



Trends between alcohol use, smoking, and sedentary lifestyle on cardiovascular disease risk factors in young adults aged 18-25 from NHANES Dataset

Raashi Garg

Abstract

Cardiovascular disease is the most common cause of death worldwide. Despite it affecting people of all ages, cardiovascular studies among young adults are lacking. While mortality rates may be low for individuals aged 18-25, behavior in early adulthood may leave a lasting impact on future risk of cardiovascular disease. The goal of this paper is to determine the extent to which smoking, drinking alcohol, and having a sedentary lifestyle among young adults demonstrates trends with multiple kinds of cardiovascular risk factors. Specifically, using the 2021-2023 NHANES data set, we examined the relationship between alcohol use, smoking, and sedentary behavior to common cardiovascular risk factors, including diabetes, high cholesterol, and blood pressure. We also considered sociodemographic factors such as race and ethnicity, and gender. We found that among individuals with high cholesterol, 4.85% smoked, 4.67% drank, and 4.58% were sedentary for more than eight hours a day. These results illuminate these behaviors as potential risk factors for high cholesterol. The trend of behaviors having a large impact on the cardiovascular risk factors of an individual was followed throughout the data. This information is absolutely vital for young adults, not only to inform, but also to implement into their daily lives. While smoking, drinking, and sitting for long periods of time may not seem destructive at first, this paper shows that these behaviors may be related to cardiovascular disease, with implications for mortality.

Introduction

Cardiovascular disease (CVD) has been the number one cause of death in the United States since 1950 (Heron & Anderson, 2016). As of 2023, CVD accounts for one in three deaths in the USA (CDC, 2024). Despite its impact, the World Heart Federation estimates that 80% of CVD is preventable (World Heart Federation, 2025). The risk of developing a CVD is shaped by cardiovascular risk factors, which span an individual's lived environment, behavior, and family history (Centers for Disease Control and Prevention, 2024). Specifically, behavioral cardiovascular risk factors such as alcohol use, smoking, and sedentary behavior can have long-lasting effects on cardiovascular health (Winpenny et al., 2020). Given that many of these behaviors emerge in early adulthood, this paper aims to address the lack of awareness among young adults about the effects of substance use and sedentary lifestyle on CVD. Indeed, 47.5% of 18-25 year olds reported drinking alcohol in the past month, which equates to 16.6 million individuals nationwide (National Institute on Alcohol Abuse and Alcoholism, 2025). Also, young adults were recently shown to be more sedentary than middle-aged adults, with a total of 9.1 hours a day in sedentary breaks (Silva et al., 2023). Together, these data highlight the work that must be done to address behaviors which are harmful to cardiovascular health.

Using the 2021-2023 NHANES data set (NHANES, 2024), I examine the relationship between behavioral risk factors (i.e., alcohol use, smoking, and sedentary activity) and biological risk factors for cardiovascular disease, including diabetes, heart attacks, coronary artery disease, high cholesterol, and hypertension. Hypertension, or high blood pressure, can thicken

the heart muscle due to excessive pumping, thereby preventing sufficient delivery of oxygen to the muscle (Penn Medicine, 2025). This, combined with cholesterol found in blood vessels, increases the risk of coronary diseases such as angina and heart attack (Penn Medicine, 2025). All of these are considered cardiovascular risk factors due to their impact on the risk of developing a cardiovascular disease (Centers for Disease Control and Prevention, 2024). Additionally, I considered sociodemographic factors such as race, and gender in my analyses. Ultimately, I aimed to answer the following question:

Research Question

In young adults aged 18-25, what is the relationship between alcohol use, smoking, and a sedentary lifestyle with early cardiovascular disease risk factors?

