Title

A Curriculum Review of Diabetes Device Technology Education at Schools/Colleges of Pharmacy in the United States

Incentive Grant Category

Residents and Their Preceptors

Introduction

The first glucose meter introduced in 1971 was available in doctors' offices and hospitals, and only provided an approximated blood glucose reading.[1] Since then, diabetes technology has rapidly evolved with current blood glucose tracking technology giving highly accurate results within seconds, providing seamless blood glucose observations and notifications throughout the day with continuous glucose monitoring (CGM) devices, and integration with insulin pumps and smart insulin pens.[2,3] This diabetes device technology has led to higher or better sense of safety among CGM users while exercising, sleeping, and driving. This includes more motivation and confidence in managing their diabetes while reducing serious hypoglycemia.[4] Diabetes device technology can empower patients to manage their health and provide data that enables shared clinical decision-making with providers.

Access to CGM devices has increased since July 2015 when Dexcom®, one of the largest suppliers of CGMs, removed the Durable Medical Equipment (DME) requirement and allowed their CGM systems to be filled at community pharmacies.[5] This removal took what was often an eight-step, month-long distribution process from a specialized supplier and converted it to a much simpler, four-step process for patients to get their device in as few as 1–2 days from a community pharmacy. With an exponential growth in the use of CGMs from 6% of patients with type 1 diabetes mellitus in 2011 to 38% in 2018, community pharmacies can expect to see the number of CGM devices dispensed increase as insurance coverage also expands.[6] Currently, most Medicare plans cover Dexcom® and Freestyle Libre® devices for select patients, with other patients choosing to pay out-of-pocket for the lower-cost, disposable Libre® sensors.[2] Updated diabetes treatment guidelines also recommend CGMs for lowering A1C and/or reducing hypoglycemia in insulin-dependent adults with type 1 or type 2 diabetes who are not meeting glycemic targets and have evident or unnoticed hypoglycemia episodes. These guidelines support consideration of CGMs for all children and adolescents with type 1 diabetes to improve glucose control regardless of their insulin delivery method.[7] The American Association of Clinical Endocrinologists recommends the use of CGM to improve glycemic control, reduce hypoglycemia, and lower diabetes costs, in addition to their use for all people with diabetes who have severe hypoglycemia or hypoglycemia unawareness.[8]

In a study by Lindsey et al., patients reported concern with "wasting their doctors' time with questions" and were more likely to ask their community pharmacists about medications or devices.[9] Patients also reported feeling a sense of empowerment when seeking care and medical advice at a community pharmacy because the interaction is on the patients' terms since they are initiating the encounter. Pharmacists are also available without an appointment and offer flexibility for interactions on evenings and weekends when most providers are not available. Community pharmacists are well positioned to build trusting patient-provider relationships and acknowledged patients' likelihood to be honest with them during a consultation as a result of this unique relationship.[9]

Recognizing the increased access, availability of insurance coverage, and guideline supported recommendations of CGMs, combined with the relationships patients report with community pharmacists, it is critically important for pharmacists to stay current with available diabetes device technology.

Continuous glucose monitoring reports offer unique information that can be available to patients and providers, along with specialized technological considerations of how to properly use these devices and pair the transmitters with a receiver (i.e. blood glucose meter, smart device, etc.).[2,10] Proper training of pharmacists on diabetes device technology is essential for safe and effective use of these devices, and can start with the education these pharmacists receive while in school.

No studies to date were found analyzing the extent to which diabetes device technology is taught in pharmacy curricula across the United States. If gaps exist in the education of current pharmacy graduates, it could be assumed that similar voids could exist for practicing community pharmacists. Practitioners in other settings have shown that the second most common reason for not managing a patient's diabetes device was a lack of provider experience. Most providers in this study described their proficiency with insulin pumps and CGMs as only having "fundamental awareness" and identified that additional medical expertise is needed in a community to adopt the use of these devices.[11] Provider support and encouragement related to diabetes device technology has also been linked with increased likelihood of patients using these devices.[12]

Overall, pharmacists in the community pharmacy setting are well positioned to serve as experts and support for patients' proper use of diabetes device technology. Proper education related to these devices can start in pharmacy school curricula and extend to continuing education opportunities for licensed pharmacists.

