

# Barriers to participation and lifestyle change among lower versus higher income participants in the National Diabetes Prevention Program: lifestyle coach perspectives

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## Abstract

Individuals from socioeconomically disadvantaged groups have lesser participation and success in the National Diabetes Prevention Program (NDPP). Barriers to NDPP participation and lifestyle change were examined from the perspective of Lifestyle Coaches serving lower versus higher income participants. Lifestyle Coaches ( $n = 211$ ) who serve lower income ( $n = 82$ ) or higher income ( $n = 129$ ) participants reported on observed barriers to NDPP participation and lifestyle change and ranked the three most significant barriers to (a) NDPP participation and (b) lifestyle change. Group differences in number/type of barriers were examined using t-tests and chi-square analyses, and ranking differences were examined using multilevel cumulative logit models. Lifestyle Coaches of lower income (versus higher income) participants reported two additional barriers on average. Ranked barriers to participation were similar between groups, and notably included physical/emotional barriers. However, for lifestyle change, those serving lower income groups were more likely to rank *lack of access to healthy grocery stores*, but less likely to rank *low motivation* and *lack of family support*. Lifestyle Coaches of lower income participants were less likely to rank *long wait period prior to enrollment* as the most significant barrier to participation, and to rank *lack of time off from work* as the most significant barrier to lifestyle change. Despite more barriers observed among lower versus higher income participants, overlap in the most significant barriers highlights the potential utility of widely addressing common barriers among NDPP participants. In particular, physical and emotional barriers have been overlooked, yet deserve greater attention in future research and practice.

## Lay Summary

The National Diabetes Prevention Program (NDPP) has less successfully reached and changed the lifestyles of lower income (versus higher income) adults in the USA who are at high risk for type 2 diabetes. In a nationwide online survey, we asked Lifestyle Coaches who deliver the NDPP to identify up to 37 potential barriers to participation and success that they had observed among their participants. We then compared the number, type, and rankings of the most significant barriers to participation and success in the NDPP from the perspective of Lifestyle Coaches estimating the majority of their participants had lower versus higher incomes. Lifestyle Coaches delivering the NDPP to lower income participants reported an average of two additional barriers to participation and success than those delivering the program to higher income participants. The barriers ranked among the most significant to NDPP participation and lifestyle change were generally similar among Lifestyle Coaches working with lower versus higher income participants. Top-ranked barriers included physical/emotional symptoms (e.g., anxiety, depression) as well as barriers previously reported in studies focused on NDPP participants. It is critical that barriers be carefully evaluated and addressed to improve the nationwide impact of the NDPP.

**Keywords:** Healthy equity, Health disparities, Diabetes prevention program, Weight loss

## Implications

**Practice:** Organizations delivering lifestyle interventions should systematically assess potential barriers to participation and lifestyle change among the participants they serve.

**Policy:** Policymakers who want to reduce diabetes disparities should consider policies that mitigate social determinants of health and other barriers that drive diabetes disparities.

**Research:** Future research should assess barriers to participation and lifestyle change in lifestyle interventions, particularly physical and emotional factors, from the perspective of additional stakeholders (e.g., socioeconomically disadvantaged participants, their referring providers).

## Introduction

Lifestyle intervention is an evidence-based approach to prevent type 2 diabetes among adults with risk factors such as prediabetes (e.g., HbA1c 5.7%–6.4%) [1]. To provide lifestyle intervention to the growing number of Americans at risk for type 2 diabetes, Congress authorized the launch of the National Diabetes Prevention Program (NDPP) in 2010 [2]. The NDPP was based on compelling results from a landmark randomized clinical trial that found 58% reduction in type 2 diabetes from lifestyle intervention [1]. Lifestyle intervention in the clinical trial was primarily delivered individually [3]. To scale-up toward reaching the 37.5% of adults in the USA who are estimated to have prediabetes [4], the year-long NDPP can be delivered through in-person group classes, online (e.g., mobile application), remotely (e.g., virtual classroom), or a combined approach [2, 5]. The NDPP has had commendable successes, including delivery to hundreds of thousands of Americans [2], yet significant challenges remain to engage individuals at highest risk for type 2 diabetes [6]. A concern is that NDPP outcomes (e.g., incident type 2 diabetes and modest weight loss) are worse for socioeconomically disadvantaged groups, often due to limited participation [7–9], despite the greater need to address health disparities [10, 11].

Recent qualitative studies described barriers to NDPP participation (e.g., attendance and program completion) from the perspective of participants [12–14]. For example, predominantly low-income participants from an urban safety-net healthcare system reported conflicting with work schedules, lack of transportation and child care, and other health issues as barriers to attendance [14]. As these findings illustrate among NDPP participants, the contexts in which individuals live substantially influence health outcomes and drive health disparities [10]. Five categories of these Social Determinants of Health (SDOH) were identified by the U.S. Department of Health and Human Services: economic stability, neighborhood and built environment, social and community context, education, and health and health care [15]. A recent review identified associations between a number of SDOH and type 2 diabetes incidence, prevalence, and outcomes [10]. Many barriers to NDPP participation identified in recent studies include SDOH (e.g., lack of transportation to/from classes) [8, 12, 13] as well as other factors related to the NDPP (e.g., program not meeting participant's expectations, confusion about the need for diabetes prevention or program requirements) [13, 14]. In considering barriers to NDPP participation and lifestyle change, we considered SDOH as well as NDPP-specific barriers from previous studies. Given the consistent findings that co-morbid health problems are a substantial barrier to NDPP participation [12–14] and psychological symptoms specifically are associated with risk for both prediabetes and type 2 diabetes [16], we replaced the SDOH “health and health care” category with “physical/emotional health” when grouping potential barriers in this study.