Methods

Data was extracted from the National Health and Nutrition Examination Survey Continuous Data Set 2021-2023 (NHANES, 2023) and analyzed with R version 4.5.1 (R Core Team, 2025). NHANES is a national health survey that measures the health and nutrition of adults and children in the United States (NHANES, 2024). Data is collected through mobile exam centers from people randomly selected using the scientific process of stratified recruitment, and oversampling minority populations (i.e. elderly, adolescent, African American, Asian, and Hispanic individuals) (NHANES, 2024). NHANES sample weights are created to estimate the entire US population (NHANES, 2024).

For this paper, I defined our cohort as 18-25 year olds in the NHANES 2021-2023 data set. As this data is fully de-identified and publicly accessible, this paper does not require review from an international review board (IRB). I first analyzed demographics, including race and ethnicity, and gender to describe the characteristics of the cohort.

This paper focuses on two types of CVD risk factors: (i) behavioral, and (ii) biological. Behavioral risk factors are defined as an individual's actions that increase the propensity of disease (Ramirez, 2013). Specifically, we examined alcohol use, smoking habits, and sedentary lifestyle.

For example, biological risk factors for CVD include hypertension, high cholesterol, and diabetes (Centers for Disease Control and Prevention, 2024). We examined the relationship between the behavioral risk factors and these biological risk factors.

Estimates based on denominator sample sizes below 30 should be interpreted with caution because small sample sizes may result in reduced statistical reliability and increased sampling variability.

Sample.

There were 847 participants who responded to the NHANES that were between the ages of 18-25 years old. Their demographics are demonstrated as follows in **Table 1**.

Table 1: Demographics of NHANES Dataset 2021-2023 for 18-25yo

Demographics	Population %	Lower 95% CI	Upper 95% CI
Race/Ethnicity			
Mexican American	11.9%	6.2%	19.9%
Other Hispanic	11.2%	8.6%	14.2%
Non-Hispanic White	50.9%	42.1%	59.6%
Non-Hispanic Black	11.6%	7.6%	16.5%
Non-Hispanic Asian	7%	4%	11.1%
Other/Multi Race	7.5%	5.3%	10.1%
Gender			
Male	50.3%	44.2%	56.3%
Female	49.7%	43.7%	55.8%

Measures.

Alcohol Use. Participants' alcohol use was measured using the following item: "During the past 12 months, about how often did you drink any type of alcoholic beverage?" (NHANES, 2023).

Smoking Habits. Participants' smoking habits were measured using the following item: "[Have you] smoked at least 100 cigarettes in [your] entire life?" (NHANES, 2023). Participants were able to respond with Yes, No, Refused, or Don't Know.

Sedentary Habits. Participants' smoking habits were measured using the following item: "The following question is about sitting at school, at home, getting to and from places, or with friends including time spent sitting at a desk, traveling in a car or bus, reading, playing cards, watching television, or using a computer. Do not include time spent sleeping. How much time [do you] usually spend sitting on a typical day?" (NHANES, 2023).

Hypertension: Participants reported if they were diagnosed with hypertension using the following item: "[Have you] ever been told by a doctor or other health professional that [you] had hypertension, also called high blood pressure?" (NHANES, 2023).

High Cholesterol. Participants reported if they were diagnosed with high cholesterol using the following item: "[Have you] ever been told by a doctor or other health professional that [you] blood cholesterol level was high?" (NHANES, 2023).

Diabetes. Participants reported if they were diagnosed with diabetes using the following item: “[Have you] ever been told by a doctor or health professional that [you had] diabetes or sugar diabetes?” (NHANES, 2023).

Heart Attack. Participants reported if they had a heart attack using the following item: “Has a doctor or other health professional ever told [you] that [you] . . . had a heart attack?” (NHANES, 2023).

Coronary Artery Disease. Participants reported if they had coronary artery disease using the following item: “Has a doctor or other health professional ever told [you] that [you] . . . had coronary heart disease?” (NHANES, 2023).

Congestive Heart Failure. Participants reported if they had congestive heart failure using the following item: “Has a doctor or other health professional ever told [you] that [you] . . . had congestive heart failure?” (NHANES, 2023).