Objectives

The purpose of this study is to quantify the extent to which diabetes device technology is taught in schools/colleges of pharmacy (SCOP) in the United States. The secondary objective is to identify reasons why pharmacy programs may not provide learning opportunities related to diabetes device technology.

Methods

Conceptual Framework

A four-dimensional healthcare curriculum framework was utilized as a tool to develop the survey in this study. This helps health professional educators link educational practice to health policy, workforce, and professional practices in a coherent and reflexive way. The four dimensions are (1) identifying future healthcare practice needs, (2) defining and understanding capabilities, (3) teaching, learning, and assessment, and (4) supporting institutional delivery.[13] The focus of the first dimension is to connect a health professional's practice needs to new and changing workplace demands. With the increased use of diabetes device technology, such as CGMs and insulin pumps, it is important that the curriculum in pharmacy school reflects this shift in community pharmacy practice.[6,14] This shift is also applicable to the second dimension of this new framework, which seeks to define the competencies and capabilities health professionals require in practice. Using the information gathered in the first two dimensions, the third dimension pertains to the design of appropriate learning, teaching, and assessment activities of students within a curriculum.[13] With the third dimension of this new framework in mind, investigators sought to quantify the extent to which diabetes device technology is taught at SCOP throughout the United States.

Survey Design

A cross-sectional study design was used to assess diabetes device technology education at (SCOP) in the United States, with survey items adapted with permission from Lang et al (2009) and Salvati et al (2020). The multiple item survey, developed using the Qualtrics survey platform, was sent via direct email link to respondents in February 2021 to gather information on the availability, structure, and frequency of

diabetes device technology education at their SCOP. The survey was pilot tested by ineligible pharmacists not included in the study prior to distribution.

Survey questions obtained program demographics such as college of pharmacy name, the average class size of the program, years the program has been established, and whether the college of pharmacy is public or private. Demographic information about the respondents was also collected such as their role within the college. Multiple choice questions regarding topics explicitly covered in the curriculum included the following answer choices: yes, no, no but we should, and not sure. There was also a free response question to address any topics covered in the SCOP curricula that were not addressed in the multiple-choice questions. For programs with a gap in their curriculum related to diabetes device technology, multiple choice questions were utilized to identify perceived barriers in developing or maintaining this content and assess the program's desire to include it in their curriculum in the future.

Data Collection and Analysis

Potential respondents were identified via review of the websites of the 143 accredited SCOP in the United States.[15] Investigators identified at least one representative from each program with title or role related to curricular oversight for the SCOP (e.g. Assistant Dean for Learning, or Curricular Development); chair of a curriculum committee, and/or faculty with an identified expertise in diabetes or other metabolic disorders. Identified individuals were sent an individualized survey link, with reminder emails every 2 weeks for total survey collection period of 6 weeks. Quantitative data was reported as descriptive statistics, with obtained from multiple-choice items. Qualitative survey statements were independently coded and categorized by two of the project authors. Following this review, the independently determined categories were compared by the authors, and those with a similar theme or intent by both authors were grouped and represented a final list of narrative survey themes.[16] This study was approved by the Purdue University Institutional Review Board.

Results

The survey was completed by 71 of 223 potential respondents (31.8%), representing 50 (35%) of the accredited SCOP in the United States. Respondent demographics are summarized in Table 1. Of the 71 respondents that completed the survey, 55 identified themselves as being involved with the coordination or teaching of information related to diabetes in their curriculum and were eligible to participate in the remainder of the survey. Fifty-one respondents completed the survey in its entirety (92.7% completion rate), with the highest percentage of respondents teaching diabetes content within their curriculum (44.2%).

A majority of the programs were identified as private institutions (57.4%), with reported average program class sizes as 51-100 students (48.5%), 101-150 students (36.8%), less than 50 students (7.4%), and greater than 150 students (7.4%). Forty-nine programs reported including diabetes device technology within their curriculum (94.2%) but 5.8% of programs either do not include or are unsure if this information is included within their curriculum.

Pharmacy skills labs (26.8%) is the most frequently reported setting in which Doctor of Pharmacy Students are receiving information regarding diabetes device technology, with Table 2 summarizing the settings in which students are receiving this information. Twenty programs (38.5%) reported that students receive information related to diabetes device technology annually. Table 3 summarizes how students are evaluated on their knowledge and skills related to diabetes device technology, with exams (20.3%) and quizzes (21.6%) as the most frequent assessment of knowledge and skills, respectively.

