HHS Public Access

Comparison of Risk of Atrial Fibrillation Among Employed Versus Unemployed (From the REasons for Geographic And Racial Differences in Stroke Study)

Elsayed Z. Soliman, MD, MSc, MS[1,2], **Zhu-Ming Zhang, MD, MPH**[1], **Suzanne Judd, PhD**[3], **Virginia J. Howard, PhD**[4], and **George Howard, DrPH**[3]

[1]Epidemiological Cardiology Research Center (EPICARE), Department of Epidemiology and Prevention, Wake Forest School of Medicine, Winston-Salem, NC

[2]Department of Internal Medicine, Section on Cardiology, Wake Forest School of Medicine, Winston Salem, NC

[3]Department of Biostatistics, School of Public Health, University of Alabama at Birmingham, Birmingham, AL

[4]Department of Epidemiology, School of Public Health, University of Alabama at Birmingham, Birmingham, AL

Abstract

Involuntary unemployment due to job loss has been associated with increased risk of cardiovascular events. Whether it also is associated with increased risk of atrial fibrillation (AF) is currently unknown. Therefore, we examined this association in 8,812 participants residing mainly in the Southeastern United States (mean age 58.1 ± 7.8 years; 63.2%; women; 43.2% black) with data on employment status who were enrolled in the REasons for Geographic And Racial Differences in Stroke (REGARDS) study between 2003 and 2007 after excluding those with voluntary unemployment (e.g. retiree and students). AF was identified by electrocardiogram and past medical history at the same period. The cross-sectional association between status and type of unemployment with AF was examined in multivariable logistic regression models. Additional analysis in 4,273 participants without baseline AF and with data on incident AF collected in a follow up visit occurred after a median of 9.4 years from baseline was also conducted. In a model adjusted for socio-demographics, health insurance, income, perceived stress and cardiovascular risk factors, unemployment was associated with 60% increased odds of AF (OR (95%CI): 1.60 (1.24, 2.07). This association was consistent in subgroups stratified by median age, sex, race, education, income, and health insurance status. Similarly, unemployment was associated with AF in those without AF at baseline who developed incident AF (OR (95%CI):1.54 (1.04, 2.37). In conclusion, involuntary unemployment is associated with increased risk of AF. This may call for

Corresponding author: Elsayed Z Soliman MD, MSc, MS, Epidemiological Cardiology Research Center, Wake Forest School of Medicine, Medical Center Boulevard, Winston Salem, NC 27157, Phone: 336-716-8632; Fax: 336-716-0834, esoliman@wakehealth.edu.

considering socio-economic determinants such as unemployment as part of the preventive strategies for AF.

Keywords

Atrial fibrillation; Unemployment; Job loss

Introduction

Employment instability affects an increasing number of adults in the United States. The psychological stress that comes with involuntary job loss or inability to find a job (i.e. unemployment) has a significant long term consequences on cardiovascular health (1). Previous reports have shown that unemployment and job loss are significant risk factors for acute cardiovascular events including myocardial infarction and stroke (2, 3, 4). Whether, unemployment is associated with increased risk of atrial fibrillation (AF) as well is currently unknown. Psychological stress has been implicated as a risk factor for AF (5–7), and hence it is possible that unemployment predisposes to development of AF. Looking for new modifiable risk factors for AF is becoming of significant importance from the public health perspective since its prevalence is expected to double by 2050 (8). Therefore, we sought to examine the association between involuntary unemployment and AF in the REasons for Geographic And Racial Differences in Stroke (REGARDS) study.

Methods

The goals and design of the REGARDS study, a U.S. national longitudinal study, have been published. REGARDS was designed to investigate causes of regional and racial disparities in stroke mortality, oversampling blacks and residents of the southeastern states "stroke belt region" (9). Individuals were recruited from a commercially available list of residents using mail and telephone contact. Demographic information and medical history including perceived stress measured by the Cohen Perceived Stress 16-point Scale (10) were obtained by telephone interview. All methods were approved by Institutional Human Subjects Review Boards. A brief physical examination was conducted 3 to 4 weeks after the telephone interview, including standardized measurements of risk factors, collection of blood and urine, and recording of resting electrocardiogram.

