

RESEARCH

Capacity Ratios to Assess the Solvency of a College's Advanced Pharmacy Practice Experience Program

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Submitted June 25, 2012; accepted October 11, 2012; published March 12, 2013.

Objective. To use the capacity ratio to determine solvency in 10 advanced pharmacy practice experiences (APPEs) offered by a college of pharmacy.

Methods. Availability in each APPE was determined based on preceptor responses, and student need was tabulated from 3 preference forms. Capacity ratios were calculated by dividing preceptor availability by the sum of student requests plus 20% of student requests; ratios ≥ 1 indicated solvency. For the 3 required APPEs, minimum capacity ratios were calculated by dividing availability by the sum of student number plus 20% of the student number. When possible, the capacity ratio for the APPE was calculated by geographic zone.

Results. The 3 required APPEs had statewide minimum capacity ratios that were consistent with solvency: advanced community (2.8), advanced institutional (1.6), and ambulatory care (2.5). Only 3 of 7 elective APPEs demonstrated solvency. The elective APPEs for which requests exceeded availability were association management (0.8), emergency medicine (0.8), cardiology (0.6), and human immunodeficiency virus (HIV) ambulatory care clinic (0.4). Analysis by zone revealed additional insolvent practice experiences in some locations.

Conclusions. The capacity ratio allowed for assessment of 10 APPEs and identification of practice experience areas that need expansion. While the capacity ratio is a proposed standardized assessment, it does have some limitations, such as an inability to account for practice experience quality, scheduling conflicts, and geographic zone issues.

Keywords: experiential education, practice experience, capacity ratio, advanced pharmacy practice experiences,

INTRODUCTION

Advanced pharmacy practice experiences represent a significant portion of a pharmacy student's education. The Accreditation Council for Pharmacy Education (ACPE) requires that 25% of the curriculum (at least 1,440 hours) consists of APPEs.¹ The current ACPE standards outline 4 required APPEs: community pharmacy, hospital or health-system pharmacy, ambulatory care, and inpatient/acute care general medicine. The remaining practice experiences may be comprised of elective experiences that further advance a student's education and may focus on students' professional interests.

Because the experiences are critical to successful completion of a doctor of pharmacy (PharmD) degree, ACPE also requires colleges and schools of pharmacy to assess their APPE capacity. The format for assessment includes calculation of the total number of pharmacy students

expected to complete APPEs in a given year, number of APPEs needed per student per setting, and total number of APPEs precepted by full-time and adjunct faculty members.² This method of assessing APPE capacity does not offer standardization, and therefore, does not provide the opportunity for comparison across multiple institutions or geographic zones. Comparisons of capacity in experiential education have become increasingly important because the strain on practice experience sites and preceptors has increased due to expansion of pharmacy class sizes and number of new pharmacy colleges and schools. In July 2012, 124 colleges and schools of pharmacy were accredited and 5 had received precandidate status,³ compared with 100 and 6, respectively, in 2008.⁴ In addition, first professional degree enrollment has risen significantly, increasing from 35,885 students in 2001 to 56,841 in 2010.⁵

Tennessee is a state in which competition has increased markedly. After decades of a single college of pharmacy in the state, 5 additional colleges and schools

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began enrollment over a period of 5 years. The University of Tennessee College of Pharmacy has an office of experiential education to oversee introductory pharmacy practice experiences (IPPE) and APPEs, which includes preceptor and site recruitment in order to maintain the capacity to meet students' needs. The college includes 2 campuses, 1 in Memphis and 1 in Knoxville, and a clinical education center in Nashville, which is approximately 200 miles from each campus location. Approximately one-third of students in the rising second-year pharmacy (P2) class relocate to Knoxville following the P1 year. Beginning in the spring semester of their third (P3) year, students are required to take 11 month-long APPEs (1,760 APPE hours) over 15 months. This is in addition to 160 hours of IPPEs (over 1 month), 1 month of classroom-based electives, and 2 to 3 off-months before graduation. Students may have anywhere from 7 to 10 direct patient care experiences. Beyond the 3 required practice experiences in ambulatory care, advanced community practice, and advanced institutional practice, students can select from over 35 elective practice experiences to meet their requirements for graduation. The college offers practice experiences in multiple geographic zones (Memphis, Knoxville, Nashville, and Chattanooga), in addition to numerous practice experiences in rural areas within the state or in other states and countries. The only out-of-state practice experiences include government APPEs and international APPEs.

