Health Care Providers' Knowledge, Attitudes, and Practices and the Association With Referrals to the National Diabetes **Prevention Program Lifestyle Change** Program

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Abstract

Purpose: To examine how health care providers' knowledge, attitudes, and practices affect their referrals to the National Diabetes Prevention Program.

Design: Cross-sectional, self-report data from DocStyles—a web-based survey

Setting: USA

Sample: Practicing family practitioners, nurse practitioners, pharmacists, and internists, n = 1,503.

Measures: Questions regarding health care providers' knowledge, attitudes, and practices and their referrals to the National Diabetes Prevention Program.

Analysis: Bivariate and multivariate analyses were used to calculate predictive margins and the average marginal effect.

Results: Overall, 15.2% of health care providers (n = 1,503) reported making a referral to the National Diabetes Prevention Program. Health care providers were more likely to make referrals if they were familiar with the program (average marginal effect = 36.0%, 95% Cl: 29.1%, 42.8%), reported knowledge of its availability (average marginal effect=49.1%, 95% Cl: 40.2%, 57.9%), believed it was important to make referrals to the program (average marginal effect = 20.7%, 95% CI: 14.4%, 27.0%), and used electronic health records to manage patients with prediabetes (average marginal effect = 9.1%, 95% Cl: 5.4%, 12.7%). Health care providers' demographic characteristics had little to no association with making referrals.

Conclusion: Making referrals to the National Diabetes Prevention Program was associated with health care providers' knowledge of the program and its reported availability, their attitudes, and their use of the electronic health record system to manage patients with prediabetes.

Keywords

chronic disease prevention, type 2 diabetes, pre-diabetes, health communication, health system referrals, interventions, health policy, lifestyle change program

Purpose

There are 88 million adults in the United States who have prediabetes, a condition characterized by blood glucose levels that are high but not high enough to be diagnosed as diabetes.¹ If left untreated, prediabetes can lead to type 2 diabetes, a devastating chronic disease that affects millions of people in the United States.¹ Diabetes is the seventh leading cause of death in the United States, and contributes to over \$320 billion dollars in direct health care expenses and reduced productivity costs.^{1,2}

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Several landmark studies, including the Diabetes Prevention Program (DPP) trial, have demonstrated that a structured lifestyle change program is an effective way to prevent or delay progression to type 2 diabetes for those at risk.³⁻⁷ Subsequently, Congress authorized the Centers for Disease Control and Prevention (CDC) to establish the National Diabetes Prevention Program (National DPP), a partnership between public and private organizations to deliver its lifestyle change program (LCP) nationwide.^{8,9}

A vital piece of the National DPP is health care providers' referrals of their at-risk patients to the LCP.³ Providers who promote the National Diabetes Prevention Program and make referrals to it can be enormously influential because they are often a trusted source for their patients and potentially influence their health behaviors.¹⁰⁻¹³ The American Diabetes Association, along with other professional organizations, has recommended that providers refer their at-risk patients to a lifestyle change program, such as the one offered through the National DPP.^{7,14-16} Evidence has shown that patients who receive a referral from their provider for a lifestyle change program are more likely to participate in such a program. However, only 15% of individuals with prediabetes have been informed that they have the condition.¹ Additionally, less than 5% of patients with prediabetes or at risk for type 2 diabetes are reported to have received a referral to a lifestyle change program.^{13,17} Also, many providers have confirmed that they had not made referrals to a lifestyle change program,¹⁸⁻²² a result that may be linked to the large number of providers reporting that they are not familiar with the program.^{19,22} It is also unclear if providers are aware of the availability of the lifestyle change program.²² Studies show that providers' attitudes toward managing prediabetes are positive, 18,21,23-25 but it is unclear if that same attitude extends to making referrals to the National DPP LCP. Therefore, the researchers sought to better understand providers' knowledge, attitudes, and practices that may be associated with their decision to refer to the National DPP LCP.

Methods

Design

The researchers used data from the web-based survey Doc-Styles,¹ administered between June and August 2018. DocStyles was commissioned by Porter Novelli Public Services,²⁶ a public relations firm, and conducted by SERMO²⁷ to solicit responses from providers regarding various health conditions. Participants from SERMO's Global Medical Panel of health care providers were sent a link to the survey and were paid an honorarium of \$40-\$90 for completing it.

Sample

SERMO set quotas to reach a certain number of family practitioners and internists (1,000), obstetrician/gynecologists

(OB/GYNs) (250), pediatricians (250), oncologists (250), nurse practitioners (250), and pharmacists (250). To meet this quota, 3,465 providers were invited to participate in the survey. Only providers who practice in the United States; who actively see patients; who work in an individual, group, or hospital practice; and who have been practicing for at least three years were selected to participate in the survey. There were 2,256 providers who met those criteria and completed the entire survey, representing a 65.1% response rate. The remaining 34.9% either did not complete the entire survey (43), were excluded based on the screener questions (99), were excluded due to filled quotas (78), or did not respond to the invitation or tried to respond after the survey closed (989). Of the 2,256 respondents, diabetes-specific questions were only given to family practitioners and internists, nurse practitioners, and pharmacists, so the final sample for the current study consisted of 1,503 providers. No individual identifying information was included in the survey dataset and therefore this analysis was deemed exempt from [details omitted for doubleanonymized peer review] Institutional Review Board approval process.

Measures

Demographic variables, including age, gender, race, ethnicity, region of practice, and provider type were collected in the survey and included in the current study. The researchers recoded the race and ethnicity variables to represent five categories: non-Hispanic white, non-Hispanic black or African American, non-Hispanic Asian, Hispanic, and non-Hispanic other (includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, two or more races, and "other" race). The researchers recoded the continuous age variable into five categories: 25–34, 35–44, 45–54, 55–64, and 65+ years.

Providers' familiarity with the program was assessed through the question, "How familiar are you with the National Diabetes Prevention Program lifestyle change program (National DPP LCP), a yearlong structured program, offered in person or online, aimed at preventing or delaying the onset of type 2 diabetes for individuals with prediabetes?". Answer choices were very familiar, somewhat familiar, or not familiar. Their reported knowledge of the program availability was assessed through the question, "Is the National DPP LCP available in your community or health system?" with answer choices being yes, no, or don't know/not sure. Skip patterns were used so that only providers who previously indicated that they were either very familiar or somewhat familiar with the National DPP LCP could respond to the second question. The main variable of interest was provider referral practices, which was addressed through the question, "Have you referred your patients with prediabetes to the in-person or online National DPP LCP to prevent or delay type 2 diabetes?". The response categories for this variable were yes, no, and don't know/not sure. Due to there being a small number of providers (N = 187)



Figure I. Health care provider-recommended prediabetes treatment/management choices, DocStyles 2018. Description: Results from the question, "Which of the following are you most likely to recommend to your patients to prevent type 2 diabetes? (Select all that apply)".²



Figure 2. Health care providers method of referral to the National DPP LCP, DocStyles 2018. Description: Results from the question, "How do you refer your eligible patients with prediabetes to an in-person or online National DPP LCP? (Select all that apply)".^{3,4}

who selected the *don't know/not sure* option, they were included with those who answered *no*. Providers' attitudes toward the National DPP LCP were examined through the question, "*How important is referring patients with prediabetes to the National DPP LCP, specifically?*". Answers were provided on a five-point Likert scale, from *very important* to *not important*. Providers were asked about whether they used an integrated electronic health record (EHR) in their practice or pharmacy. For those who did, they were then asked, "Do you use the capabilities of your integrated EHR system to identify and manage your patients with prediabetes?" Answer choices were yes, my EHR does not have this capability, don't know/not sure, and no. Since the number of providers who selected my EHR does not have this capability and don't know/

not sure were too small to change the results of the analysis, they were included with those who said *no*. Two additional questions were asked (Figures 1 and Figure 2) to further understand providers' treatment preferences for their patients with prediabetes and referral practices.

