

# Current Practice Patterns and Identified Educational Needs of Health Care Providers in Managing Patients With Type 2 Diabetes

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The prevalence of diabetes is increasing at an alarming rate, and its incidence is nearing epidemic levels across a variety of populations. Diabetes affects nearly 25.6 million people in the United States, or 8.3% of the population. Type 2 diabetes accounts for ~90–95% of all cases of diabetes.<sup>1</sup> Each year, ~1.3 million people in the United States are newly diagnosed with the disease.<sup>2</sup> An analysis of data from the National Health and Nutrition Examination Survey showed that the prevalence of type 2 diabetes increased significantly, from 5.1% during the period from 1988 to 1994 to 6.5% from 1999 to 2002.<sup>3</sup> A more recent study estimated that the prevalence of diagnosed type 2 diabetes rose to 7.8% between 2003 to 2006.<sup>4</sup>

Advancing age, obesity, and lack of physical activity all contribute to the risk of developing type 2 diabetes. The disease is more prevalent in women who have had gestational diabetes, in individuals with hypertension or dyslipidemia, and in certain racial and ethnic subgroups such as African Americans and Native Americans. Diabetes is also often associated with a strong genetic predisposition, although the genetics of this disease are complex and not clearly understood.<sup>5</sup>

Management of type 2 diabetes has evolved tremendously in the past decade. The addition of new insulin

formulations such as insulin analogs and the incorporation of new classes of agents into treatment regimens (e.g., glucagon-like peptide-1 [GLP-1] receptor agonists, dipeptidyl peptidase-4 [DPP-4] inhibitors, dopamine agonists, bile acid sequestrants, and amylin mimetics) have brought the number of drug classes available for treatment to 11.<sup>6,7</sup> Diabetes management can be challenging because of the complex nature of the disease itself, the multitude of therapeutic options available, and multiple provider types involved in the continuum of care.

Diabetes care providers may include endocrinologists, primary care providers (PCPs), including family medicine physicians, internists, physician assistants (PAs), and nurse practitioners (NPs), along with other allied health care providers

(HCPs) such as certified diabetes educators (CDEs) and hospital- and retail-based pharmacists. Identifying and understanding the management choices these providers make for their patients with type 2 diabetes, as well as their perceptions of management, can provide valuable insights into their educational needs with regard to providing care for patients with this disease. This study was conducted to gain a better understanding of existing practice patterns and educational gaps among this group of HCPs.

## Study Methods

The study centered on survey instruments that were developed for each of the provider types included in the study: endocrinologists, family medicine physicians, internists, NPs, PAs, CDEs, and retail- and hospital-based pharmacists.<sup>8</sup> Although tailored to each provider type, the survey versions were made as similar as possible to allow for meaningful comparison of the results. Each version contained case vignettes of patients with type 2 diabetes whose blood glucose remains uncontrolled despite therapy (i.e., for endocrinologists, patients whose blood glucose remains uncontrolled with two or three oral antidiabetic medications (OADs); for PCPs and CDEs, patients whose diabetes remains uncontrolled on one or two OADs; and for pharmacists, patients

## IN BRIEF

This article describes the results of surveys distributed to a national audience of specialty, primary care, and allied health care providers (HCPs) who manage patients with type 2 diabetes on a daily basis. The results provide insights into current educational needs and can inform the design and development of education programs for these HCPs.

during hospitalization and post-discharge. The survey also included standardized questions across the different versions regarding guideline familiarity; knowledge of different insulin formulations, GLP-1 receptor agonists, and DPP-4 inhibitors; referral patterns; and barriers to management. Demographic questions were also included. Attitudinal issues were assessed using a 10-point Likert rating scale.

After drafts of the surveys were developed, each was pilot-tested with their respective target groups to ensure clarity and accuracy of the case vignettes and questions. The surveys were distributed to a nationally representative random sample of U.S. HCPs by e-mail and fax during June and July 2011. Inclusion criteria included: 1) must be a practicing provider in the target provider type and 2) must see at least one patient per week with type 2 diabetes.