In order to maintain the college's diversity and number of experiences, it is important to have a means of assessing the current state of the experiential program. Danielson and colleagues offered a novel method for standardizing the way pharmacy colleges and schools can assess their experiential education.⁶ They described the capacity ratio, which can be calculated by dividing the number of available practice experiences by the number of placements needed to determine solvency within a program. The capacity ratio is similar to the *current ratio* in business, which divides assets by liabilities to determine a company's solvency. Companies are deemed solvent when the current ratio is greater than 1. Similarly, experiential programs are considered solvent when the capacity ratio for APPEs indicates more availability than student needs. However, literature suggests that as much as 15% to 20% excess availability is needed to account for scheduling changes made throughout the APPE cycle,⁷ and a recent report by Duke and colleagues demonstrated scheduling change rates as high as 52.5% for some private institutions.⁸ Based on these data, a change factor of at least 15% to 20% must be included in the denominator of the capacity ratio equation to adequately reflect solvency when the ratio is greater than or equal to 1.

Haswell and colleagues recently assessed the capacity ratios for the University of Tennessee College of Pharmacy's IPPEs across the state and found solvency, with all ratios greater than 1 and some as high as 8 when analyzed via geographic zone.⁹ The purpose of this paper was to expand the assessment to include capacity ratios for the required APPEs and a selection of elective APPEs chosen by the college's office of experiential education. With the information from this analysis, we hoped to gain insight into the solvency of the college's APPEs across the state and by geographic zone in order to find areas of increased need for future years.

METHODS

Prior to the start of this analysis, an informal e-mail was sent to current P4 students graduating in May 2012 asking for feedback regarding their most important APPEs and the APPEs to which they desired to be assigned but were not. Based on their responses and selection by personnel in the Office of Experiential Education, we chose 10 APPEs to be analyzed: advanced community, advanced institutional, ambulatory care, medicine, emergency medicine, mental health, HIV ambulatory care clinic, government, association management, and cardiology. Government practice experiences are located in Alaska, Wyoming, Arizona, New Mexico, and Kentucky. Association management is a practice experience provided by the Tennessee Pharmacists Association. The 10 APPEs chosen included 3 required APPEs, 3 elective APPEs that appeared to have ample availability despite high demand, and 4 elective APPEs where we believed that requests exceeded availability.

The analysis was performed with the class of 2013, who were scheduled to complete APPEs from January 2012 to April 2013. The students' APPEs were scheduled in fall 2011 using the E*Value program (Advanced Informatics, Minneapolis, MN). Before scheduling, students were given 3 forms on which to specify preferences: 1 for listing their 3 top-priority APPE selections, 1 for listing their ambulatory care/advanced community practice/advanced institutional practice preferences, and 1 for ranking their preference for up to 30 desired elective APPEs. APPE assignments based on student preferences were made when possible. Numbers of student requests for each practice experience were calculated based on the submitted preference forms. During calculation, a maximum of 1 student request per practice experience category was recorded, unless a student asked for more than 1 practice experience in a given category and was assigned more than 1 APPE in that category (eg, 2 APPEs in ambulatory care). Because all students are required to complete 1 advanced community, 1 advanced institutional,

and 1 ambulatory care APPE, student requests for those APPEs were calculated by adding the required practice experience to the student's preference for an additional practice experience in that category beyond the requirement. The class of 2013's APPEs schedules were reviewed to calculate the number of student placements in each APPE category. The study design was submitted to the Institutional Review Board at the University of Tennessee Health Science Center and was granted exempt status.

Preceptors were contacted via e-mail in June, July, and August to submit their availability. Following the third general e-mail, an additional targeted e-mail was sent to preceptors in areas of high demand if they had not previously provided the office of experiential education with their availability. When availability was received via e-mail or facsimile, it was categorized based on site, practice experience category, months, and number of student placements per month. For this analysis, members of the office of experiential education reviewed the availability that had been provided by preceptors across the state and subcategorized the availability based on geographic zone. Capacity ratios were calculated by dividing the total availability of an APPE by the sum of the total number of student requests for that APPE and a change factor (15% and 20% of student requests). For the 3 required practice experiences (advanced community practice, advanced institutional practice, and ambulatory care), we also calculated minimum capacity ratios by dividing total availability by the sum of the number of students and the change factor (15% and 20% of the number of students). This last calculation measured the college's ability to meet the minimum requirements for every student to have 1 practice experience in each of the 3 categories. We used a capacity ratio ≥ 1 to indicate solvency.