Analysis

Cross tabulations were used to conduct bivariate analyses to determine the association between providers' referrals to the National DPP LCP and providers' demographics, knowledge, attitudes, and practices; Wald test was used to obtain *P*-values.

Multiple logistic regression was used to generate predictive margins and 95% confidence intervals (CI) to estimate the

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Familiarity with National DPP LCP763 (50.8)Not familiar763 (50.8)Somewhat familiar540 (35.9)Very familiar200 (13.3)Importance of referring to the National DPP LCP specifically322 (21.4)Not important322 (21.4)Slightly important297 (19.8)Moderately important389 (25.9)Important321 (21.4)Very important321 (21.4)Very important174 (11.6)Uses EHR to identify and manage patients with prediabetes ^b N = 1,239No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	No/don't know	1 275 (84.8)
Not familiar763 (50.8)Somewhat familiar540 (35.9)Very familiar200 (13.3)Importance of referring to the National DPP LCP specifically322 (21.4)Not important322 (21.4)Slightly important297 (19.8)Moderately important389 (25.9)Important321 (21.4)Very important174 (11.6)Uses EHR to identify and manage patients with prediabetes ^b N = 1,239No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (77.8)	Familiarity with National DPP LCP	1,275 (01.6)
Note tarintal100 (000)Somewhat familiar540 (35.9)Very familiar200 (13.3)Importance of referring to the National DPP LCP specifically322 (21.4)Not important297 (19.8)Moderately important389 (25.9)Important321 (21.4)Very important174 (11.6)Uses EHR to identify and manage patients with prediabetes ^b N = 1,239No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	Not familiar	763 (50.8)
Very familiar210 (13.3)Importance of referring to the National DPP LCP specifically322 (21.4)Not important322 (21.4)Slightly important297 (19.8)Moderately important389 (25.9)Important321 (21.4)Very important174 (11.6)Uses EHR to identify and manage patients with prediabetes ^b N = 1,239No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	Somewhat familiar	540 (35.9)
Importance of referring to the National DPP LCP specifically322 (21.4)Not important3297 (19.8)Slightly important389 (25.9)Important321 (21.4)Very important174 (11.6)Uses EHR to identify and manage patients with prediabetes ^b N = 1,239No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	Very familiar	200 (13 3)
Not important $322 (21.4)$ Slightly important $297 (19.8)$ Moderately important $389 (25.9)$ Important $321 (21.4)$ Very important $174 (11.6)$ Uses EHR to identify and manage patients with prediabetes ^b $N = 1,239$ No $703 (56.7)$ Yes $536 (43.3)$ National DPP LCP available in their community or health system ^c $N = 740$ Don't know/Not sure $351 (47.4)$ No $183 (24.7)$ Yes $206 (27.8)$	Importance of referring to the National DPP I CP specifically	200 (1010)
Slightly important $322 (21.1)$ Slightly important $297 (19.8)$ Moderately important $389 (25.9)$ Important $321 (21.4)$ Very important $174 (11.6)$ Uses EHR to identify and manage patients with prediabetes ^b $N = 1,239$ No $703 (56.7)$ Yes $536 (43.3)$ National DPP LCP available in their community or health system ^c $N = 740$ Don't know/Not sure $351 (47.4)$ No $183 (24.7)$ Yes $206 (27.8)$	Not important	322 (21 4)
Moderately important $389 (25.9)$ Important $321 (21.4)$ Very important $174 (11.6)$ Uses EHR to identify and manage patients with prediabetes ^b $N = 1,239$ No $703 (56.7)$ Yes $536 (43.3)$ National DPP LCP available in their community or health system ^c $N = 740$ Don't know/Not sure $351 (47.4)$ No $183 (24.7)$ Yes $206 (27.8)$	Slightly important	297 (19.8)
InstructionStateImportant $321 (21.4)$ Very important $174 (11.6)$ Uses EHR to identify and manage patients with prediabetes ^b $N = 1,239$ No $703 (56.7)$ Yes $536 (43.3)$ National DPP LCP available in their community or health system ^c $N = 740$ Don't know/Not sure $351 (47.4)$ No $183 (24.7)$ Yes $206 (27.8)$	Moderately important	389 (25.9)
With the second seco		321 (21.4)
Uses EHR to identify and manage patients with prediabetes $N = 1,239$ No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	Verv important	174 (11.6)
No703 (56.7)Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	Uses EHB to identify and manage patients with prediabetes ^b	N = 1.239
Yes536 (43.3)National DPP LCP available in their community or health system ^c N = 740Don't know/Not sure351 (47.4)No183 (24.7)Yes206 (27.8)	No	703 (56 7)
National DPP LCP available in their community or health system ^c N = 740 Don't know/Not sure 351 (47.4) No 183 (24.7) Yes 206 (27.8)	Yas	536 (43 3)
Don't know/Not sure 351 (47.4) No 183 (24.7) Yes 206 (27.8)	National DPP I CP available in their community or health system ^c	N = 740
No Yes 206 (27.8)	Don't know/Not sure	351 (47 4)
Yes 206 (27.8)	No	183 (247)
	Yes	206 (27.8)

Table I. Health Care Provider Demographic Characteristics, Knowledge, Attitudes, and Practices: DocStyles 2018 Survey Respondents.

EHR, Electronic Health Record.

^aOther includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, two or more races, and other.

^bOnly asked of providers who indicated that they use an integrated electronic health record (EHR) at their pharmacy or practice (n = 1,239).

^cOnly asked of providers who answered that they were very familiar or somewhat familiar with National DPP LCP (n = 740).

probability of making referrals based on provider characteristics, knowledge, attitudes, and EHR use.^{28,29} The first adjusted model included only providers who responded to the question regarding using the EHR to manage their patients with prediabetes (N = 1,239 of 1,503). The second adjusted model further narrowed the sample because the addition of the

National DPP LCP, National Diabetes Prevention Program Lifestyle Change Program.