Angina. Participants reported if they had angina using the following item: “Has a doctor or other health professional ever told [you] that [you] . . . had angina?” (NHANES, 2023).

Note: Estimates based on denominator sample sizes below 30 should be interpreted with caution because small sample sizes may result in reduced statistical reliability and increased sampling variability.

Results

Of individuals aged 18-25 with diabetes ($n = 11$), 1.63% reported smoking 100 cigarettes in their lifetime, 1.25% reported alcohol use in the past week, and 1.82% reported eight or more hours of daily sedentary activity (**Table 2, Figure 1**). However, the incidence of these risk factors was higher among young adults with hypertension and high cholesterol. Among young adults with hypertension ($n = 37$), 4.85% smoked, 4.67% drank, and 4.58% were sedentary for eight or more hours daily. Among young adults with high cholesterol ($n = 51$), 6.73% smoked, 7.82% drank alcohol, and 7.42% were sedentary for eight or more hours (**Table 2, Figure 1**).

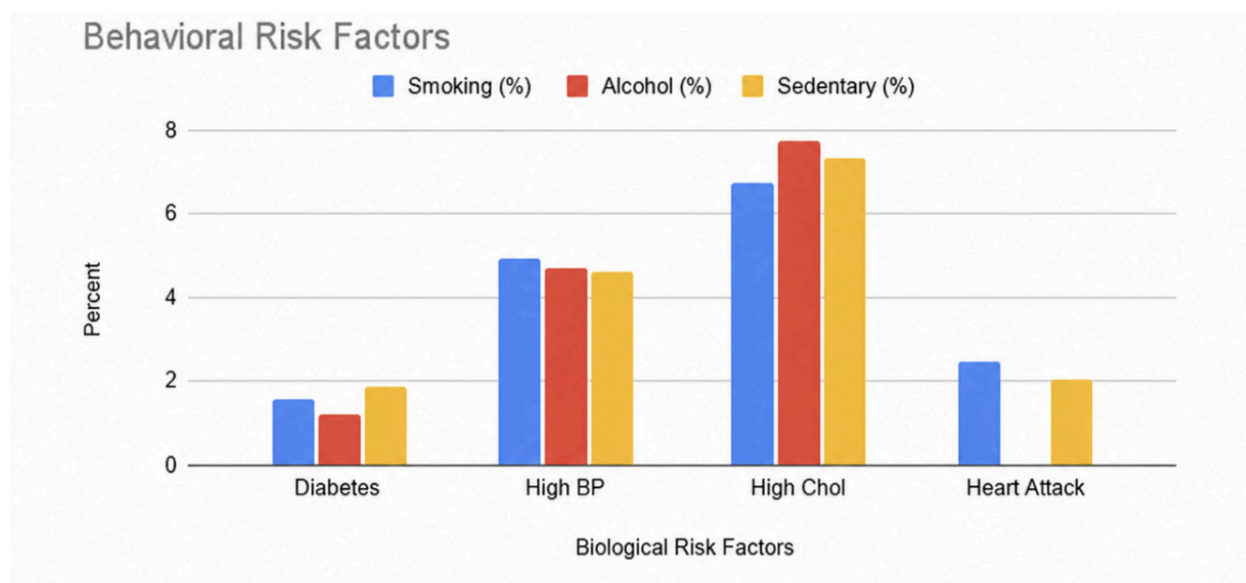
However, out of young adults aged 18-25 who had heart attacks ($n = 2$), the individuals in the dataset had not had any alcohol in the past week, but 2.53% still smoked, and 2.01% were still sedentary (**Table 2, Figure 1**).

None of the studied behaviors were observed in those who had coronary artery disease (CAD), congestive heart failure (CHF) and angina (**Table 2, Figure 1**). However, this lack of data cannot rule out the possibility of any trends between cardiovascular diseases and behavioral risk factors, as the other cardiovascular risk factors (e.g., diabetes, hypertension, high cholesterol, and heart attacks) were observed amongst those with other CVDs.

