

RESEARCH ARTICLES

Independent Community Pharmacists' Perspectives on Compounding in Contemporary Pharmacy Education

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Objectives. To identify compounding practices of independent community pharmacy practitioners in order to make recommendations for the development of curricular objectives for doctor of pharmacy (PharmD) programs.

Methods. Independent community practitioners were asked about compounding regarding their motivations, common activities, educational exposures, and recommendations for PharmD education.

Results. Most respondents (69%) accepted compounding as a component of pharmaceutical care and compounded dermatological preparations for local effects, oral solutions, and suspensions at least once a week. Ninety-five percent were exposed to compounding in required pharmacy school courses and most (98%) who identified compounding as a professional service offered in their pharmacy sought additional postgraduate compounding education. Regardless of the extent of compounding emphasis in the practices surveyed, 84% stated that PharmD curricula should include compounding.

Conclusions. Pharmacy schools should define compounding curricular objectives and develop compounding abilities in a required laboratory course to prepare graduates for pharmaceutical care practice.

Keywords: pharmaceutical care, compounding, independent community pharmacy, curricula

INTRODUCTION

The change to the PharmD degree as the first professional degree for all pharmacists has had many repercussions, one being that pharmacy programs had to establish or restructure their curricula to meet evolving Accreditation Council for Pharmaceutical Education (ACPE) standards.^{1,2} Among the changes, ACPE has directed that each pharmacy school establish curricular outcomes that identify the knowledge, skills, and attitudes of a generalist pharmacy practitioner.^{3,4}

The current North American Pharmacist Licensure Examination registration bulletin retains competency statements that refer to compounding skill and practice.⁵ The licensure examination presumably encompasses competencies necessary to assure that graduates can meet the demands of contemporary generalist pharmacy practice. What evidence exists that shows compounding is a component of contemporary practice? If compounders are, by and large, a group of older, predominantly male,

established business owners (the stereotypical independent pharmacist), educated prior to integration of pharmaceutical care, compounding may decline rapidly as many hit retirement age. Identification of the characteristics of pharmacists who are compounding is an essential step to establish if compounding outcomes should be a part of PharmD education.

Pharmaceutical care has evolved within the profession of pharmacy and, for the purposes of this research, is defined as "...the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life..." and "...involves the process through which a pharmacist cooperates with a patient and other professionals in designing, implementing, and monitoring a therapeutic plan that will produce specific therapeutic outcomes for the patient."⁶ This vision espoused by Hepler and Strand does not denigrate the product historically central to the practice of pharmacy; rather, it reinforces the use of the correct product to optimize patient therapy outcomes.⁶ The correct drug product, for an individual patient, may in fact be a compounded one. Elucidating the factors that contribute to the decision to compound for a particular patient and

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describing the scenarios that can lead to compounding in contemporary practice establishes a framework for articulating necessary educational exposures.^{7,8}

Collaborations between educators and practitioners facilitate development of contemporary curricular outcomes and licensure requirements.⁷⁻⁹ Independent pharmacists account for 42% of all US community pharmacists, dispensing approximately 41% (1.4 billion) of the prescriptions filled annually.^{10,11} Independent community pharmacy is a unique setting in which the pharmacist can decide how he or she will balance many different professional roles with the need to develop a successful business. Seventy-nine percent (79%) of National Community Pharmacists Association members report compounding as one of the professional services offered.¹⁰ Independent community pharmacy has been a prime target for Food and Drug Administration scrutiny of medication errors, focusing on compounded preparations that allegedly did not contain the labeled contents or were contaminated.¹² Although it can be argued whether this scrutiny is appropriate, avoidable medication errors are clearly within the expertise of the pharmacist and at the heart of the message sent to the profession by Hepler and Strand.⁶ The tenets of pharmaceutical care, in part, direct pharmacists to accept a societal role as the drug expert, minimizing avoidable medication errors to reduce drug-related morbidity and mortality. No other healthcare professional is expected to develop comprehensive understanding of how drugs and dosage forms work for the patient physicochemically and physiologically. Discerning how this understanding fits into pharmaceutical care practice is needed to craft essential compounding objectives.

The collective experience of these practitioners is a starting point for discernment of compounding competencies for PharmD programs. Current practitioners who compound are in a good position to look back over their compounding education and exposures to suggest ways to include the knowledge and skills required for contemporary pharmacy education. Their suggestions should bear weight as PharmD curricular refinement continues. Recognizing that some compounding is done in chain community pharmacy and a significant amount is done in institutional practice, this research is one step toward definition of appropriate compounding educational experiences for generalist practice.