Respondents received a small honorarium (\$50 gift card) for completing the survey.

Responses were collected using an online platform and recorded as aggregate data for analysis. All statistical analyses were completed with PASW Statistics 19 (SPSS, Chicago, Ill.). Descriptive statistics were used to summarize survey responses. Chi-square and *t* test analyses were used to compare responses among clinician cohorts. Some percentages presented do not total to 100% because of rounding.

**Study Results**

A total of 974 surveys were returned, including 150 from endocrinologists, 150 from family medicine physicians, 151 from internists, 125 from NPs, 126 from PAs, 121 from CDEs, 100 from retail-based pharmacists, and 51 from hospital-based pharmacists. Response rates varied among HCPs,

with the highest response rate being CDEs (68%) and the lowest being hospital-based pharmacists (17%). Responses rates from the other provider types were endocrinologists, 36%; family medicine physicians, 30%; internists, 30%; NPs, 36%; PAs, 42%; and retail-based pharmacists, 33%. The overall response rate was 37%. The demographics of each sample, along with response rates, can be found in Table 1.

**Overall perceptions and attitudes regarding type 2 diabetes management**

*Awareness of and opinions about guidelines.* Familiarity with diabetes guidelines from the American Diabetes Association (ADA) and the American Association of Clinical Endocrinologists (AACE) was found to be much higher among endocrinologists and CDEs (~ 70% perceive themselves as “very familiar” [rated

**Table 1. Survey Responder Demographics**

	<b>ENDOs (n = 150)</b>	<b>FPs (n = 150)</b>	<b>IMs (n = 151)</b>	<b>PAs (n = 126)</b>	<b>NPs (n = 125)</b>	<b>R-PHs (n = 100)</b>	<b>H-PHs (n = 51)</b>	<b>CDEs (n = 121)</b>
<b>Years in practice (mean [SD])</b>	24 (10)	23 (10)	24 (10)	12 (8)	12 (6)	20 (11)	16 (10)	15 (7)
<b>Patients seen/week (mean [SD])</b>	103 (53)	112 (42)	112 (44)	99 (50)	79 (37)	–	–	28 (24)
<b>Patients with type 2 diabetes seen/week (mean [SD])</b>	59 (16)	30 (17)	39 (20)	31 (18)	26 (15)	–	–	–
<b>Practice location (%)</b>								
<b>Urban</b>	44.7	20.7	39.7	31.7	28.8	30.0	51.0	44.6
<b>Suburban</b>	50.0	54.7	53.0	42.1	32.8	44.0	27.5	39.7
<b>Rural</b>	5.3	24.7	7.3	26.2	38.4	26.0	21.6	15.7
<b>Present employment (%)</b>								
<b>Sole practice</b>	28.7	29.0	31.1	29.4	14.4	–	–	–
<b>Group practice</b>	59.3	61.3	56.3	52.4	59.2	–	–	–
<b>Medical school</b>	4.7	2.0	2.0	0.8	1.6	–	–	–
<b>HMO</b>	1.3	2.0	1.3	1.6	–	–	–	–
<b>Nongovernment hospital</b>	2.0	3.3	6.0	3.2	4.8	–	–	–
<b>Government</b>	2.7	1.3	3.3	6.3	7.2	–	–	–
<b>Other</b>	1.3	0.7	–	6.3	12.8	–	–	–
<b>Response rate (%)</b>	36.3	30.0	30.0	41.9	36.2	33.3	17.0	67.5

*ENDO, endocrinologist; FP, family medicine physician; HMO, health maintenance organization; H-PH, hospital-based pharmacist; IM, internal medicine physician; R-PH, retail-based pharmacist.*

as 8, 9, or 10 on a 10-point scale of familiarity with ADA guidelines] than among PCPs and either type of pharmacists (< 40% were very familiar with ADA guidelines). All groups with the exception of hospital pharmacists were more familiar with ADA guidelines than with AACE guidelines (the percentage who were very familiar with ADA and AACE guidelines, respectively, were endocrinologists, 70 and 65%; CDEs, 71 and 65%; internists, 34 and 30%; family practitioners, 33 and 19%; NPs, 38 and 26%; PAs, 34 and 23%; hospital pharmacists, 8 and 8%; and retail pharmacists, 8 and 7%).

