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## An Examination of Gender Differences in the National Diabetes Prevention Program's Lifestyle Change Program

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### Abstract

**Purpose**—The purpose of this study is to explore how gender is related to enrollment and number of sessions attended in the National DPP LCP.

**Methods**—To better understand program uptake, a population of those who would be eligible for the LCP was compared to those who actually enrolled. Estimates of those eligible were computed using data from the National Health and Nutrition Examination Survey (NHANES), whereas enrollment and sessions attended were computed using data from the Centers for Disease Control and Prevention's Diabetes Prevention Recognition Program (DPRP).

**Results**—Results revealed that, although similar numbers of males and females were eligible for the program, only 39,321 males versus 121,007 females had enrolled in the National DPP LCP by the end of 2017 (odds ratio [OR] 3.20; 95% CI: 3.17 to 3.24). The gender differences persisted even when stratifying by age or race/ethnicity. In contrast, no significant gender differences were found between the average number of sessions attended for males (14.0) and females (13.8).

**Discussion**—These results can inform efforts to market and tailor programs to appeal more directly to men and other groups that are underrepresented in the National DPP LCP.

More than 30 million people in the United States suffer from diabetes, which can result in many complications. It is the leading cause of kidney failure<sup>1</sup> and blindness in adults<sup>2</sup>. In addition, individuals with diabetes are more likely to develop heart disease (CVD) or have a stroke<sup>3</sup>. Diabetes is also the seventh leading cause of death<sup>1</sup> in the United States. These complications resulted in annual diabetes-related direct and indirect costs of \$327 billion in 2017<sup>4</sup>.

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Prediabetes, which affects an estimated 84 million Americans, is a condition that puts an individual at high risk for developing type 2 diabetes (the most common form of diabetes), as well as heart disease and stroke<sup>5</sup>. Individuals with prediabetes have glucose levels that are elevated but not yet high enough to indicate the presence of type 2 diabetes<sup>5</sup>. The National Diabetes Statistical Report, 2017, showed that more men than women had prediabetes (36.6% vs. 29.3%) and that prevalence was similar across racial/ethnic groups<sup>6</sup>.

Randomized controlled trials assessing participation in the Diabetes Prevention Program (DPP), a structured lifestyle change program (LCP), have found that among both men and women with prediabetes, the risk of developing type 2 diabetes is reduced by 58% by participating<sup>8</sup>. Based on these results, the Centers for Disease Control and Prevention developed a National DPP LCP consisting of a minimum of 22 coach-led group sessions that encourage increased exercise and healthier nutritional habits<sup>8</sup>. Sites began offering the National DPP LCP in 2010, while implementation efforts expanded in 2013 when the CDC provided grants to all 50 states in order to increase participation in the program<sup>9</sup>. As of April 2017, the National DPP LCP network has served 98,137 participants in 746 organizations across 48 states and D.C in various settings from private programs to community health centers. To be eligible for the LCP, individuals must: 1) be 18 years of age and not pregnant; 2) be overweight or obese; 3) not have a previous diagnosis of diabetes; and 4) have prediabetes identified either by a blood test or by a self-administered risk test<sup>10</sup>.

One important challenge for program implementation is that, to date, far fewer men have enrolled than women<sup>11</sup>. Gender differences often emerge in chronic disease prevention programs. A study using the Medical Expenditures Panel Survey revealed that women utilize preventive care services more frequently than men<sup>12</sup>. More specifically, females are more likely to enroll in chronic disease prevention programs<sup>13</sup>. Group-based programs that focus on nutrition and physical activity, like weight management programs, tend to have lower participation rates among men than women<sup>13,14</sup>. However, specific kinds of programs have higher engagement among men. For example, men are more likely to enroll in cardiac rehabilitation programs<sup>15,16</sup>, and are referred to cardiac rehabilitation programs more often than women<sup>17</sup>. Findings such as these demonstrate the need to better understand the role that gender plays in National DPP LCP enrollment.

The main purpose of this study is to explore whether enrollment and number of sessions attended in the National DPP LCP vary by gender. This study attempts to accomplish this by comparing eligibility data to enrollment data. Such comparisons indicate whether programs such as the National DPP LCP are reaching those who need them most and can inform program development related to enrollment and attendance.

