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Research Paper

Self-employment and cardiovascular risk in the US general population

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ABSTRACT

Background: Studies on self-employment and cardiovascular risk are very limited. We examined the relationship between self-employment and cardiovascular risk among the general population in the United States from 1999 to 2016.

Methods: Using the National Health and Nutrition Examination Survey (NHANES), we identified all patients with hypertension (HTN), hyperlipidemia (HLD), diabetes mellitus (DM), stroke, heart failure (HF), and coronary artery disease (CAD) between 1999 and 2016. Type of job was defined based on the participant's response to the survey question as "an employee of a private company, business, or individual for wages, salary, or commission" or "self-employed in own business, professional practice or farm". Multivariable logistic regression analyses were performed to adjust for confounders.

Results: Of 30,103 patients, 2835 (9.4%) were self-employed in their own business, professional practice, or farm and 27,268 (90.6%) were employed by a private company, business, or government. After adjusting for age, race, sex, BMI, marital status, educational level, health insurance status, smoking status, sleep duration and lipid profiles, self-employed individuals had a higher prevalence of HTN (OR: 1.12; 95% confidence interval [CI] 1.05–1.20), HLD (OR: 1.10; 95% CI 1.07–1.31), stroke (OR: 1.45; 95% CI 1.27–1.67), HF (OR: 1.17; 95% CI 1.03–1.32), and CAD (OR: 1.26; 95% CI 1.13–1.35) (all P v< 0.05).

Conclusions: Self-employment may be associated with greater cardiovascular risk in the US general population. Further prospective studies are urgently needed to establish the optimal preventive strategy to reduce cardiovascular risk in self-employed individuals.

1. Introduction

Governments worldwide are trying to encourage self-employment to boost growth and enhance business to become a priority in contemporary economies. Studies have shown that self-employment may lead to adversity and was associated with being prescribed anxiolytics [1,2]. However, studies on self-employment and cardiovascular risk are very limited and inconsistent [3–6]. Farmers, for example, tend to have less cardiovascular risk [5] than other occupational groups, while self-employed professionals have a greater observed all-cause mortality than employed professionals in the USA [7]. Financial instability, social isolation, unstable working schedule, operational issues, work-related stress, economic insecurity, and local policies could be mechanisms by which self-employment could lead to adverse cardiovascular outcomes, depending on the exact nature of the business [8]. Most importantly, occasional natural disasters (e.g., floods, hurricanes, tornadoes) or infectious disease outbreaks (e.g., COVID-19) may cause business interruption due to operational costs (e.g., inventory, event cancellation, rent, supply chain losses, exposure liabilities, or employee compensation). This study sought to investigate associations between self-employment and cardiovascular risk using the NHANES survey between 1999 and 2016.

2. Methods

The NHANES survey, a series of complex and multistage surveys of general health, employment characteristics, nutritional status, lifestyle

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factors, and laboratory values, was conducted by the Centers for Disease Control and Prevention (CDC) along with the National Center for Health Statistics (NCHS) (https://www.cdc.gov/nchs/nhanes/). Data from 9 NHANES cohorts (1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008, 2009–2010, 2011–2012, 2013–2014, 2015–2016) were merged. All participants signed consent for participation, and the National Center for Health Statistics Research Ethics Review Board reviewed and approved the NHANES survey.

We compared differences amongst those who were self-employed in their own business, professional practice, or farm and those who were employed by a private company, business, or government. The primary outcomes were the presence of diabetes mellitus (DM), hyperlipidemia (HLD), hypertension (HTN), coronary artery disease (CAD), heart failure (HF), and stroke, defined based on the participant's response to survey questions, between self-employed and employed individuals. (Online Supplementary Table 1). The main question was used as the inclusion criteria for the study sample. Type of job was defined based on the participant's response to the survey question: 'Which of these best describes your job or work situation?' The participant's response as "an employee of a private company, business, or individual for wages, salary, or commission", "self-employed in own business, professional practice or farm" were included. Respondents who responded, "don't know" or "refused" for the question were excluded. We reported continuous variables as mean ± standard deviation. We performed multivariable logistic regression adjusting for age, race, sex, BMI, marital status, educational level, health insurance coverage, smoking status, sleep duration, and lipid profiles. R 3.4.0 and Stata version 14.2 were used for analyses.