Approximately 80% of all clinicians, on average, said they “agree” or “somewhat agree” with guideline recommendations regarding 1) the importance of carbohydrate monitoring, 2) quarterly A1C testing in patients whose therapy has changed or who are not meeting glycemic goals, 3) treating systolic blood pressure to < 130 mmHg, and 4) setting an LDL cholesterol goal of < 100 mg/dl for patients with overt cardiovascular disease.

**Comfort level with and opinions about different insulin regimens.** In using different insulin formulations, PCPs and retail-based pharmacists were most comfortable using long-acting basal insulin analogs (~ 75% of PCPs and 55% of retail-based pharmacists indicated that they were “very comfortable” with this regimen) but less comfortable using a basal-bolus insulin regimen (PCPs ~ 64%, retail-based pharmacists 40%) and were even less comfortable using pre-mixed human (PCPs ~ 54%, retail-based pharmacists 39%) or analog insulins (PCPs ~ 53%, retail-based pharmacists 40%) or NPH insulin alone (PCPs ~ 48%, retail-based pharmacists 43%) CDEs and hospital-based pharmacists were equally comfortable with long-acting once-daily basal insulin and basal-bolus therapy

(97% and 49% for both regimens, respectively) and less so with the other insulin types (pre-mixed human: CDE 67%, hospital pharmacists 39%; analog insulins: CDE 68%, hospital pharmacists 40%; NPH insulin alone: CDE 73%, hospital pharmacists 31%).

Regarding opinions about analog and human insulins, 80% of endocrinologists and 78% of CDEs indicated that they “agree” or “somewhat agree” with the incorrect statement that analog insulins are more effective than human insulins, and the majority (77% of endocrinologists and 60% of CDEs) said they consider analog insulins to be safer. For PCPs and both types of pharmacists, approximately half of the respondents agreed with both statements.

**Awareness of and opinions about incretin therapy.** Almost 30% of PCPs and retail-based pharmacists indicated that they “agree” or “somewhat agree” with the incorrect statement that DPP-4 inhibitors are more effective than GLP-1 receptor agonists. However, far fewer hospital-based pharmacists (20%), CDEs (13%), or endocrinologists (9%) agreed with this statement. Only in the endocrinology and CDE groups did a majority of respondents indicate that they fully understand the difference in effectiveness between GLP-1 receptor agonists and DPP-4 inhibitors (94 and 63%, respectively, marking “agree” or “somewhat agree” with stated differences).

Knowledge of incretins’ mechanism of action was also assessed. Most endocrinologists (89%) and CDEs (67%) identified correctly that “stimulation of insulin release from  $\beta$ -cells of the pancreas in a glucose-dependent manner” was the primary mechanism of GLP-1 receptor agonists in reducing glucose levels, whereas the other groups seemed less knowledgeable (internists, 61%; hospital-based pharmacists, 51%; PAs, 41%; family medicine physicians and

NPs, 39%). Knowledge of DPP-4 inhibitors’ primary mechanism of inhibiting the breakdown of GLP-1 was lower in general (endocrinologists, 73%; CDEs, 48%; internists, 40%; hospital- and retail-based pharmacists, 33%; family medicine physicians, 29%; PAs, 21%; and NPs, 13%).