To fully understand the day-to-day impact of a multi-level intervention such as the NDPP, it is critical that stakeholder engagement in the evaluation process occur across levels, as factors at each level can substantially affect the success and sustainability of intervention implementation [17]. In addition to the aforementioned qualitative studies of participants, the CDC has systematically evaluated participant- and organization-level [6, 18]. Although the CDC reported plans to collect data on Lifestyle Coaches [18], to the best of our

knowledge, implementation has not been assessed from the perspective of these front-line providers, despite their critical role to influence program outcomes while serving participants during the NDPP. For one, having Lifestyle Coaches build meaningful relationships with participants was identified as the most widely successful retention strategy in a recent qualitative study of NDPP delivery to “high-need” populations in Los Angeles, and Lifestyle Coaches at Community-Based Organizations (CBOs) were noted for their efforts to understand and resolve barriers to attendance among their participants [19]. Thus, Lifestyle Coaches are a key stakeholder group to examine and are also likely to be uniquely aware of the barriers their participants face.

Lifestyle Coaches have regular contact with participants over the course of the year-long NDPP. In the context of the in-person program, Lifestyle Coaches deliver a minimum of 22 classes (16 classes in the first 6 months, 6+ classes in the second 6 months) to a “cohort” (small group) of adults at risk for type 2 diabetes with overweight or obesity [5]. Even Lifestyle Coaches in completely virtual NDPPs (e.g., via lessons in a web application), which were allowed beginning in January 2015, have weekly communication with their participants (e.g., email and webconferencing) [2, 5]. Thus, Lifestyle Coaches are in a unique position to observe—and when possible, to attempt to mitigate—barriers experienced by participants [19]. Examples of strategies Lifestyle Coaches may use to promote equitable access to the NDPP and relevant resources include clearly communicating the program goals to set participant expectations, assessing understanding of program content and explaining unfamiliar concepts, and referring participants in need to organizations that provide access to healthy foods, health care, and income assistance.

The current study aims to (a) describe Lifestyle Coach perceptions of barriers to NDPP participation (i.e., enrollment, attendance at sessions, and program completion) and lifestyle change (i.e., increased physical activity, improved nutrition, greater weight loss), and (b) examine differences in perceived barriers between Lifestyle Coaches who work with mostly lower versus higher income participants in (1) the number of barriers observed and (2) the type and rankings of the barriers perceived to be most significant to participation and lifestyle change. We hypothesize that Lifestyle Coaches who work with lower versus higher income groups will perceive a greater number of barriers among their participants.

## Methods

### Participants

Lifestyle Coaches who have delivered the year-long NDPP to at least one cohort of participants were eligible for the study. From May to June 2021, the research team emailed contacts from the database of CDC-recognized organizations that provide the NDPP with information about the study and a link to an online screening form. The team emailed invitations for Lifestyle Coaches to participate in the study to all organizations with “Preliminary” or “Full” recognition from the CDC (denoting fidelity to published CDC guidelines for delivering the NDPP) [5]. Lifestyle Coaches received a \$10 electronic gift card for completing a 30-min online questionnaire. Of the 335 eligible Lifestyle Coaches who were sent a link to the consent cover letter and survey, 305 participated in the study by the end of data collection in June 2021 (91.0% response

rate). The University of Utah Institutional Review Board approved all study procedures.

## Measures

In the online questionnaire, Lifestyle Coaches were asked to report on their individual demographics and training, characteristics of the organization/NDPP where they deliver the intervention, barriers to NDPP participation and lifestyle change among their participants, strategies for recruitment and engagement, and implementation outcomes based on Proctor's taxonomy [20]. As an indication of the general socioeconomic status of their participants, Lifestyle Coaches were asked to provide information on the populations they served, including the estimated frequency of participants' receipt of federal assistance (*Do your participants have access to federal food assistance, or any other financial aid/supplemental income program?* Response options: Yes, most do; Yes, many do; Yes, some do; Yes, a few do; No; I don't know) and percentage of participants with low incomes (*Approximately what percent of your NDPP participants have low incomes?* Response options: 0–25%; 25–50%; 50–75%; 75–100%; I don't know). While Lifestyle Coaches may not have objective data on participant incomes, these items may nonetheless capture their general awareness based on the setting (e.g., Federally Qualified Health Center [FQHC] vs. private clinic), data on participant education level (required for reporting to the CDC) [5], and discussions with participants about social needs (e.g., housing and/or food insecurity). The measurement approach used builds upon previous work that identified whether NDPPs served primarily “high-need populations” based on a broader question: “Can you describe the characteristics of [NDPP] participants at your organization?” [19]

Lifestyle Coaches endorsed up to 37 barriers to NDPP participation and lifestyle change in the survey (Table 1). Our team developed the list of barriers by (a) sorting barriers from previous NDPP research into SDOH domains [15] (replacing “health and health care” with “physical/emotional health,” as mentioned above) or an NDPP/organization-level barrier category [8, 12–14, 19], and (b) considering additional barriers that our team believed could be relevant to participants in the NDPP from within the SDOH domains. Based on the community-based participatory research on mental health carried out by an author (AA), the term “emotional symptoms” was used as this term was preferred and viewed as less stigmatizing than “psychological symptoms” or “mental health symptoms” [21]. These barriers were presented to all Lifestyle Coaches in the same order, with no response bias due to order of presentation ( $r = -0.049$ ,  $p = .772$ ). Lifestyle Coaches then ranked the three *most significant* barriers from the list of barriers they endorsed to (a) participation (i.e., enrollment, attendance at sessions, and program completion) and (b) lifestyle change (i.e., increased physical activity, improved nutrition, and greater weight loss).

Following the list of 37 specific barriers, Lifestyle Coaches had the option of describing additional barriers in open-ended responses. Examples of responses include *technology barriers*, *length of the program*, *lack of match between Lifestyle Coach and the community served*, and *accessibility barriers for individuals with disabilities*. Although Lifestyle Coaches could include their open-ended responses in their rankings of the most significant barriers, the current analysis focuses on the barriers identified a priori for consistency across subjects,

and given the range of responses and the small percentage of ranked barriers that were open-ended responses (9.8% of most significant barriers to participation, 6.6% of most significant barriers to lifestyle change).

