

ORIGINAL RESEARCH

Implementation of a Continuous Glucose Monitoring User Wear Experience in a Longitudinal Primary Care Clerkship

Kathryn P. Lin, PharmD, BCACP¹, Morgan P. Stewart, PharmD, BCACP, BC-ADM¹, April Hinds, PharmD, BCACP, CDCES², Catherine Nghiem, PharmD¹, Jennifer Cavin, MD³ 

¹ College of Pharmacy, The University of Texas at Austin, ² Clinical Pharmacy, Community Care, ³ Population Health, The University of Texas at Austin

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Introduction

Continuous glucose monitors (CGMs) are increasingly central to diabetes care. In pharmacy and graduate medical education, CGM wear experiences improve empathy and counseling confidence; evidence in undergraduate medical education is lacking.

Objective

This study evaluated the impact of a CGM wear experience for second-year medical students during orientation for a longitudinal primary care clerkship.

Methods

The orientation, facilitated by clinical pharmacists, included a didactic lecture and skills laboratory on insulin dosing, administration, and CGM fundamentals. Students applied a CGM sensor to wear for up to 10 days. Pre- and post-intervention surveys assessed demographics, CGM-related confidence, empathy toward people with CGMs, and practice-changing intent. Surveys were administered one week before and 12 days after the lab and results were analyzed using student t-tests.

Results

Of 50 enrolled students, 37 completed the pre-survey and 19 completed the post-survey. Baseline demographics demonstrated limited prior CGM experience (13.5%). Empathy scores were high at baseline, with higher ratings for expected healthcare professional empathy compared to self-reported empathy (6.25 vs. 4.10, $p < 0.001$). Overall empathy significantly increased following the intervention (+1.25, $p < 0.001$). Confidence across CGM competencies significantly improved, with an overall increase of 3.07 points ($p < 0.001$), particularly in CGM application, data interpretation, and counseling on access. Post-survey responses demonstrated strong practice-changing intent, including plans to incorporate CGMs into future practice and improved understanding of CGM-informed decision-making (mean scores $> 6.3/7$).

Conclusion

A CGM wear experience for undergraduate medical students improved empathy for patients wearing CGMs, increased confidence in CGM-use and counseling, and led to a high number of participants planning to incorporate CGMs into their practice. Findings will inform strategies for early integration of wearable diabetes technology into medical curricula.

BACKGROUND

Continuous glucose monitoring (CGM) systems have become central to the treatment of diabetes given the many clinical benefits such as lowered hemoglobin A1C values, improved quality of life, and reduced incidence of hypoglycemia.¹ Furthermore, expanded indications of use in the last few years and emerging benefits for patients not using insulin therapy have increased the potential number of people who may benefit.^{2,3} However, while CGM uptake and prescribing has been increasing in the last few years, significant barriers to patient access persist including inadvertent prescriber gatekeeping due to system, interpersonal, and individual-level factors.⁴

The Association of American Medical Colleges (AAMC) has issued an emerging area of medicine competency focused on telehealth and virtual care, responding to a shifting landscape of the use of technology to deliver health care, which includes remote patient monitoring such as CGMs.⁵ Furthermore, development of empathy in patient care skills is integral to medical school education, with published foundational competencies highlighting the need to incorporate patient context and experiences in practice.⁶ Incorporating student experience with technology innovations aligns with Dell Medical Schools Educational program objectives, which emphasizes patient centered care and the integration of patient context and lived experience into clinical decision making

Diabetes technology is a rapidly growing aspect of primary care management of diabetes, as historically CGM was focused within specialty settings.⁷ In pharmacy and graduate medical education, CGM wear experiences improve knowledge, confidence, empathy and counseling confidence.⁸⁻¹² However, the landscape of formal training on diabetes technology in medical school education is not yet fully described in the literature. One study of twenty volunteers from a student-run free clinic, which included sixteen medical students at various stages of their training, found that a 3-part interactive training with a 2-week user wear experience improved participant confidence, knowledge, and attitudes toward CGMs.¹³ However, this study was limited to engaged volunteers in an underserved setting. Another small study of medical and dental students used a CGM wear experience to enhance nutrition education.¹⁴ This study is the first of its kind to evaluate the impact of a CGM wear experience in a general medical student population, with dual focus on skill development and empathy outcomes.