Table 2: Association Between Behavioral Risk Factors and Cardiovascular Risk Factors (% and 95% Confidence Intervals)

Group	Smoking (% , 95% CI)	Alcohol (% , 95% CI)	Sedentary (% , 95% CI)
Diabetes	1.63 (0.11–6.62)	1.25 (0.22–3.75)	1.82 (0.50–4.44)
Hypertension	4.85 (2.78–7.71)	4.67 (1.26–11.30)	4.58 (2.15–8.29)
High Cholesterol	6.73 (1.58–17.13)	7.82 (2.22–18.19)	7.42 (3.72–12.80)
Heart Attack	2.35 (0.06–12.06)	NA	2.01 (0.17–7.70)

Figure 1: Prevalence of Behavioral Risk Factors Across Cardiovascular Risk Factors



Descriptive Statistics of Risk Factors by Demographic Characteristics

Among Non-Hispanic white young adults ($n = 391$), 20.7% reported smoking at least 100 cigarettes in their lifetime, 37% drank alcohol in the past week, and 32.8% were sedentary for eight or more hours daily. Among Non-Hispanic Black young adults ($n = 118$), 9.5% reported smoking at least 100 cigarettes in their lifetime, 24.8% drank alcohol in the past week, and 30.7% were sedentary for eight or more hours daily. Among Mexican-American young adults ($n = 107$), 7.3% reported smoking at least 100 cigarettes in their lifetime, 27.6% drank alcohol in the past week, and 19% were sedentary for eight or more hours daily. Among Hispanic young

adults ($n = 107$), 21% reported smoking at least 100 cigarettes in their lifetime, 26.2% drank alcohol in the past week, and 34.3% were sedentary for eight or more hours daily. There was no available data on how many Non-Hispanic Asian young adults ($n = 52$) smoked at least 100 cigarettes over their lifetime. However, 21.4% drank alcohol in the past week and 39.7% were sedentary for eight or more hours daily. Among young adults of other or mixed ethnicities ($n = 72$), 21.3% smoked at least 100 cigarettes, 25.8% drank alcohol in the past week, and 39.7% were sedentary for eight or more hours daily.

Among young adult men ($n = 408$) 24.3% have smoked at least 100 cigarettes, 34.8% drank alcohol in the last week, and 29.2% were sedentary for eight or more hours daily. Among young adult women ($n = 439$), 8.5% have smoked at least 100 cigarettes, 29.2% drank alcohol in the past week, and 33.9% were sedentary for eight or more hours daily. (**Table 3, Table 4, Table 5**)

Table 3. Prevalence (%) of Smoking ≥ 100 Cigarettes in Lifetime by Race/Ethnicity and Gender in 18-25yo adults

	Group	Prevalence (%)	Lower 95% CI	Upper 95% CI
Race/Ethnicity	Non-Hispanic White	20.7	12.6	30.8
	Non-Hispanic Black	9.5	3	20.8
	Mexican American	7.3	2.7	15
	Hispanic	21	12.2	32
	Non-Hispanic Asian	NA	NA	NA
	Other/Multi-Racial	21.3	7.9	41
Sex	Male	24.3	16.4	33.5
	Female	8.5	5.2	12.9

Table 4: Prevalence (%) of Alcohol Consumption in the Past Week by Race/Ethnicity and Gender in 18-25yo adults

Group Category	Group	Prevalence (%)	Lower 95% CI	Upper 95% CI
Race/Ethnicity	Non-Hispanic White	37	28.6	45.9
	Non-Hispanic Black	24.8	9.1	47.3

	Mexican American	27.6	14	44.9
	Hispanic	26.2	11.5	45.9
	Asian	21.4	6	45.9
	Other	25.8	14.9	39.1
Sex	Male	34.8	23.6	47.1
	Female	29.2	21	38.5

