Trends in Weight Loss Activity Among Adults with Pre-diabetes and Obesity in the United States: 2009-2020

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Introduction

Prediabetes, a condition characterized by blood glucose levels higher than normal but not yet in the diabetic range, affects approximately 38% of the U.S. adult population, with even higher prevalence in adults aged 65 years or older (CDC, 2024). Without intervention, nearly 70% of individuals with prediabetes are at risk of progressing to type 2 diabetes within their lifetime (Knowler et al., 2002). This transition poses significant public health and economic challenges, with annual U.S. diabetes-related costs exceeding $400 billion (Parker et al., 2024).

Lifestyle interventions, including healthy diet and exercise, have demonstrated efficacy in preventing diabetes progression. Each kilogram of weight loss reduces diabetes risk by 16% (Elmaleh-Sachs et al., 2023). However, obesity, prevalent in 42% of U.S. adults, exacerbates insulin resistance and complicates prediabetes management (Elmaleh-Sachs et al., 2023). Understanding the prevalence and predictors of weight loss activities, including physical activity, dietary modifications, and other behavioral interventions, is critical for improving prediabetes care.

- **Objective #1:** To estimate the prevalence of adult individuals with prediabetes who engaged in different weight loss activities
- **Objective #2:** To analyze the trends of engaging in any weight loss activity across survey waves (2009-2020)
- **Objective #3:** To estimate the prevalence of individuals who engaged in any weight loss activity among adult with prediabetes by demographic and socioeconomic subgroups

Methods

- **Data Source**: NHANES (2009–2020), a nationally representative survey combining interviews, physical exams, and laboratory tests.
- **Inclusion Criteria**:
  - Adults aged ≥20 years with prediabetes or (HbA1C: 5.7–6.4%, FBG: 100–125 mg/dL, or OGTT: 140–199 mg/dL), and:
  - **BMI thresholds:** The BMI ranges used in the inclusion criteria align with established thresholds for weight loss treatment: ≥30 kg/m² for the general population, ≥27 kg/m² for individuals with hypertension or high cholesterol, and ≥27.5 kg/m² for Asian individuals.
- **Exclusion Criteria**: Diagnosed diabetes or use of insulin/oral antidiabetic medications. Missing data on prediabetes criteria, BMI, or weight loss activities.
- **Final Sample**: 1,180 participants representing approximately 4.2% of all U.S. adults and 50.0% of adults with obesity in the NHANES sample (N = 27,960).
- **Exposure**
  - **Engagement in Weight Loss Activities**:

  Activities included moderate/vigorous physical activity, dietary modifications, using prescription or non-prescription medications, and other interventions (weight loss programs or surgery). Participants not engaging in any of these were classified as unexposed.
- **Predictors for Subgroup Analysis**
  - **Sociodemographic**: Age, gender, race/ethnicity, income-to-poverty ratio, education level.
  - **Clinical :** Systolic/diastolic blood pressure, lipid profile (total cholesterol, HDL, LDL, triglycerides).
  - **Behavioral**: Smoking status, Heavy alcohol drinking history.
  - **Health Insurance Status**: Insured or uninsured.
  - **Survey Waves:** 2009-2010, 2011-2012, 2013-2014, 2015-2016, and 2017-2020
- **Statistical Plan**
  - **Descriptive Statistics**: Counts and percentages to summarize engagement in weight loss activities and stratified by predictors overall by survey wave and within subgroups.
  - **Chi-Squared Tests**: To evaluate associations between categorical predictors and engagement in weight loss activities across survey waves.
  - **Logistic Regression**: Dependent variable was “engagement of weight loss activity”, a binary (yes/no) variable, and independent variables were sociodemographic and clinical variables. Independent variables of significant univariable associations (p<0.05) were included in multivariable regression model. Relationships were described using odds ratios and 95% confidence intervals.

Results

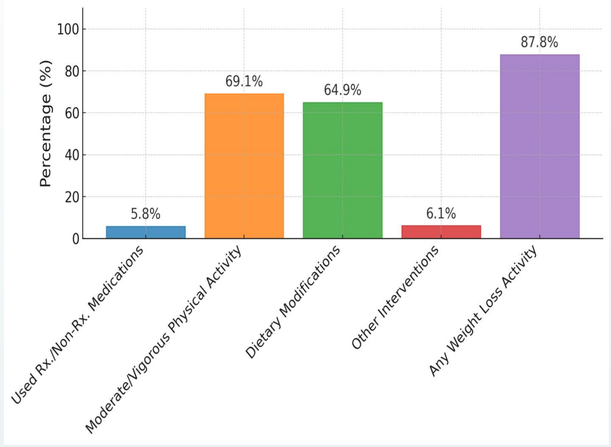

Figure 1: Prevalence of Weight Loss Activities Among Adults with Prediabetes and Obesity.