## Data analysis

Lifestyle Coach demographics and training, characteristics of their organization/NDPP, and perceived barriers to program participation and lifestyle change were analyzed descriptively using SPSS. Lifestyle Coaches were categorized into two groups: (a) those who reported the majority of their participants are members of lower income groups (i.e., responses of “Yes, most do” or “Yes, many do” on the federal assistance item, or responses of “50–75%” or “75–100%” on the low income item), and (b) those who reported the majority of their participants are members of higher income groups (i.e., responses of “Yes, some do,” “Yes, a few do,” or “No” on the federal assistance item, and responses of “0–25%” or “25–50%” on the low income item). Lifestyle Coaches who participated in the larger study but responded “I don't know” to both the federal assistance and low-income status items ( $n = 94$ ) were excluded from this analysis.

Group differences in the number of barriers identified were examined with independent samples *t*-tests, and group differences in the barriers identified as most significant to participation and lifestyle change were examined with Pearson chi-square tests in SPSS. Finally, differences between groups in *rankings* of the most significant barriers to participation and lifestyle change were analyzed with multilevel cumulative logit models with restricted penalized quasi-likelihood estimation [22] in Hierarchical Linear and Nonlinear Modeling [23] (HLM 7). Barriers ranked among the most significant by at least 10% of Lifestyle Coaches in one or both groups were included as Level-1 dummy-coded predictors in the models (12 barriers in the participation model, 14 barriers in the lifestyle change model). The reference group was the barrier to the model outcome that was most frequently endorsed to (i.e., *lack of time off from work* for the participation model, *cost of health foods/access to affordable grocery stores* for the lifestyle change model). Group (lower income = 1, higher income = 0) was included at Level 2, along with cross-level interactions between each barrier and group. The total number of barriers each Lifestyle Coach endorsed was included as a Level-2 covariate on the overall intercept of the models. As the variance components were not significantly different from zero, random effects were not included in the final models.

## Results

### Sample characteristics

Among the 211 Lifestyle Coaches in this analysis, 82 (38.9%) reported serving mostly participants of lower income groups (i.e., low-income and/or receiving federal assistance) and 129 (61.1%) reported serving mostly participants of higher income groups. Most Lifestyle Coaches identified as women ( $n = 199$ ; 94.3%), with an average age of 48.7 years ( $SD = 13.2$ ), and a college degree or higher (85.7%). Racial/ethnic identities of Lifestyle Coaches included white, non-Hispanic ( $n = 159$ ; 75.4%), Hispanic/Latinx ( $n = 20$ ; 9.5%), African American/Black ( $n = 16$ ; 7.6%), Asian ( $n = 7$ ; 3.3%), American Indian/Alaska Native ( $n = 6$ ; 2.8%), and multiracial ( $n = 3$ ; 1.4%).

**Table 1** | Frequency of Lifestyle Coach endorsement of participant barriers by group

Barrier	Lower income		Higher income	
	%	<i>n</i>	%	<i>n</i>
Economic/financial barriers				
Cost of the program [13]	24.4%	20	33.3%	43
Cost of healthy foods/access to affordable grocery stores	76.8%	63	65.1%	84
Cost of transportation [12]	47.6%	39	28.7%	37
Cost of childcare [13, 14]	41.5%	34	18.6%	24
Lack of time off from work (e.g., due to long hours, irregular schedule) [14, 19]	82.9%	68	86.8%	112
Neighborhood/environmental barriers				
Inconvenient class location [13, 14, 19]	30.5%	25	35.7%	46
Lack of transportation [12, 13]	59.8%	49	39.5%	51
Lack of access to healthy grocery stores	56.1%	46	33.3%	43
Lack of access to green space (e.g., parks) for outdoor activity	39.0%	32	20.2%	26
Lack of recreational facilities (e.g., gyms)	51.2%	42	38.0%	49
Climate that often impedes outdoor activity or traveling to classes [12]	48.8%	40	44.2%	57
Unsafe neighborhood	41.5%	34	17.1%	22
Social/community barriers				
Difficulty communicating in the language used in the course [13]	9.8%	8	6.2%	8
Lack of connection with me and/or other NDPP participants [13, 14, 19]	12.2%	10	19.4%	25
Lack of family support within the household [13]	65.9%	54	72.1%	93
Lack of social support outside the NDPP [12, 14]	61.0%	50	59.7%	77
Lack of childcare [13, 14]	43.9%	36	20.9%	27
Lack of time [13, 14, 19]	74.4%	61	78.3%	101
Other family/caregiving responsibilities [12, 13]	67.1%	55	70.5%	91
Conflicts with work or school schedule [12–14, 19]	76.8%	63	81.4%	105
Unstable life circumstance(s) [13]	50.0%	41	40.3%	52
Educational barriers				
Difficulty understanding the program content [13, 14]	24.4%	20	10.1%	13
Lack of knowledge about program concepts [12]	56.1%	46	36.4%	47
Learning disabilities or difficulties	28.0%	23	18.6%	24
Physical/emotional health barriers				
Chronic pain and/or other physical health conditions [12–14]	80.5%	66	88.4%	114
Inability to drive due to health issues (e.g., advanced age, seizure disorder) [14]	28.0%	23	20.2%	26
Lack of access to preventive care [12]	29.3%	24	15.5%	20
Emotional symptoms (e.g., anxiety, depression)	75.6%	62	75.2%	97
Lack of confidence in ability to make healthy lifestyle changes [12]	79.3%	65	81.4%	105
Problems with sleep	46.3%	38	53.5%	69
Low motivation [12, 19]	81.7%	67	82.2%	106
NDPP or organizational-related barriers				
NDPP content not meeting participant expectations [8, 13]	26.8%	22	31.0%	40
Dissatisfaction with the class format [13]	20.7%	17	14.7%	19
Dissatisfaction with the class leaders [13]	3.7%	3	3.1%	4
Goals of participants differ from goals of NDPP [13]	37.8%	31	47.3%	61
Confusion about NDPP relevance and/or requirements [8, 14]	30.5%	25	30.2%	39
Long wait period prior to enrollment or new classes starting [13]	30.5%	25	35.7%	46

% = percentage of Lifestyle Coaches in group that endorsed the barrier.

Citations are included for the barriers that are based on previous NDPP research findings. Lower income = Lifestyle Coaches delivering the NDPP to primarily lower income participants (*n* = 82); Higher income = Lifestyle Coaches delivering the NDPP to primarily higher income participants (*n* = 129).