3. Results

A total of 30,103 patients who represented the total US civilian, non-institutionalized population of 299.3 million people between 1999 and 2016 were included: 2,835 (9.4%) were self-employed in their own business, professional practice, or farm, and 27,268 (90.6%) were employed by a private company, business, or government. Self-employed individuals were older, more likely to be male, had higher systolic, diastolic blood pressure, cholesterol, triglyceride, and LDL cholesterol levels than employed individuals (all p-values < 0.0001). Compared with employed individuals, those who were self-employed had a higher reported prevalence of DM, HTN, HLD, stroke, HF, and CAD (all p-values < 0.05) (Table 1). After adjusting for age, race, sex, BMI, marital status, educational level, health insurance status, smoking status, sleep duration and lipid profiles, self-employed individuals had a higher prevalence of HTN (OR: 1.12; 95% confidence interval [CI] 1.05–1.20), HLD (OR: 1.10; 95% CI 1.07–1.31), stroke (OR: 1.45; 95% CI 1.27–1.67), HF (OR: 1.17; 95% CI 1.03–1.32), CAD (OR: 1.26; 95% CI 1.13–1.35), compared with employed individuals (all p-values < 0.05) (Table 2).

Table 1
Baseline characteristics of individuals with vs. without self-employment in own business, professional practice, or farm.

Variables	Self-employed		P value*
	Yes (n = 2,835)	No (n = 27,268)	
Age (years)	48.5 ± 14.9	38.9 ± 14.9	<0.0001
Women	36.1%	47.7%	<0.0001
BMI	28.3 ± 5.8	28.3 ± 6.6	0.99
White	53.4%	40.6%	<0.0001
Marital Status (married)	62.5%	47.4%	<0.0001
Education: above college	27.9%	23.1%	<0.0001
Health insurance coverage	66.1%	76.3%	<0.0001
Heart failure	1.3%	0.6%	0.0001
Coronary artery disease	2.8%	1.2%	<0.0001
Stroke	1.4%	0.8%	0.0010
Hypertension	21.2%	16.1%	<0.0001
Diabetes mellitus	7.9%	5.8%	<0.0001
Hyperlipidemia	28.2%	21.2%	<0.0001
Total cholesterol level (mg/dL)	199.9 ± 42.9	191.3 ± 40.9	<0.0001
Direct HDL-Cholesterol (mg/dL)	52.6 ± 16.5	52.7 ± 15.6	0.74
Triglyceride (mg/dL)	136.5 ± 127.4	120.7 ± 101.7	<0.0001
LDL-cholesterol (mg/dL)	118.3 ± 35.1	112.8 ± 34.3	<0.0001
How much sleep do you get (hours)?	6.9 ± 2.6	6.7 ± 1.4	<0.0001

Table 2
Multiple logistic regression for self-employed in own business, professional practice or farm.

Variable	Self-employed in own business, professional practice, or farm	
	Adjusted OR [95% CI]	Adjusted P value
Heart failure		
No adjustment	1.82 (1.68–1.98)	<0.0001
Multivariable adjusted	1.17 (1.03–1.32)	0.02
Coronary artery disease		
No adjustment	1.74 (1.64–1.84)	<0.0001
Multivariable adjusted	1.26 (1.13–1.35)	<0.0001
Stroke		
No adjustment	1.42 (1.31–1.54)	<0.0001
Multivariable adjusted	1.45 (1.27–1.67)	<0.0001
Diabetes		
No adjustment	1.36 (1.32–1.41)	<0.0001
Multivariable adjusted	0.97 (0.93–1.04)	0.30
Hyperlipidemia		
No adjustment	1.29 (1.26–1.31)	<0.0001
Multivariable adjusted	1.10 (1.07–1.14)	<0.0001
Hypertension		
No adjustment	1.71 (1.64–1.78)	<0.0001
Multivariable adjusted	1.12 (1.05–1.20)	0.001

Multivariable adjusted for age, race, sex, BMI, marital status, educational level, health insurance status, smoking status, sleep duration, and lipid profiles.