**Knowledge of appropriate reasons for referral.** Referral by HCPs to endocrinologists or CDEs was assessed under various clinical situations. Referral to an endocrinologist by a PCP was assessed for the following patient circumstances: 1) consideration of an insulin pump, 2) recurrent hypoglycemia and inability to get blood glucose levels to goal, 3) presence of multiple comorbidities, and 4) need to start insulin therapy. PCPs were most likely (> 80%) to refer patients to an endocrinologist when considering an insulin pump, followed by situations involving recurrent hypoglycemia (family medicine physicians, 50%; internists, 59%; PAs, 71%; NPs, 67%) and in cases in which patients present with comorbidities (family medicine physicians, 19%; internists, 25%; PAs, 37%; NPs, 38%). PCPs were least likely (< 20%) to refer patients to endocrinologists who need to start insulin therapy.

In addition, patterns for referrals to CDEs by endocrinologists and PCPs were assessed under the following clinical situations: 1) if there are complex dietary issues from other medical problems, 2) at diagnosis, 3) if carbohydrate counting is needed, 4) if patients have difficulty losing weight, and 5) if patients are initiating an injectable therapy. Although > 50% of each group indicated that they would refer patients to a CDE in every circumstance presented, there was no circumstance listed for which > 82% of any of the five groups would refer patients. The circumstance most likely to trigger referral to a CDE

**Table 2. Endocrinologist Management of a Patient With Uncontrolled Type 2 Diabetes**

Case and Question	Options	Endocrinologists' Responses (%) (n = 150)
<p>Case 1: A 49-year-old woman diagnosed with type 2 diabetes 9 months ago who is obese, on maximal doses of metformin and glimepiride, and has an A1C of 8.9%.</p> <p>Q: What would you do next to manage this patient's diabetes? (select only one)</p>	<ul style="list-style-type: none"> <li>• Add a GLP-1 receptor agonist</li> <li>• Add insulin</li> <li>• Add a DPP-4 inhibitor</li> <li>• Add a TZD</li> <li>• Other</li> </ul>	<p>59.3</p> <p>27.3</p> <p>6.0</p> <p>3.3</p> <p>4.0</p>
<p>Case 2: A 55-year-old obese man diagnosed with type 2 diabetes 10 years ago, who has an A1C of 8.3% on metformin 1,000 mg twice daily, pioglitazone 45 mg/day, and sitagliptin 100 mg/day with no hypoglycemia.</p> <p>Q: What is your next step in managing the patient's diabetes? (select only one)</p>	<ul style="list-style-type: none"> <li>• Stop DPP-4 and add a GLP-1 receptor agonist</li> <li>• Stop DPP-4 inhibitor and start a basal insulin analog</li> <li>• Stop DPP-4 inhibitor and start bedtime NPH insulin</li> <li>• Stop DPP-4 inhibitor and add a sulfonylurea</li> <li>• Other</li> </ul>	<p>54.0</p> <p>36.6</p> <p>4.7</p> <p>1.3</p> <p>3.4</p>

among all five groups was the presence of complex dietary issues; the circumstance least likely to trigger referral to a CDE was when patients need to initiate an injectable therapy. Endocrinologists were most likely to refer patients to a CDE at diagnosis (79%), whereas internists were the least likely to do so (61%) of all the PCPs surveyed. From the CDE perspective, at least 96% of CDEs recommended referral to a CDE for all of the circumstances listed, with the exception of “if patients have difficulty losing weight,” for which 87% recommended referral to a CDE.

**Knowledge of barriers to diabetes management.** With regard to cultural barriers confronted in managing patients with type 2 diabetes, all groups identified either high-carbohydrate diets or language differences as barriers that most impede patient care. The most-cited barriers impeding communication with patients about their type 2 diabetes included “language differences,” “time constraints,” “patients’ understanding of the disease,” and “patients’ knowledge level.” “Time constraints” was the primary barrier that impeded communication with other providers.

**Endocrinologist management of patients with uncontrolled type 2 diabetes**

The results of the treatment selections made by endocrinologists for two different patient scenarios are presented in Table 2. Most endocrinologists (59%) indicated that they would recommend adding a GLP-1 receptor agonist to the regimen of an obese patient with type 2 diabetes whose A1C remains at 8.9% despite maximal doses of metformin and glimepiride; 27% said they would add insulin.