Lifestyle Coaches had 4.2 years' experience delivering the NDPP on average (*SD* = 2.2 years), among whom 84.8% (*n* = 179) had experience delivering the NDPP in person, 57.3% (*n* = 121) delivering it remotely (e.g., classes held via Zoom), 26.1% (*n* = 55) delivering it through an online platform, and 36.5% (*n* = 77) through a combination of these modalities. Lifestyle Coaches delivered the NDPP in various settings, including Hospital/Healthcare Systems (*n* = 67; 31.8%),

CBOs/Community Health Centers/FQHCs (*n* = 35; 16.6%), YMCAs (*n* = 25; 11.8%), State or Local Health Departments (*n* = 25; 11.8%), or one of several other types of organization (e.g., Indian Health Service, Senior Center, University; *n* = 59; 28.0%).

To assess for potential bias in our subsample for analysis, we conducted *z*-tests and *t*-tests of differences in demographic characteristics and experiences (years of experience,

organization type, modality) of the 211 Lifestyle Coaches included in this study compared with the 94 removed from the current analyses. There were no significant differences in demographic characteristics (age, education, racial/ethnic identity), years of experience, or proportion of Lifestyle Coaches delivering the NDPP in each of the four modalities (i.e., in-person, distance learning, online, combination). However, a larger proportion of Lifestyle Coaches included in the current study were from organizations defined as Community-Based Organization/Community Health Center/Federally Qualified Health Center ( $n = 35$ ; 16.6%) compared with those who were excluded due to a lack of knowledge about participant economic status ( $n = 5$ ; 5.3%).

### Validity of lifestyle coach grouping strategy

To assess the validity of our strategy for grouping Lifestyle Coaches into those who work with mostly lower versus higher income participants, we examined  $z$ -tests of group differences in responses to the items used to create the grouping and the NDPP organization type. A greater proportion of Lifestyle Coaches in the lower (versus higher) income group reported 50%–75% and 75%–100% of their participants had low incomes, and a smaller proportion reported 0%–25% and 25%–50% of their participants had low incomes. An identical pattern of significant differences was found in the federal assistance item responses. Finally, there was a significantly larger proportion of Lifestyle Coaches in the lower (vs. higher) income group at CBOs/Community Health Centers/FQHCs and Indian Health Services organizations, and a smaller proportion at University or Hospital/Healthcare Systems. As the former are more likely to serve lower income groups, and the latter higher income groups, this provides additional support for the groupings used in this study.

### Group differences in number of barriers to participation and lifestyle change

Lifestyle Coaches endorsed an average of 16.3 ( $SD = 6.3$ ) of the 37 possible barriers to participation and lifestyle change in the NDPP experienced by their participants. The frequency with which barriers were endorsed by Lifestyle Coaches in each group are presented in Table 1. Lifestyle Coaches working primarily with lower income groups reported their participants experienced an average of nearly two additional barriers to participation and lifestyle change in the NDPP ( $M = 17.4$ ,  $SD = 7.1$ ) compared with those working with higher income groups ( $M = 15.5$ ,  $SD = 5.7$ ),  $t = 2.11$ ,  $p = .036$ .

### Most significant barriers to participation and lifestyle change

Table 2 presents the most frequently ranked barriers to participation and lifestyle change (i.e., ranked among the three most significant barriers by  $\geq 10\%$  of Lifestyle Coaches in one or both groups), along with contingency tables and results of Pearson chi-square analyses. There were no significant group differences in the most common ranked barriers to NDPP participation or lifestyle change when  $p$ -values were compared with the Bonferroni-corrected criterion.

### Rankings of most significant barriers to participation and lifestyle change

There were some differences in the order in which Lifestyle Coaches ranked specific barriers to NDPP participation, but

only one significant group difference in rankings (i.e., a significant difference between Lifestyle Coaches working with lower versus higher income participants). Results of the multilevel cumulative logit models focused on barriers to NDPP participation revealed that, relative to rankings of *lack of time off from work* (the reference barrier), Lifestyle Coaches who work with higher income participants were less likely to rank *chronic pain and/or other physical health conditions* ( $p = .018$ ; point estimate  $B = -1.46$ , odds ratio = 0.23) and *emotional symptoms* (e.g., anxiety, depression) ( $p = .026$ ; point estimate  $B = -1.81$ , odds ratio = 0.16) as the most significant barrier to participation (i.e., they were less likely to assign a rank of 1 vs. a rank of 2 or 3). These effects were not moderated by group ( $p$ 's = .071 and .569), suggesting the same pattern among Lifestyle Coaches who work with lower versus higher income participants. Thus, regardless of the income status of the participants served, Lifestyle Coaches were less likely to rank *chronic pain and/or other physical health conditions* and *emotional symptoms* as the most significant barrier to participation compared with *lack of time off from work*.

The one barrier to participation in the NDPP that was ranked differently based on Lifestyle Coach group was *long wait period prior to enrollment or new classes starting* ( $p = .011$ ). Lifestyle Coaches who work with lower income groups were more likely to rank *long wait period prior to enrollment or new classes starting* as the most significant barrier to participation compared with *lack of time off from work* (point estimate  $B = 1.16$ , odds ratio = 3.18), whereas Lifestyle Coaches who work with higher income groups were less likely to rank *long wait period prior to enrollment or new classes starting* as the most significant barrier to participation compared with *lack of time off from work* ( $p = .01$ ; point estimate  $B = -1.60$ , odds ratio = 0.20).

Similar to the pattern of findings related to barriers to NDPP participation, there was one difference in the order in which Lifestyle Coaches ranked barriers (i.e., *lack of time off from work*;  $p = 0.044$ ), and this varied by Lifestyle Coach group. Lifestyle Coaches who work with lower income groups were less likely to rank *lack of time off from work* as the most significant relative to *cost of healthy foods/access to affordable grocery stores* (point estimate  $B = -0.92$ , odds ratio = 0.40), whereas those who work with mostly higher income groups were equally as likely to rank *lack of time off from work* than *cost of healthy foods/access to affordable grocery stores* ( $p = .179$ ; point estimate  $B = 0.06$ , odds ratio = 1.06).