METHODS

During orientation for a longitudinal primary care clerkship through the University of Texas at Austin Dell Medical School, second-year medical students underwent an “Insulin & CGM Boot Camp” facilitated by clinical pharmacists from CommUnityCare Health Centers. The first component of this experience was a didactic lecture that discussed the role of CGMs in self-monitoring of blood glucose for patients with diabetes. This included information about the physical mechanism of CGMs, the necessary equipment associated with CGMs, application of CGM sensors, and interpretation of CGM reports.

For the second portion of this experience, students took part in a skills laboratory during which they were invited to install and wear a Dexcom G7 CGM sensor for 10 days. Dexcom G7 CGM sensors were obtained via samples ordered and sponsored by an endocrinologist from CommUnityCare Health Centers with which the faculty members were affiliated. Since no CGM readers were provided, subjects were instructed to download and connect their sensors to the Dexcom G7 smartphone app in order to monitor their blood glucose during the study period.

To measure the change in participants’ knowledge, empathy, and confidence regarding CGMs, they were requested to fill out a 10-item, optional pre- and post-survey. Students completed the pre-survey before installing the CGM sensor and the post-survey 12 days after attending the lab. All surveys were self-completed by subjects via Qualtrics® (Provo, Utah). The pre-survey collected information related to participant demographics. To assess students’ attitudes and feelings towards patients with CGMs, an 8-item empathy scale was created using a modified and shortened version of the validated Kiersma-Chen Empathy Scale.¹⁵ Items were selected to reduce redundancy, minimize survey fatigue, and ensure direct relevance to the module content. A 7-point Likert scale rating from 0 = unnecessary to 6 = extremely necessary was assessed for each question, with higher scores indicating higher empathy. To evaluate subjects’ confidence in making clinical decisions and educating patients regarding CGMs, they rated their self-perceived ability using a 7-point Likert scale from 0 = not confident and 6 = extremely confident. In addition, the post-survey included three items about participants’ satisfaction with the CGM wear experience.

Descriptive statistics and a paired, students’ t-test were used to analyze changes in pre- to post-scores for each item. Students were included in data analysis if they answered 100% of the questions on either the pre- or post-survey.

This study was approved by the University of Texas at Austin Institutional Review Board.

RESULTS

Of 50 enrolled students, 37 completed the pre-survey and about 40 attended the lab. Nineteen students completed the post-survey but only 17 of those had also completed the pre-survey for pairing of the scores. Full collected data is presented in the tables and text below as paired t-tests indicated the same trends. Baseline demographics included in [Table 1](#) demonstrate limited prior CGM experience (13.52%).

Empathy

Empathy scores were generally high at baseline, higher when describing that healthcare professionals should be able to demonstrate empathy vs. describing their own empathy (mean 6.25 vs. 4.10, $p < 0.001$). ([Table 2](#)) Overall, empathy improved (+1.25, $p < 0.001$). When describing healthcare professional empathy, there was just a slight, yet still statistically significant increase (0.36, $p < 0.001$). When describing their own empathy, there was a more modest increase of 2.08 points ($p < 0.001$).

Confidence

Pre-survey shows a low to moderate self-rated confidence across competencies, with the lowest in data interpretation, CGM application and set-up counseling, and describing accessibility. ([Table 3](#)) Post surveys demonstrate a strong increase in confidence with an overall change of 3.07 ($p < 0.001$).

Practice-Changing Language

Practice-change language reported on post-surveys was high as a result of this activity. On a scale of Strongly disagree (1) to Strongly Agree (7), students indicated they intend to incorporate CGMs in the care of patients with diabetes when they are in clinical practice (6.33), the activity helped them learn how to use a CGM (6.61), the activity increased their likelihood to recommend a CGM to patients (6.33), and the activity improved their understanding of how CGM data informs treatment decisions (6.50).

DISCUSSION

This novel study design evaluated empathy and understanding with regard to CGM users from a personal and healthcare perspective in medical students who had limited baseline exposure to CGM use prior to the study (5.4%). This study also assessed healthcare professionals' confidence level regarding CGM knowledge and application.