Of 30 239 REGARDS participants enrolled between 2003 and 2007, employment status was evaluated in 18,800 REGARDS participants. Participants were specifically asked: "*Are you currently employed for wages, self-employed, out of work for >1 year, out of work for <1 year, a homemaker, a student, retired, or unable to work?*" For the purpose of this analysis, we excluded those who refused to answer (n=9) and unemployed voluntarily (retired (n=8,655), homemaker (n=1,046) and student (n=47)) as well as those with missing AF data (n=231).

AF was identified in study participants at baseline by the scheduled electrocardiogram (ECG) and also from self- reported history of a physician diagnosis during the computer-assisted telephone interview surveys. The ECGs were read and coded at a central reading

center by electrocardiographers who were blind to other REGARDS data. Self-reported AF was defined as an affirmative response to the following question: "Has a physician or a health professional ever told you that you had atrial fibrillation? (11).

The cross-sectional association between status and type of unemployment with AF was examined in multivariable logistic regression models. Multivariable models were constructed with incremental adjustments as follows: Model 1 adjusted for age, sex, race, region of residence, and education level; Model 2 adjusted for Model 1 covariates plus income, and insurance status; Model 3 adjusted for Model 2 covariates plus perceived stress; Model 4 adjusted for model 3 plus Systolic blood pressure, high density lipoprotein cholesterol, low density lipoprotein cholesterol, body mass index, smoking status, diabetes, blood pressure lowering medications use, lipid-lowering medications use, history of coronary heart disease, history of stroke, high-sensitivity C-reactive protein levels, albumin-to-creatinine ratio, history of heart failure, history of stroke, and electrocardiographic left ventricular hypertrophy using Sokolow-Lyon criteria. Additional analysis in those without baseline AF and with data on incident AF collected during REGARDS second in-home visit was also conducted.

Results

This analysis included 8,812 participants residing mainly in the Southeastern United States (mean age 58.1 ± 7.8 years; 63.2%; women; 43.2% black). Hypertension, dyslipidemia and diabetes were common (prevalence 52.2%, 54.5% and 19.5% respectively) and most participants (88.6%) had health insurance. Unemployed participants (total n=2095; out of work >1 year n=295; out of work <1 year n=287; unable to work n=1513) were more likely to be slightly older, women, black, with lower levels of socio-economic markers, and higher prevalence of cardiovascular risk factors compared to employed participants (total n=6717; employed for wages n=5009; self-employed n=1708) (Table 1).

AF was detected in 673 (7.6%) participants (13.4% in unemployed vs. 5.8% in employed; p-value <0.001). In a socio-demographic model, unemployment was associated with more than double the odds of AF. This association was attenuated to be 60% (p<0.001) by further adjustment for health insurance, income, perceived stress cardiovascular risk factors (Table 2). These results were consistent in subgroups stratified by median age (57 years), sex, race, education, income, and health insurance status (Figure 1). Compared to the employed participants, the highest odds of AF were observed in those unable to work, then lost job for > a year then lost job for < a year (Odd ratio (95% Confidence Interval) (OR (95% CI): 1.77(1.33, 2.36); 1.45(0.84, 2.49); 1.09(0.61, 1.93), respectively; trend p-value <0.01).

In additional analysis limited to 4,273 participants without AF at baseline and with follow up data, AF (n=227) developed more often during a median follow up of 9.4 years in the unemployed compared to the employed (6.4% vs. 5.1%, p<0.001). The OR (95% CI) was 1.73 (1.15, 2.58) in the socio-demographics and economic factors model, which became 1.66 (1.09, 2.50) with further adjustment for perceived stress, then 1.54 (1.04, 2.37) with further adjustment for key CVD risk factors (hypertension, diabetes, dyslipidemia, smoking and electrocardiographic left ventricular hypertrophy).