Table 5: Prevalence(%) of Sedentary Behavior ≥ 8 hours per day by Race/Ethnicity and Gender in 18-25yo adults

Group Category	Group	Prevalence (%)	Lower 95% CI	Upper 95% CI
Race/Ethnicity	Non-Hispanic White	32.8	27.8	38.1
	Non-Hispanic Black	30.7	18.5	45.1
	Mexican American	19	7.5	36
	Hispanic	34.3	24.3	45.3
	Asian	39.7	26.5	54
	Other	32.8	21	46.3
Sex	Male	29.2	22.6	36.4
	Female	33.9	27.6	40.6

However, when I examined the relation between different combinations of these behavioral risk factors and percentages of any of the three clinical risk factors already established (hypertension, high cholesterol, and diabetes), it was discovered that 18-25 year olds who have smoked at least 100 cigarettes and are sedentary for more than 8 hours a day had the greatest percent of clinical risk factors, but those who solely reported being sedentary for more than 8 hours had the smallest percent of clinical risk factors (**Table 6**).

Table 6: Prevalence of Clinical Risk Factors (Hypertension, Diabetes, and High Cholesterol) Among Individuals Aged 18–25, Stratified by Behavioral Risk Profiles

Behavioral Risk Profile	Percent of 18-25yo with clinical rfs (%, 95% CI)	Percent of 18-25yo without clinical rfs (%, 95% CI)
-------------------------	--	---

Smoked 100 cigarettes in lifetime	13.19% (5.23%, 25.52%)	86.8% (74.5%, 94.8%)
Drank alcohol in the last week	13.68% (7.07%, 22.83%)	86.3% (77.2%, 92.9%)
Sedentary ≥ 8 hours per day	12.4% (8.2%, 17.7%)	87.6% (82.3%, 91.8%)
Smoking + Alcohol	14.79% (4.46%, 32.22%)	85.2% (67.8%, 95.5%)
Smoking + Sedentary	22.45% (1.79%, 65.33%)	77.6% (34.7%, 98.2%)
Alcohol + Sedentary	16.32% (5.52%, 33.56%)	83.7% (66.4%, 94.5%)
Smoking + Alcohol + Sedentary	N/A	N/A

Discussion

Early caution is critical for reducing the risk of cardiovascular disease (Kahn et al., n.d.). By decreasing intake of alcohol and cigarettes, and increasing physical activity, people have a much lower risk of contracting CVD (World Heart Federation, n.d.).

This study was done to explore trends between behavioral risk factors such as smoking, drinking, and sedentary behavior and typical clinical risk factors to cardiovascular disease such as diabetes, hypertension, and high cholesterol.

Although I aimed to be as comprehensive in the data analysis as possible, there are several limitations worth acknowledging. First, I was not able to identify behaviors as *causative* to our CVD risk factors due to a lack of longitudinal data available for survey participants. Second, I also was not able to directly demonstrate trends with these behaviors and cardiovascular disease itself, as CVD develops over a long period of time and my analysis only describes trends in the survey population at a specific point in time. Third, several demographic subgroups had denominator sample sizes below 30. Therefore, estimates for these groups may have reduced reliability and greater sampling variability and should be interpreted with caution.

This work adds to a growing literature on cardiovascular risk factors among young people. For example, Rahul Aggarwal (2023) used NHANES to examine cardiovascular risk factors for young adults aged 20-44. The present work aligns with their observation of variation between the risk factors while comparing the different ethnicities. However, his study was a longitudinal one from 2010 to 2020, so he was able to obtain more comprehensive causation data, which was one of the limitations of this paper. Aggarwal found that the percentages of the population with diabetes and obesity had increased in the longitudinal study, but percentages of hypertension stayed the same and hyperlipidemia decreased. However, he did not compare these to the participants' behavioral risk factors, so our findings diverged in that manner (Aggarwal, 2023).