## Methods

### Data Collection

Because it was not feasible to identify and follow a cohort of eligible individuals to measure enrollment over time, two datasets were used to compare prevalence of eligibility with cumulative enrollment in the National DPP LCP. This was a secondary data collection and thus, consent was not sought. Eligibility for the LCP was assessed largely based on risk of

developing type 2 diabetes, through pre-determined criteria (discussed below). Eligibility data came from the National Health and Nutrition Examination Survey (NHANES), which includes both interview and physical examination data, and provides an accurate analysis of those at risk for type 2 diabetes as well as those with a diagnosis of prediabetes (NHANES, 2017). Enrollment was assessed by using data from CDC's Diabetes Prevention Recognition Program (DPRP) – the quality assurance arm of the National DPP – to determine the number of individuals enrolled in the LCP. The DPRP management team compiles these data from CDC-recognized LCPs across the country<sup>10</sup>.

### Measures/Variable Definitions

Using NHANES data from 2011–2014, program eligibility was estimated by first identifying individuals who had prediabetes or a history of gestational diabetes. Criteria for defining a diagnosis of prediabetes were fasting glucose of 100 to 125 mg/dl or A1c of 5.7–6.4 mmol/mol. To be eligible, individuals also had to be 18 years of age or older, not be pregnant, and qualify as overweight or obese. Overweight/obesity was defined BMI of  $\geq 23$  kg/m<sup>2</sup> for Asian Americans and  $\geq 25$  kg/m<sup>2</sup> for those of other races/ethnicities. Respondents were excluded if they answered “yes” to the question, “Other than during pregnancy, have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?”. The time period 2011–2014 was chosen because it was the most recent NHANES data available at the time of analysis and because it was approximately concurrent with the years during which we measured cumulative enrollment in the National DPP LCP.

Next, program enrollment was calculated using DPRP data from participants enrolled in the National DPP LCP from February, 2012 through December, 2017<sup>10</sup>. To be recognized by the DPRP, organizations must submit data every 6 months. These data include, but are not limited to: session date, participant's state of residence, age, sex, race/ethnicity, height, weight, and physical activity minutes during the preceding week<sup>10</sup>.

### Data Analysis

Enrollment was compared to eligibility using Chi-Square tests, odds ratios, and 95% confidence intervals (CIs) for population subgroups defined by age (18–44, 45–64, or 65–75 years) and race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other). These statistical measures were also used to examine gender differences stratified by race/ethnicity and age. Associations were considered statistically significant if the corresponding 95% confidence interval did not include the value one.

Due to the fact that the delivery and timing of in-person sessions tend to be fairly homogeneous, whereas the delivery and timing of virtual sessions tend to be more heterogeneous, we focused on sessions delivered in-person. The differences in number of sessions attended between men and women was examined among persons who attended at least one in-person session and who had at least 12 months elapse since their first session date. The number of sessions was assessed due to findings demonstrating that the more sessions an individual attends, the more likely he or she is to experience positive outcomes such as weight loss<sup>11</sup>. For these analyses, we cut off number of sessions attended at 44 weeks due to higher variability among programs in number of sessions offered after 44

weeks. A t-test was used to test the statistical significance of the mean difference in sessions attended between men and women.

SAS version 9.3 (SAS Institute Inc., Cary, NC) and SAS-callable SUDAAN (to account for sampling weights in the NHANES data only), release 11.0.0 (RTI International, Research Triangle Park, NC), were used for the analyses.

## Results

Analyses comparing those eligible (NHANES data) to those enrolled in the program (DPRP data) revealed differences between males and females. Fewer men (39,321) than women (121,007) enrolled in the LCP even though slightly more males (32,043,820) than females (30,861,053) were eligible (Table 1). Thus, eligible women were approximately three times more likely than eligible men to enroll in the program (OR 3.20; 95% CI: 3.17 to 3.24). This difference persisted when stratifying by age or race/ethnicity (Table 2). Furthermore, confidence intervals did not overlap for most of the variable categories, indicating that there was significant interaction of gender by age and gender by race/ethnicity.

The ratios of enrollment to eligibility also varied by age and race/ethnicity (Table 1). For age, relative to eligibility, enrollment was highest in the 45–64 years age group, next highest in the 18–44 age group, and lowest in the 65–75 age group. For race/ethnicity, relative to eligibility, enrollment was highest among Other-race/ethnicities and lowest among Hispanics.

In contrast, there were no meaningful differences found in the number of sessions attended between males (14.0) and females (13.8) (Table 3). These similarities in number of sessions attended by gender persisted even when stratifying by age or race/ethnicity (Table 3).

## Discussion

Our main finding was that far fewer men than women have enrolled in the National DPP LCP, even after accounting for eligibility differences. However, among those who enrolled, numbers of sessions attended were similar by gender. These findings appear to be consistent across age and race/ethnicity groups. Results such as these demonstrate a need to further explore why men do not enroll in the program as often as women, and how more at-risk men can be encouraged to participate.