Discussion

The prevalence of AF is expected to double by 2050 (8), and hence identifying new risk factors for AF is becoming of a significant public health importance. Up to our knowledge, this is the first report that links unemployment, a socio-economic problem that concerns a large sector of the United States population, with AF. This may suggest considering the socio-economic factors not only the traditional risk factors when it comes to discussing potential preventive strategies for AF.

Psychological stress and lack of financial resources have been suggested as key factors contributing to increased risk of cardiovascular events in individuals losing their jobs or unable to work (2, 3). This could be the case too with AF, given the observed attenuation after adjustments for these factors in our study. Notably, the association remained strong despite adjustment for dozen potential confounders suggesting that the impact of unemployment on AF is more complex than being mediated by common risk factors. Further studies should investigate the mechanisms by which unemployment leads to AF and to identify viable targets for successful interventions.

Our results should be read in the context of certain limitations. Residual confounding and inability to confirm temporal relationship, which we tried to address by adjusting for several potential confounders and supplementing our results by additional longitudinal analysis, should be noted. Also, one of the methods we used in AF ascertainment was self-reported history of past physician diagnosis which is subject to recall bias. Since not all of the participants had health insurance, we might have missed some paroxysmal AF cases that might have occurred in those uninsured which would have been picked by self-reported past medical history and unlikely be picked by study scheduled ECG. Despite these limitations, this is the first report linking unemployment to AF using data from a racially diverse cohort that has a large sample size and with well-ascertained outcomes.

Acknowledgments

References

1. Weber A, Lehnert G. Unemployment and cardiovascular diseases: a causal relationship? Int Arch Occup Environ Health. 1997; 70:153–160. [PubMed: 9298397]

2. Dupre ME, George LK, Liu G, Peterson ED. The cumulative effect of unemployment on risks for acute myocardial infarction. Arch Intern Med. 2012; 172:1731–1737. [PubMed: 23401888]

3. Gallo WT, Teng HM, Falba TA, Kasl SV, Krumholz HM, Bradley EH. The impact of late career job loss on myocardial infarction and stroke: a 10 year follow up using the health and retirement survey. Occup Environ Med. 2006; 63:683–687. [PubMed: 16798871]

4. Henriksson KM, Lindblad U, Agren B, Nilsson-Ehle P, Rastam L. Associations between unemployment and cardiovascular risk factors varies with the unemployment rate: the Cardiovascular Risk Factor Study in Southern Sweden (CRISS). Scand J Public Health. 2003; 31:305–311. [PubMed: 15099037]

5. Eaker ED, Sullivan LM, Kelly-Hayes M, D'Agostino RB Sr, Benjamin EJ. Anger and hostility predict the development of atrial fibrillation in men in the Framingham Offspring Study. Circulation. 2004; 109:1267–1271. [PubMed: 14993133]

6. Eaker ED, Sullivan LM, Kelly-Hayes M, D'Agostino RB Sr, Benjamin EJ. Tension and anxiety and the prediction of the 10-year incidence of coronary heart disease, atrial fibrillation, and total mortality: the Framingham Offspring Study. Psychosom Med. 2005; 67:692–696. [PubMed: 16204425]

7. Lampert R, Jamner L, Burg M, Dziura J, Brandt C, Liu H, Li F, Donovan T, Soufer R. Triggering of symptomatic atrial fibrillation by negative emotion. J Am Coll Cardiol. 2014; 64:1533–1534. [PubMed: 25277622]

8. Go AS, Hylek EM, Phillips KA, Chang Y, Henault LE, Selby JV, Singer DE. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the AnTicoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. JAMA. 2001; 285:2370–2375. [PubMed: 11343485]

9. Howard VJ, Cushman M, Pulley L, Gomez CR, Go RC, Prineas RJ, Graham A, Moy CS, Howard G. The reasons for geographic and racial differences in stroke study: Objectives and design. Neuroepidemiology. 2005; 25:135–143. [PubMed: 15990444]

10. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983; 24:385–396. [PubMed: 6668417]

