients. A clinical pharmacokinetics service supports therapeutic drug monitoring throughout the hospital. Pharmacists respond to acute cardiac and respiratory emergencies throughout the patient care areas. When patients come to the emergency department with signs or symptoms of chest pain or stroke, a pharmacist assists in patient assessment and prepares thrombolytics. Pharmacy also actively identifies all HIV-seropositive patients upon their admission and intervenes to minimize medication errors.

Purpose of program

The residency on-call program was designed to offer a supportive environment in which the resident is held accountable for pursuing optimal outcomes of drug therapy. The program provides opportunities for the resident to engage in independent decision-making, care for a wide variety of patients, and manage acute illness. Extensive support and performance assessment are provided by preceptors.

Both patients and residents stand to benefit from the on-call program. Services are available overnight, on weekends, and on holidays. Anecdotal reports indicate that program participants relish the challenge of quick decision-making and the exposure to a broad variety of patient types during an on-call shift. Residents also report a greater feeling of camaraderie with and respect from medical residents. The on-call program can be a recruiting tool; each year, many residency candidates indicate a desire to participate in it.

Responsibilities of residents

The responsibilities of the on-call resident encompass those of a pharmacist caring for individual patients. During late evenings, nights, weekends, and holidays, the primary pharmacist or the clinical pharmacokinetics service may not be available to assess and respond to supratherapeutic serum drug concentrations. The on-call resident is then assigned to provide such services. Over a six-month period, pharmacokinetic monitoring represented 52% of on-call resident activities.

Drug information consultation includes recommending drug therapy (commonly antimicrobial agents), assessing adverse drug events, recommending specific drug administration techniques (e.g., electrolyte infusion), screening for drug interactions, recommending treatment for drug toxicity or poisonings, and identifying solid oral dosage forms. The resident also responds to emergency requests submitted to the drug information center after business hours and on holidays and evaluates patients for specific drug therapy, including drotrecogin alpha. Participation in medication histories for HIV-seropositive patients is required of the resident during evenings and weekends.

The resident is exposed to emergency patient management primarily through direct participation in adult and pediatric resuscitation efforts. Critical care specialists are the first pharmacist responders to such emergencies involving adults during the day shift, while centralized pharmacists respond evenings and nights. Residents also participate in emergency responses, and their support is crucial when the event is distant from a pharmacy area (e.g., in a remote medicine clinic) or at night when only one other pharmacist is in the institution. The on-call pharmacy resident is the first to respond to all pediatric emergencies. (Pediatric pharmacy specialists also participate during the day and evening shifts.) Residents gain further experience in managing acute illness by responding to emergency department alerts concerning chest pain or stroke.

It may be impractical for an institution to have clinical pharmacists available 24 hours a day, but having an on-call resident monitor selected patients (e.g., those expected to become more ill or others requiring...
particularly close attention) can extend a pharmacy department’s ability to provide intensive care consistently. This model resembles the medical house-staff cross-cover model. Before leaving for the day, the primary pharmacist may inform the on-call resident of anticipated serum drug concentrations, as well as pending results of cultures and other laboratory tests that may require close monitoring. The resident provides the requested service during the on-call shift and, on the following day, informs the primary pharmacist about changes in the patient’s condition and any interventions. This contributes to a continuity of high-level care.

Program structure and resources

Each pharmacy resident participates in the on-call program regardless of the focus of his or her residency. On-call services are provided in single 24-hour shifts beginning at 0800 each day. The on-call resident remains in the institution overnight and carries additional pagers, each devoted to a defined role or on-call activity. All pharmacy residents are considered house-staff officers and receive many of the same benefits as their medical resident colleagues. Pharmacy residents are provided an assigned room in the on-call suite for house-staff officers, a cafeteria stipend for each on-call shift, and appropriate attire (e.g., scrubs). After an on-call shift, residents are expected to fulfill any required rotation duties before leaving the hospital by no later than 1400. (This early departure helps ensure that the resident is not overtaxed by program requirements.)