Most individuals engaged in moderate/vigorous physical activity (69.1%), followed by dietary modifications (64.9%). A smaller proportion used prescription or non-prescription medications (5.8%) or participated in other interventions like weight loss programs or surgery (6.1%). A high percentage (87.8%) engage in at least one weight loss activity.

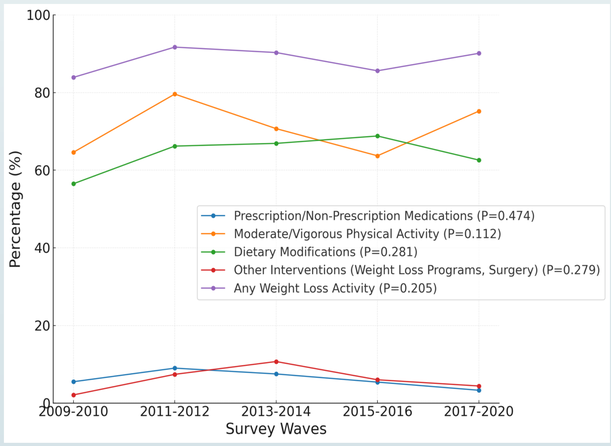

Figure 2: Trends in Weight Loss Activities Among Adults with Prediabetes and obesity: NHANES 2009–2020.

The trends in weight loss activities among adults with prediabetes remained relatively stable across study waves, ranging from 83.9% in 2009–2010 to 90.1% in 2017–2020, with no statistically significant changes observed (p > 0.05). Physical activity and dietary modifications were consistently the most common approaches, reflecting a steady preference for lifestyle interventions, while the use of medications and other interventions like surgery also showed no significant variation over time.

Medication List In Analysis

References

Results

Table: Prevalence of Weight Loss Activity Engagement by Demographic and Socioeconomic Subgroups.

Characteristic	Engage in any weight loss activity								
	Count	Percentage (%)	95% CI	OR	95% CI	P-value	Adjusted OR	95% CI	P-value
Age						0.002			0.002*
< 45	266	91.1	86.8-94.1	2.589	1.468-4.565		3.896	1.881-8.070	
45-64	487	89.9	86.6-92.4	2.243	1.325-3.798		2.548	1.403-4.627	
≥ 65	264	79.8	72.5-85.6	Ref.	-		Ref.	-	
Gender						0.152			
Male	436	89.7	85.7-92.7	Ref.	-				
Female	581	86.2	82.5-89.3	0.715	0.45-1.135				
Race/Ethnicity						0.403			
Hispanic	232	85.1	79.3-89.5	Ref.	-				
Non-Hispanic White	293	89.3	85.2-92.3	1.456	0.84-2.523				
Non-Hispanic Black	240	90.2	85.4-93.6	1.619	0.884-2.967				
Non-Hispanic Asian	52	82.9	71.9-90.2	0.85	0.39-1.853				
Other	42	88.6	61.9-97.4	1.366	0.27-6.924				
Household Income Ratio						0.039			0.039*
<1	183	81.9	74.2-87.7	Ref.	-		Ref.	-	
1 to <3	364	85.4	79.6-89.8	1.294	0.71-2.356		1.308	0.707-2.419	
≥ 3	367	90.6	86.8-93.5	2.135	1.173-3.886		1.774	0.897-3.51	
Education level						0.014			0.014*
High school graduate or less	409	83.2	78.3-87.3	Ref.	-		Ref.	-	
Some college or higher	608	90.2	86.5-92.9	1.847	1.133-3.01		1.327	0.745-2.365	
Systolic blood pressure						0.24			
Controlled	229	88.6	83.3-92.4	Ref.	-				
Uncontrolled	361	84.5	79.4-88.6	0.703	0.388-1.275				
Diastolic Blood pressure						0.739			
Controlled	460	86.5	82.3-89.8	Ref.	-				
Uncontrolled	130	84.9	74.4-91.6	0.878	0.402-1.917				
Total Cholesterol						0.429			
Controlled	602	87.2	82.9-90.5	Ref.	-				
Uncontrolled	394	89.3	85.4-92.2	1.226	0.737-2.038				
LDL level						0.929			
Controlled	182	88.4	81.9-92.8	Ref.	-				
Uncontrolled	388	88.1	81.7-92.4	0.967	0.452-2.068				
HDL level						0.612			
Desirable	518	88.5	85.6-90.8	1.12	0.720-1.741				
Undesirable	415	87.3	82.2-91.1	Ref.	-				
Triglyceride						0.214			
Controlled	411	89.2	83.5-93	Ref.	-				
Uncontrolled	164	84.9	77.5-90.2	0.684	0.373-1.252				
Cigarette smoking						0.982			
Smoker	178	86.9	78.7-92.2	Ref.	-				
Non-smoker	307	87	81.7-90.9	1.007	0.566-1.79				
Heavy alcohol drinking						0.903			
History of heavy alcohol drinking	118	89.1	81.3-93.9	Ref.	-				
No history of heavy alcohol drinking	588	89.5	85.9-92.3	1.044	0.514-2.121				
Health insurance coverage status						0.035			0.035*
Covered	877	88.7	86-90.9	1.895	1.048-3.424		2.404	1.076-5.371	
Not covered	139	80.5	70.4-87.8	Ref.	-		Ref.	-	