RESULTS

The class of 2013 consisted of 147 students: 74 students in the Memphis zone, 51 students in the Knoxville zone, 17 students in the Nashville zone, and 5 students in the Chattanooga zone. The capacity ratio for the entire APPE program was 1.8 regardless of whether 15% or 20% was used as the change factor. Table 1 provides the results for the 3 required APPEs in advanced community practice, advanced institutional practice, and ambulatory care. Table 2 also lists the results for the 7 selected elective APPEs. All 3 of the required APPEs demonstrated solvency, with advanced community practice having both the highest minimum capacity ratio and the highest capacity ratio. For the minimum capacity ratio, it was 2.8 with a 20% change factor and 2.9 with a 15% change factor. For the capacity ratio, it was 1.8 using both a 15% and 20% change factor. The marked difference between minimum capacity ratio and capacity ratio for ambulatory care and advanced community APPEs demonstrate that a large number of students selected a second APPE in 1 or both of these categories. Among the elective practice experiences, medicine had the highest statewide capacity ratio (1.7 with a 20% change factor and 1.8 with a 15% change factor). The HIV ambulatory care clinic APPE had the lowest statewide ratio at 0.4 using a 20% change factor and 0.5 using a 15% change factor. Only 3 of the elective APPEs met the definition of solvency: medicine, mental health, and government. The largest difference in percentage of requests versus placements was in the cardiology category, with 87% of students requesting a cardiology practice experience in their initial selections and 44% receiving that APPE. Association management had the smallest difference (2%) when comparing placement to requests.

Table 1. Capacity Ratio Data for Required Advanced Pharmacy Practice Experiences (APPEs) at a College of Pharmacy

	Advanced Community Practice Experience	Advanced Institutional Practice Experience	Ambulatory Care Practice Experience
Students, No.	147	147	147
Student APPE requests, No. (%) ^a	231 (157)	159 (108)	248 (169)
Placements, No. (%) ^a	179 (122)	151 (103)	199 (135)
Total positions available, No.	489	275	443
Minimum capacity ratio, 20% change factor ^b	2.8	1.6	2.5
Minimum capacity ratio, 15% change factor ^c	2.9	1.6	2.6
Capacity ratio, 20% change factor ^d	1.8	1.4	1.5
Capacity ratio, 15% change factor ^e	1.8	1.5	1.5

^a Student request for a pharmacy practice experience assignment. The percent is calculated based on total class size of 147 students.

^b $CR_M = \text{availability} / [\text{student number} + 20\% \times \text{student number}]$

^c $CR_M = \text{availability} / [\text{student number} + 15\% \times \text{student number}]$

^d $CR = \text{availability} / [\text{requests} + 20\% \times \text{request number}]$

^e $CR = \text{availability} / [\text{requests} + 15\% \times \text{request number}]$

Table 2. Capacity Ratio Data for Elective Advanced Pharmacy Practice Experiences at a College of Pharmacy

	Type of Advanced Pharmacy Practice Experience						
	Medicine	Emergency Medicine	Mental Health	HIV	Government	Association Management	Cardiology
Requests, No. (%) ^a	185 (126)	60 (41)	117 (80)	37 (25)	58 (39)	10 (7)	128 (87)
Placements, No. (%) ^a	179 (122)	25 (17)	63 (43)	11 (7)	49 (33)	7 (5)	65 (44)
Total positions available, No.	387	60	150	16	81	10	99
Capacity ratio, 20% change factor ^b	1.7	0.8	1.1	0.4	1.2	0.8	0.6
Capacity ratio, 15% change factor ^c	1.8	0.9	1.1	0.5	1.2	0.9	0.7

Abbreviations: HIV = human immunodeficiency virus ambulatory care clinic.