Participation in the on-call program begins approximately one month after the start of the residency year following orientation to the medical center, the pharmacy department, and the residency program. During the orientation sessions, residents are introduced to departmental and drug policies and attend sessions on pharmacokinetic monitoring principles and policies for all drugs assessed by the therapeutic drug monitoring laboratory. To increase the resident’s comfort with emergencies, there are meetings devoted to cardiopulmonary resuscitation, including simulations requiring the provision of medication from an emergency drug cart. Pediatric emergencies are also reviewed. Residents also complete the examination for adult cardiac life support (ACLS). Upon certification as an ACLS provider, the resident is eligible to begin on-call shifts. Should a resident fail to obtain pharmacy licensure before the first on-call shift, all of his or her written patient care recommendations must be cosigned by a pharmacist.

Residents in pharmacy practice and specialty areas beginning their residency training at UK Chandler Medical Center are each matched with a resident who has completed a pharmacy practice residency at the institution and has elected to continue specialized training there. The incoming resident shadows the veteran during the evening or night hours of an on-call shift. In turn, the incoming resident may request that the partner shadow him or her throughout the first shift. If this request is not made, the veteran partner is prepared to report to the hospital at any time during the on-call shift should the new resident request it for direct support.

All pharmacy residents have 24-hour access to the drug information center, the medical center library, and electronic drug information resources. They are expected to contact a pharmacist (e.g., preceptor, clinical specialist) whenever they need advice. A directory of broad therapeutic categories and 24-hour contact information for at least two pharmacists with expertise in those categories is provided to the resident. Residents also have access to previously documented on-call experiences.

Scheduling

On-call resident services are provided throughout the year, regardless of program activities. Through this mechanism, clinical services are provided by onsite pharmacists every day. If residents are not present to provide the services (e.g., during a residency conference), clinical pharmacy specialists are assigned to on-call shifts. The pharmacy department then provides appropriate compensation to the specialists. If a resident undertakes a learning experience outside the medical center, he or she cannot be expected to participate in the on-call program. The assignment of on-call shifts takes this into consideration; the number of shifts before or after that rotation is increased. During business hours, residents practicing at the Kentucky Clinic, which is located across the street from UK Hospital, are unable to respond quickly to cardiopulmonary-resuscitation requests. During these times, the resi-

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Table 1.

**Activities of On-Call Residents, July through December 2002 (n = 863)**

<table>
<thead>
<tr>
<th>Activity</th>
<th>No. (%) Encounters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug information consultation</td>
<td>319 (37)</td>
</tr>
<tr>
<td>Cardiopulmonary resuscitation response</td>
<td>86 (10)</td>
</tr>
<tr>
<td>Emergency stroke response</td>
<td>9 (1)</td>
</tr>
<tr>
<td>Pharmacokinetic monitoring*</td>
<td>449 (52)</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>152 (34)</td>
</tr>
<tr>
<td>Digoxin</td>
<td>13 (3)</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>45 (10)</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>45 (10)</td>
</tr>
<tr>
<td>Theophylline</td>
<td>4 (1)</td>
</tr>
<tr>
<td>Valproic acid</td>
<td>9 (2)</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>166 (37)</td>
</tr>
<tr>
<td>Other</td>
<td>15 (3)</td>
</tr>
</tbody>
</table>

*For individual drugs, percentage is based on denominator of 448.
Residents work together to identify an individual who can respond.

Each year, the incoming pharmacy chief resident develops the on-call schedule for the upcoming residency class. Each resident is assigned an equal number of shifts, as well as a comparable number of shifts on each day of the week. Distribution of the shifts generally begins with each resident assigned a shift every 14th day. However, a resident is dropped from the rotation each cycle to enable the variety of shift timing, and returning specialized residents provide all on-call services in the first month of the residency year. In addition, residents are assigned to provide on-call services during the evening and on-call pager numbers. The an- call program was begun in 1984. It was developed, and the residency on-call program was designed to provide direct patient care throughout the institution. In 1986, 62% of the activities occurred during the evening and night shifts. 