## Discussion

Lifestyle Coaches from CDC-recognized organizations across the USA endorsed a number of barriers to NDPP participation and lifestyle change among their participants. Barriers included those identified in previous NDPP participation research, as well as barriers from within SDOH categories that were identified for the first time (Table 1). Lifestyle Coaches who work primarily with lower income participants observed a greater total number of barriers compared with those working with higher income participants. However, there were no group differences in which barriers were ranked among the most significant to NDPP participation and lifestyle change, and few group differences in the order in which these barriers were ranked. We discuss these findings in more depth, place them in the context of the broader literature, and discuss

**Table 2** | Most commonly ranked barriers to NDPP participation and lifestyle change by Lifestyle Coach group

Barriers to Participation	Top Ranked	Group		$\chi^2$	<i>p</i>
		Lower Income	Higher Income		
Lack of time off from work [14, 19]	Yes	30 (41.7%)	46 (37.1%)	0.401	.527
	No	42 (58.3%)	78 (62.9%)		
Lack of time [13, 14, 19]	Yes	18 (25.0%)	34 (27.4%)	0.137	.711
	No	54 (75.0%)	90 (72.6%)		
Low motivation [12, 19]	Yes	15 (20.8%)	25 (20.2%)	0.123	.910
	No	57 (79.2%)	99 (79.8%)		
Conflicts with work or school schedule [12–14, 19]	Yes	14 (19.4%)	28 (22.6%)	0.266	.606
	No	58 (80.6%)	96 (77.4%)		
Lack of family support within the household [13]	Yes	12 (16.7%)	20 (16.1%)	0.010	.922
	No	60 (83.3%)	104 (83.9%)		
Chronic pain and/or other physical health conditions [12–14]	Yes	11 (15.3%)	15 (12.1%)	0.401	.527
	No	61 (84.7%)	109 (87.9%)		
Other family/caregiving responsibilities [12, 13]	Yes	10 (13.9%)	23 (18.5%)	0.706	.401
	No	62 (86.1%)	101 (81.5%)		
Emotional symptoms (e.g., anxiety, depression)	Yes	9 (12.5%)	7 (5.6%)	2.855	.091
	No	63 (87.5%)	117 (94.4%)		
Cost of healthy foods/access to affordable grocery stores	Yes	9 (12.5%)	11 (8.9%)	0.655	.418
	No	63 (87.5%)	113 (91.1%)		
Lack of confidence in ability to make healthy lifestyle changes [12]	Yes	9 (12.5%)	22 (17.7%)	0.940	.332
	No	63 (87.5%)	102 (82.3%)		
Cost of the program [13]	Yes	6 (8.3%)	19 (15.3%)	2.000	.157
	No	66 (91.7%)	105 (84.7%)		
Long wait period [13]	Yes	4 (5.6%)	14 (11.3%)	1.796	.180
	No	68 (94.4%)	110 (88.7%)		
Barriers to Lifestyle Change	Top Ranked	Lower Income	Higher Income	$\chi^2$	<i>p</i>
Cost of healthy foods/access to affordable grocery stores	Yes	22 (30.1%)	26 (20.8%)	2.188	.139
	No	51 (69.9%)	99 (79.2%)		
Chronic pain and/or other physical health conditions	Yes	19 (26.0%)	30 (24.0%)	0.102	.750
	No	54 (74.0%)	95 (76.0%)		
Emotional symptoms (e.g., anxiety, depression)	Yes	17 (23.3%)	18 (14.4%)	2.502	.114
	No	56 (76.7%)	107 (85.6%)		
Low motivation	Yes	17 (23.3%)	46 (36.8%)	3.879	.049
	No	56 (76.7%)	79 (63.2%)		
Lack of time off from work (e.g., due to long hours, irregular schedule)	Yes	13 (17.8%)	19 (15.2%)	0.231	.631
	No	60 (82.2%)	106 (84.8%)		
Climate that often impedes outdoor activity or traveling to classes	Yes	12 (16.4%)	16 (12.8%)	0.502	.478
	No	61 (83.6%)	109 (87.2%)		
Lack of time	Yes	12 (16.4%)	33 (26.4%)	2.604	.107
	No	61 (83.6%)	92 (73.6%)		
Lack of confidence in ability to make healthy lifestyle changes	Yes	11 (15.1%)	32 (25.6%)	3.001	.083
	No	62 (84.9%)	93 (74.4%)		
Lack of recreational facilities (e.g., gyms)	Yes	9 (12.3%)	10 (8.0%)	0.995	.318
	No	64 (87.7%)	115 (92.0%)		
Lack of access to healthy grocery stores	Yes	8 (11.0%)	2 (1.6%)	8.418	.004
	No	65 (89.0%)	123 (98.4%)		
Lack of family support within the household	Yes	8 (11.0%)	33 (26.4%)	6.692	.010
	No	65 (89.0%)	92 (73.6%)		
Lack of social support outside the NDPP	Yes	8 (11.0%)	14 (11.2%)	0.003	.958
	No	65 (89.0%)	111 (88.8%)		

Barriers to Participation	Top Ranked	Group		$\chi^2$	<i>p</i>
		Lower Income	Higher Income		
Conflicts with work or school schedule	Yes	5 (6.8%)	17 (13.6%)	2.126	.145
	No	68 (93.2%)	108 (86.4%)		
Other family/caregiving responsibilities	Yes	7 (9.6%)	15 (12.0%)	0.271	.603
	No	66 (90.4%)	110 (88.0%)		

Citations are included for previously identified barriers to NDPP participation. Of the Lifestyle Coaches who work primarily with lower income groups, 10 did not rank barriers to participation and 9 did not rank barriers to lifestyle change. Of the Lifestyle Coaches who work primarily with higher income groups, 5 did not rank barriers to participation and 4 did not rank barriers to lifestyle change. Top ranked [Yes = *n* (%) that included barrier in the 3 most significant barriers; No = *n* (%) that did not include barrier in the 3 most significant]. To adjust for the 26 chi-square tests and maintain a familywise alpha of .05, we used a Bonferroni-corrected *p* value of .002 (alpha of .05 divided by 26 tests), and therefore conclude there were no significant differences in the rate at which barriers were ranked by Lifestyle Coaches in the lower versus higher income groups.

strategies and policies that may reduce barriers and promote health equity.