Conclusion

Understanding behavioral risk factors are vital in reducing the risk of cardiovascular disease, as biological risk factors were more prevalent in populations with behavioral risk factors. While there is some level of awareness on the subject of behavioral risk factors of CVD, its effects on young adults are not publicized enough (Trejo et al., 2018). Preventing cardiovascular disease should begin long before the diagnosis, with early identification of risk factors serving as an important part of improving long-term cardiovascular health.

References

1. Aggarwal, R. (2023, March 21). *Cardiovascular Risk Factor Prevalence, Treatment, and Control in US Adults Aged 20 to 44 Years, 2009 to March 2020*. National Library of Medicine. <https://pubmed.ncbi.nlm.nih.gov/36871237/>
2. American Heart Association. (2024, January 10). *What Is Cardiovascular Disease?* American Heart Association. Retrieved September 7, 2025, from <https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease>
3. American Heart Association. (2025, January 30). *Angina (Chest Pain)*. American Heart Association. Retrieved September 6, 2025, from <https://www.heart.org/en/health-topics/heart-attack/angina-chest-pain>
4. Centers for Disease Control and Prevention. (2024, October 24). *Heart Disease Facts | Heart Disease*. CDC. Retrieved September 6, 2025, from <https://www.cdc.gov/heart-disease/data-research/facts-stats/index.html>
5. Centers for Disease Control and Prevention. (2024, December 2). *Heart Disease Risk Factors | Heart Disease*. CDC. Retrieved September 8, 2025, from <https://www.cdc.gov/heart-disease/risk-factors/index.html>
6. Heron, M., & Anderson, R. N. (2016, August). *Changes in the Leading Cause of Death: Recent Patterns in Heart Disease and Cancer Mortality*. PubMed. Retrieved February 1, 2026, from <https://pubmed.ncbi.nlm.nih.gov/27598767/>
7. Institute of Medicine. (1991). *Disability in America: Toward a National Agenda for Prevention*. National Academies Press. Retrieved June 18, 2026, from <https://nap.nationalacademies.org/read/1579/chapter/5>
8. Kahn, R., Robertson, R. M., Smith, R., & Eddy, D. (n.d.). *The Impact of Prevention on Reducing the Burden of Cardiovascular Disease*. PubMed Central. Retrieved September 8, 2025, from <https://pmc.ncbi.nlm.nih.gov/articles/PMC2494659/>
9. Murray, C. J. L., & Lopez, A. D. (1996, November 1). Evidence-based health policy — Lessons from the Global Burden of Disease Study. *Science*, 274(5288), 740–743. 10.1126/science.274.5288.740
10. National Heart, Lung, and Blood Institute. (2022, March 24). *Heart-Healthy Living - Understand Your Risk for Heart Disease*. NHLBI. Retrieved September 8, 2025, from <https://www.nhlbi.nih.gov/health/heart-healthy-living/risks>
11. National Heart, Lung, and Blood Institute. (2023, February 1). *Numbers to know for a healthy heart*. NHLBI. Retrieved September 6, 2025, from <https://www.nhlbi.nih.gov/news/2023/numbers-know-healthy-heart>
12. National Institute on Alcohol Abuse and Alcoholism. (2025, August 12). *Alcohol and Young Adults Ages 18 to 25*. National Institute on Alcohol Abuse and Alcoholism (NIAAA). Retrieved September 6, 2025, from <https://www.niaaa.nih.gov/alcohols-effects-health/alcohol-topics-z/alcohol-facts-and-statistics/alcohol-and-young-adults-ages-18-25>
13. NHANES. (2023, August). *NHANES August 2021-August 2023*. National Health and Nutrition Examination Survey. Retrieved September 8, 2025, from <https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/default.aspx?Cycle=2021-2023>
14. NHANES. (2024, December 18). *About NHANES | National Health and Nutrition Examination Survey*. CDC. Retrieved September 6, 2025, from <https://www.cdc.gov/nchs/nhanes/about/index.html>