This study is based on findings from a survey conducted in 2005 by a faculty team at the St. Louis College of Pharmacy interested in collecting factual data about the extent of compounding in contemporary practice. A 4-page survey instrument for independent community pharmacists was created and administered in 2005 to as-

certain whether compounding was an active part of independent pharmacy practice, and if so, to obtain insights to guide the development of appropriate compounding competencies for PharmD candidates.¹³ The survey was mailed to 1,643 independent community pharmacies which were identified from the licensure records of 4 states—Illinois, Iowa, Kansas, and Missouri (estimated total licensed pharmacist population 18,500).¹³ The authors considered compounding as defined by the National Association of Boards of Pharmacy (NABP) as the “preparation, mixing, assembling, packaging, or labeling of a drug or device as the result of a practitioner’s Prescription Drug Order or initiative based on the pharmacist/patient/prescriber relationship in the course of professional practice. . .”¹⁴ Unfortunately, the definition was not included in the survey, leaving some uncertainty in the definition(s) of compounding considered by the respondents.

The first research goal, to quantify the amount of compounding done by independent pharmacists, was published as census data. It was found that compounding services are offered by 87% of the respondents in their pharmacies, confirming that compounding is an active part of contemporary independent community pharmacy practice.¹³ Details regarding human subjects protection, survey protocol, data collection procedures, and limitations, as well as the survey instrument, can be found in the authors’ initial publication or can be made available upon request.

The goal of the current work, the second research goal of the 2005 survey, was to identify common compounding activities of independent community pharmacy practitioners in a 4-state region (Illinois, Iowa, Kansas, and Missouri) in order to make recommendations for the development of curricular objectives for PharmD programs. Three research questions were developed to inform this objective: (1) What are the characteristics of the independent pharmacists who compound? (2) What opportunities did respondents identify for compounding? (3) How are compounding knowledge and skills acquired by the independent community pharmacists?

METHODS

This study expands on the analysis of the original data collection to address the second research goal: What recommendations for the development of curricular objectives for PharmD programs can be drawn from the original 2005 survey data? Can information be gleaned that is useful to guide schools of pharmacy toward the incorporation of contemporary, relevant compounding experiences into PharmD curricula?

To address these questions, the authors analyzed data gathered in the 2005 survey focusing on responses

specific to the compounding activities and exposures of the respondents to compounding in their education, as well as opinions of how compounding should be included in contemporary education. Descriptive statistics were used to reveal common experiences and opinions germane to the role of compounding in contemporary and patient-centered practices.

Statistical analysis of responses for the second and third research questions were taken a step beyond descriptive statistics to see if the answers were contingent on the degree the pharmacist had earned, the number of years in practice (entering practice before or after 1975), the pharmacist's gender, total prescription volume of the pharmacy, or compounding prescription volume (as a percentage of the total prescription volume). Statistical analyses were based on the responses of 321 independent pharmacists who indicated their pharmacy offered compounding services. Some of the 48 independent pharmacists who indicated that compounding was not among the pharmacy's professional services provided responses that informed the second and third research questions; however, their responses were not included in the chi-square analysis. Rather, their input is incorporated as part of the discussion and conclusions. Responses for both groups are included in Tables 3 and 4 to facilitate comparison.

When the survey was conducted in 2005, the data were entered into SPSS files in the order in which the survey responses were received. Frequency, cross-tab and chi-square analyses were performed using SPSS Version 14.0.1 (SPSS, Chicago, IL) at a significance level of 0.05.

RESULTS

Of the 1,643 survey instruments sent out in 2005, 1,597 were deliverable, 46 were nondeliverable, and 369 were returned and deemed usable. The usable response rate was 23.1% (369/1597). Of the 369 usable responses gathered, 321 were from independent pharmacists who indicated compounding services were offered in their pharmacies. Key respondent characteristics, disaggregated by total respondents and respondents who compound, are summarized in Table 1. Table 2 presents characteristics of the compounding practice environments represented by the respondents.