Quality assurance

Assessment and feedback are vital to residents' learning and to the quality assurance of the care they provide. Because our residents provide care autonomously, it is especially important that assessment be timely. The medical resident model of morning reports is not followed, since the schedules of pharmacists, residents, and preceptors are too variable. Instead, the residents are required to document each of their on-call activities and to summarize them after a shift. They submit this summary to all pharmacists and residency program preceptors via e-mail by 1200 after each shift. The summary includes the caller's specialty or medical team, pertinent patient information, the specific actions requested of the resident, recommendations made or actions taken, the name of the pharmacist who may have been consulted to assist in the recommendation, and sources used to answer any drug information questions. This system enables preceptors to disseminate advice on patient management to the entire group by replying to all message recipients. Any feedback about the resident's performance can be provided on an individual basis. Residency program directors review these summaries as well to ensure that preceptors are providing proper guidance to each resident. Current residents report satisfaction with this system for assessment and feedback, which was designed by past residents.

The residency executive committee, which consists of all residency program directors, the chief pharmacy resident, the chief pharmacy officer, and the pharmacy practice director from the college of pharmacy, has oversight over all residency programs. The specific responsibilities of residents participating in the on-call program, as well as overall program aims and structure, are determined by this committee. Small changes in the program may be made at any point during the residency year. Significant changes are generally implemented during the following residency year after a retreat for all preceptors and outgoing residents.

Evolution of the program

The pharmacy residency on-call program evolved from a system created to support research and patient care activities at the institution. In the early 1980s, clinicians were engaged in a study that involved pharmacists and pharmacy residents in the rapid intravenous administration of phenytoin to patients, as well as monitoring of responses to the drug. These activities required on-call availability of pharmacists or pharmacy residents. Twenty-four-hour on-call services that did not require in-house presence were also provided by four pharmacists and residents rotating among the medicine, surgery, pediatrics, and intensive care areas. As the scope of the patient care and research activities increased—as well as the demand for pharmacists to provide therapeutic drug monitoring—the possibility of involving all residents in these services on a routine basis was recognized. A single program designed to provide direct patient care throughout the institution was developed, and the residency on-call program was begun in 1984. During the program's inaugural year, all 14 residents participated.

The scope and duration of residents' activities during on-call shifts have changed over the past 20 years. Experiences with the program during its first year were described in 1986. More than half of service requests were for therapeutic consultation (27%) or pharmacokinetic dosing or monitoring (23%). Intravenous phenytoin administration (13%), questions about drug distribution (9%), and consultation requests from nurses about drug compatibility, administration, and narcotic record keeping (8%) were also common. Sixty-two percent of the activities occurred during the evening and night shifts.
The services provided by the program were analyzed again 12 years later. Over a four-month interval, an average of 7.4 on-call activities were provided each day. The average number of activities per day rose from 6.8 during the week to 8.7 on weekends. Two thirds of all activities occurred during the evening and night shifts. Excluding interventions that were characterized as responses to acute cardiac and respiratory emergencies or chest pain or responses to supratherapeutic serum drug concentrations, physicians initiated 83% of the requests, followed by pharmacists (12%) and nurses (5%). The on-call activities required an average of 19 minutes to complete; 31% were documented in the progress notes section of the medical record.

By 2002, the program provided an average of 6.5 activities per day during a six-month period. Emergency responses accounted for 4% of activities in 1998 and 10% in 2002, while requests for pharmacokinetic monitoring increased from 38% of activities to 52%. These trends may represent the increasing acuity of illness of the hospitalized patient and the expanded access to computerized drug information (reducing the number of routine requests for drug information). As in the program’s inaugural year, all pharmacy practice residents (n = 7–8) and specialized residents (n = 6–7) are currently involved in the on-call program. Because most pharmacy practice residents elect to complete their specialized training at UK Chandler Medical Center each year, they continue in the program and serve as mentors for those new to it.