11. Soliman EZ, Howard G, Meschia JF, Cushman M, Muntner P, Pullicino PM, McClure LA, Judd S, Howard VJ. Self-reported atrial fibrillation and risk of stroke in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. Stroke. 2011; 42:2950–2953. [PubMed: 21817138]
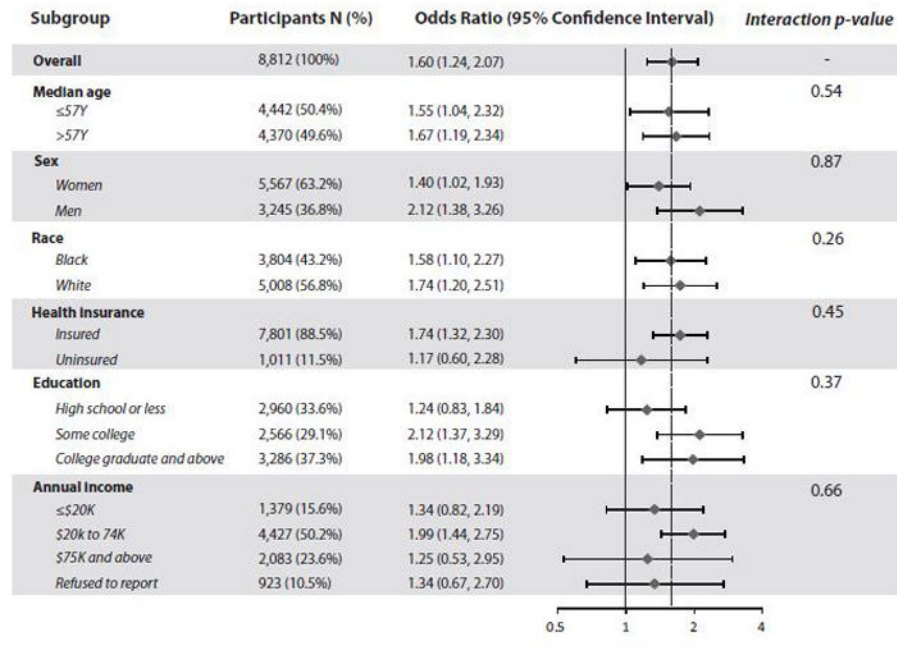
Subgroup	Participants N (%)	Odds Ratio (95% Confidence Interval)		Interaction p-value
Overall	8,812 (100%)	1.60 (1.24, 2.07)		-
Median age				0.54
≤57Y	4,442 (50.4%)	1.55 (1.04, 2.32)		
>57Y	4,370 (49.6%)	1.67 (1.19, 2.34)		
Sex				0.87
Women	5,567 (63.2%)	1.40 (1.02, 1.93)		
Men	3,245 (36.8%)	2.12 (1.38, 3.26)		
Race				0.26
Black	3,804 (43.2%)	1.58 (1.10, 2.27)		
White	5,008 (56.8%)	1.74 (1.20, 2.51)		
Health Insurance				0.45
Insured	7,801 (88.5%)	1.74 (1.32, 2.30)		
Uninsured	1,011 (11.5%)	1.17 (0.60, 2.28)		
Education				0.37
High school or less	2,960 (33.6%)	1.24 (0.83, 1.84)		
Some college	2,566 (29.1%)	2.12 (1.37, 3.29)		
College graduate and above	3,286 (37.3%)	1.98 (1.18, 3.34)		
Annual Income				0.66
≤$20K	1,379 (15.6%)	1.34 (0.82, 2.19)		
$20k to 74K	4,427 (50.2%)	1.99 (1.44, 2.75)		
$75K and above	2,083 (23.6%)	1.25 (0.53, 2.95)		
Refused to report	923 (10.5%)	1.34 (0.67, 2.70)		

Figure 1. Association of unemployment with atrial fibrillation in subgroups

Odds ratio for AF in unemployed vs. employed participants using logistic regression analysis in model adjusted for age, sex, race, region of residence, education level, income and health insurance status, perceived stress, systolic blood pressure, high density lipoprotein cholesterol, low density lipoprotein cholesterol, body mass index, smoking status, diabetes, blood pressure lowering medications use, lipid-lowering medications use, history of coronary heart disease, history of stroke, high-sensitivity C-reactive protein levels, albumin-to-creatinine ratio, history of heart failure, history of stroke, and electrocardiographic left ventricular hypertrophy.