			Bivari	ate (Un;	adjusted) Results			Multivariate	e (Adjusted) Result	Sc	
variable Total N = [1,39] x role N = [1,37] x role N = [1,37] x role N = [1,31] x role N = [1,32] x role N = [1,31] x role N = [1,32] x role N = [1,32] <th></th> <th></th> <th>Made Referi N = 2</th> <th>rals, 202</th> <th>Difference from Referent Category</th> <th>95% CI</th> <th></th> <th>Predictive Margin</th> <th>Average Marginal Effect^d</th> <th>95% CI</th> <th></th>			Made Referi N = 2	rals, 202	Difference from Referent Category	95% CI		Predictive Margin	Average Marginal Effect ^d	95% CI	
Age Set 1 0 Ref 13 Ref 133 Set	Variables	Total N = 1,239		%	%	%	P Value	%	%	%	P Value
54 7 103 Ref -	Age										
	>64	64	7	10.9	Ref			13.2	Ref		
45-54 32 47 134 24 -60, 108 596 136 04 -72, 87 91 35-44 141 68 209 10 14, 186 67 13, 10 737 148 16 -73, 103 733 2-34 81 1 18 12, 4 14, 186 -73, 103 733 84 -73, 103 733 2-34 60 109 15 104 -45, 36 816 -73, 103 733 2-34 73 18 12, 33 820 16, 106 -05 -42, 31 731 710 73 73 73 820 14, 130 003 125 86f -73, 103 133 105 73 11, 130 003 226 66 -13, 47 823 -13, 47 823 Non-Hispanic Othe* 73 14, 130 003 226 66 -13, 47 823 130, 168 177 130, 168 177	55-64	269	44	16.4	5.4	-3.4, 14.2	.283	18.5	5.3	-3.3, 13.9	.256
	4554	352	47	13.4	2.4	-6.0, 10.8	.598	13.6	0.4	-7.8, 8.7	.915
	35-44	411	86	20.9	01	1.4, 18.6	.067	18.1	4.9	-3.3, 13.2	.243
	25–34	143	8	12.6	1.6	-7.7, 11.0	.737	14.8	l.6	-7.5, 10.9	.723
	Gender										
Reraile57993[6] -04 $-45, 36$ 329 [60 -05 $-42, 31$ 731 731 Non-Hispanic Write826109132876 $-20, 172$ 075 143 -13 $-80, 54$ 705 Non-Hispanic Atain24952209 77 21, 132 003 161 05 $-31, 47$ 823 Non-Hispanic Atain2495252209 77 21, 132 003 161 05 $-17, 449$ 123 Non-Hispanic Atain2491230016824, 31.1 $.004$ 226 65 $-17, 149$ 123 Non-Hispanic Atain24123001682, 43.11 $.004$ 226 70 $-30, 168$ $.72$ Non-Hispanic Black or African American4012300168 $24, 31.1$ $.004$ 226 70 $-30, 168$ $.72$ Non-Hispanic Black or African American4012300168 $24, 31.1$ $.004$ 226 $-25, 98$ $.54$ Non-Hispanic Black 414 52149 21 $-33, 76$ $.51$ $.61, 94$ $.61, 98$ $.72$ Non-Hispanic Black 414 52168 $.72$ $.64, 104$ $.72$ $-25, 98$ $.54$ Non-Hispanic Black $.72$ $.67$ $.24, 137$ $.23$ $.64, 144$ $.72$ $.67, 137$ $.23$ Non-Hispanic Region $.72$ $.73$ $.2137$ $.203$ $.21137$ $.213$ <td< td=""><td>Male</td><td>660</td><td>601</td><td>I 6.5</td><td>Ref</td><td> </td><td> </td><td>16.5</td><td>Ref</td><td> </td><td> </td></td<>	Male	660	601	I 6.5	Ref			16.5	Ref		
Racefetnicity Ref - - 15.6 Ref - - Non-Hispanic Write 73 13 20.8 7.5 -20.172 073 16.1 0.5 -37.47 823 Non-Hispanic Write 73 14 20.8 7.5 -20.172 073 16.1 0.5 -37.47 823 Non-Hispanic Main 249 52 20.9 7.7 21.132 003 16.1 0.5 -37.47 823 Non-Hispanic Main 24 30 16.8 2.4,311 .004 22.6 7.0 -30.16.8 172 Non-Hispanic Main 40 12 300 16.8 2.4,311 .004 22.6 7.0 -30.16.8 172 Non-Hispanic Materican 24 21 2.4,311 .004 22.6 7.0 -30.16.8 172 Nore region 21.13 .017 .013 .013 .013 .133 21.0 2.5 .66 .197 .179 </td <td>Female</td> <td>579</td> <td>93</td> <td>16.1</td> <td>-0.4</td> <td>-4.5, 3.6</td> <td>.829</td> <td>16.0</td> <td>-0.5</td> <td>—4.2, 3.I</td> <td>.781</td>	Female	579	93	16.1	-0.4	-4.5, 3.6	.829	16.0	-0.5	—4.2, 3.I	.781
	Race/Ethnicity										
	Non-Hispanic White	826	601	13.2	Ref			15.6	Ref		
	Non-Hispanic Other ^e	72	15	20.8	7.6	-2.0, 17.2	.075	14.3	-1.3	-8.0, 5.4	.705
Hispanic521426.913.714,26.000722.26.6 -1.7 ,14.9123Non-Hispanic Back or African American401230.06.82.4,31.10.0422.56.6 -1.7 ,14.9123Non-Hispanic Back or African American401230.06.82.4,31.10.0422.56.6 -1.7 ,14.9123Norrebarribore2343012.8Ref $ -$ 18.6Ref $ -$ Family practitioner1346.214.92.1 -3.3 ,7.645116.1 -2.5 -8.4 ,3.4411Pharmacist1342.518.65.8 $2.11.3$.05514.6 -4.0 $-9.8,1.9$ 189Pharmacist1342.518.65.8 $2.11.3$.05514.6 -4.0 $-9.8,1.9$ 189Pharmacist1342.518.65.8 $2.11.3$.05514.6 -4.0 $-9.8,1.9$ 189Pharmacist2.0417.92.50.4717.92.5 $-6.9.6$ 0.8Pharmacist2.0417.92.3116.12.7 $-1.9,7.3$ 2.56Nidwest region2.3514.6 -1.7 $-2.9.1,7.7$ $-2.6.9.6$ $-6.9.6$ 0.84 Nidwest region2.855.91.5 $0.12.5$ 0.47 17.9 4.5 $-6.9.6$ 0.84 Northast region2.855.91.5 $0.12.5$ $0.12.5$ 0.77 </td <td>Non-Hispanic Asian</td> <td>249</td> <td>52</td> <td>20.9</td> <td>7.7</td> <td>2.1, 13.2</td> <td>.003</td> <td>16.1</td> <td>0.5</td> <td>-3.7, 4.7</td> <td>.823</td>	Non-Hispanic Asian	249	52	20.9	7.7	2.1, 13.2	.003	16.1	0.5	-3.7, 4.7	.823
	Hispanic	52	4	26.9	13.7	1.4, 26.0	.007	22.2	6.6	-1.7, 14.9	.123
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Non-Hispanic Black or African American	40	12	30.0	16.8	2.4, 31.1	.004	22.6	7.0	-3.0, 16.8	.172
	Provider type										
	Nurse practitioner	234	30	12.8	Ref			18.6	Ref		
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Family practitioner	414	62	14.9	2.1	—3.3, 7.6	.451	16.1	-2.5	-8.4, 3.4	411