A number of barriers were viewed as particularly pervasive by Lifestyle Coaches, regardless of the poverty status of the participants they served. The following barriers were endorsed by more than 75% of Lifestyle Coaches in both the lower and higher income groups, and were also ranked among the most significant to both participation and lifestyle change (i.e., at least 10% of Lifestyle Coaches in at least one group ranked them among the top 3): *lack of time off from work, conflicts with work or school schedule, chronic pain and/or other physical health conditions, emotional symptoms, lack of confidence in ability to make lifestyle changes, and low motivation*. Several other barriers were not as frequently endorsed, but were among the most significant to both participation and lifestyle change: *lack of time, lack of family support within the household, other family/caregiving responsibilities, and cost of healthy foods/access to affordable grocery stores*. Aside from *emotional symptoms* and *cost of healthy foods/access to affordable grocery stores*, these barriers from the economic/financial, social/community, and physical/emotional health categories of SDOH were all based on those previously identified in NDPP participation research [12–14, 19]. Findings from the current study extend this previous work with the finding that many of the most significant barriers to participation are *also among the most significant barriers to lifestyle change*. Addressing these barriers could be particularly powerful, as they may facilitate increases in participation and greater lifestyle change in the NDPP.

As noted above, *emotional symptoms* has not been reported as a barrier in previous work, yet Lifestyle Coaches—regardless of the poverty status of their participants—perceived it to be both common and impactful for participation as well as lifestyle change. There is a relative dearth of research on emotional/psychological symptoms in the context of lifestyle interventions. This is surprising in light of documented associations between psychological symptoms and heightened risk for type 2 diabetes [16], and between antidepressant use and greater diabetes risk in the lifestyle intervention arm of the initial Diabetes Prevention Program randomized clinical trial [24]. Although lifestyle interventions may improve symptoms of depression [25], these symptoms may attenuate outcomes. A recent study found smaller increases in physical activity during lifestyle intervention among individuals with depressive symptoms relative to those without [26], and difficulty achieving physical activity goals in the NDPP can lead

to early dropout [27]. Our findings placing *emotional symptoms* among the most frequently endorsed barriers and the most significant barriers to participation and lifestyle change, combined with these previous research findings, suggest an increased focus on psychological symptoms is warranted. We recommend NDPP programs consider implementation of a systematic screening process for psychological symptoms and referral to mental health services when indicated.

Lifestyle Coaches viewed *cost of the program* and *long wait period prior to enrollment* among the most significant barriers to NDPP participation. Although there were not statistically significant group differences in the rates at which Lifestyle Coaches ranked these barriers, the inclusion of these barriers was driven by Lifestyle Coaches who work with higher income groups (15.3% and 11.3% ranked among the most significant), since less than 10% of those who work with lower income groups ranked these barriers as among the most significant (8.3% and 5.6%). As the NDPP is currently a covered benefit of Medicare (with no copayment), and Medicaid in select states [2], it is not surprising that cost would be a more common barrier among higher income groups who are more likely to have private insurance plans that are not mandated to cover the NDPP [28]. As inclusion of the NDPP as a covered benefit continues to increase, it is likely program cost will be a less common participation barrier. Although just 5.6% of Lifestyle Coaches working with lower income groups ranked *long wait period prior to enrollment* among the most significant barriers, those who *did* rank it were more likely to consider it the top barrier to participation. Organizations may seek to structure program delivery so that new classes begin with greater frequency and capacity.

Turning to the barriers to lifestyle change identified in the current study, several aspects of food access and the physical environment were included among the most significant: *cost of healthy foods/access to affordable grocery stores, climate that impedes outdoor activity or traveling to classes, lack of recreational facilities, and lack of access to healthy grocery stores*. Access to healthy foods and the physical environments in which individuals live are key SDOH that drive disparities in type 2 diabetes [10], but only *climate that impedes outdoor activity or traveling to classes* had been identified in previous NDPP participation research [12]. However, in contrast to previous research, climate was not among the most significant barriers to participation in the current study. Lifestyle Coaches serving lower and higher income participants ranked the impact of *climate that impedes outdoor activity or*

traveling to classes similarly, although this barrier likely varies by region of the country (data we did not collect in the current survey).

Lifestyle Coaches serving lower income groups ranked *cost of healthy foods/access to affordable grocery stores* more frequently than any other barrier to lifestyle change (30.1%) and were more likely to rank it as *the most significant* barrier to lifestyle change. This barrier was also among the most frequently ranked barriers to lifestyle change among Lifestyle Coaches serving higher income groups (20.8%), although these Lifestyle Coaches were not more likely to rank it as the most significant. In contrast, the inclusion of *lack of access to healthy grocery stores* and *lack of recreational facilities* was driven by the rankings of Lifestyle Coaches serving lower income participants (11.0% and 12.3% of this group ranked the barriers, respectively). Although there were not significant group differences in the rate of ranking these barriers, less than 10% of Lifestyle Coaches serving higher income participants ranked them (1.6% and 8.0%, respectively).

Although there is clear evidence that “food deserts” are more common in socioeconomically disadvantaged communities [29], and communities with limited access to healthy foods and physical activity facilities have higher rates of type 2 diabetes [10], our findings suggest that the food and physical environments in which individuals live affect NDPP lifestyle change regardless of poverty status, but may have a more significant impact on lower income participants. Given the timing of data collection, it is possible Lifestyle Coach responses to the food items in particular were affected by recency bias, as they completed the survey in the midst of the COVID-19 pandemic at a time when food insecurity had more than tripled, affecting 38% of households nationwide [30]. Nonetheless, in light of the significance of these barriers across groups, it is recommended that—regardless of participant income status—NDPPs: (a) share resources for food assistance in the local community, (b) implement food insecurity screenings and assessment of the degree to which physical environment in which participants live may help or hinder lifestyle change, and (c) incorporate discussion and local resources during the delivery of NDPP focused on meals that are both healthy and affordable, and strategies to facilitate physical activity in the absence of access to recreational facilities and a pleasant climate.

