

RESEARCH ARTICLES

The Impact of Diabetes Concentration Programs on Pharmacy Graduates' Provision of Diabetes Care Services

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Objective. To determine practice outcomes associated with doctor of pharmacy (PharmD) graduates from 2 universities who completed a diabetes-concentration.

Methods. An online survey instrument was sent to 93 PharmD graduates who completed a concentration in diabetes and 94 control graduates to determine their knowledge of and skills in providing diabetes care and how frequently they provided diabetes care services.

Results. Ninety-seven graduates (52%) responded. Significantly more graduates with a diabetes concentration rated their ability to instruct patients on insulin administration, blood glucose monitoring, foot care, and insulin dose adjustment as good or excellent compared to a control group of graduates. Graduates with a diabetes concentration also rated their ability to perform blood glucose monitoring and foot examinations higher than graduates without a diabetes concentration ($P < 0.05$).

Conclusion. Completing a diabetes concentration increased graduates' knowledge of diabetes and confidence in their ability to provide care but did not appear to alter their practice patterns significantly. Further study is needed to determine whether other barriers to pharmacists providing diabetes care exist in practice settings.

Keywords: diabetes, pharmacy practice, medication therapy management

INTRODUCTION

Given their level of contact with patients, pharmacists are in a unique position to provide valuable patient-centered care services to people with diabetes, a chronic disease with a prevalence of over 25 million in the United States.¹ This level of contact is explained by the availability and convenience of pharmacies (found in most urban, suburban, and rural communities), accessibility of pharmacists for questions and counseling (appointments not usually required), and the strong professional relationship that pharmacists develop with their patients and their patients' families.

The American Diabetes Association (ADA) recommends that individuals with diabetes receive medical care from a physician-coordinated team, which often includes a pharmacist.² In their daily interactions with patients, pharmacists provide diabetes education about the proper use, expected outcomes, and potential side effects of their

medications. Furthermore, pharmacists supply glucose monitors and diabetes care supplies, instructing patients on their proper use and role in diabetes management. Pharmacists' capacity to assist patients in improving their glycemic control and achieving goals of therapy has been well documented.³⁻¹⁶

To prepare pharmacy students to provide diabetes care services, formalized curricular concentrations in diabetes care have been developed.^{17,18} Johnson and colleagues described a 3-credit-hour advanced diabetes care elective course that was part of a 24-credit-hour diabetes concentration.¹⁷ The course was designed to increase student knowledge of medical and psychosocial issues in diabetes, pharmacotherapy of diabetes, diabetes medical nutrition management, marketing diabetes care services, and diabetes patient education. Pre- and post-course surveys indicated that this course increased students' skills and knowledge. At another college of pharmacy, students completing a diabetes concentration program performed better on a diabetes-focused written examination and practicum compared to a group of control students.¹⁸

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A review of the literature reveals that information is lacking on how the participants of these educational programs use their diabetes management education after they graduate from pharmacy school. The objective of this project was to determine what skills the graduates of diabetes concentration programs at 2 pharmacy programs use and whether they provide a different amount of diabetes care services compared to graduates who did not participate in these programs as students.

METHODS

Drake's diabetes concentration program for doctor of pharmacy (PharmD) students was initiated in 2002, and 60 graduates had completed the program as of May 2009. Mercer's program was initiated in 2005 and 30 PharmD graduates had completed the diabetes certification program as of May 2009. Faculty members from both programs collaborated on the current project. Table 1 contains the requirements for both programs

Survey Instrument Development

The survey instrument was developed by diabetes specialist faculty members from the Mercer University, Drake University, and University of Washington pharmacy programs. Survey design and content were evaluated by 3 graduates of each institution (N=9). Four items were identified as potentially confusing. These were further explored using cognitive testing in a focus group of fourth-year pharmacy students and practice faculty members. These items were then modified before inclusion in the final survey instrument.