Opportunities for Compounding in Independent Community Practice

Therapy problems (patient, drug or dosage form) resolved by compounding that respondents most frequently cited were: combination of ingredients not commercially available (76%), dosage form not commercially available (63.2%), and strength not commercially available (43.6%). A variety of dosage forms were compounded by the respondents at least once per month. Of the respondents who offered compounding services to their patients, dermatological preparations for local effects (including ointments, creams, and gels) were the most common preparations compounded (90.7%). Oral solutions (73.2%) and suspensions (70.4%) were the second and third most frequently prepared, respectively. Topical solutions, suppositories, transdermal ointments (including creams and gels), and immediate-release capsules were prepared at least once per week by 30% to 46% of the

Table 1. Characteristics of Independent Community Pharmacists

| Characteristics | All Respondents, No. (%) ^a | Respondents Who Compound, No. (%) ^b |
|--|--|---|
| Number with bachelor of science (pharmacy) degree | 331 (89.7) | 291 (90.7) |
| Number with doctor of pharmacy degree only | 21 (5.7) | 18 (5.6) |
| Number with both doctor of pharmacy and bachelor of science degrees | 13 (3.5) | 9 (2.8) |
| Number educated before 1975 | 128 (34.7) | 107 (33.3) |
| Number educated since 1975 | 241 (65.3) | 214 (66.7) |
| Number of male respondents | 275 (76.4) | 243 (75.7) |
| Number of female respondents | 87 (23.6) | 75 (23.4) |
| Independent pharmacists who compound to provide full care to the patient | 256 (69.4) | 254 (79.1) |
| Independent pharmacists who compound as a response to prescriber demand | 169 (45.8) | 168 (52.3) |
| Independent pharmacists who compound as "just a part of the job" | 123 (33.3) | 121 (37.7) |
| Number of independent pharmacists (or staff members) who lack appropriate training to compound | 18 (4.9) | 1 (0.3) |

^a n = 369

^b n = 321

Table 2. Compounding Characteristics of Independent Pharmacists' Community Practices

| Characteristics | All Respondents, No. (%) ^a | Respondents Who Compound, No. (%) ^b |
|---|--|---|
| Range of compounded preparations made weekly and percentage compounds contribute to total prescriptions dispensed | 6-800 (0-100) | 6-800 (0-100) |
| Number of respondents who reported dispensing no compounded prescriptions | 34 (9.2) | 11 (3.4) |
| Number of pharmacies receiving no prescriptions for compounded preparations | 31 (8.4) | 3 (0.9) |
| Pharmacies dispensing 4 or fewer compounded preparations each day | 300 (81.3) | 266 (82.9) |
| Pharmacies that limit compounding to mixing commercial ointments and/or liquids | 35 (9.5) | 9 (2.8) |
| Number of respondent's pharmacies compounding 0.5% ^c or more of total prescription volume | 177 (48.0) | 177 (55.1) |
| Number of respondents who work at compounding-only pharmacies and do not dispense manufactured medicines | 7 (1.9) | 7 (2.2) |
| Number of respondent's pharmacies dispensing 980 ^c or more prescriptions (any type) each week | 181 (49.1) | 164 (51.1) |

^a n = 369

^b n = 321

^c Median values for compounding (%) and total prescription volumes were determined from all responses (n = 369).

independent pharmacists. Other dosage forms were compounded in fewer than 30% of the pharmacies.

When pharmacists' responses were compared by pharmacy degree earned (BS, PharmD or both degrees), significant differences were found for desired therapeutic outcomes not met with manufactured products (therapeutic outcomes, $p < 0.05$). Independent pharmacists with BS degrees (17.2%, 12 selected as first choice) were less likely to select therapeutic outcomes as their response than those with either PharmD (50%, 6 selected as first choice) or both degrees (55.6%). Dermatological preparations for local effects (including ointments, creams, and gels) ($p < 0.01$), transdermal ointments ($p < 0.05$), controlled-release (CR) capsules ($p < 0.01$) and troches ($p < 0.01$) were dosage forms that showed significant differences based on respondent's degree: PharmDs prepared relatively more. Chi-square analyses for opportunities to compound evaluated by respondents' gender or years in practice revealed few significant differences and none were deemed relevant to the current analysis.

How Knowledge and Skills Were Acquired by Respondent Independent Pharmacists

Table 3 summarizes sources of compounding knowledge and skills other than pharmacy school courses. The top 4 responses were: from other pharmacists on the job (68.2%); from text or reference books (67.6%); self-taught (56.1%); and from continuing education program (34.6%). The remaining responses were marked by fewer than 22% of the independent pharmacists.