Forty-six programs (90.2%) include information on available blood glucose meters, with 50 (98%) allowing opportunities to practice patient education related to these devices. Thirty-seven programs (72.6%) educate students on available CGMs, with 12 programs (23.5%) indicating they don't provide this content but 100% of them agreeing is be included in their curriculum (Table 4).

Twenty-five programs (49%) identified having barriers or difficulties in developing, maintaining, or providing diabetes device technology information to their students, with crowding in the curriculum (36.6%) as the most frequent issue. Lack of demonstration devices was the frequent (N=16, 40%) qualitative response as to reasons why diabetes device technology was not included in their curriculum.

Discussion

As insurance coverage and accessibility of diabetes devices in the community pharmacy setting increase, organic interactions between patients and pharmacists in the community setting occur more frequently. With the four-dimensional healthcare curriculum framework in mind, it is imperative that SCOP programs meet the demands of the healthcare practice needs.[13] To the knowledge of the authors, this is the first study to examine the extent to which diabetes device education is included in the SCOP curriculum. Identifying gaps in the curriculum on this topic will provide guidance on changes within the curriculum as well as opportunities for continuing education (CE) for practicing pharmacists.

In this study, we asked representatives from each accredited SCOP in the United States to identify what topics related to diabetes device technology included in their curriculum, topics that they do not include but should be including, and barriers to providing education on this topic within their curriculum. We identified that 90.2% of programs include information about available blood glucose meters and 98% allow opportunities to practice patient education on these devices. As the technology becomes more advanced such as CGM systems and insulin pumps, we identified that fewer programs include education on these topics within their curriculum. Interestingly, 100% of programs that do not provide education on available CGM devices do think that their program should be incorporating this topic within their curriculum. Over the years, CGM devices have become increasingly popular in practice and have been recommended for use to lower A1c and/or reduce hypoglycemia in insulin-dependent adults with type 1 or type 2 diabetes.[7,8] With the first dimension of our cited conceptual framework in mind, respondents have identified that due to a shift in guideline recommendations and accessibility of CGM devices in the community setting there is a need to include this topic within the curriculum to better support the changing needs of practice.[6,13,14]

We also identified that when asked about more advanced technology topics such as how to use insulin pumps, sensor augmented insulin pumps, and closed loop CGM/insulin pump systems, less respondents that did not include this topic in their curriculum thought that they should be including it. This could be due to the complexity of the devices and the specialized training that could be necessary to manage a patient on a device such as a sensor augmented or closed loop insulin pump. A study of practitioners in other settings yielded similar results. Providers in this study described their proficiency with the complex devices as only having "fundamental awareness" and identified that due to their lack of experience with diabetes devices, they were less likely to manage a patient's device.[11] Although pharmacists are well positioned to serve as experts and provide support to patient's utilizing these devices, some of the more advanced diabetes devices should be reserved for those providers with specialized training.

Surprisingly, 25 programs identified having barriers or difficulties in developing, maintaining, or providing diabetes device technology information to their students. Crowding in the curriculum and a lack of diabetes device demos were the two most frequently reported barriers for participating programs. The most frequent setting that students receive diabetes device technology education is in a pharmacy skills lab, so without demonstration devices for students to engage in hands on learning, programs may be less likely to include this topic within their curriculum.

In the future, repeated studies in large sample sizes could be beneficial to confirm the results seen in this study. Additionally, there are opportunities available within the curriculum to include information about diabetes device technology, especially available CGM devices. There is also an opportunity for manufacturers of these devices to partner with SCOP programs to provide demonstration devices for programs to eliminate a barrier to providing this education to their students. With this identified gap in the SCOP curriculum, it could be assumed that practicing pharmacists also do not have the appropriate background to provide education on these devices. Pharmacist continuing education (CE) opportunities may help bridge this gap in practice.

Limitations

The primary limitation of this study was the low survey response rate (31.8%). The low survey response rate could likely be contributed to the time of year that the survey was sent to participants. February is often a busy time for those in academia as they are beginning the spring semester. Additionally, the challenges of COVID-19 and adjusting to hybrid learning could have contributed to a lower than expected survey response rate. Despite a low survey response rate, we were able to obtain valuable results that can help identify needs within the SCOP curriculum moving forward. Future research including more SCOP programs could be warranted to validate these results.