Table 1

Characteristics of the study participants by employment status

Characteristic	Unemployed (n=2,095)	Employed (n=6,717)	P-value
Age (years)	58.6 ± 7.8	58.0 ± 7.8	.002
Women	68.1%	61.7%	<.001
Black	55.0%	34.7%	<.001
Region of residence *			<.001
Stroke Belt	37.6%	34.7%	
Stroke Buckle	29.4%	25.4%	
Non-belt	33.1%	39.9%	
Education			<.001
High school or less	49.4 %	22.4%	
Some college	30.8 %	28.1%	
College graduate and above	19.8 %	49.5%	
Annual income			<.001
< $20k	41.6%	7.6%	
$20k to $74k	37.3%	54.3%	
>$75k	4.8%	29.5%	
Refused to answer	16.3%	8.7%	
Health insurance	82.8%	90.3%	<.001
Perceived stress score	5.2 ± 3.4	3.1 ± 2.6	<.001
Smoker			<.001
Current	26.5%	14.8%	
Past	33.1%	33.6%	
Body mass index (kg/m^2)	31.7 ± 7.8	29.6 ± 6.2	<.001
Diabetes mellitus	34.1%	14.0%	<.001
Systolic blood pressure (mm Hg)	126 ± 16.6	123.0 ± 15.1	<.001
Blood pressure lowering medications use	67.2%	47.3%	<.001
Left ventricular hypertrophy	9.8%	6.3%	<.001
LDL-cholesterol (mg/dL)	113.7 ± 37.5	116.6± 34.4	.002
HDL-cholesterol (mg/dL)	51.3 ± 15.8	53.1 ± 16.2	.002
Lipid-lowering medication use	35.7%	25.8%	<.001
Log(hs-CRP) (mg/L)	1.2 ± 1.2	0.70 ± 1.2	<.001
Log (ACR) (mg/g)	2.6 ± 1.5	2.1 ± 1.0	<.001
Prior coronary heart disease	21.4%	9.5%	<.001
Prior stroke	12.3%	2.2%	<.001
Prior heart failure	21.4%	8.0%	<.001

*
Stroke Belt (southeast states of North Carolina, South Carolina, Georgia, Tennessee, Alabama, Mississippi, Louisiana, and Arkansas) Stroke Buckle (coastal plains of North Carolina, South Carolina, and Georgia)

†Perceived stress was measured by the Cohen Perceived Stress 16-point Scale

ACR=urine albumin-to-creatinine ratio; HDL=high-density lipoprotein; LDL=Low-density lipoprotein; hs-CRP=high-sensitivity C-reactive protein

Table 2

Association of unemployment with atrial fibrillation

	Model	Odds ratio (95% Confidence Interval) [*]	p-value
1:	*Socio-demographic variables [†]*	2.44 (2.05, 2.90)	<.001
2:	*Model 2 plus economic variables[‡]*	2.31 (1.88, 2.83)	<.001
3:	*Model 2 plus perceived stress [§]*	2.02 (1.63, 2.50)	<.001
4:	*Model 3 plus cardiovascular risk factors[||]*	1.60 (1.24, 2.07)	<.001

[*] Odds ratio for AF in unemployed vs. employed participants using logistic regression analysis.

[†] Age, sex, race, region of residence, education level

[‡] Income and health insurance status

[§] Perceived stress measured by the Cohen Perceived Stress 16-point Scale

[||] Systolic blood pressure, high density lipoprotein cholesterol, low density lipoprotein cholesterol, body mass index, smoking status, diabetes, blood pressure lowering medications use, lipid-lowering medications use, history of coronary heart disease, history of stroke, high-sensitivity C-reactive protein levels, albumin-to-creatinine ratio, history of heart failure, history of stroke, and electrocardiographic left ventricular hypertrophy.