Internist4578518.65.82, 11.305514.6 -4.0 $-9.8, 1.9$ $.189$ Region of practice2973712.5Ref $ -13.4$ Ref $ -19, 7.3$ $.256$ Nidwest region4226615.63.1 $-11.9, 8.2$ $.231$ 16.1 2.7 $-19, 7.3$ $.256$ South region2354418.76.2 $0.12.5$ $.047$ 17.9 4.5 $-6.9.1$ $.084$ West region2355319.36.8 $0.12.5$ $.047$ 17.9 4.5 $-6.9.1$ $.084$ Northeast region2354418.76.2 $0.12.5$ $.047$ 17.9 4.5 $-6.9.1$ $.084$ Northeast region2355319.36.8 $0.12.5$ $.047$ 17.9 4.5 $-6.9.1$ $.084$ Northeast region2354418.76.2 $0.12.5$ $.047$ 17.9 4.5 $-6.9.1$ $.084$ Northeast region2355319.36.8 $0.12.5$ $.047$ 17.9 4.5 $-6.9.1$ $.084$ Some what lamilar411 97 22.020.5 $14.3.9, 58.6$ $<.001$ 19.5 17.6 0.1 Very familar182968.55.0119.517.7 $4.0, 14.6$ $.001$ Importance of referring to the National DPP LCP specifically1829.68.5 $4.5, 12.4$ $<.001$ 19.5	Pharmacist	134	25	18.6	5.8	-2.0, 13.7	.133	21.0	2.3	-5.2, 9.8	.554
Region of practice $ -$ Nidwest region2973712.5Ref $ -$	Internist	457	85	18.6	5.8	.2, 11.3	.055	14.6	-4.0	-9.8, 1.9	.189
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Region of practice										
South region 422 66 15.6 3.1 -1.9, 8.2 2.31 16.1 2.7 -1.9, 7.3 2.56 West region 235 44 18.7 6.2 0, 12.5 047 17.9 4.5 -6, 9.1 088 Familiarity with National DPP LCP 285 55 19.3 6.8 .9, 12.7 0.25 17.7 4.2 -6, 9.1 088 Familiarity with National DPP LCP 616 9 1.5 Ref - 2.0 Ref - -6, 9.1 088 Not familiar 616 9 1.5 Ref - 2.0 Ref - - 6, 9.1 0.8 Not familiar 441 97 22.0 20.5 16.5, 24.5 6.001 19.5 17.7 4.2 -6, 9.1 088 Not familiar 182 9 52.7 51.2 439, 58.6 6.001 38.0 36.01 40, 14.6 401 Not important 260 3	Midwest region	297	37	12.5	Ref			13.4	Ref		
West region 235 44 18.7 6.2 0, 12.5 047 17.9 4.5 6, 9.6 084 Northeast region 285 55 19.3 6.8 9, 12.7 0.0 12.9 4.5 6, 9.6 084 Familiarity with National DPP LCP 285 55 19.3 6.8 9, 12.7 0.0 13.9 1 0.8 Not familiar 616 9 1.5 Ref - 2.0 Ref - 6, 9.1 0.08 Not familiar 616 9 1.5 Ref - 2.0 Ref - 6, 9.1 0.08 Not familiar 411 97 2.0 20.5 16.5, 24.5 6.001 19.5 17.5 4.01 4.00 Very familiar 182 9 5.1.2 43.9, 58.6 6.001 38.0 36.0 29.1, 42.8 6.001 Important 260 3 19.5 16.5, 24.5 6.001 19.5 4.0, 14.6	South region	422	66	15.6	3.I	—I.9, 8.2	.231	16.1	2.7	-1.9, 7.3	.256
Northeast region 285 55 19.3 6.8 9, 12.7 .025 17.7 4.2 6, 9.1 .088 Familiarity with National DPP LCP 616 9 1.5 Ref - 2.0 Ref - 6, 9.1 .088 Familiarity with National DPP LCP 616 9 1.5 Ref - 2.0 Ref - 6, 9.1 .088 Not familiar 616 9 1.5 Ref - 2.0 Ref - - - 6, 9.1 .088 .001 .08 .08 .03, 21.1 .001 .088 .001 .09.5 13.9, 21.1 8.001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .014 .001 .014 .001 .016 .016 .016 .016 .016 .016 .016 .016 .016 .016 .016	West region	235	4	18.7	6.2	.0, 12.5	.047	17.9	4.5	—.6, 9.6	.084
Familiarity with National DPP LCP 616 9 1.5 Ref $ 2.0$ Ref $ 2.0$ Ref $ -$ Not familiar 616 9 1.5 Ref $ 2.0$ Ref $ 2.0$ Ref $ -$ Somewhat familiar 441 97 22.0 20.5 16.5 , 24.5 <001 19.5 17.5 13.9 , 21.1 <001 Very familiar 182 96 52.7 51.2 43.9 , 58.6 <001 38.0 36.0 29.1 , 42.8 <001 Very familiar 182 96 52.7 51.2 43.9 , 58.6 <001 38.0 36.0 29.1 , 42.8 <001 Moortance of referring to the National DPP LCP specifically 1.1 Ref $ 3.1$ Ref $ -$ Not important 260 3 1.1 Ref $ 3.1$ Ref $ -$ Not important 239 23 9.6 8.5 $4.5, 12.4$ <001 12.4 9.3 $4.0, 14.6$ $.001$ Moderately important 272 73 26.8 25.7 $20.2, 31.1$ <001 13.9 17.7 $12.6, 22.7$ <001 Important 272 73 26.8 25.7 $20.2, 31.1$ <001 20.8 17.7 <001	Northeast region	285	55	19.3	6.8	.9, 12.7	.025	17.7	4.2	—.6, 9.1	.088
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Familiarity with National DPP LCP										
Somewhat familiar 441 97 22.0 20.5 16.5, 24.5 <001 19.5 17.5 13.9, 21.1 <001 Very familiar 182 96 52.7 51.2 43.9, 58.6 <001	Not familiar	616	6	Ι.5	Ref			2.0	Ref		
Very familiar 182 96 52.7 51.2 43.9, 58.6 <.001 38.0 36.0 29.1, 42.8 <.001 Importance of referring to the National DPP LCP specifically 1.1 Ref — 3.1 Ref — — 3.1 Ref — Moitiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	Somewhat familiar	441	67	22.0	20.5	16.5, 24.5	<.001	19.5	17.5	13.9, 21.1	<.001
Importance of referring to the National DPP LCP specifically 3 1.1 Ref - 3.1 Ref -	Very familiar	182	96	52.7	51.2	43.9, 58.6	<.001	38.0	36.0	29.1, 42.8	<.001
Not important 260 3 1.1 Ref — 3.1 Ref — … I <td>Importance of referring to the National DPP</td> <td>LCP specifically</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Importance of referring to the National DPP	LCP specifically									
Slightly important 239 23 9.6 8.5 4.5, 12.4 <.001 12.4 9.3 4.0, 14.6 .001 Moderately important 319 46 14.4 13.3 9.1, 17.3 <.001 13.9 10.8 6.1, 15.4 <.001 Important 272 73 26.8 25.7 20.2, 31.1 <.001 20.8 17.7 12.6, 22.7 <.001	Not important	260	m		Ref			3.1	Ref		
Moderately important 319 46 14.4 13.3 9.1, 17.3 <.001 13.9 10.8 6.1, 15.4 <.001 Important 272 73 26.8 25.7 20.2, 31.1 <.001	Slightly important	239	23	9.6	8.5	4.5, 12.4	<.001	12.4	9.3	4.0, 14.6	100.
Important 272 73 26.8 25.7 20.2, 31.1 <.001 20.8 17.7 12.6, 22.7 <.001	Moderately important	319	4	14.4	13.3	9.1, 17.3	<.001	13.9	10.8	6.1, 15.4	<.001
	Important	272	23	26.8	25.7	20.2, 31.1	<.001	20.8	17.7	12.6, 22.7	<.00I