BS pharmacists (200/291, 68.7%) selected books as a source of compounding information more frequently

than either of the PharmD degree groups (both 55.6%) ($p < 0.05$). Pharmacists who entered practice prior to 1975 (69/107, 64.5%) identified themselves as self-taught more frequently than pharmacists in practice 1-29 years (entering practice after 1975, 111/214, 51.9%) ($p < 0.01$). More independent pharmacists entering practice after 1975 (45/214, 21.0%), indicated receiving compounding information from other sources (eg, chemical and equipment suppliers) more frequently than pharmacists in practice prior to 1975 (14/107, 13.1%) ($p < 0.05$).

Table 3 also shows how each respondent's pharmacy school compounding exposure was structured. The vast majority (95.3%) of the independent pharmacists graduated from a program that included a required course with a laboratory component.

Recommendations for Education

Respondents were asked to choose one or more options describing their recommendation(s) for compounding course structures for contemporary pharmacy education (Table 4). Most (84.7%) indicated that compounding should be taught in a required course with a laboratory component. An elective course with laboratory component was supported by 18.7% of the respondents. Some respondents (24, 7.5%) indicated both required and elective courses with laboratory components should be available. Of the respondents with BS degrees, 84% (278/331) indicated that compounding should be a required course with laboratory. Among the 21 respondents with PharmD degrees, 90.5% (19) agreed. All 13 respondents with both degrees preferred having a required compounding course with laboratory component.

Table 3. How Independent Pharmacists Learned Compounding Knowledge and Skills

| Survey Statement | Independent Pharmacists Who Compound (n = 321) No. (%) | Independent Pharmacists Who Do Not Compound (n = 48) No. (%) |
|---|--|--|
| Outside of pharmacy school | | |
| Other pharmacists on the job | 219 (68.2) | 10 (20.8) |
| Texts/books | 217 (67.6) | 8 (16.7) |
| Self-taught | 180 (56.1) | 10 (20.8) |
| Continuing education course | 111 (34.6) | 1 (2.1) |
| Postgraduate training courses | 71 (22.1) | 1 (2.1) |
| Other | 59 (18.4) | None |
| Internet | 42 (13.1) | 3 (6.3) |
| E-mail/list serves | 10 (3.1) | None |
| Other (sources) ^c | 59 (18.4) | None |
| In pharmacy school ^b | | |
| Part of a required course, with hands-on compounding experience | 306 (95.3) | 44 (91.7) |
| Part of a required course, without hands-on compounding experience | 3 (0.9) | None |
| Part of an elective course, with hands-on compounding experience | 10 (3.1) | 1 (2.1) |
| Part of an elective course, without hands-on compounding experience | 0 | None |
| Compounding was not offered in my pharmacy curriculum | 8 (2.5) | 1 (2.1) |
| Other | 2 (0.6) | None |

^a Most respondents ranked 3 items.

^b Respondents could select multiple responses, hence percentages total to more than 100%.

^c Compounding and chemical suppliers' training courses.

Written comments from 5 respondents who supported inclusion of compounding in PharmD education in a required course with a laboratory indicated that their training was neither contemporary nor relevant, and that pharmacy education should be both. In written suggestions, respondents recommended more in-depth experiences be offered in pharmacy school for students interested in a compounding specialty practice, such as advanced pharmacy practice experiences that involved compounding for patients.

DISCUSSION

Respondents' demographics coincided with other published data for US pharmacists in terms of percentage

who compounded,¹⁰ gender,^{8,15} and degree earned; thus, the respondents have no apparent distinguishing characteristics.

Most of the independent pharmacists compounded, although some (9.5%) limited the complexity of compounding to mixing commercial products.^{10,13} Because the survey instrument lacked a compounding definition, some respondents may have interpreted such mixing as compounding, a potential limitation of this work. No information was collected to distinguish between preparations made from the component ingredients or those made by mixing 2 or more commercially available products, although some respondents volunteered clarifying

Table 4. Independent Pharmacists' Opinions: How Compounding Should Be Included in Doctor of Pharmacy Curricula

| Survey Statement | Independent Pharmacists Who Compound ^a (n = 321) No. (%) | Independent Pharmacists Who Do Not Compound ^a (n = 48) No. (%) |
|--|---|---|
| Required course with a laboratory component ^b | 272 (84.7) | 38 (79.2) |
| Required course without a laboratory component | 4 (1.2) | None |
| Elective course with a laboratory component ^b | 60 (18.7) | 10 (20.8) |
| Elective course without a laboratory component | 2 (0.6) | None |
| Do not offer | 2 (0.6) | 1 (2.1) |
| Other | 4 (1.2) | None |

^a Multiple response items; hence, percentages total to more than 100%.