One explanation for the lower enrollment is that men's health care seeking behaviors might be influenced by the nature of their interaction with the health care system. Some challenges to enrollment are experienced at the provider level<sup>18</sup>. One study reported that men tend to receive less medical advice, specifically advice related to preventive action<sup>20</sup>. Indeed, reports suggest that men may not even be aware of chronic disease prevention programs, such as the National DPP LCP<sup>18</sup>.

External barriers, or those outside of how men perceive care, have also been identified as influencers of how men approach their health care decisions. That is, men often have difficulty taking time off work in order to participate in health care efforts, due to the effect

on family finances<sup>18</sup>. Other studies have reported that inconvenient “open” hours make it more difficult for men to participate in the most basic preventive measures, such as health screenings<sup>20</sup>. Findings such as these indicate a need to approach men’s health care differently from that of women’s, perhaps taking into account both scheduling issues and how information is delivered.

In addition, men might not participate in health-related programs for reasons tied to how they view themselves and the world around them. For example, hegemonic masculinity, the dominant ideas of masculinity, and the social construction of gender more broadly, can have a significant impact on men’s health seeking behavior<sup>21,22</sup>. For example, men often see programs offering nutrition advice as more for women, given the perception of food preparation as a feminine role and women as experts on nutrition<sup>23</sup>. Similarly, this sense of masculinity may become heightened such that men develop a “Superman” image, where they feel they must represent masculinity as an image of strength and health to others, leading some to view illness as weakness<sup>18</sup>. These perceptions often make it difficult for men to seek help and instead develop an undue sense of self-reliance<sup>19</sup>. Studies assessing how physicians view obstacles to treating men have reported that men can be perceived as not addressing a problem head on. Men tend to ask more general questions about their health rather than asking about the specific ailment or condition<sup>24</sup>, thus making it difficult for a physician to make appropriate referrals. These perceptions, particular to men, might serve as obstacles to enrollment in the National DPP LCP.

The potential barriers men encounter also provide opportunities for program developers to modify how a program is marketed, making it more attractive to men. For example, men prefer to hear health messages from program participants from their own community and from other men<sup>13,19</sup>. Thus, marketing efforts that incorporate testimonials from successful participants who resemble the desired audience may be more appealing to men. In addition, by hearing other men’s stories, potential participants might begin to see seeking help as just something men do. Attempting to recruit men using a marketing strategy focused on sports has been identified as a potential strategy to increase participation<sup>19,25</sup>. Strategies such as these could mitigate the perceived stigma as well as increase knowledge of the program by presenting a program that is already attended by men.

Barriers to enrollment can also be addressed through customized approaches to program delivery, whether via program staff or location. For example, in one study where men were asked about the design of type 2 diabetes prevention programs, many suggested that programs should be led by male coaches and should incorporate physical activity as a form of competition<sup>26</sup>. A literature review found that, in several studies of weight loss programs at football training locations, men cited the sports-related location as a draw to the program<sup>13</sup>. A randomized controlled trial conducted at Scottish football clubs successfully attracted men, while also reporting greater weight loss and better nutrition than for those in the wait-list intervention group<sup>27</sup>. Finally, studies have reported that offering programs at workplaces, thus increasing accessibility, can deliver positive health outcomes for men<sup>28</sup>. These findings demonstrate that programs that are marketed and tailored to men, whether addressing perceptions or obstacles related to location, can achieve successful enrollment and outcomes.

In contrast to our enrollment findings, the number of sessions attended did not significantly vary by gender. We hypothesize that men and women who self-select to enroll in the National DPP LCP may be more similar in their approach to health care seeking behaviors than are men and women in the general population. This hypothesis could be explored in future studies by examining the characteristics of those who did and did not enroll.

Secondary findings from this study demonstrate that, not only are there enrollment differences by gender, but also by age and race/ethnicity. In particular, enrollment was lower than would be expected among both younger and older individuals compared to middle-aged individuals, and among Hispanics compared to non-Hispanics. It is important to understand why certain groups are less likely to enroll, and how programs can improve enrollment for these groups.

One strength of this study is the generalizability of the findings. Eligibility data from NHANES is nationally representative and based on tens of thousands of individuals, and the DPRP enrollment data capture information from all CDC-recognized sites offering the National DPP LCP. Another strength is that this study is the first to compare enrollment to eligibility at a national level. Our findings were consistent with previous research on enrollment only, that found fewer men enrolled than women (12), but went further by accounting for the differing prevalence of eligibility among men and women.