The final survey instrument consisted of 49 items covering the following areas: respondent's background (13 questions), frequency of providing diabetic services (13 questions), self-ratings of ability (13 questions), and educational preferences (2 questions). The collected back-

ground information included: demographics, current work setting, and diabetes training while in school and after graduation. Respondents were asked to report: referral sources; billing practices; the frequency with which they provided education to patients on 6 topics (insulin administration, blood glucose monitoring, foot care, hypoglycemia symptoms/treatment, insulin dose adjustment, and nutrition); and the frequency with which they performed 7 diabetes clinical services (checking blood glucose levels, checking blood pressure, interpreting blood glucose levels, changing medications, completing foot examinations, reviewing laboratory work, and providing medication therapy management [MTM]). Frequency was reported as 0, 1 to 5, 6 to 10, or ≥ 10 times per week. Respondents were asked to rate their ability to provide education or perform clinical skills on a 4-point scale of poor, fair, good, or excellent. If they rated their ability as fair or poor, they were asked to indicate the type of educational activity they would prefer to help them improve their skills. Study approval was obtained from the institutional review board of each university.

Survey Administration

In November 2009, an e-mail with an invitation to participate in the research project and a link to the electronic survey instrument was distributed to 2006-2009 PharmD graduates (N=187) who had completed a diabetes concentration program at either Drake University College of Pharmacy and Health Sciences or Mercer College of Pharmacy and Health Sciences. Subjects only were included if the respective institution had an e-mail address on file for them. Control subjects were randomly selected from the same classes. Qualtrics (Qualtrics, Inc, Provo, UT), a Web-based survey software system, was used to administer the survey, manage the follow-up reminders, and collect data. Skip patterns were used to omit questions that were irrelevant to specific participants.

The first item on the questionnaire was an informed consent statement that allowed participants to opt out of the survey by declining to participate. As an incentive to participate and thereby increase the response rate, respondents were entered into a drawing for a 1-year membership in the American Society of Health-System Pharmacists (ASHP) or the American Pharmacist Association (APhA). The protocol called for an initial drawing 4 weeks after the first e-mail was sent and a second and final prize drawing if/when a 60% response rate was achieved. The online survey instrument was open from November 18, 2009, through November 18, 2010. Nonresponders were contacted via e-mail 5 additional times, and then received a follow-up phone call if a current phone number was available.

Table 1. Diabetes-Concentration Program Requirements

Drake University	
Two of the following pharmacy elective courses:	
Advanced Diabetes Care (Web-based)	
Principles of Nutrition (Web-based)	
Integrated Diabetes Cases	
Three credit hours of courses related to psychosocial issues.	
Ten credit hours of diabetes focused advanced pharmacy practice experience.	
Mercer University	
A didactic elective in diabetes care in the third professional year.	
A diabetes-focused advanced pharmacy practice experience	
A written and an oral examination with a minimum of 75% combined grade	

Statistical Analysis

Assuming an 11% baseline proportion, 86 subjects were needed to detect a 25% difference in the number of subjects who provided specific diabetes care services ($\beta = 0.80$ and two-sided $\alpha = 0.05$). Parametric categorical data were analyzed with a chi-square test, and if cell size was ≤ 5 , Fisher exact test was used. Parametric continuous data were analyzed with a Student *t* test. Statistical analyses were performed in SAS, version 7.2 (SAS Institute, Gray, NC). Responses were assessed for validity and deleted if the data submitted were not feasible or if the data appeared to be incorrect. If a subject graduated in 2009, completed the survey instrument between November 2009 and July 2010, and reported they completed a residency, then they were considered to be a first-year resident. Similarly, if a subject graduated in 2010, completed the survey instrument between November 2009 and July 2010, and reported they completed a second-year residency or fellowship, then they were considered to be a second-year resident or fellow.

RESULTS

The link to the online questionnaire was sent to 187 subjects, 94 who completed a diabetes concentration program and 93 controls. Fifty-two percent (97/187) responded to the invitation. Two graduates (1%) declined to participate and 7 (3.4%) indicated that they did not provide care to people with diabetes. One completed questionnaire was deemed invalid because of the unfeasible responses provided and was removed from the analysis. Eighty-seven responses were analyzed; 46 in the diabetes-concentration group and 41 in the control group.

Sample demographic characteristics are listed in Table 2. The only difference in baseline demographics was that significantly more Mercer graduates who had completed the diabetes concentration responded to the survey compared to Mercer graduates in the control group. Twenty (23%) of the respondents were completing a residency at the time they participated in the survey. There was no difference between the number of current residents or fellows in the diabetes concentration group ($N=10$, 22%) and the control group ($N=10$, 22%, $P > 0.05$).