^b 24 respondents selected both of these options; 20 were independent pharmacists who compound and 4 were among those who do not offer compounding services.

information. However, the inclusion of mixing commercial products as compounding was not necessarily inappropriate. Mixing commercial products can require application of the pharmacist's education to avoid dispensing a preparation of unacceptable quality.

Respondents identified the 3 most common cases presenting in their pharmacy that stimulated compounded solutions to optimize patient therapies. Combinations of ingredients and dosage forms not commercially available were the reasons that compounding was most frequently carried out, regardless of independent variable considered, in a majority of the respondent's pharmacies. Compounding dilutions or higher strength preparations are regular tasks in almost 44% of the respondent's pharmacies. As considered previously, even "simple" mixing requires understanding of chemical and physical compatibility of active and inactive ingredients. Concepts from physics and chemistry are applied to plan and execute basic compounding. Although the science foundation knowledge to compound is in courses prerequisite to the pharmacy professional program, transfer of knowledge from one field to another has to be guided, suggesting that compounding education is a necessity.^{16,17}

The independent pharmacists selected reasons to compound that were consistent with tenets of pharmaceutical care. Independent pharmacists with PharmD degrees were more likely to compound because therapeutic outcomes were not met with commercial products. Although ranked as sixth based on percent of responses overall, 24.3% of the clinical respondents identified this reason for compounding (18 selected as first choice), compared with 11.2% of pharmacists educated before 1975 (1 selected as first choice). This difference was not significant, possibly because of the lower number of respondents that selected the option: still the numerical differences were striking. Those with PharmD degrees (either as only or second degree) prepared relatively more of most dosage form types than did their colleagues with BS degrees. Almost 80% (79.1%) of the respondents wanted to compound to provide care to the patient. More than 50% (52.3%) specified compounding in concert with a prescriber, including 53.7% of the independent pharmacists who began practice since 1975 and 49.5% of those who began practice in 1975 or before ($p < 0.01$). Independent pharmacists who began practice prior to 1975 (40.0%) were more likely to say compounding was just a part of the job ($p < 0.01$). This statement may be evidence of the intended change in viewpoint, from product-focused to patient focused, first introduced as *clinical care* in the 1960s and punctuated later by the definition of *pharmaceutical care* by Hepler and Strand.⁶ A higher number of independent pharmacists who began practice more re-

cently than 1975 selected patient care as an important reason to compound (81.3%; 110 of these selected patient care as the primary reason to compound), suggesting that those entering practice since 1975 completed their education with the understanding and expectation of patient-focused care. This finding is consistent with Schommer and Cable's suggestion that those who began practice after 1975 experienced a patient-focused education (ie, clinical) compared with those educated prior to that time, who received a more product-focused education (ie, pre-clinical).⁸

A relatively higher prescription volume does not diminish the emphasis that the respondent pharmacists placed on providing compounding services to meet patient needs, as more pharmacists with a prescription volume of 980 prescriptions or more per week (median prescription volume for all respondents, $n = 369$) selected patient care as an important reason to compound (84.1%, compared with 72.8% of pharmacists dispensing less than 980 prescriptions per week, $p < 0.05$), indicating that the choice to compound is based on a patient's therapy needs to a greater extent than on the total prescription volume of a pharmacy. Approximately 27% of those who compound more than 0.5% (median percentage of compounds to total prescription volume for all respondents, $n = 369$) of the total prescription volume selected therapeutic outcomes as an important reason to compound, compared with only 11.5% of respondents compounding less than 0.5% of their total prescription volume ($p < 0.05$). These findings highlight younger pharmacists (entered practice since 1975) included compounding services as an ongoing component of contemporary practice and recognized the patient as a reason to do it regardless of pharmacy prescription volume. Hence, compounding is not limited to independent pharmacists trained primarily in BS programs prior to 1975.

Identification of the dosage forms most frequently compounded by the respondents establishes an initial definition of knowledge and skill sets appropriate for generalist pharmacy practice. The top 3 dosage forms (based on percentage of independent pharmacists that make each) are the same regardless of variable used for analysis, and are dermatological preparations for local effects (including ointments, creams, and gels), oral solutions, and suspensions for oral use. Sterile compounding was done in fewer than 10% of the respondent pharmacies, but the decision to limit the practice types surveyed is a factor here. Expansion of this work into additional practice types is necessary to fully define relevant curricular objectives for generalist practitioner preparation.