		Bivariat	e (Una	djusted) Results			Multivariate	(Adjusted) Result	U.	
		Made Referra N = 20	2 s	Difference from Referent Category	95% CI		Predictive Margin	Average Marginal Effect ^d	95% CI	
Variables	Total N = 1,239		%	%	%	P Value	%	%	%	P Value
Very important	149	57	38.2	37.1	29.1, 45.0	<.001	23.8	20.7	14.4, 27.0	<.001
Uses EHR to identify and manage patients with No	h prediabetes 703	56	8.0	Ref		I	11.2	Ref		I
Yes	536	146	27.2	19.2	15.0, 23.5	<.001	20.3	9.1	5.4, 12.7	<.001
EHR, Electronic Health Record. National DPP LCP, National Diabetes Prevention Pr ^a Note: There may be rounding errors present in the ^b This model only includes providers who responded ^c Adjusted for age, gender, race/ethnicity, provider typ prediabetes.	ogram Lifestyle Char e table and bold indic 1 to the question reg e, region of practice,	ge Progra ates stati urding usi familiarity	am. stical sig ng an El with Na	jnificance HR in their practice or ational DPP LCP, impor	pharmacy (n=1	239) ng to Nation	al DPP LCP spe	scifically, and use of EH	HR to manage po	tients with
^d The predicted change in the percentage of referrals	s to the National DP	P LCP ass	sociated	with a 1-unit change ir	the independe	nt variable (eg, change bet	ween males and fem:	ales or from 0 t	o I).