The table highlights significant disparities in engagement in weight loss activities ($p < 0.05$). Younger individuals (<45 years) had the highest odds (adjusted odds ratio [AOR]: 3.896) compared to older adults (≥65 years). Higher income (≥3 income ratio) and some college or higher education also increased the odds of engaging in weight loss activities (AORs: 1.774 and 1.327, respectively). Additionally, health insurance coverage significantly increased engagement (AOR: 2.404) compared to uninsured individuals. These findings emphasize the impact of age, income, education, and insurance on weight loss efforts, underscoring the need for targeted support for disadvantaged groups.

Discussion

- **Comprehensive Analysis**: This study is the first to analyze weight loss activities among adults with prediabetes and obesity using nationally representative NHANES data.
- **High Engagement**:
  - 87.8% of participants engaged in at least one weight loss activity.
  - Dietary modifications (64.9%) and physical activity (69.1%) were the most common strategies, aligning with the Diabetes Prevention Program's (DPP) focus on lifestyle interventions.
- **Underutilization of Medications**:
  - Only 5.8% of participants reported using prescription or non-prescription weight loss medications. This usage is low compared to clinical guidelines recommending pharmacological treatment for individuals with a BMI ≥27 kg/m² and comorbidities.
  - Findings mirror Levin et al. (2022), which found only 2.2% of individuals with type 2 diabetes qualified for anti-obesity medications were using them.
- **Reliance on Lifestyle Approaches**: Highlights the feasibility of non-pharmacological methods while underscoring the underutilization of effective pharmacological therapies.
- **Stable Trends Over Time**:
  - Engagement in any weight loss activity remained stable, increasing slightly from 83.9% in 2009–2010 to 90.1% in 2017–2020.
  - Specific activities, such as dietary modifications, physical activity, and medication use, showed no significant changes during this period.
- **Rising Obesity Rates**: The prevalence of adult obesity increased from 35.7% in 2009–2010 to 42.4% in 2017–2018 (Hales, 2020), contrasting with the stability in weight loss activity engagement.
- **Disparities in Engagement**:
  - Younger adults (<45 years), individuals with higher incomes, those with greater education levels, and participants with health insurance engaged more frequently in weight loss activities.
  - Systematic reviews (Summers, Lea, & East, 2024) highlight socioeconomic and healthcare access barriers to weight management, particularly in disadvantaged populations.

Limitations

- **Cross-sectional design**: NHANES data capture a single point in time, preventing analysis of the duration or consistency of weight loss activities.
- **Self-reported data**: Potential for recall bias and inaccuracies in reporting weight loss activities, such as exercise or dietary modifications in the surveys.
- **Timeframe of data collection**: GLP-1 receptor agonists were not yet approved for weight loss during the study period, limiting the findings' applicability to current practices.
- **Missing data:** The dataset has 31%-52% missing data in variables such as triglycerides, LDL cholesterol, blood pressure, heavy alcohol drinking, and smoking status, potentially affecting the analysis.
- **Confounding factors**: Unmeasured factors, such as psychological conditions, additional health issues, or healthcare access, may influence the relationship between weight loss activities and prediabetes outcomes.

Conclusion

- Most obese adults with prediabetes in the United States—approximately 8 out of 10—engaged in at least one weight loss activity.
- Dietary modifications and physical activity were the primary weight loss methods, emphasizing their central role in weight management and diabetes prevention.
- Engagement in weight loss activities remained consistently high between 2009 and 2020.
- Individuals with lower education levels, lower household income, older age, and no health insurance were less likely to engage in weight loss activities.
- This study establishes a foundation for evaluating weight loss activities in the context of emerging pharmacological treatments, such as GLP-1 receptor agonists.
- Future studies should investigate how the widespread adoption of newer medications influences engagement in weight loss efforts.