



Social Isolation and Cardiovascular Health in US Adults

Chi Kieu,¹ Susan Behforooz,¹ Nathan D Wong,¹

Abstract

Background/Aim: The relation of social isolation (SI) to global cardiovascular health (CVH) is not clear. In this paper the association of CVH metrics to SI within US adults was investigated.

Methods: Using the US National Health and Nutrition Examination Survey, the association of SI with American Heart Association's Life's Simple 7 (LS7) CVH components (smoking, body mass index, physical activity, total cholesterol, diet, blood pressure, fasting blood glucose) was examined. The sum of the components (scored 1 for poor, 2 for intermediate and 3 for ideal) created a composite CVH score. Multiple logistic regression provided the odds of SI according to levels of the LS7 components adjusted for age, sex, and ethnicity.

Results: A total of 3,528 adults aged ≥ 40 were studied. The mean age, sex and ethnicity-adjusted composite CVH scores were 14.1 vs 14.6 in those with vs without SI ($p < 0.01$). Multiple logistic regression examined individual LS7 components in relation to SI and showed the adjusted odds for SI for those with ideal vs poor smoking status to be 0.57 (range 0.38-0.85), ideal vs poor physical activity 0.53 (range 0.37-0.76) and ideal vs poor fasting glucose 0.65 (range 0.47-0.91).

Conclusion: This study generally shows lower levels of CVH in those with vs without SI, with non-smoking status; ideal physical activity and ideal glucose levels were all less likely associated with SI, suggesting the potential value for screening for SI in identifying those at potential cardiovascular disease risk.

Key words: cardiovascular health, social isolation, risk factors.

(1) Heart Disease Prevention Program, Division of Cardiology, University of California, Irvine, CA, USA.

Correspondence:
NATHAN D WONG
E: ndwong@uci.edu

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Introduction

Social support is a key psychosocial factor that has a prominent and powerful impact on physical and mental health. Previous research has indicated that there is a decreased risk of mortality in those with significant quality or quantity of social connections compared to those with low quality or quantity of social networks, when adjusted for baseline health status.¹ Subsequently, data show that psychosocial factors, including low social support, are correlated to greater risk of cardiovascular disease (CVD).²⁻⁶ The impact of social relationships on cardiovascular health has also been shown to be comparable with that of stan-

dard traditional risk factors.⁷ In addition, social connections have been shown to be associated with the development and progression of CVD.⁸⁻¹³

The American Heart Association (AHA) had set a goal to improve cardiovascular health (CVH) of the general American population by 20 % by the year of 2020. The AHA promotes and encourages primary prevention of CVD by describing 7 cardiovascular and behavioural health factors or Life's Simple 7 (LS7) including fasting glucose, blood pressure, total cholesterol, body mass index (BMI), smoking, diet and physical activity as

poor, intermediate and ideal.¹⁴ Although the relation of these metrics with heart failure,^{15, 16} CVD,¹⁷ chronic pulmonary obstructive disease¹⁸ and cancer¹⁹ have been shown, no study has examined the connection between social isolation and the

metrics of CVH. This study examines the relation of social isolation (SI) with AHA's LS7 metrics of CVH, in an effort to further document the role of inadequate social support in CVH.

Methods

A total of 3,528 adults aged ≥ 40 from the National Health and Nutrition Examination Survey (NHANES) were examined. NHANES is a cross-sectional, multistage, stratified, clustered probability sample of the US non-institution-

alised population conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS). Participants underwent a clinical examination including blood collection and answering a household interview; the

Table 1. AHA's Life's Simple 7 Measures

	Poor	Intermediate	Ideal
Smoking	Yes	Former or quit ≤ 12 months prior	Never or quit > 12 months prior
Body Mass Index	≥ 30 kg/m ²	25.0-29.9 kg/m ²	< 25.0 kg/m ²
Physical Activity	None	1-149 min/wk moderate intensity 1-74 min/wk vigorous intensity or 1-149 min/wk moderate+vigorous	≥ 150 min/wk moderate intensity ≥ 75 min/wk vigorous or ≥ 150 min/wk moderate+vigorous
Diet	0-1	2-3 components	4-5 components
Total Cholesterol	≥ 240 mg/dL	200-239 mg/dL or treated to goal	< 200 mg/dL untreated
Blood Pressure	Systolic ≥ 140 or Diastolic ≥ 90 mmHg	Systolic 120-139 or Diastolic 80-89 mmHg or treated to goal	< 120 / < 80 mmHg untreated
Fasting Blood Glucose	≥ 126 mg/dL	100-125 mg/dL or treated to goal	< 100 mg/dL untreated

precise methods and study design for NHANES have been previously described.^{20, 21} The study was conducted using data from 2007-2008, which is the last wave of data that includes social support questionnaires. Participants aged < 40 years were excluded, as they were not included in the sample given social support questionnaires. All participants gave a written informed consent. The current analysis utilised de-identified data from NHANES and was thus exempt from institutional review board approval.

The primary measure of social support was self-reported through a household questionnaire, which queried the participant as to whether there is anyone to provide adequate social support for both male and female participants. Participants who answered negatively for this question were indicated as being socially isolated.