Table 2. (continued)

"Other includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, two or more races, and "other" race

			Bivar	ate (U	nadjusted) Results			Multivariate	e (Adjusted) ^c Result	S	
Variables Total N = 623 x x y value x			Made Refer N =	rals, 193	Difference from Referent Category	95% CI		Predictive Margin	Average Marginal Effect ^d	95% CI	
April April <t< th=""><th>Variables</th><th>Total N = 623</th><th></th><th>%</th><th>%</th><th>%</th><th>P Value</th><th>%</th><th>%</th><th>%</th><th>P Value</th></t<>	Variables	Total N = 623		%	%	%	P Value	%	%	%	P Value
564 33 7 212 Ref - 237 Ref - 00.0199 514 45.44 128 44 131 -15, 131 057 335 48 -00.0199 514 45.54 533 5 213 11 14, 132.1 057 335 48 -95, 192 509 55.34 53 5 233 5.6 -148, 200 73 33 49 -194, 141 306 55.34 533 20 86 - - 30 86 - -95, 193 373 55.34 33 03 256 - - 309 86 -	Age										
554 12 44 349 137 $-25, 293$ 138 49 $-100, 193$ 54 55.54 16 25, 33 1 $-121, 184$ 69 210, 121 649 55.54 16 25, 33 16 15 238 26 $-144, 144$ 96 55.54 16 20 27 16 27 33 48 $-95, 195$ 50 60 25 24 16 20 20 87 216 $-144, 144$ 96 60 20 88 20 18 54 10 216 $-95, 156$ $-143, 200$ 73 30 $-144, 144$ 96 Female 20 88 20 18 $-54, 91$ 64 $-95, 126$ $-90, 125, 200$ $-144, 144$ 96 $-160, 129, 233$ $-164, 144$ $96, 233$ $-144, 144$ $96, 233$ $-160, 120, 234$ $-160, 120, 232$ $-160, 120, 232$ $-160, 120, 232$ $-160, 120, 232$ -1	-64	33	7	21.2	Ref			28.7	Ref		
45-54 (5) $25,34$ (5) $-121,184,69$ (5) $-124,121,64$ $-95,192,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,123,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,124,25$ $-95,12$	55-64	126	44	34.9	13.7	-2.5, 29.9	.138	33.6	4.9	-10.0, 19.9	.514
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	45-54	185	45	24.3	3.1	-12.1, 18.4	669.	28.7	.03	- 14.4, 14.4	966.
$ 25-34 \qquad $	35-44	216	82	37.9	16.7	1.4, 32.1	.067	33.5	4.8	-9.5, 19.2	.509
	25-34	63	15	23.8	2.6		.774	25	-3.6	-19.4, 12.1	.648
Male 346 IOS 30.2 Ref 30.9 Ref 97 Rare Emrition 373 IOS 275 88 32.0 18 30.2 Ref 90.9 71 97 97 Rare Emrition 373 IOS 216 5.3 14 32.6 5.0 -5.3 86 5.3 -7.1 87 37 Non-Hispanic Chere* 31 14 45.1 17.5 -5.3 5.6 042 36.0 38 5.3 -4.9 -15.5 8.3 Non-Hispanic Chere* 31 14 45.1 17.5 -5.3 5.6 042 38 5.3 -7.1 187 37 Non-Hispanic Chere* 32 23 26 -19 -13 35.3 4.9 -7.1 17.3 37.4 Provider 72 13 24 -13 36.0 32.8 36.0	Gender										
Remain 275 88 32.0 1.8 -5.4 , 9.1 6.24 31.0 0.1 $-6.0, 6.2$ 373 Recellenticity Non-Hispanic Witte 373 103 27.6 86 -9.7 , 19.6 495 5.3 -9.7 , 19.8 5.5 373 103 27.6 87 $-5.3.5.6$ 31.9 1.7 $-5.5.5.8$ 373 Non-Hispanic Asian 13 14 32.6 5.0 22.3 49 25.3 -49 $-15.5.5.8$ 373 Non-Hispanic Asian 13 14 32.6 50 22.5 38.0 50 $-15.5.5.8$ 373 Non-Hispanic Mittee 21 12 54.5 25.5 042 38.6 50 $-71.18.7$ 374 How the space discert 19 50 21.5 55.6 010 38.5 65.2 374 Non-Hispanic Black on African American 21 53.5 $56.48.2$ 010 38.6 $-1.13.173$	Male	348	105	30.2	Ref			30.9	Ref		
Referencicy Non-Hispanic Other 373 103 27.6 Ref - 30.2 Ref -	Female	275	88	32.0	<u>8. I</u>	-5.4, 9.1	.624	31.0	0.1	-6.0, 6.2	979.
	Race/Ethnicity										
	Non-Hispanic White	373	103	27.6	Ref			30.2	Ref		
	Non-Hispanic Other ^e	43	4	32.6	5.0	-9.7, 19.6	.495	25.3	-4.9	-15.5, 5.8	.373
Hispanic Onchlighanic311445.117.5 $-5, 35.6$ 042 360 58 $-7.1, 18.7$ 377 Non-Hispanic Black or African American221254.526, 48201038.58.3 $-7.1, 18.7$ 374 Non-Hispanic Black or African American221254.526, 48201038.58.3 $-82, 248$ 2.7 Non-Hispanic Black or African American222331.5Ref $ -$	Non-Hispanic Asian	154	50	32.5	4.8	-3.8, 13.5	.265	31.9	1.7	-5.3, 8.8	.635
	Hispanic	31	4	45. I	17.5	5, 35.6	.042	36.0	5.8	-7.1, 18.7	.377
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Non-Hispanic Black or African American	22	12	54.5	26.9	5.6, 48.2	010.	38.5	8.3	-8.2, 24.8	.324
	Provider type										
Family practitioner1965829.6-1.9-1.33, 9.5.73929.7-4.1-1.39, 5.7.417Pharmacist75243200.5-1.37, 14.6.947.3885.0-7.3, 17.3.424Internist768231.50.0-11.0, 11.0.99829.0-4.8-1.46, 5.0.342Region of practice138362.6.1Ref2.2.28.4-5.2, 14.1.37330.01.8-5.9, 9.5.552Nidwest region1274333.97.8-3.2, 18.7.16832.74.8-5.9, 13.0.304Northeast region1274333.97.8-3.2, 18.7.16832.74.8-3.3, 13.0.248Northeast region1555233.57.4-2.9, 17.8.16832.74.8-3.3, 13.0.246Somewhat familiar with National DPP LCP1829.652.730.7.16832.74.8-3.3, 13.0.246Somewhat familiar with National DPP LCP419722.0Ref<	Nurse practitioner	92	29	31.5	Ref			33.8	Ref		
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Family practitioner	196	58	29.6	-1.9	— I3.3, 9.5	.739	29.7	-4.1	—I3.9, 5.7	.417
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Pharmacist	75	24	32.0	0.5	-13.7, 14.6	.947	38.8	5.0	-7.3, 17.3	.424
Region of practiceRef—282Ref——Nidwest region1383626.1Ref—2338.6230.54.4-55, 14.1.37330.01.8-59, 9.5552552South region1274333.97.8-53, 18.7.16832.74.5-40, 13.0.348West region1274333.57.4-2.9, 17.8.16633.04.8-3.3, 13.02.48Northeast region1555233.57.4-2.9, 17.8.16633.04.8-3.3, 13.02.48Familarity with National DPP LCP1555233.77.4-2.9, 17.8.16636.07.5.4, 14.6.038Familarity with National DPP LCP1829652.730.722.5, 38.9 <.001 36.07.5.4, 14.6.038Important5835.23.10.72.5, 38.9 <.001 36.7.4, 14.6.05Not important1042221.216.06.2, 25.6 013 27.216.84.9, 28.7.005Moderately important1777039.534.325.1, 43.5 <.001 36.728.419.7.005Very finiportant1045523.323.125.1, 43.5 <.001 36.726.9.001Very finiportant1777039.534.325.1, 43.5 <.001 36.518.7.005<	Internist	260	82	31.5	0.0	-11.0, 11.0	.998	29.0	-4.8	— I 4.6, 5.0	.342
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Region of practice										
South region 203 62 30.5 4.4 -5.2, 14.1 373 30.0 1.8 -5.9, 9.5 6.52 West region 127 43 33.9 7.8 -3.2, 18.7 1.68 32.7 4.5 -4.0, 13.0 3.04 Northeast region 155 52 33.5 7.4 -2.9, 17.8 1.65 33.0 4.8 -5.3, 9.5 6.52 Familiarity with National DPP LCP 41 97 22.0 Ref - 2.8.5 Ref - - 3.0 1.8 -3.3, 13.0 2.48 -3.3, 13.0 3.48 Somewhat familiar with National DPP LCP 441 97 22.0 Ref - - 2.3.5 8.6 - -3.3, 13.0 2.48 -3.3, 13.0 2.48 -3.3, 13.0 2.48 -3.3, 13.0 2.48 -3.3, 13.0 2.48 -3.3, 13.0 2.48 - - - - - - - -3.3, 13.0 2.48 -3.3, 13.0 2.48 - 0.13<	Midwest region	138	36	26.1	Ref			28.2	Ref		
West region 127 43 33.9 7.8 3.2, 18.7 1.68 32.7 4.5 4.0, 13.0 3.04 Northeast region 155 52 33.5 7.4 -2.9, 17.8 1.65 33.0 4.8 -3.3, 13.0 2.48 Familiarity with National DPP LCP 411 97 22.0 Ref - 28.5 Ref - - -3.3, 13.0 3.48 Somewhat familiar with National DPP LCP 411 97 22.0 Ref - 2.86.5 Ref - - - 3.0 1.48 -3.3, 13.0 3.48 Somewhat familiar with National DPP LCP 182 96 52.7 30.7 22.5, 38.9 <001	South region	203	62	30.5	4.4	-5.2, 14.1	.373	30.0	B.I	-5.9, 9.5	.652
Northeast region 155 52 33.5 7.4 -2.9, 17.8 .165 33.0 4.8 -3.3, 13.0 248 Familiarity with National DPP LCP 441 97 22.0 Ref - 28.5 Ref - - - - -3.3, 13.0 248 Familiarity with National DPP LCP 441 97 22.0 Ref - - 28.5 Ref - - - - -3.3, 13.0 248 -3.3, 13.0 248 Somewhat familiar with National DPP LCP 441 97 22.0 Ref - - 28.5 8.6 - 36.0 7.5 .4, 14.6 .038 Importance of referring to the National DPP LCP specifically 3 5.2 Ref - - - - - 14.6 .038 Not important 5.8 3 5.2.5.6 .013 36.5 28.4 18.0 6.9, 28.7 .005 Not important 104 22 21	West region	127	43	33.9	7.8	-3.2, 18.7	.168	32.7	4.5	-4.0, 13.0	.304
Familiarity with National DPP LCP 441 97 22.0 Ref — 28.5 Ref — … <t< td=""><td>Northeast region</td><td>155</td><td>52</td><td>33.5</td><td>7.4</td><td>-2.9, 17.8</td><td>.165</td><td>33.0</td><td>4.8</td><td>-3.3, 13.0</td><td>.248</td></t<>	Northeast region	155	52	33.5	7.4	-2.9, 17.8	.165	33.0	4.8	-3.3, 13.0	.248
Somewhat familiar with National DPP LCP 441 97 22.0 Ref — 28.5 Ref — … Most is the important 13.6 35.0 7.5 36.1 36.0 35.5 34.14.6 33.8 Most is the important … … … … … … … … … … … … … …	Familiarity with National DPP LCP										
Very familiar with National DPP LCP 182 96 52.7 30.7 22.5, 38.9 <.001 36.0 7.5 .4, 14.6 .038 Importance of referring to the National DPP LCP specifically 58 3 5.2 Ref — — 10.4 Ref — … … … … … … … … … … … … … … </td <td>Somewhat familiar with National DPP LCP</td> <td>441</td> <td>67</td> <td>22.0</td> <td>Ref</td> <td> </td> <td> </td> <td>28.5</td> <td>Ref</td> <td> </td> <td> </td>	Somewhat familiar with National DPP LCP	441	67	22.0	Ref			28.5	Ref		
Importance of referring to the National DPP LCP specifically 3 5.2 Ref — — 10.4 Ref — …	Very familiar with National DPP LCP	182	96	52.7	30.7	22.5, 38.9	<.001	36.0	7.5	.4, 14.6	.038
Not important 58 3 5.2 Ref — — 10.4 Ref — …	Importance of referring to the National DPP L	-CP specifically									
Slightly important 104 22 21.2 16.0 6.2, 25.6 .013 27.2 16.8 4.9, 28.7 .005 Moderately important 180 43 23.9 18.7 10.2, 27.1 .005 28.4 18.0 6.9, 28.9 .001 Important 177 70 39.5 34.3 25.1, 43.5 <.001	Not important	58	m	5.2	Ref			10.4	Ref		
Moderately important 180 43 23.9 18.7 10.2, 27.1 .005 28.4 18.0 6.9, 28.9 .001 Important 177 70 39.5 34.3 25.1, 43.5 <.001	Slightly important	104	22	21.2	16.0	6.2, 25.6	.013	27.2	I 6.8	4.9, 28.7	.005
Important 177 70 39.5 34.3 25.1, 43.5 <.001 35.4 25.0 13.7, 36.2 <.001 Very important 104 55 52.9 47.7 36.5, 58.8 <.001	Moderately important	180	43	23.9	18.7	10.2, 27.1	.005	28.4	18.0	6.9, 28.9	100.
Very important 104 55 52.9 47.7 36.5, 58.8 <.001 38.5 28.1 15.4, 40.8 <.001	Important	177	70	39.5	34.3	25.1, 43.5	<.001	35.4	25.0	13.7, 36.2	<.001
	Very important	104	55	52.9	47.7	36.5, 58.8	<.001	38.5	28.I	15.4, 40.8	<.001