15. NHANES. (2024, December 18). *Who Participates In NHANES | National Health and Nutrition Examination Survey*. CDC. Retrieved September 8, 2025, from <https://www.cdc.gov/nchs/nhanes/about/who-participates.html>
16. Paul, M. (2014, February 5). *Heart Disease Warning Signs Appear as Early as 18 - News Center*. Feinberg News Center. Retrieved September 8, 2025, from https://news.feinberg.northwestern.edu/2014/02/05/heart_disease_warning/
17. Penn Medicine. (2025). *Hypertensive heart disease*. Penn Medicine. Retrieved September 6, 2025, from <https://www.pennmedicine.org/conditions/hypertensive-heart-disease>
18. R Core Team. (2025). *R: A Language and Environment for Statistical Computing*. The R Project for Statistical Computing: R. Retrieved September 6, 2025, from <https://www.r-project.org/>
19. Ramirez, A. G. (2013, May 5). *Behavioral Risk Factors in Adults - The South Texas Health Status Review - NCBI Bookshelf*. NCBI. Retrieved June 18, 2026, from <https://www.ncbi.nlm.nih.gov/books/NBK543618/>
20. Rodgers, J. L., Jones, J., Bolleddu, S. I., Vanthenapalli, S., Rodgers, L. E., Shah, K., Kaira, K., & Panguluri, S. K. (2019, April 27). *Cardiovascular Risks Associated with Gender and Aging*. PubMed Central. Retrieved September 8, 2025, from <https://pmc.ncbi.nlm.nih.gov/articles/PMC6616540/>
21. Silva, G. O., Cunha, P. M., Oliveira, M. D., Christofaro, D., Tebar, W. R., Gerage, A. M., Kanegusuku, H., Correia, M. A., & Ritti-Dias, R. M. (2023, March 13). *Patterns of sedentary behavior in adults: A cross-sectional study*. PubMed Central. Retrieved September 6, 2025, from <https://pmc.ncbi.nlm.nih.gov/articles/PMC10042287/>
22. Singh, S. S., Stranges, S., Wilk, P., Tang, A. S. L., & Frisbee, S. J. (2023, February 21). *Influence of the Social Environment on Ideal Cardiovascular Health*. PubMed. Retrieved September 8, 2025, from <https://pubmed.ncbi.nlm.nih.gov/36789849/>
23. Trejo, R., Cross, W., & Stephenson, J. (2018). *Young adults' knowledge and attitudes towards cardiovascular disease: A systematic review and meta-analysis*. PubMed. Retrieved September 8, 2025, from <https://pubmed.ncbi.nlm.nih.gov/29775496/>
24. *What we do: Prevention*. (n.d.). World Heart Federation. <https://world-heart-federation.org/what-we-do/prevention>
25. Winpenny, E. M., Winkler, M. R., Stochl, J., van Sluijs, E. M. F., Larson, N., & Neumark-Sztainer, D. (2020, October 9). *Associations of early adulthood life transitions with changes in fast food intake: a latent trajectory analysis - International Journal of Behavioral Nutrition and Physical Activity*. International Journal of Behavioral Nutrition and Physical Activity. Retrieved September 8, 2025, from <https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-020-01024-4>
26. World Heart Federation. (2025). *CVD Prevention | What We Do*. World Heart Federation. Retrieved September 6, 2025, from <https://world-heart-federation.org/what-we-do/prevention/>
27. Yaribeygi, H., Maleki, M., Sathyapalan, T., Jamialahmadi, T., & Sahebkar, A. (n.d.). *Pathophysiology of Physical Inactivity-Dependent Insulin Resistance: A Theoretical Mechanistic Review Emphasizing Clinical Evidence*. PubMed Central. Retrieved September 8, 2025, from <https://pmc.ncbi.nlm.nih.gov/articles/PMC8516544/>