Regardless of degree earned, inclination toward or opportunity to compound, the vast majority (94.9%) of

the responding pharmacists completed a required course in pharmacy school that had a laboratory component (Table 3). Lack of education or training for compounding was cited as an issue for only a small subset of the respondent pharmacists (4.6%); hence, most received at least an exposure to compounding in pharmacy school. No information was collected systematically as to the quantity or quality of the experience, although voluntary comments from 4 respondents revealed their experiences in pharmacy school were inadequate for contemporary or complex compounding (eg, “very limited,” “make it relevant info, not how things were made 50 years ago,” etc).

Most pharmacists educated prior to 1975 reported being self-taught and learning from books, suggesting that pharmacy school education was insufficient in itself to provide the full complement of knowledge and skill. It is unlikely that any pharmacist began his or her practice with all of the compounding knowledge needed. Even with a strong pharmacy school foundation, new drugs and drug products are regularly released without dosage forms or excipient combinations appropriate or palatable to each potential patient. Outside of pharmacy school, a variety of sources are available for pharmacists to develop their knowledge base and gain experience (Table 3). More recent graduates have relied on compounding support services (Other [sources], Table 3) offered by commercial organizations. This switch to outside agencies for training may be in response to the decline in compounding education in schools of pharmacy or may reflect the growth of niche compounding businesses, where the pharmacist must extend his/her knowledge base beyond the basics from pharmacy school to meet more patients' needs.¹⁸ More inquiry is required to identify if other factors also contribute.

Most of the respondents (84.7% of those who offer compounding services and 79.2% of those who do not) believe compounding should be taught in PharmD curricula as a required course with a laboratory (Table 4). Clearly, independent pharmacists would like to see compounding outcomes in the curriculum to prepare student pharmacists with basic compounding skill and knowledge for pharmaceutical care practice.

Recommendations Based on the data and perceptions gathered, pharmacists should be able to meet patient care needs by compounding. Several dosage forms were compounded at least once per week in more than half of the practices surveyed. At a minimum, each graduate should be capable of designing, preparing, and evaluating compounded dermatological preparations for local effects (ointments, creams and gels), oral solutions, and oral suspensions that meet all aspects of pharmaceutical care practice. A generalist pharmacist can reasonably ex-

pect to be called upon to make these and should be qualified to do so. Graduates should also be able to combine and/or dilute commercial products and modify dosage forms to meet patient therapy needs, and be able to affirm that all preparations dispensed will be safe and effective within a specified timeframe.

Additional dosage forms may be common regionally and it would be incumbent on each PharmD program to appropriately consider this in curricular development. A well-developed program should address, at a minimum, specific content and skill guidelines identified by the United States Pharmacopeia, Center for the Advancement of Pharmacy Education, and National Association of Boards of Pharmacy to graduate generalist pharmacists capable of basic compounding. Curricular objectives should specify that students demonstrate competency in a problem-solving process to design, prepare, and evaluate compounded dosage forms, and confidently describe how the resultant preparation is appropriate for the patient and drug. PharmD education should demonstrate the role compounding has in optimizing patient outcomes, emphasizing the relevance of compounding to pharmaceutical care practice.

When asked to comment on how compounding education should be carried out in pharmacy school, 24 respondents (7.5%) selected both required course and elective course (each with laboratory component). These responses suggest that an optimal approach to teaching compounding would prepare students for generalist practice and allow options for students planning for compounding practice. In addition to the required basic knowledge and skills, elective options can provide deeper and broader compounding exposure. Alternately, a longitudinal compounding experience might be considered, with didactic instruction and laboratory experiences early followed by practice collaborative experiential training.

As a service to graduates and the profession, pharmacy schools might consider offering continuing education (CE) programs for pharmacists who specialize in compounding. CE programs for contemporary practice would be an extension of a well-structured curriculum, bring practitioners and educators together, and provide a great opportunity for curricular dialog to strengthen professional pharmacy education and practice.

CONCLUSIONS

Pharmaceutical compounding is among the services offered by contemporary independent community pharmacists to provide patients with pharmaceutical care. A wide variety of prescription compounding is being done and the number of compounded preparations dispensed

annually is significant. The majority of respondent pharmacists share the opinion that development of requisite knowledge and skills to compound should begin in pharmacy school.

PharmD graduates provided with relevant compounding experiences will be better equipped to optimize patient outcomes than graduates who are not trained in compounding.

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