Endocrinologists were also more likely (54%) to add a GLP-1 receptor agonist after stopping DPP-4 inhibitor therapy for an obese patient with type 2 diabetes whose A1C remains at 8.3% while taking 1,000 mg twice daily of metformin, 100 mg/day of sitagliptin, and 45 mg/day of pioglitazone than to initiate basal insulin analog therapy (37%). Most endocrinologists (51%) set an A1C goal of < 7.0% for this patient; 43% set a goal of < 6.5%.

**PCP and CDE recommendations for patients with uncontrolled type 2 diabetes**

Treatment selections and recommendations made by PCPs and CDEs are

presented in Table 3. Providers chose between adding a GLP-1 receptor agonist, insulin, a DPP-4 inhibitor, or a sulfonylurea to intensify therapy for an obese patient whose A1C remains at 8.7% while taking 1,000 mg twice daily of metformin and 45 mg/day of pioglitazone. Although PCPs were divided with regard to their therapy selections, there was more agreement among CDEs, who were most likely to add a GLP-1 receptor agonist to the regimen (42%).

In setting an A1C goal for this patient, PCPs and CDEs were most likely to set a goal of < 7.0% (family medicine physicians, 59%; internists, 50%; NPs, 50%; PAs, 48%; CDEs 69%), followed by a goal of < 6.5% (family medicine physicians, 31%; internists, 42%; NPs, 32%; PAs, 34%; CDEs, 24%).

Recommendations varied for an overweight patient whose A1C remains at 8.0% after having her metformin increased from 500 mg twice daily to 500 mg three times daily. Most likely additions recommended among PCPs included a sulfonylurea (PAs, 33%; NPs, 26%; family practice physicians, 25%) and a DPP-4 inhibitor (internists,

**Table 3. PCP and CDE Management of a Patient With Uncontrolled Type 2 Diabetes**

Case and Question	Options	Responses (%)				
		FPs (n = 150)	IMs (n = 151)	PAs (n = 126)	NPs (n = 125)	CDEs (n = 121)
Case 1: A 55-year-old obese man diagnosed with type 2 diabetes 10 years ago who has an A1C of 8.7% and fasting glucose levels of 110–170 mg/dl on metformin 1,000 mg twice daily and pioglitazone 45 mg daily. Q: What is your next step in managing the patient’s diabetes? (select only one)	• Add a GLP-1 receptor agonist	29.3	27.2	28.6	24.0	42.1
	• Add insulin	24.7	29.8	23.0	28.0	24.8
	• Add a DPP-4 inhibitor	25.3	26.5	19.8	22.4	18.2
	• Add a sulfonylurea	19.3	15.9	28.6	20.0	9.9
Case 2: A 49-year-old woman diagnosed with type 2 diabetes 9 months ago who is overweight and has an A1C of 8.0% on metformin 500 mg three times daily and needs treatment intensified. Q: What would you do next to manage this patient’s diabetes? (select only one)	• Add a GLP-1 receptor agonist	9.3	8.6	7.1	8.8	25.6
	• Add insulin	12.7	17.2	14.3	16.0	18.2
	• Add a DPP-4 inhibitor	20.7	35.1	19.0	22.4	25.6
	• Add a TZD	22.7	19.2	23.0	18.4	10.7
	• Add sulfonylurea	24.7	16.6	33.3	26.4	15.7
	• Other	10.0	3.3	3.2	8.0	4.1

FP, family medicine physician; IM, internal medicine physician.

35%). CDEs were equally likely to recommend either a GLP-1 receptor agonist (26%) or a DPP-4 inhibitor (26%); < 10% of PCPs indicated that they would recommend a GLP-1 receptor agonist for this overweight patient.