Conclusion

A majority of programs are providing education on blood glucose meters and opportunities to practice providing patient education. Opportunities exist within the SCOP curriculum to provide diabetes device education, especially on CGM devices as 100% of the programs that do not include this topic in their curriculum believe that they should. Additionally, obtaining training demonstration devices and dedicating time in the curriculum to provide diabetes device education can help bridge the gap between practice and the SCOP curriculum.

Timetable

Jun 2021	• Manuscript submission to American Journal of Pharmacy Education (AJPE)

Evaluation Strategy

Research project progress will be evaluated by peer pharmacy residents, pharmacy fellows, and residency research mentors and advisors on a biweekly basis. PGY1 Community Pharmacy Residents of programs partnered with Purdue University participate in a structured Research Project Development Program created and led by **Dr. Margie Synder, PharmD, MPH, FCCP**. Dr. Synder is an Associate Professor at the Purdue University College of Pharmacy and Co-Director of Community Pharmacy Programs, a role in which she founded and directs the Medication Safety Research Network of Indiana (Rx-SafeNet), a statewide practice-based research network of approximately 140 community pharmacies. Dr. Snyder has published over 45 peer-reviewed journal articles and mentored over 45 residents and fellows on research, many of which have received grant funding and/or publications in peer-reviewed journals. Dr. Synder's total extramural funding support to date equals approximately $2.5 million as Principal Investigator and

exceeds $1 million as Co-Investigator. Dr. Synder serves as a temporary reviewer for the NIH HSOD and AHRQ HCRT study sections. She has been named an outstanding/top reviewer for several major pharmacy journals including the *Journal of the American Pharmacists Association, Pharmacotherapy, and Research in Social and Administrative Pharmacy.*

The Research Project Development Program is also co-facilitated by Dr. Snyder's research fellow, **Dr. Molly Nichols, PharmD**. Dr. Nichols successfully completed the research series as a PGY-1 Resident for Walgreens/Purdue University in 2019 prior to becoming Dr. Snyder's research fellow. Molly has published 1 peer-reviewed journal article in the *Journal of American Pharmacists Association* and has served as a peer reviewer for the journal. As a PGY-1 resident, Molly received a $1,000 American Pharmacists Association Foundation Incentive Grant for her research project and was awarded the Nicholas G. Popovich Excellence in Teaching award from the Indiana Pharmacy Teaching Certificate program.

Dr. Zach Weber, PharmD, BCPS, BCACP, CDCES, FASHP is serving as the primary research mentor and Principle Investigator on this project. Dr. Weber is the Director of Interprofessional Education and a Clinical Associate Professor of Pharmacy Practice for Purdue College of Pharmacy, as well as the Assistant Dean for Education for the Indiana University Interprofessional Practice and Education Center. He has written over 21 peer-reviewed publications and 4 book chapters and has served as the principle- or co-investigator on over $10,000,000 worth of extramural funding. He serves as a reviewer for several major journals, including the Journal of Interprofessional Education and Practice, American Journal of Health System Pharmacy, and the American Journal of Pharmaceutical Education. He has also mentored at least 13 pharmacy residents and 15 pharmacy students, many of whom have presented at national meetings and published in peer reviewed journals.

Dr. Stephanie Arnett, PharmD, CDE, is serving as research site supervisor with Walgreen Co. and Co-Investigator on this project. Dr. Arnett is the Residency Program Director for the Walgreens/Purdue PGY1 program where she has directed and mentored over 7 residents. She has worked in community pharmacy practice for over 17 years, 12 years as a pharmacist. Currently focusing in Specialty Pharmacy in the community setting, she is an Adjunct Clinical Assistant Professor of Pharmacy Practice and Regional Faculty Coordinator for Purdue University College of Pharmacy. The 2017-2018 and 2019-2020 resident of the Walgreens/Purdue program successfully published their research in the *Journal of American Pharmacists Association* under mentorship of Dr. Arnett.

Areas of evaluation will include IRB protocol compliance via protocol checklist, manuscript draft review, resolution steps, and identification of professional presentation opportunities including poster presentations.

Budget

Category	Item	Budget
Participant Incentives	$10 Starbucks Gift card x22	$220
		Total: $220 ($780 remaining funds)

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