Diabetes Education

Table 3 shows the number of subjects in each group who provided diabetes education at least once a week. There were no significant differences between groups in the percent of subjects who provided any 6 types of diabetic education. However, significantly ($P < 0.05$) more diabetes-concentration graduates rated their ability to teach insulin administration, blood glucose monitoring, foot care, and insulin dose adjustment to patients as

good or excellent compared to graduates in the control group (Table 3). Self-reported ability to provide education about hypoglycemia and diet information was not significantly different between groups.

Clinical Skills

No significant differences were observed in respondents' self-reported clinical skills. Table 4 contains the percent of subjects who rated their ability to perform specific diabetes-related clinical skills as good or excellent. Relative to the control group, more diabetes-concentration graduates rated their ability to check blood glucose ($P = 0.02$) and perform a foot examination ($P = 0.02$) as good or excellent. The differences between the 2 groups in other clinical skills, while higher for the diabetes education graduates, were not significant.

Educational Preferences

If respondents rated their ability as poor or fair in providing any of the patient education topic(s) or performing any of the clinical skill(s), then they were asked to choose which educational activities would enhance their skill(s). Seventy-nine (91%) subjects rated their skills as poor or fair for at least 1 education topic and 82 (94%) rated their ability at one of the clinical skills as poor or fair. In order to improve clinical skills, 57 (66%) subjects preferred demonstration as the educational activity, 47 (54%) chose supervision by someone trained in diabetes education, lecture ($n = 36$, 41%), and role-play exercises ($n = 27$; 31%). Forty-two (49%) of the respondents chose supervision by someone trained in diabetes education as their educational activity of choice and 15 (18%) chose lecture.

DISCUSSION

These findings provide insight into how a cohort of graduates from 2 different colleges/schools of pharmacy uses their diabetes-specific knowledge and skills. Our subjects appear to be fairly similar to the respondents of other alumni questionnaires, which strengthens the external validity and generalizability of our results. Thirty-five percent of our respondents worked in a hospital setting compared to 32.6% of respondents in the American Association of Colleges of Pharmacy (AACP) alumni survey, while 36% of our subjects practiced at chain or independent pharmacies compared to 44% of respondents in the 2005-2009 (AACP) alumni survey.¹⁹ Fifty-two percent of the respondents in our study completed a residency or fellowship. According to ASHP, each year, from 14% to 16% of pharmacy school graduates match for a residency program (J. Teeters, Director, Accreditation Services

Table 2. Demographics of Pharmacy Graduates Who Participated in a Survey to Determine the Impact of Completing a Diabetes Concentration on Practice After Graduation, N = 87.

	Diabetes Concentration Group (n=46)	Control Group (n =41)	P
Gender, % ^a			
Male	7 (15)	11 (28)	
Female	39 (85)	28 (72)	0.16
Average age, yrs (SD) ^b	27.6 (6)	26.6 (4)	0.37
Program attended			
Drake University	29 (63)	35 (85)	
Mercer University	17 (37)	6 (15)	0.02
Year since graduation from pharmacy school ^a			0.18
2006	3 (7)	4 (10)	
2007	7 (15)	4 (10)	
2008	18 (39)	8 (21)	
2009	18 (39)	23 (59)	
Completed or completing postgraduate training? ^c			
Yes	23 (52)	18 (50)	0.84
No	21 (48)	18 (50)	
Completed at least one APhA certificate training program	18 ^d	15	0.81
Received a certification ^e	5 (17)	0	0.051
Current work setting ^f			0.82
Retail/Community	19	17	
Hospital	21	14	
Other	12	10	
Job function			0.41
Owner, manager, director	4 (9)	3 (8)	
Dispensing/staff	10 (22)	11 (28)	
Clinical	14 (30)	13 (32)	
Mixed dispensing/clinical	18 (39)	10 (24)	
Other ^g	0	2 (5) ^b	
Average hours worked per week (SD)	47±10	45±10	0.36

^a Not all respondents answered all items, n = 85.

^b n = 78

^c n = 80

^d Four of the 18 graduates completed 2 programs each.

^e n = 66

^f Some subjects provided more than 1 response.

^g Other responses included regulatory (1) and prescription benefit management (1).