**Pharmacist management of hospitalized and discharged patients with type 2 diabetes**

Pharmacists’ insulin recommendations for a hospitalized patient are summarized in Table 4. The survey for hospital-based pharmacists focused on management of patients during hospitalization, whereas the survey for retail-based pharmacists included management of patients after hospital discharge and focused on retail-based pharmacists’ awareness and familiarity with side effects and other characteristics of diabetes therapies.

In selecting an A1C goal for patients at discharge, most retail- and hospital-based pharmacists set

a goal of < 7.0% or 6.5%, in agreement with guidelines. Of those not setting guideline-based goals, 26% of retail-based pharmacists and 20% of hospital-based pharmacists set a too-stringent goal (< 6.0%). In addition, hospital-based pharmacists set low blood glucose goals relative to guideline recommendations for a patient in a surgical intensive care unit, with 53% setting a goal range of 100–140 mg/dl, 24% setting a range of 80–120 mg/dl, and another 24% setting a range of 140–180 mg/dl.

For a patient on intravenous (IV) insulin who is recovering from surgery and getting ready to start a clear liquid diet, most hospital-based pharmacists (79%) indicated that they would stop IV insulin and initiate another type of insulin or start metformin or sulfonylurea rather than continuing IV insulin until the patient is ready for solid food. Additionally, 28% of hospital-based pharmacists said they would recommend only basal-bolus insulin

for this patient once the patient starts solid food; most indicated they would start either an OAD (26%) or OADs and basal-bolus insulin therapy (29%).

With regard to the effects of diabetes therapies on weight, only 52% of retail-based pharmacists recognized the potential for weight gain associated with sulfonylurea therapy, and 38% recognized the potential weight gain effect of thiazolidinedione (TZD) therapy. Twenty-eight percent incorrectly associated metformin with a weight gain risk. Most hospital-based pharmacists (61%) recognized the potential weight loss effects associated with metformin; fewer (49%) associated weight loss with GLP-1 receptor agonists, and 28% incorrectly associated weight loss with DPP-4 inhibitors.

**Discussion of Findings**

Based on the results of these surveys, most patients with type 2 diabetes are receiving evidence-based care.

**Table 4. Pharmacist Postoperative and Discharge Recommendations for Patients With Type 2 Diabetes**

Case and Question	Option	Responses (%)	
		H-PHs (n = 51)	R-PHs (n = 100)
<p><b>H-PH Case:</b> Postoperative recommendation for a 62-year-old obese woman diagnosed with type 2 diabetes 2 years ago who is on 1,000 mg metformin twice daily and was admitted for cholecystitis. Admission glucose was 298 mg/dl, A1C is 8.6%. After surgery, she was admitted to the surgical intensive care unit, was taking nothing by mouth, had a blood glucose of 183 mg/dl, and was started on IV insulin. After 8 hours, her blood glucose on IV insulin is 120 mg/dl. She is transferred to a regular bed and will start a clear liquid diet.</p> <p><b>Q:</b> What would you expect her physician to do at this point? (select only one)</p>	• Stop IV insulin and start sliding-scale insulin regimen	47.1	—
	• Stop IV insulin and start long-acting basal insulin	27.5	—
	• Wait until the patient is ready for solid foods before discontinuing IV insulin drip	21.6	—
	• Stop IV insulin and start metformin	2.0	—
	• Stop IV insulin and start a sulfonylurea	2.0	—
<p><b>R-PH Case:</b> Discharge recommendation for a 62-year-old obese woman diagnosed with type 2 diabetes 2 years ago who was just discharged from the hospital post-cholecystectomy on metformin 1,000 mg twice daily and insulin detemir 30 units at bedtime. Today, her fasting glucose is 320 mg/dl. Her A1C is 8.4%, and her fasting glucose levels at home are 150–160 mg/dl.</p> <p><b>Q:</b> What would you recommend to manage this patient's diabetes? (select only one)</p>	• Increase insulin detemir	—	39.0
	• Add a sulfonylurea	—	25.0
	• Add a GLP-1 receptor agonist	—	15.0
	• Add a DPP-4 inhibitor	—	12.0
	• Increase metformin to 850 mg three times daily	—	5.0
	• Add a TZD	—	4.0

*H-PH, hospital-based pharmacist; R-PH, retail-based pharmacist.*

However, gaps in care, to varying degrees, were identified in all the provider groups studied.