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		Bivariate	e (Uni	adjusted) Results			Multivariat	e (Adjusted) ^c Result:	S	
		Made Referral N = 19:	ς, ω	Difference from Referent Category	95% CI		Predictive Margin	Average Marginal Effect ^d	95% CI	
Variables Total N	V = 623	~		%	%	P Value	%	%	%	P Value
Uses EHR to identify and manage patients with predial	betes									
No	86	51	7.8	Ref			25.0	Ref		
Yes 3.	37	142 4	2.1	24.3	17.4, 31.1	<.001	35.I	10.1	3.7, 16.3	.002
National DPP LCP available in their community or hea	alth system	~								
Don't know/Not sure 2'	16	30	0.3	Ref			13.1	Ref		
No	45	27	8.6	8.3	1.0, 15.5	.017	21.1	8.0	.09, 15.9	.047
Yes	87	136 7	2.7	62.4	55.1, 69.6	<.001	62.2	49.I	40.2, 57.9	<.001
EHR, Electronic Health Record. National DPP LCP, National Diabetes Prevention Program Lif "Note: There may be rounding errors present in the table an "This model further narrows the sample because it only include very familiar or somewhat familiar with National DPP LCP (\hbar "Adjusted for age, gender, race/ethnicity, provider type, region prediabetes, and reported knowledge of the availability of the "The predicted change in the percentage of referrals to the \hbar "	ifestyle Char nd bold india ss providers N = 623). e National DP National DP merican Ind	nge Progr cates stati who resp , familiari OPP LCP as: ian or Ak	am. istical s onded ty with ty with sociate	ignificance to the question regardi I National DPP LCP, im d with a 1-unit change ative, two or more rac	ng using an EHF portance of re in the indepen :es, and other.	λ to identify ε ferring to Ν dent variabl	and manage pat ational DPP LC e (eg. change I	ients with prediabetes : CP specifically, use of E oetween males and fen	and indicated the HR to manage p nales or from 0	t they were atients with to 1).

Table 3. (continued)

question regarding reported program availability only included providers from the first model who were *very familiar* or *somewhat familiar* with the National DPP LCP (N = 623 of 1,239). For both models, additional covariates were included that had the potential to influence provider referrals, that is, age, race, gender, region of practice, and provider type. The analyses were carried out in 2020 using SAS Enterprise Guide, version 6.1 and Stata/IC, version 11.2.

Results

The providers in the sample (N = 1,503) were most often male (55%), non-Hispanic White (69%), between the ages of 35-44 (31%), internists (35%), and practicing in the South (34%) (Table 1). Only 15.2% of providers reported that they had made referrals to the National DPP LCP, and when provided with a list of options (Figure 1), they mostly selected that they provide educational materials to their patients to prevent type 2 diabetes. Nearly half of providers were somewhat (36%) or very (13%) familiar with the National DPP LCP. Among those who were familiar (N = 740), 27.8% reported that the National DPP LCP was available in their community or health system, while 24.7% reported that it was not and 47.4% did not know or were not sure. Most providers believed that there was value in making referrals to the National DPP LCP, with nearly 60% reporting that it was at least moderately important. Among providers who had integrated EHR capabilities (N = 1239), 43% indicated that they used that system to identify and manage their patients with prediabetes. Of providers who made referrals to the National DPP (N = 228), 58% used the EHR system to do so (Figure 2).

On the basis of the predictive margins from the model limited to providers who use EHRs in their practice (Table 2), results indicated that providers who had any familiarity with the program were much more likely to make referrals than those who were not familiar (average marginal effect [AME] = 18%, 95% CI: 13.9%, 21.1% for those somewhat familiar, and AME=36%, 95% CI: 29.1%, 42.8% for those very familiar). The average marginal effect estimates the change in the percentage of referrals associated with a 1-unit increase in the independent variable and provides the difference in the percentage of referrals from the reference group-in this case, 38% of those who were very familiar made referrals vs 2% of those who were not familiar (i.e., the reference group). Similarly, the likelihood of referral increased with perceived importance of referring to the program: providers who thought it was very important to refer to the National DPP LCP were much more likely to make referrals versus those who did not think it was important (AME = 20.7%, 95% CI: 14.4%, 27.0%). The researchers also found that providers who used EHR's to manage their patients with prediabetes were nearly twice as likely to make referrals versus those who did not (AME = 9.1%, 95% CI: 5.4%, 12.7%). In the model restricted to providers who use EHR's and were at least somewhat familiar with the National DPP, (Table 3), results indicate that providers who said the National DPP LCP was available in

their community or health system were much more likely to make referrals in comparison to those who did not know or were not sure of its availability (AME = 49.1%, 95% CI: 40.2%, 57.9%). The effects of the other variables were similar in this second model to what they were in the first.