American Society of Health-System Pharmacist, e-mail communication, January 2010). In another report on practice characteristics of pharmacists, 33.5% of the respondents completed a residency.²⁰ The percentage of respondents who were completing or had completed a residency may reflect an area of possible bias because students who completed a diabetes-concentration program may have been more likely to pursue postgraduate training programs. In our study, there was not a significant difference in the percent of subjects in each group who had completed

postgraduate training (53% diabetes-concentration group vs. 50% in the control group).

Consistent with national pharmacy graduation data, the majority (67%) of our subjects were female.^{19,20-23} Also similar with AACP's alumni survey, the response rate inversely correlated with time since graduation. The highest percentage (48%) of responses came from the most recent graduation class and the percent decreased as years since graduation increased. This trend may result from changes in contact information over time.

Table 3. Pharmacy Graduates' Frequency and Self-Rating of Diabetes Education Skills

	Graduates Providing Diabetes Education to Patients, %			Graduates Rating Their Skills as Good/Excellent, %		
	Diabetes Certification Group	Control Group	<i>P</i>	Diabetes Certification Group	Control Group	<i>P</i>
	Insulin administration	43		35	0.44	
Blood glucose monitoring	57	65	0.44	95	80	0.03
Proper foot care	20	18	0.73	84	48	0.0004
sx/tx of hypoglycemia	55	60	0.61	91	85	0.4
Insulin dose adjustment	39	38	0.91	77	55	0.03
Diet Information	41	55	0.20	75	65	0.31

Abbreviations: sx/tx = side effects and treatment

Although significant differences in the frequency of providing diabetes education and performing clinical skills were not observed, the results of this survey provide useful information for those who train students to provide care to patients with diabetes. Educating patients on the use of blood glucose monitors and hypoglycemia was done in practice by more than 55% of graduates in both groups, possibly because pharmacist education of patients about hypoglycemia should be a routine part of counseling when a prescription for antidiabetic agents is filled. Because patients can purchase their blood glucose testing supplies from a pharmacy, pharmacists are a likely source of information on and training in the use of these products. More than 80% of the respondents rated their ability to educate patients on these topics as good or excellent. Significantly more ($P < 0.05$) of the diabetes-concentration graduates rated themselves as good or excellent at training patients in blood glucose monitoring. Although diet was the third most frequently reported educational topic, relative to hypoglycemia and blood glucose monitoring, fewer graduates reported their ability to provide education as good or excellent ($P < 0.05$). Thus, both groups of graduates may need more training in diet education be-

cause many of them will use this information on a weekly basis. However, in both programs, the training on diet involved teaching students enough to reinforce the diet education that patients receive from dietitians rather than preparing them to be a primary educator in this area.

More pharmacists reported providing education about hypoglycemia and blood glucose monitoring (55%-65%), than insulin administration or dosing (35%-43%, Table 3), but the difference was not significant ($P > 0.05$). However, control subjects were significantly less confident in their ability to provide education on insulin compared to the diabetes-concentration subjects ($P < 0.05$). Furthermore, diabetes-concentration graduates rated these skills lower than their ability to teach patients to perform blood glucose monitoring and recognize the signs of hypoglycemia. It was unclear whether the graduates provided these services less frequently because they felt less confident in performing these skills, or were less proficient because they did not have the opportunity to provide these services as often.

Education on proper foot care was the least frequently reported diabetes education topic. Also of interest, the largest disparity in confidence rating was observed for education on foot care (84% for diabetes concentration

Table 4. Pharmacy Graduates' Frequency and Self-Rating of Diabetes Clinical Skills