The program has also changed significantly with respect to drug distribution. During the 1990s, clinical activities were the top priority of the on-call resident. Required distributive shifts, which averaged eight hours per week, could not conflict with scheduled on-call shifts. We now incorporate four hours (1600–2000) of the drug distribution requirement within each on-call shift. During this period, residents continue to carry the on-call pagers and respond to emergencies. Because this four-hour period occurs during the evening, another pharmacist is readily available if the resident must leave the pharmacy to address a problem. One reason for this change was the implementation of maximum duty hours for residents involved in our hospital’s graduate medical education program. Our pharmacy residency program complies with the new Accreditation Council for Graduate Medical Education (ACGME) duty-hour limits.7 We believe that pharmacy residents should not be overburdened with program requirements, and we encourage residents to maintain a healthy lifestyle that diminishes the likelihood of poor decisions and medication errors.

The type and frequency of activities conducted in the on-call program have changed as well. The changes reflect both contemporary practice and the evolution of drug policy management tools. For example, the administration of intravenous phenytoin loading doses once required the direct presence and supervision of a pharmacy resident.5 Fosphenytoin has widely replaced phenytoin for intravenous loading doses, so a resident’s presence is no longer required. On-call resident involvement in clinical drug research, including enrolling patients and drawing blood samples, was fairly common in 1986, but this is no longer the case in 2003. On-call residents became involved in clinical drug research, including enrolling patients and drawing blood samples, was fairly common in 1986, but this is no longer the case in 2003. On-call residents became involved in the chest-pain-alert program in 1993 and in obtaining medication histories for patients with HIV and screening eligibility for drotrecogin alfa in the past three years.

The new ACGME duty-hour standards also affected on-call activities. Responsibility for patient care needs anticipated in the late evening or night historically belonged to individual residents assigned to specific patient care services, not the on-call resident. In some cases this responsibility has been passed off to the on-call resident, and this action has reduced the duty hours for residents who are not on call. In fact, “pass-off” care was the fourth most common on-call activity in July 2002 (19 [10%] of 197 activities) but the second most common activity in April 2003 (43 [28%] of 155 activities). Drug information consultation occurred more frequently in July 2002 (50% of activities) than in April 2003 (35%), while other activities occurred with similar frequency during both months (pharmacokinetic monitoring, 22% and 21%; emergency resuscitation response, 12% and 12%; medication histories in HIV-positive patients, 4% and 2%; candidacy screening for drotrecogin alfa, 2% and 3%; emergency stroke response, 2% and <1%).

Documentation and assessment of residents’ actions while on call continue to change. Residents now receive a list of pharmacists who are experts on content in various therapeutic categories. Such a list did not exist in previous years. Feedback on performance formerly relied on paper documentation and now involves e-mail. We are currently integrating personal digital assistants (PDAs) into documentation. PDAs will prompt the resident to provide the desired information for each type of on-call activity. The time needed to transmit information to preceptors will be reduced, since residents will synchronize the PDA with a database, which will send an e-mail to the desired recipients. A searchable database of all on-call activities will be available and will provide controlled access to any necessary patient information, promoting compliance with the Health Insurance Portability and Accountability Act.

Similar programs

While other pharmacy residencies may incorporate a clinical inhouse on-call program, literature describing such programs primarily reflects
the University of Illinois at Chicago (UIC) program, which began in 1979.9 Providing 24-hour pharmaceutical services in the emergency department appears to have been a primary goal, as residents were initially engaged in the emergency department to provide around-the-clock pharmacologic and toxicologic consultations and to obtain and process serum levels for a variety of medications. Although services could be provided to other patient care areas, 80% of activities occurred in the emergency department. Beginning in 1981, each call was assessed and discussed by residents and preceptors at a pharmacy morning report. An evaluation of the morning report affirmed the value of the program,10 and subsequent articles have updated the UIC experience.11,12

Conclusion
An on-call program for pharmacy residents provides a valuable learning experience while enhancing patient care.

References