Discussion

The results indicate that making referrals to the National DPP LCP was strongly and independently associated with providers' knowledge of the program and its reported availability, their attitudes, and their use of the EHR system to manage patients with prediabetes. In contrast, making referrals had little or no association with providers' demographic characteristics. These findings are encouraging because they suggest that referrals might be increased by addressing changeable factors such as knowledge, attitudes, and practices. This study had several strengths, including a high response rate (65.1%) which was consistent with previous analyses of DocStyles.19,30 Also, the current study builds upon a previous analysis¹⁹ by adding pharmacists to the sample, asking providers specifically about the National DPP LCP, and including new variables to assess providers' attitudes toward the program and its reported availability. Finally, because provider demographics, knowledge, attitudes, and EHR use were included in the models, the relative importance of all these factors could be shown, thus providing valuable insight into where to focus new approaches to provider engagement. These factors will now be explored in more depth.

Providers' familiarity with the National DPP LCP and the reported the availability of the program were both shown to be highly associated with making referrals. To our knowledge, this is the first study to show the association between providers' reported knowledge of the availability of the National DPP LCP and making referrals to the program. In fact, this variable had the strongest association with referrals of all the variables examined. Other studies have found similar evidence showing that providers who had heard of a LCP¹⁹ or reported knowledge of the availability of one³⁰ were more likely to make referrals. Despite these promising results, the additional analysis showed that when given the opportunity to select their preferred treatment choice for patients with prediabetes, few providers chose National DPP LCP. In addition, 50% of the sample reported not being familiar with the National DPP LCP and over 70% reported that the program was either not available or they were not sure if it was, results which are consistent with another study that assessed providers' awareness of the National DPP LCP.²² Of note, although the multivariate results demonstrated a strong association between familiarity with the program and referrals, the predicted probability of referrals for those who were familiar was less than 40% when holding all other factors constant, indicating that it may be valuable to explore additional factors beyond familiarity with the program. Suggested strategies for increasing providers' referrals to health-related programs include providing professional development/training about the program that explains the referral process, the benefits of referring their patients, and reinforces clinical guidelines³¹⁻³⁴; encouraging positive referral behaviors through audit and feedback^{31,35}; and increasing providers' awareness of locally available programs.^{33,35,36} These results suggest that future marketing and engagement efforts may be beneficial if they include increasing providers' familiarity with the National DPP LCP in addition to increasing their awareness of the program's availability in their community or health system.

The current study showed that providers' attitudes about the importance of making referrals to the National DPP LCP was associated with making referrals. As providers' opinions of the importance of referral became more positive, the likelihood of referring increased, even after adjusting for other factors. To our knowledge, this is the first study to address providers' attitudes toward making referrals to the National DPP LCP specifically, whereas other studies have assessed attitudes toward prediabetes screening and treatment.²¹⁻²⁵ Although the multivariate results demonstrated that attitudes regarding the importance of making a referral was associated with the outcome, the majority of providers did not make a referral, even those who thought it was at least *important* to refer. This suggests that it may be valuable to explore additional factors that might influence providers referral behaviors. Another study found that providers' attitudes and beliefs are significant barriers to making referrals to intensive behavioral counseling programs, and recommended strategies that reinforce the importance and effectiveness of the program to overcome any potentially negative attitudes.³⁷ Strategies to engage providers in the National DPP LCP referral process could include methods to bolster positive attitudes toward referring such as reinforcing the importance and effectiveness of the program, in addition to identifying any other attitudes that could be influencing referral behaviors.

Health care providers who used the EHR system to identify and manage their patients with prediabetes were more likely to make a referral to the National DPP LCP than those who did not. These results are in line with other studies where an increase in referrals was observed once providers were trained on using an integrated EHR system to do so.^{32,34} The additional analysis revealed that for providers who made referrals to the program, using the capabilities of the EHR system was their most common method of carrying out the referral. This indicates the potential benefits of encouraging the use of the EHR system to manage patients with prediabetes. Future strategies to increase provider referrals could consider promoting the use of the EHR system to manage patients,^{31,32} ensuring referring providers are confident in their ability to use the EHR system,²⁵ using opt-out vs opt-in referral pathways,³⁸ and promoting a seamless automated referral process to prevent disruption of current workflow.³²⁻³⁴ Doing so could increase the number of providers who use the EHR system to identify and manage their patients with prediabetes and subsequently make referrals to the National DPP LCP.

This study had several limitations. DocStyles consists of selfreported survey data, so recall bias could have affected the accuracy of the answers. Also, geographical bias could have influenced responses since approximately a third of the providers in the sample were practicing in the South region. In addition, social desirability bias may have led to providers responding that they were familiar with the program or made referrals even when those answers may not have been accurate. However, this seems unlikely to be highly prevalent since many providers indicated that they were not familiar with the program and had not made referrals. Also, because this was a cross-sectional survey, associations could only be viewed at a single point in time and the researchers cannot be sure that knowledge or attitudes predict future referral behaviors. Finally, selection bias could have occurred because the survey set a quota for number of provider types eligible to respond, so the responses collected may not reflect a generalizable sample of relevant health care providers.

So What?

What is already known on this topic?

Research has been done to understand primary care providers' knowledge, attitudes, and practices as they relate to prediabetes and lifestyle change programs.

What Does This Article Add?

Health care providers' familiarity with and reported knowledge of the National Diabetes Prevention Program (National DPP), as well as their attitude about the importance of referrals to the program, and their use of the EHR system to identify and manage their patients with prediabetes were independently associated with making referrals to the National DPP.

What are the Implications for Health Promotion Practice or Research?

This analysis gives credence to the need for provider engagement strategies that increase health care providers' knowledge of the National DPP and its availability, that promote both the importance and effectiveness of making referrals to the program, and the use of the EHR system to manage patients with prediabetes. Addressing these malleable factors could not only increase referrals but may also influence the uptake of the National DPP. This could ultimately lead to a reduction in the incidence rate of type 2 diabetes because of the integral role that providers play in managing their patients' health.

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Declaration of Conflicting Interests

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Author's Note

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention, CyberData Technologies Inc., University of Central Florida, or the American Medical Association.

Ethical Approval

No individual identifying information was included in the survey dataset and therefore this analysis was deemed exempt from CDC's Institutional Review Board approval process.

Notes

- Two surveys were conducted in 2018 and are designated A and B. This methodology covers survey A which captured the questions about diabetes.
- 2. Not mutually exclusive because more than one answer choice could be selected, N = 1,503.
- 3. Only asked of providers who indicated that they had made referrals to National DPP LCP, N=228.
- 4. Not mutually exclusive because more than one answer choice could be selected.

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