Baseline empathy scores regarding the viewpoint of a healthcare professional were high, so change after the intervention, while still statistically significant, was slight. This implies medical students recognize the importance of expressing empathy as a healthcare professional, which may not be limited to

Table 1. Baseline Demographics

Demographic	Pre-Survey, n (%) (n=37)	Post-Survey, n (%) (n=19)
Age (y)		
18-24	28 (75.68)	15 (78.95)
25-32	9 (24.32)	4 (21.05)
Gender		
Male	14 (37.84)	7 (36.84)
Female	23 (62.16)	12 (63.16)
Non-Binary/Non-Conforming	0 (0)	0 (0)
Ethnicity		
Asian	14 (37.84)	5 (26.32)
White	12 (32.43)	7 (36.84)
Hispanic, Latino/Latina/LatinX, or Spanish Origin	4 (10.81)	3 (15.79)
Middle Eastern or North African	3 (8.11)	2 (10.53)
Black or African American	3 (8.11)	1 (5.26)
Mixed Response	1 (2.70)	1 (5.56)
American Indian or Alaska Native	0 (0)	0 (0)
Prior experience using or counseling someone to use a CGM		
Yes	2 (5.41)	Not asked
No	32 (86.49)	
Maybe	3 (8.11)	

Table 2. Change in mean empathy pre-survey and post-survey

Section 1: How necessary is it for healthcare professionals to be able to.... *	Pre (n=37)	Post (n=19)	Change	P- Value
1. Comprehend patients using continuous glucose monitors (CGMs) experiences	6.24	6.53	0.29	0.090
2. Express an understanding of patients using CGM's feelings	6.41	6.63	0.22	0.141
3. Value patients who use CGM's point of view	6.3	6.79	0.49	0.006
4. View the world for patients taking CGM's perspective	6.05	6.47	0.42	0.050
Section 1 Overall	6.25	6.61	0.36	<0.001
Section 2: I am able to... †				
5. Comprehend patients using CGM's experiences	3.57	6.05	2.48	<0.001
6. Express an understanding of patients using CGM's feelings	4.16	6.16	2.00	<0.001
7. Value patients who use CGM's point of view	5.22	6.37	0.94	<0.001
8. View the world from patients taking CGM's perspective	3.46	6.37	2.91	<0.001
Section 2 Overall:	4.10	6.24	2.08	<0.001
Section 1 and 2 Overall	5.18	6.43	1.25	<0.001

*Questions were assessed using a 7-point rating where 1 = unnecessary and 7 = extremely necessary

†Questions were assessed with a 7-point rating where 1 = does not describe me and 7 = describes me extremely well

patients using CGM devices compared to other individuals. Personal empathy scores significantly improved regarding CGM user experience, feelings, perspective, and valuing the user's perspective. Increased personal empathy scores will help study participants to be more understanding of CGM users in the practice setting and may lead to improved patient-provider satisfaction.

Participants demonstrated a statistically significant mean change in confidence in regard to assessing candidates for CGM appropriateness, including pros/cons of CGMs, overall knowledge of AGP report utilization, interpretation and application, ability to counsel on CGM use, and explaining access for CGMs. This demonstrates the value in self-application

Table 3. Change in mean confidence pre-survey and post-survey

Rate each of the following statements regarding your confidence level*	Pre (n=37)	Post (n=19)	Change	P-Value
1. Explain the pros/cons of CGMs	2.89	5.47	2.58	<0.001
2. Identify patients who would be a good candidate for a CGM	2.84	5.16	2.32	<0.001
3. Describe the data on the AGP	2.19	5.53	3.34	<0.001
4. Identify the glucose goals of AGP	2.65	5.79	3.14	<0.001
5. Interpret the AGP to develop a patient-specific diabetes plan	2.41	5.58	3.17	<0.001
6. Counsel a patient on application and set up of the CGM	2.30	6.32	4.02	<0.001
7. Describe accessibility for CGMs	2.35	5.26	2.91	<0.001
Overall	2.52	5.59	3.07	<0.001

*Questions were assessed using a 7-point rating where 1 = not confident at all and 7 = extremely confident

Abbreviations: CGM: Continuous glucose monitors; AGP: ambulatory glucose profile

of CGM devices for healthcare professionals to significantly improve their ability to discuss, recommend, and understand CGM devices. This may help healthcare professionals to increase the utilization of CGMs in their own practice settings and better assist new or current CGM users. This finding is consistent with previous reports and calls to action that support early immersion in health wearables in undergraduate medical education.¹⁴

Limitations

Limitations include low post-survey completion rates compared to pre-survey completion rates. In addition, some participants that completed the post-survey (n=2) did not complete the pre-survey so the researchers were unable to pair these participants to the pre-survey results. The medical students in the survey acknowledged the significant need for empathy towards CGM users in the pre-survey, which suggested ceiling effects. This may have influenced the ability to detect change in the post-survey empathy score, resulting in a low change in mean empathy score (0.36).

CONCLUSION

Integration of a CGM user-wear experience for second-year medical students can enhance confidence, knowledge, and empathy. This project offers a replicable, low-cost model for integrating wearable diabetes technology into medical curricula.

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