4. Discussion

In the present study using a large-scale national survey, we found that self-employed individuals had a higher prevalence of cardiovascular risks, including HLD, HTN, stroke, HF, and CAD in the contemporary US population. Self-employed individuals may encounter adversity such as financial management (e.g., very low-profit margin, rent, lack of funding/line of credit, high customer acquisition cost), work-related stress, unstable working schedule (e.g., working on weekends, no time for annual physical, or routine doctor visits), operational problems (e.g., inability to control expenses or overexpansion), local policies, and a lack of essential health insurance, leading to cardiovascular risk [1,9–12]. [13] Studies have shown that, compared with employed individuals, self-employed individuals are likely to be dedicated, self-determined [14,15], have high workloads [16], a strong work-commitment [17], low support [18], economic insecurity [19], and be more motivated to engage with their work [20], resulting in insufficient time and effort into their health (e.g., unhealthy diet and lifestyle). A previously published study showed that self-employed individuals, particularly those with small business owners, were probably exposed to socioeconomic instability and unstable working conditions, compared with employed individuals [21]. Another possibility is that a majority of self-employment may be forced self-employment, and therefore forced self-employment may have high stress and high burden, resulting in cardiovascular risk. However, given the nature of the observational study, correlation does not imply causation. The existence of co-existing or pre-existing medical conditions in some people may prevent job employment or lead to forced self-employment. Several studies showed that individuals who have pre-existing medical conditions such as HTN, DM, CAD are associated with problems in obtaining employment. In addition, pre-existing medical conditions are associated with self-reported job insecurity [22–25]. However, in this cohort, we could not differentiate between selective self-employment or forced self-employment. A prior study suggested that involuntary job loss can be considered as a cardiovascular risk factor

[26], while selective self-employment is associated with better health status than forced self-employment because of healthy people perhaps self-selected into self-employment [2]. Moreover, a subgroup of forced self-employment may already have underlying diseases, chronic illness, or mental disabilities and, therefore, could not work as an employee. Most importantly, occasional natural disasters (e.g., floods, hurricanes, tornadoes) or infectious disease outbreaks (e.g., COVID-19 or 1918 influenza pandemics) may turn employed individuals towards forced self-employment and damage business owners due to event cancellation, supply chain losses, or exposure liabilities.

However, these factors are probably dependent on the company and a country's work culture, local and national policy. For example, known as an intense work culture in Japan, a study in the Japanese population showed no significant difference in cardiovascular risk and mortality between employed individuals and self-employed [27]. In contrast, a study reported that self-employed individuals in European countries are more satisfied with their lives than employed individuals [28]. The self-employed had better self-rated health and workability than employed individuals in the Netherlands [29], while higher cardiovascular mortality among self-employed men and women than among other occupational classes in Sweden [5]. As such, it is important to understand these differences to promote a healthy work culture among self-employed individuals in the US.

The present study has certain limitations. First, there may be residual or unmeasured confounders due to undiagnosed or latent risk factors. For example, the exact mechanisms that underlie the association between self-employment and cardiovascular risk may be confounded by other lifestyle factors (e.g., unhealthy diet, infrequent exercise, poor sleep hygiene, or long working hours). Second, this analysis was cross-sectional in nature, and therefore we could not infer causality. Third, as discussed earlier, those with poor health status, particularly established cardiovascular risk, may be forced into self-employment. Last, we could not find a difference in job details. One study [30] showed mortality is lower among those self-employed who run a limited liability company than among paid employees.