	Graduates Providing Diabetes Care to Patients, %			Graduates Who Rated Their Skills as Good/Excellent		
	Diabetes Certification Group	Control Group	<i>P</i>	Diabetes Certification Group	Control Group	<i>P</i>
	Check blood glucose	23		20	0.76	
Check blood pressure	32	30	0.86	81	75	0.48
Interpret blood glucose	57	53	0.69	88	75	0.11
Change medication	70	65	0.64	88	85	0.65
Foot examination	5	5	0.92	44	20	0.02
Laboratory	59	45	0.20	84	70	0.14
Medication therapy management	53	50	0.75	81	80	0.87

group and 48% for the control group, $P < 0.02$, Table 3). Although diabetes-concentration graduates seemed confident in their ability to educate patients on foot care, they used it relatively infrequently ($\leq 20\%$ of both groups reported providing this education to patients at least once a week). Although foot care is a part of our educational programs and patient education on preventative foot care can reduce the number of amputations,^{24,25} many patients may not feel comfortable discussing this topic with their pharmacist in a pharmacy. Additionally, pharmacists may not focus on foot care because it does not improve glycemic control and is not a monitoring parameter for drug therapy. Educational programs for pharmacists that include preventative foot care should include how to incorporate the service into their routine practice.

Changing or recommending changes to patients' diabetes medications was the most frequently reported clinical skill, followed by ordering and interpreting laboratory tests and interpreting blood glucose patterns (Table 4). These activities may be the most commonly performed clinical activities because they fall under traditional clinical pharmacy services, while monitoring blood glucose, checking blood pressure, and examining feet usually are performed by other members of the medical team or by pharmacists in other practice settings such as ambulatory care. Interestingly, providing MTM services, which could offer opportunities for adjusting medication and monitoring laboratory parameters, was reported less frequently than the other 2 activities. Respondents may have interpreted MTM to be only associated with Medicare Part D. The diabetes-concentration graduates reported a higher confidence in their ability to check a blood glucose level and conduct a foot examination, even though they rarely did either of these skills. Consistent ratings in graduates' ability to check blood glucose and ability to train a patient on how to use their blood glucose monitor were not surprising as the tasks require similar skills and knowledge. Foot examinations, similar to foot care, were not performed often and graduates gave the lowest confidence rating in their ability to perform this skill. The reason may be because most pharmacists do not have the opportunity to use those skills, foot examinations may be done by other health professionals, and foot examinations may be perceived as not being directly related to drug therapy.

Respondents felt that preceptorships and demonstrations were the best methods for learning diabetes care skills. Future education programs designed to improve diabetes patient care and education skills should incorporate these methods.

There are several limitations to this study. Although an overall response rate of 52% was achieved, a response rate over 60% would have made the results more gener-

alizable. A larger sample size also would have reduced the chance of a type II error. As with any survey, there is the potential of selection bias.²⁷ A relatively large percent of the group completed a residency. Even if the diabetes-concentration graduates were more inclined to pursue a residency, this does not explain why so many of the control group participants also were residency trained.

Nonresponse bias is a possible limitation to this survey.²⁶ Only those graduates who were routinely providing diabetes care may have responded to the survey. We attempted to decrease response bias by offering an incentive to respondents.

Self-reporting of activities and ability is associated with bias, and objective measures of frequency and ability would have better identified any differences between the study and control groups.^{27,28} Information regarding time spent providing diabetes care would have been informative. To decrease self-reporting error, an ideal trial also would have included a time-motion study that examined the amount of time that pharmacists spent providing diabetes care to quantify how much time was spent performing the target activities.

The diabetes-concentration graduates probably had more interest in the topic of provision of diabetes care, as evidenced by their completion of the program. This limitation only could have been overcome by randomizing students to the program and to a control group, which was not feasible.

This study did not ask respondents about potential barriers in their practice settings that may have impacted their ability to provide services to patients with diabetes. Plake and colleagues found that, while the provision of diabetes care services was higher than reported in earlier studies, not receiving reimbursement, having a heavy workload, and not having enough time remain the primary barriers cited by pharmacists to providing diabetes care.²⁹

Although there were differences between both institutions' diabetes concentration program, there were no differences in the results for the 2 programs (student performance data not shown). Further studies should determine what affects a diabetes-concentration program has on patient outcomes, pharmacists' job satisfaction, and graduates' marketability. Additionally, methods for training participants in changing practice patterns also should be tested.

CONCLUSION

Pharmacy graduates who completed a diabetes concentration reported a higher level of confidence in their ability to provide diabetes education and diabetes-related care to patients although they did not perform these skills more frequently than graduates who did not complete a

diabetes concentration. Completing a diabetes concentration may increase pharmacy students' knowledge of diabetes but not alter practice patterns of graduates, indicating that more research is needed to determine whether there are other barriers to pharmacists providing diabetes care in practice settings.

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