^a % based on total class size of 147 students

^b CR = availability/[requests + 20% × request number]

^c CR = availability/[requests + 15% × request number]

Table 3 depicts the data for the 7 practice experiences that were assessed by zone. The HIV ambulatory care clinic and the association management practice experiences are offered in only 1 zone, and the government APPEs are not categorized into a zone because of their location outside of Tennessee. Chattanooga and Nashville did not have sites for emergency medicine, and Chattanooga did not have sites for cardiology, so geographic-zone ratios were not applicable in those categories. In every zone, required APPEs were solvent based on minimum requirements, with minimum capacity ratio ranging from 1.3 (using both a 15% and 20% change factor) to 6.1 (with a 20% change factor) and 6.4 (with a 15% change factor). When compared to the other 3 zones, Memphis had the lowest capacity ratios for advanced community practice, ambulatory care practice, emergency medicine, mental health, and cardiology APPEs—all of which (excluding advanced community) were insolvent in that zone. Knoxville was insolvent in mental health and cardiology, and Nashville was insolvent in medicine and cardiology. These capacity ratios were all based on the number of student requests. All of Chattanooga's categories were solvent, with capacity ratios ranging from 2.0 to 2.5. The medicine practice experiences in Memphis and Knoxville, the mental health practice experiences in Nashville, and the advanced institutional and ambulatory care practice experiences in Chattanooga all were able to provide placements equal to or greater than the number of student requests.

DISCUSSION

The solvency of the 3 required practice experiences was not surprising based on the office's knowledge that all P3 students were able to be scheduled in those areas. The minimum capacity ratios for those practice experiences were high, indicating more than sufficient availability to meet student needs. In addition, all of our students exceeded the ACPE requirement for 1 inpatient/acute care APPE, with some completing as many as 8 practice

experiences in that particular category. For the class of 2013, students were required by the college to complete a minimum of 7 direct patient care APPEs. This was an increase from previous years that resulted from a change from 10 to 11 APPEs per student. Community practice experiences tend to have higher capacity ratios than institutional practice experiences,⁶ and this was reflected in our data. This is the result of fewer institutional sites. Our desire to assess capacity within our APPEs stemmed from questions regarding our ability to meet student requests for elective APPEs. The findings of our analysis speak to the wide range of capacity ratios among the various electives and help our office highlight areas in need of site and preceptor development. Since completion of this analysis, we have added an emergency medicine APPE in Memphis, and will have access to another HIV clinic soon in 1 of the other zones.

The capacity ratios calculated at our college of pharmacy share some similarities to those found by Danielson and colleagues when they assessed APPE capacity ratios in the Northwest Pharmacy Experiential Consortium (NWPEC) and the Southeastern Pharmacy Experiential Education Consortium (SPEEC).⁶ Their overall capacity ratios for total APPEs in the Northwest ranged from 1.5 to 2.4, but the subanalysis revealed ratios as low as 1.2 for acute care/general medicine, and as high as 3.9 in community APPEs. The SPEEC data were not further analyzed beyond total APPEs, but their overall capacity ratio was 1.6 for the 2006-2007 academic year, and the projected 2010-2011 capacity ratio was 1.34.⁶ For both the NWPEC and SPEEC institutions, solvency was demonstrated based on the provided data. They did not further assess capacity ratios based on individual elective practice experience categories, so we were unable to compare our ratios with these particular colleges.

Previous work done by the college's office of experiential education focused on IPPE capacity and calculated those ratios based on geographic zone.⁹ For the

Table 3. Capacity Ratio Data for Required and Elective Practice Experiences by Geographic Zone