This study has limitations. First, the analysis of barriers in this study—while guided by the SDOH framework and previous research—focused only on a list of barriers developed by the research team. Future qualitative research is important to understand impacts of a broader range of barriers in more depth. Second, the determination of groups (lower versus higher income) was based on subjective responses from Lifestyle Coaches rather than objective data. Although there was support for the validity of our grouping strategy generally, there are Lifestyle Coaches in each of the groups who work with participants from a range of economic statuses. Third, participants were asked to rank the most significant barriers to multiple aspects of participation (i.e., enrollment, attendance at sessions, and program completion) and multiple aspects of lifestyle change (i.e., increased physical activity, improved nutrition, and greater weight loss). It is possible the most significant barriers vary by the aspect of participation or lifestyle change considered. Finally, the study is limited by our focus on data collected from Lifestyle Coaches in the midst of the COVID-19 pandemic. Although survey instructions to

Lifestyle Coaches did not ask that they consider barriers at a specific time period in relation to the pandemic (“We are interested in barriers to NDPP participation and/or lifestyle change that you have observed among your participants.”), those who are economically disadvantaged have been disproportionately affected by the pandemic [31] and this may have affected responses. Finally, it is possible the assessment of these barriers from the perspective of other stakeholders (e.g., referring providers, participants) would yield different results.

Taken together, results from this study demonstrate a large number of factors that impede participation and lifestyle change in the NDPP from the perspective of Lifestyle Coaches across the country, while highlighting those perceived to most significantly affect outcomes. Consistent with our hypothesis, Lifestyle Coaches who work primarily with lower versus higher income participants observed more barriers to NDPP participation and lifestyle change. Despite this, the most significant barriers and rankings of these barriers were similar across groups. In addition to implementing screening and referral processes related to psychological symptoms, food insecurity, recreational facilities, and other SDOH, participants may benefit from discussion of potential barriers to participation and lifestyle change early in the NDPP. Furthermore, careful needs assessments related to SDOHs and action plans for specific populations that organizations serve may help mitigate some barriers and facilitate equitable access to the NDPP for individuals from economically disadvantaged groups.

However, it is important that the burden of reducing type 2 diabetes disparities does not fall exclusively on the shoulders of Lifestyle Coaches, programs, and participants. Many argue that true population-based diabetes prevention cannot be achieved within the health sector without policy-level solutions that address the combination of social, economic, and environmental policies that have led to the explosion of diabetes among Americans. While we must continue to seek global solutions to the burden of diabetes, at the level of the health sector, considering systems- and practice-level solutions may help mitigate these barriers. For example, the implementation of small financial incentives by payers to attend sessions can improve engagement and retention in the sessions [32]. At the health system level, implementing guidelines and workflows that encourage clinicians to screen and refer eligible patients to the NDPP may help boost enrollment in this underutilized resource. Finally, social policies that “make healthy behaviors easy to adopt or even the default” [11]—including those that aim to address SDOH, such as reducing poverty, increasing access to environments and resources that facilitate physical activity and nutrition, increasing community and social support, increasing educational access, and addressing comorbid health problems—have great potential to increase participation and lifestyle change in the NDPP among socioeconomically disadvantaged populations.

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## Compliance with Ethical Standards

**Conflicts of Interest:** All authors declare that they have no conflicts of interest.

**Ethical Approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The University of Utah Institutional Review Board reviewed all study procedures. This article does not contain any studies with animals performed by any of the authors.

**Authors' Contributions:** All authors were involved in the preparation of this manuscript and read and approved the final version.

**Informed Consent:** Informed consent was obtained from all individual participants included in the study.

## Transparency Statements

**Study registration:** This study was not formally pre-registered.

**Analytic plan pre-registration:** The analysis plan was not formally pre-registered.

**Data availability:** De-identified data from this study are not available in a public archive. De-identified data from this study will be made available (as allowable according to institutional IRB standards) by emailing the corresponding author. Analytic code used to conduct the analyses presented in this study are not available in a public archive. They may be available by emailing the corresponding author. Materials used to conduct the study may be obtained by emailing the corresponding author.