Although PCPs and pharmacists were much less familiar with ADA and AACE guidelines than other providers, respondents from all provider groups were most likely to set A1C goals based on those recommendations. Moreover, the vast majority (~ 80%) of clinicians had some level of agreement with ADA guideline statements regarding carbohydrate counting, A1C testing, and blood pressure and LDL cholesterol treatment goals for patients with diabetes.

At least 75% of PCPs indicated that they are very comfortable using long-acting basal analog insulin but are considerably less comfortable with other regimens (e.g., basal-bolus

therapy, human and analog mixed formulations, or NPH insulin alone). Despite this lack of comfort, these clinicians are not likely (< 20%) to refer patients to an endocrinologist if they need to initiate insulin therapy.

This study identified gaps in knowledge of insulin therapies. The majority of endocrinologists and CDEs indicated that they “agree” or “somewhat agree” that analog insulin products are more effective and safer than human insulins. Although current evidence supports the improved safety of analog insulins resulting from a lower risk of hypoglycemia, it does not support improved efficacy.<sup>9</sup> PCPs and pharmacists also demonstrated a lack of knowledge, evident in their almost equal likelihood to agree or disagree with these statements.

Gaps in perceptions and knowledge regarding incretins were more pronounced. Approximately half of PCPs perceive that they do not fully understand the differences in effectiveness between GLP-1 receptor agonists and DPP-4 inhibitors, which was apparent when almost 30% of these clinicians indicated that they “agree” or “somewhat agree” that DPP-4 inhibitors are more effective than GLP-1 receptor agonists. Additionally, less than half of these clinicians identified the primary action of either agent in reducing glucose levels.

These gaps were considerably smaller among endocrinologists and CDEs and appear to translate into practice. In the case vignettes presented in the surveys, for the same patient with type 2 diabetes and a

BMI of 35 kg/m<sup>2</sup>, CDEs were more likely than PCPs (42 vs. 27%, respectively) to add a GLP-1 receptor agonist to the patient's regimen. The difference was more evident for the vignette involving a patient whose BMI was lower (28 kg/m<sup>2</sup>) but who was still overweight: 26% of CDEs added a GLP-1 receptor agonist to the patient's regimen versus 9% of PCPs. In the case of a patient with a BMI of 35 kg/m<sup>2</sup>, 54% of endocrinologists added a GLP-1 receptor agonist to the patient's regimen, and 37% added a basal insulin analog.

For retail- and hospital-based pharmacists, similar gaps in knowledge of diabetes therapies were observed. Additional gaps were observed in hospital-based pharmacists' post-surgical recommendations for patients with type 2 diabetes, both in setting blood glucose levels and in knowing when and how to switch a patient from IV insulin to other forms of insulin as the patient transitions back to solid food.

The consensus among all providers that high-carbohydrate cultural diets are a barrier that impedes patient care demonstrates the need for providing HCPs with strategies for improving patient communication regarding diet.

### Conclusion

The gaps identified in this study regarding the perception, knowledge, and practice of managing patients with type 2 diabetes provide ample targets for educating HCPs involved in the care of patients with this disease. Reviews of the latest evidence on and guideline recommendations for type 2 diabetes management for the PCPs and allied HCPs are warranted, as well as reinforcement of the

efficacy and safety data of available diabetes therapies.

It is the hope of those involved with this study that its results will be used to inform the development of effective diabetes education for all of the providers that play a role in the continuum of care for patients with diabetes. With the increasing prevalence of diabetes, education designed to improve HCP competence and performance will play a major role in improving patient outcomes.

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