	Advanced Community	Advanced Institutional	Ambulatory Care	Emergency Medicine	Emergency Medicine	Mental Health	Cardiology
Memphis							
Students, No.	74	74	74	74	74	74	74
Requests, No.	115	77	139	90	35	48	69
Placements, No.	86	76	100	94	11	19	31
Total Availability	204	153	154	212	19	21	47
Minimum capacity ratio, 20% change factor ^a	2.3	1.7	1.7	N/A	N/A	N/A	N/A
Minimum capacity ratio, 15% change factor ^b	2.4	1.8	1.8	N/A	N/A	N/A	N/A
Capacity ratio, 20% change factor ^c	1.5	1.7	0.9	2.0	0.5	0.4	0.6
Capacity ratio, 15% change factor ^d	1.5	1.7	0.9	2.0	0.5	0.4	0.6
Knoxville							
Students, No.	51	51	51	51	51	51	51
Requests, No.	81	58	74	70	25	48	43
Placements, No.	60	53	69	70	14	24	21
Total Availability	203	77	174	133	41	37	36
Minimum capacity ratio, 20% change factor ^a	3.3	1.3	2.8	N/A	N/A	N/A	N/A
Minimum capacity ratio, 15% change factor ^b	3.5	1.3	3.0	N/A	N/A	N/A	N/A
Capacity ratio, 20% change factor ^c	2.1	1.1	2.0	1.6	1.4	0.6	0.7
Capacity ratio, 15% change factor ^d	2.2	1.1	2.0	1.6	1.4	0.7	0.7
Nashville							
Students, No.	17	17	17	17	17	17	17
Requests, No.	24	19	28	17	N/A	16	15
Placements, No.	23	17	23	8	N/A	16	13
Total Availability	125	42	98	19	N/A	78	16
Minimum capacity ratio, 20% change factor ^a	6.1	2.1	4.8	N/A	N/A	N/A	N/A
Minimum capacity ratio, 15% change factor ^b	6.4	2.1	5.0	N/A	N/A	N/A	N/A
Capacity ratio, 20% change factor ^c	4.3	1.8	2.9	0.9	N/A	4.1	0.9
Capacity ratio, 15% change factor ^d	4.5	1.9	3.0	1.0	N/A	4.2	0.2
Chattanooga							
Students, No.	5	5	5	5	5	5	5
Requests, No.	11	5	7	8	N/A	5	N/A
Placements, No.	10	5	7	7	N/A	4	N/A
Total Availability	32	14	17	23	N/A	14	N/A
Minimum capacity ratio, 20% change factor ^a	5.3	2.3	2.8	N/A	N/A	N/A	N/A
Minimum capacity ratio, 15% change factor ^b	5.6	2.4	3.0	N/A	N/A	N/A	N/A
Capacity ratio, 20% change factor ^c	2.4	2.3	2.0	2.4	N/A	2.3	N/A
Capacity ratio, 15% change factor ^d	2.5	2.4	2.1	2.5	N/A	2.4	N/A

^a $CR_M = \text{availability}/[\text{student number} + 20\% \times \text{student number}]$

^b $CR_M = \text{availability}/[\text{student number} + 15\% \times \text{student number}]$

^c $CR = \text{availability}/[\text{requests} + 20\% \times \text{request number}]$

^d $CR = \text{availability}/[\text{requests} + 15\% \times \text{request number}]$

IPPE data analysis conducted by Haswell and colleagues, trends similar to those depicted in our data were found — Memphis and Knoxville exhibited the lowest ratios (although they remained solvent and had the majority of

students), and Nashville and Chattanooga had ratios of >2.5 , respectively.⁹ Our geographic trends for APPEs were not as evident and were not consistent across all categories. However, the highest ratios found

were the minimum capacity ratios (6.1 and 5.3) for the advanced community practice APPEs in Nashville and Chattanooga, respectively. The simplest explanation for these results is the lower number of students placed in the Nashville and Chattanooga zones compared to the number placed in the Memphis and Knoxville zones. However, these data are important for making future considerations of student placements by zone and for recognizing areas of need in specific geographic locations across the state.

Emergency medicine is a growing area for pharmacists, and there is an increased number of student requests for APPEs in this type of practice site. Although the overall capacity ratio was 0.8, the bulk of the availability was found in Knoxville, with a capacity ratio of 1.4. Memphis' poor capacity ratio of 0.5 shows us the need to focus efforts on increasing availability in this zone, as well as in the Nashville and Chattanooga zones that do not offer any practice experiences in that category. Similarly, mental health and cardiology are areas of need, particularly in Memphis and Knoxville.