## References

1. The Diabetes Prevention Program Research Group. Reduction in the incidence of Type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002;346(6):393–403. doi:10.1056/NEJMoa012512.
2. Gruss SM, Nhim K, Gregg E, Bell M, Luman E, Albright A. Public health approaches to type 2 diabetes prevention: the US National Diabetes Prevention Program and beyond. *Curr Diab Rep.* 2019;19(9):78. doi:10.1007/s11892-019-1200-z.
3. The Diabetes Prevention Program Research Group. The Diabetes Prevention Program (DPP): description of lifestyle intervention. *Diabetes Care.* 2002;25(12):2165–2171.
4. Cheng YJ, Kanaya AM, Araneta MRG, et al. Prevalence of diabetes by race and ethnicity in the United States, 2011–2016. *JAMA.* 2019;322(24):2389–2398. doi:10.1001/jama.2019.19365.
5. Centers for Disease Control and Prevention. Diabetes prevention recognition program standards and operating procedures. Published online May 1, 2021. <https://www.cdc.gov/diabetes/prevention/pdf/dprp-standards.pdf>
6. Ely EK, Gruss SM, Luman ET, et al. A national effort to prevent type 2 diabetes: participant-level evaluation of CDC's National Diabetes Prevention Program. *Diabetes Care.* 2017;40(10):1331–1341. doi:10.2337/dc16-2099.
7. Ritchie ND, Sauder KA, Phimphasone-Brady P, Amura CR. Rethinking the national diabetes prevention program for low-income whites. *Diabetes Care.* 2018;41(4):e56–e57. doi:10.2337/dc17-2230.
8. Cannon MJ, Masalovich S, Ng BP, et al. Retention among participants in the National Diabetes Prevention Program lifestyle change program, 2012–2017. *Dia Care.* 2020;43(9):2042–2049. doi:10.2337/dc19-2366.
9. O'Brien MJ, Whitaker RC, Yu D, Ackermann RT. The comparative efficacy of lifestyle intervention and metformin by educational attainment in the Diabetes Prevention Program. *Prev Med.* 2015;77:125–130. doi:10.1016/j.ypmed.2015.05.017.
10. Hill-Briggs F, Adler NE, Berkowitz SA, et al. Social determinants of health and diabetes: a scientific review. *Diabetes Care.* Published online November 2, 2020. doi:10.2337/dci20-0053.
11. Spencer Bonilla G, Rodriguez-Gutierrez R, Montori VM. What we don't talk about when we talk about preventing Type 2 diabetes—addressing socioeconomic disadvantage. *JAMA Intern Med.* 2016;176(8):1053–1054. doi:10.1001/jamainternmed.2016.2952.
12. Ritchie ND, Phimphasone-Brady P, Sauder KA, Amura CR. Perceived barriers and potential solutions to engagement in the National Diabetes Prevention Program. *ADCES in Practice.* 2021;9(1):16–20. doi:10.1177/2633559X20966275.
13. Baucom KJW, Pershing ML, Dwenger KM, Karasawa M, Cohan JN, Ozanne EM. Barriers and facilitators to enrollment and retention in the National Diabetes Prevention program: perspectives of women and clinicians within a health system. *Women's Health Reports.* 2021;2(1):133–141. doi:10.1089/whr.2020.0102.
14. Harrison CR, Phimphasone-Brady P, DiOrio B, et al. Barriers and facilitators of National Diabetes Prevention Program engagement among women of childbearing age: a qualitative study. *Diabetes Educ.* 2020;46(3):279–288. doi:10.1177/0145721720920252.
15. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2020 Social Determinants of Health.* Accessed December 3, 2021. <https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health>
16. Eriksson AK, Ekbom A, Granath F, Hilding A, Efendic S, Östenson CG. Psychological distress and risk of pre-diabetes and Type 2 diabetes in a prospective study of Swedish middle-aged men and women. *Diabet Med.* 2008;25(7):834–842. doi:10.1111/j.1464-5491.2008.02463.x.
17. Kirchner JE, Parker LE, Bonner LM, Fickel JJ, Yano EM, Ritchie MJ. Roles of managers, frontline staff and local champions, in implementing quality improvement: stakeholders' perspectives on implementing QI. *J Eval Clin Pract.* 2012;18(1):63–69. doi:10.1111/j.1365-2753.2010.01518.x.
18. Nhim K, Gruss SM, Porterfield DS, et al. Using a RE-AIM framework to identify promising practices in National Diabetes Prevention Program implementation. *Implement Sci.* 2019;14(1):81. doi:10.1186/s13012-019-0928-9.
19. Green G, DeFosset AR, Sivashanmugam M, Mosst J, Kuo T. Current practices, facilitators, and barriers experienced by program providers implementing the National Diabetes Prevention Program in Los Angeles County. *Transl Behav Med.* 2021;11(2):430–440. doi:10.1093/tbm/ibaa033.
20. Proctor E, Silmere H, Raghavan R, et al. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Adm Policy Ment Health.* 2011;38(2):65–76. doi:10.1007/s10488-010-0319-7.
21. Asnaani A, Sanchez-Birkhead A, Kaur K, et al. Utilizing community partnerships to devise a framework for cultural adaptations to evidence-based mental health practice in diverse communities. *Cogn Behav Pract.* In press.
22. Bauer DJ, Sterba SK. Fitting multilevel models with ordinal outcomes: performance of alternative specifications and methods of estimation. *Psychol Methods.* 2011;16(4):373–390. doi:10.1037/a0025813.

23. Raudenbush SW, Bryk AS, Cheong YF, Congdon RT, du Toit M. *HLM7 Hierarchical Linear and Nonlinear Modeling User Manual: user Guide for Scientific Software International's (S.S.I.) Program*. Scientific Software International, Incorporated. 2016.
24. Rubin RR, Ma Y, Marrero DG, et al. Elevated depression symptoms, antidepressant medicine use, and risk of developing diabetes during the Diabetes Prevention Program. *Diabetes Care*. 2008;31(3):420–426. doi:10.2337/dc07-1827.
25. Cezaretto A, Ferreira SRG, Sharma S, Sadeghirad B, Kolahdooz F. Impact of lifestyle interventions on depressive symptoms in individuals at-risk of, or with, type 2 diabetes mellitus: a systematic review and meta-analysis of randomized controlled trials. *Nutr Metab and Cardiovasc Dis*. 2016;26(8):649–662. doi:10.1016/j.numecd.2016.04.009.
26. Yates T, Gray LJ, Henson J, Edwardson CL, Khunti K, Davies MJ. Impact of depression and anxiety on change to physical activity following a pragmatic diabetes prevention program within primary care: pooled analysis from two randomized controlled trials. *Diabetes Care*. Published online August 9, 2019. doi:10.2337/dc19-0400
27. Ritchie ND, Carroll JK, Holtrop JS, Havranek EP. Effects of physical activity goal attainment on engagement and outcomes in the National Diabetes Prevention Program. *Transl Behav Med*. 2018;8(6):932–937. doi:10.1093/tbm/ibx021.
28. Kaestner R, Lubotsky D. Health insurance and income inequality. *J Econ Perspect*. 2016;30(2):53–78. doi:10.1257/jep.30.2.53.
29. Karpyn AE, Riser D, Tracy T, Wang R, Shen Y. The changing landscape of food deserts. *UNSCN Nutr*. 2019;44:46–53.
30. Wolfson JA, Leung CW. Food insecurity during COVID-19: an acute crisis with long-term health implications. *Am J Public Health*. 2020;110(12):1763–1765. doi:10.2105/AJPH.2020.305953.
31. Paremoer L, Nandi S, Serag H, Baum F. COVID-19 pandemic and the social determinants of health. *BMJ*. 2021;372:n129. doi:10.1136/bmj.n129.
32. Desai JR, Vazquez-Benitez G, Taylor G, et al. The effects of financial incentives on diabetes prevention program attendance and weight loss among low-income patients: the We Can Prevent Diabetes cluster-randomized controlled trial. *BMC Public Health*. 2020;20(1):1587. doi:10.1186/s12889-020-09683-5.