5. Conclusion

We found a significant association between self-employment and a higher prevalence of cardiovascular risks, including DM, HTN, HLD, HF, stroke, and CAD, than in the US general population. Further prospective studies are urgently needed to establish the optimal preventive strategy for reducing cardiovascular risk in self-employed individuals.

Declaration of Competing Interest

Dr. Chayakrit Krittanawong discloses the following relationships – Journal of the American Heart Association (Early Career Editorial board); The Journal of Scientific Innovation in Medicine (Associate Editor); Member of the American College of Cardiology Solution Set Oversight Committee. Dr. Deepak L. Bhatt discloses the following relationships - Advisory Board: Cardax, Cereno Scientific, Elsevier Practice Update Cardiology, LevelEx, Medscape Cardiology, PhaseBio, PLX Pharma, Regado Biosciences; Board of Directors: Boston VA Research Institute, Society of Cardiovascular Patient Care, TobeSoft; Chair: American Heart Association Quality Oversight Committee; Data Monitoring Committees: Baim Institute for Clinical Research (formerly Harvard Clinical Research Institute, for the PORTICO trial, funded by St. Jude Medical, now Abbott), Cleveland Clinic (including for the ExCEED trial, funded by Edwards), Duke Clinical Research Institute, Mayo Clinic, Mount Sinai School of Medicine (for the ENVISAGE trial, funded by Daiichi Sankyo), Population Health Research Institute; Honoraria: American College of Cardiology (Senior Associate Editor, Clinical Trials and News, ACC.org Vice-Chair, ACC Accreditation Committee), Baim Institute for Clinical Research (formerly Harvard Clinical Research Institute; RE-DUAL PCI clinical trial steering committee funded by Boehringer Ingelheim; AEGIS-II executive committee funded by CSL Behring), Belvoir Publications (Editor in Chief, Harvard Heart Letter), Duke Clinical Research Institute (clinical trial steering committees, including for the PRONOUNCE trial, funded by Ferring Pharmaceuticals), HMP Global (Editor in Chief, Journal of Invasive Cardiology), Journal of the American College of Cardiology (Guest Editor; Associate Editor), Medtelligence/ReachMD (CME steering committees), Population Health Research Institute (for the COMPASS operations committee, publications committee, steering committee, and USA national co-leader, funded by Bayer), Slack Publications (Chief Medical Editor, Cardiology Today's Intervention), Society of Cardiovascular Patient Care (Secretary/Treasurer), WebMD (CME steering committees); Other: Clinical Cardiology (Deputy Editor), NCDR-ACTION Registry Steering Committee (Chair), VA CART Research and Publications Committee (Chair); Research Funding: Abbott, Afimmune, Amarin, Amgen, AstraZeneca, Bayer, Boehringer Ingelheim, Bristol-Myers Squibb, Cardax, Chiesi, CSL Behring, Eisai, Ethicon, Ferring Pharmaceuticals, Forest Laboratories, Fractyl, Idorsia, Ironwood, Ischemix, Lexicon, Lilly, Medtronic, Pfizer, PhaseBio, PLx Pharma, Regeneron, Roche, Sanofi Aventis, Synaptic, The Medicines Company; Royalties: Elsevier (Editor, Cardiovascular Intervention: A Companion to Braunwald's Heart Disease); Site Co-Investigator: Biotronik, Boston Scientific, CSI, St. Jude Medical (now Abbott), Svelte; Trustee: American College of Cardiology; Unfunded Research: FlowCo, Merck, Novo Nordisk, Takeda. None of the other authors have any disclosures

CRediT authorship contribution statement

Chayakrit Krittanawong: Conceptualization, Methodology, Software, Formal analysis, Writing - original draft. **Anirudh Kumar:** Conceptualization, Methodology, Writing - review & editing, Visualization, Data curation. **Zhen Wang:** Methodology, Software, Formal analysis, Validation. **Usman Baber:** Writing - review & editing, Visualization, Investigation, Resources. **Deepak L. Bhatt:** Writing - review & editing, Visualization, Supervision, Project administration, Conceptualization, Methodology.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijchy.2020.100035.

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