Practice experience availability is a fluid number that is affected by a variety of factors, such as preceptor employment changes, site closings, and use by other colleges and schools of pharmacy. The loss of those available spots can have a significant effect when it comes to scheduling changes that occur throughout the year. Kawahara and colleagues assessed scheduling changes at their institution for the 1997-1998 academic year and found a change rate of approximately 15%.⁷ They concluded that institutions would need to account for these changes by having at least 15% to 20% more availability beyond their calculated needs. Considering the significant changes in the climate of pharmacy experiential education over the last 15 years (first with the change to all first professional degree PharmD programs and then the addition of APPE and IPPE requirements), the data by Kawahara and colleagues may not accurately reflect the number of APPE scheduling changes at today's colleges and schools of pharmacy.^{1,7,8} Danielson and colleagues also assessed the number of changes at 5 colleges and schools of pharmacy in the NWPEC during the 2009-2010 academic year and found change rates of 2% to 15% (mean 6%) for APPEs.⁶ A study of 5 colleges and schools of pharmacy in Georgia and Alabama (members of SPEEC) reported change rates from approximately 14% to 53% during the 2008-2009 academic year, with an overall rate of 32%.⁸ The authors noted that the higher rates were in private institutions, and when further analysis was done to assess rates in private vs public institutions, the public institutions had an overall rate of approximately 21%. The authors also revealed a possibly skewed number of changes

in some institutions that resulted from scheduling practices and more lenient rules regarding student-initiated changes. As our college is a public institution and we limit student-initiated changes to reasonable hardships, and because Danielson and colleagues found relatively low change rates consistent with no more than 15% changes, we elected to use change factors of 15% and 20% to assess placement changes over the 15-month practice experience cycle. Additional research will be needed to accurately calculate the change rate at our institution and validate the use of 15% to 20% change factors.

When performing our analysis, several issues arose that reflect the limitations of a capacity ratio. When unused availability is taken by another college or school of pharmacy, the revised capacity ratio actually decreases from that originally calculated. Capacity ratio also does not consider the quality of the practice experiences, whether the months of availability align with student schedules, or whether students are actually receiving the practice experiences that they request. Quality of practice experiences is an issue that is gaining more attention, and the focus has shifted to the importance of direct patient care activities in APPEs.¹⁰ In addition, our college of pharmacy spans the state and offers students multiple locations to take APPEs. For the purposes of analysis, student requests and placements were recorded as being in a single zone, but our office allows students to complete up to 3 practice experiences outside of their assigned zone. Therefore, our results for availability, student requests, and placements do not necessarily align based on zone. In addition, student requests were calculated based on the 3 preference forms, 1 of which allows students to list up to 30 elective practice experience preferences, even though they would only be assigned 7 from these choices. Furthermore, our institution chooses to use full-time faculty members as preceptors as much as possible because of budget constraints and for quality control. A student who has not requested any practice experiences with full-time faculty members will probably be scheduled for as many as 4 full-time faculty APPEs to meet the college's requirements. Issues regarding the adequacy of the number of APPEs and scheduling optimization are areas for future research and beyond the scope of this paper.

As Harralson noted in his findings from a survey of experiential directors, the most frequently cited concern by directors of APPE programs is their ability to find, develop, and maintain sites and preceptors.¹¹ Although the survey was performed in 2001, this concern is just as relevant, if not more so, in today's experiential education climate of increasing student enrollment and numbers of pharmacy colleges and schools. Competition for preceptors and sites is directly related to the capacity of

experiential education programs, and a great deal of the literature focuses on delineating barriers to increasing capacity, forming new methods for preceptor and site development, and describing the benefits of precepting student pharmacists.^{4,9,12-15} Our office is now faced with the task of using the information gained in this analysis to increase capacity in those areas found to be insolvent. Additional research will be needed to calculate capacity ratios for all elective practice experiences in order to find other categories in need of expansion. However, assessing the complex variables that affect the final APPE schedules for students also will be important. With this information, the college's office of experiential education can continue to improve its current offerings and provide an objective assessment of the program's capacity.

CONCLUSIONS

The capacity ratio offered a systematic approach to assessing the solvency in a college of pharmacy's 3 required APPEs and 7 selected elective practice experiences. We were also able to assess solvency based on geographic zone across the state. Overall solvency was demonstrated for 6 of the 10 practice experiences, which allowed the college's office of experiential education to highlight 4 categories of elective practice experiences in need of expansion. Use of the capacity ratio is beneficial, but the results/findings must be carefully considered in combination with other factors when assessing a program's solvency. Further research to validate a change factor of 15% or 20% is needed if the ratio is to be used across a broad range of institutions.

ACKNOWLEDGMENTS

The authors wish to thank Laverne R. Jones, coordinator for the Office of Experiential Education, and Cristina L. Gewin, administrative aide for the Office of Experiential Education, from the University of Tennessee College of Pharmacy, for their assistance with data collection for the manuscript.

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