One limitation of this study is that there might be unmeasured factors that are associated with both gender and the decision to enroll in a National DPP LCP. The DPRP data include only a limited number of variables related to participant characteristics. Furthermore, the DPRP data do not typically include information on program characteristics (e.g., program marketing, gender of coach, nature of class location) that may affect enrollment gender differences. Another limitation is that it was not possible to make an exact comparison of eligibility and enrollment. That is, eligibility (from NHANES) was an average prevalence over four years, whereas enrollment (from the DPRP) was cumulative across five years.

## Implications for Diabetes Educators

Our results demonstrated that enrollment varies significantly by gender while number of sessions attended does not. Understanding these findings could facilitate the development of programs that are more attractive to men. For example, using tailored marketing strategies to highlight education and program delivery strategies that are more appealing to men, may serve as viable methods for enrolling more men.

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Eligibility for and enrollment in the National Diabetes Prevention Program Lifestyle Change Program among adults by sex, age, and race/ethnicity

**Table 1.**

	NHANES DATA N Eligible	N enrolled	P-Value	OR	95% CI
<b>Overall</b>	62,904,873	160,328			
<b>Sex</b>			<0.0001		
Male	32,043,820	39,321		1	
Female	30,861,053	121,007		3.20	3.17 3.24
<b>Age group (yrs)</b>			<0.0001		
18–44	22,026,719	48,090		1	
45–64	26,883,699	85,339		1.46	1.44 1.47
65–75	13,994,455	26,899		0.88	0.87 0.89
<b>Race/ethnicity</b>			<0.0001		
Non-Hispanic white	41,115,636	98,970		1	
Non-Hispanic black	8,091,665	19,879		1.02	1.01 1.04
Hispanic	9,814,710	14,652		0.62	0.61 0.63
Other	3,882,862	26,827		2.88	2.84 2.92

**Table 2.** Eligibility for and enrollment in the National Diabetes Prevention Program Lifestyle Change Program between men and women by age and race/ethnicity

	Men		Women		P-Value <sup>1</sup>	Odds Ratio (women to men) <sup>2</sup>		
	NHANES DATA N Eligible	DPRP data N enrolled	NHANES N Eligible	DPRP N enrolled		OR	95% CI	
<b>Overall</b>	32,043,820	39,321	30,861,053	121,007	<0.0001	3.20	3.17	3.24
<b>Age group (yrs)</b>								
18-44	12,874,860	12,147	9,151,859	35,943	<0.0001	4.18	4.09	4.26
45-64	12,835,647	20,034	14,048,053	65,305	<0.0001	2.99	2.94	3.04
65-75	6,333,314	7,140	7,661,141	19,759	<0.0001	2.29	2.23	2.35
<b>Race/ethnicity</b>								
Non-Hispanic white	21,008,987	26,155	20,106,649	72,815	<0.0001	2.92	2.87	2.96
Non-Hispanic black	3,551,371	3,081	4,540,293	16,798	<0.0001	4.28	4.12	4.44
Hispanic	5,424,979	3,318	4,389,730	11,334	<0.0001	4.23	4.07	4.40
Other	2,058,482	6,767	1,824,380	20,060	<0.0001	3.37	3.28	3.47

<sup>1</sup> P-value for the difference of enrollment between men and women, Chi-Square test.

<sup>2</sup> All odds ratios in Table 2 are significant at a P-Value of <0.05.

Comparison of number of sessions attended through 44 weeks for men and women overall and by age and race/ethnicity.<sup>1</sup>

**Table 3.**

	Men			Women			Difference (Men–Women)		
	N	Mean	SE	N	Mean	SE	Mean	95% CI	P-Value <sup>2</sup>
<b>Overall</b>	7,525	14.0	0.08	30,916	13.8	0.04	0.12	-0.04 0.29	0.144
<b>Age group (yrs)</b>									
18–44	1,162	11.9	0.20	5,736	12.3	0.09	-0.41	-0.85 0.02	0.062
45–64	3,833	13.9	0.11	17,359	13.9	0.05	-0.06	-0.29 0.17	0.611
65–75	2,530	15.0	0.12	7,821	14.7	0.07	0.30	0.03 0.58	0.032*
<b>Race/ethnicity</b>									
Non-Hispanic white	4,169	15.3	0.10	16,609	15.0	0.05	0.35	0.14 0.56	0.001*
Non-Hispanic black	844	12.8	0.26	4,881	13.2	0.10	-0.38	-0.88 0.13	0.169
Hispanic	567	12.2	0.30	2,833	13.0	0.14	-0.76	-1.42 -0.11	0.023*
Other	1,945	12.0	0.15	6,593	11.8	0.08	0.23	-0.10 0.55	0.167

<sup>1</sup> Number of sessions attended through 44 weeks was examined in men and women who attended at least one session and had at least 12 months elapse since the first session.

<sup>2</sup> T-Test

\* P<.05