Based on the American Heart Association's Life's Simple 7, each of the 7 health factors and behaviours including diet, BMI, blood pressure, total cholesterol, fasting blood glucose, smoking status, and physical activity were classified as

poor, intermediate, and ideal; specific and detailed descriptions of individual metrics are presented in Table 1.

Participants scoring poor for an individual measure were given a score of 1, intermediate score of 2, or ideal score of 3, respectively. Aggregating the scores assigned for the 7 metrics, a cumulative Life's Simple 7 score (LS7 score) was calculated from the sum of all 7 individual risk factor scores, resulting in a cumulative range of 7 to 21. A score of 7 correlated to the poorest health and 21 corresponded to optimal health.

Analysis of variance (ANOVA) was performed to compare the means of LS7 among subjects with and without SI, while adjusting for age, gender, and ethnicity. Additionally, logistic regression was used to calculate the odds of SI, comparing ideal and intermediate versus poor levels for all the LS7 measures adjusting for age, gender, and ethnicity. Any and all statistical analyses and/or computation of weighted estimates for the general US population were performed using SAS version 9.0.3 (SAS Institute Inc.).

Results

A total of 3,528 adults aged ≥ 40 were included (50.9 % females, 18.8 % African American, 26.2 % Hispanics). Of the total study population, 90.4 % were classified as being absent of SI (having social support) and 9.6 % being socially isolated. The mean adjusted composite CVH score was 14.6 without vs 14.1 in those who were socially isolated ($p < 0.01$). There were significantly lower

proportions of persons with ideal levels of physical activity and fasting blood glucose in those who were socially isolated ($p < 0.01$). Among those who were socially isolated compared to those who were not, there were higher proportions who were Hispanic (26.1 % vs 8.6%) but lower proportions who were African American (7.7 % vs 9.7 %) (both $p < 0.01$) (Table 2). Multiple logistic re-

Table 2. Demographic characteristics comparing those with versus without social isolation

Measures	Social Isolation Absent (n=3191, 90.4 %)	Social Isolation Present (n=337, 9.6 %)	p-value
Age (mean \pm SD)	56.9 \pm 0.33	57.5 \pm 0.68	0.46
Female (%)	6.2 M (52.9%)	4.0 M (49.5 %)	0.44
African American (%)	11.3 M (9.7%)	0.6 M (7.7 %)	< 0.0001
Hispanics (%)	6 M (8.6%)	2.1 M (26.1 %)	< 0.0001
Total Cholesterol, mg/dL (mean \pm SD)	202.4 \pm 1.07	208.7 \pm 3.53	0.119
HDL-Cholesterol, mg/dL (mean \pm SD)	52.9 \pm 0.54	51.3 \pm 1.26	0.176
Systolic Blood Pressure, mmHg (mean \pm SD)	125.8 \pm 0.49	127.8 \pm 1.27	0.116
Diastolic Blood Pressure, mmHg (mean \pm SD)	71.9 \pm 0.42	72.1 \pm 0.79	0.835
Body Mass Index, kg/m ² (mean \pm SD)	28.8 \pm 0.14	28.5 \pm 0.49	0.44
AHA Life's Simple 7 Measures (%):			
Smoking			
Current	18.8	24.9	0.086
Past	1.97	3.73	
Never	79.2	71.3	
Obesity			
Obese	35.3	33.3	0.714
Overweight	36.7	40.1	
Normal	27.9	26.5	
Total Cholesterol			
Poor	17.6	23.2	0.323
Intermediate	48.0	43.3	
Ideal	34.3	33.5	
Blood Pressure			
Poor	21.9	25.4	0.492
Intermediate	50.4	47.8	
Ideal	21.9	26.7	
Diet			
Poor	73.5	70.1	0.474
Intermediate	22.3	23.6	
Ideal	4.21	6.32	
Exercise			
Poor	26.8	37.9	0.0002
Intermediate	46.3	41.0	
Ideal	26.9	21.0	
Fasting Blood Glucose			
Poor	12.2	18.5	0.0092
Intermediate	16.8	17.9	
Ideal	71.0	63.5	
*AHA Life's Simple 7 Score (mean \pm SD)	14.6 \pm 0.09	14.1 \pm 0.11	0.003

gression (Table 3) shows that compared to participants those at poor levels of health metrics, the age, ethnicity, and gender-adjusted odds (95 %) for social isolation among those at ideal fasting blood glucose were 65 % ($p < 0.05$) as likely to be socially isolated. Compared to non-smokers, cur-

Table 3. Multivariable logistic regression odds of social isolation among AHA's LS7 measures

Measures	Odds Ratio (95 % CI)	p-value
Age (per 10 years)	1.09 (0.95-1.26)	0.2113
Female (vs. Male)	0.81 (0.58-1.13)	0.2148
Black (vs. White)	0.88 (0.51-1.53)	0.6460
Hispanics (vs. White)	4.00 (2.94-5.44)	<0.0001
Other Race (vs. White)	2.94 (1.67-5.20)	0.0002
Diet 2 vs. 1	1.01 (0.67, 1.51)	0.9727
Diet 3 vs. 1	1.49 (0.58, 3.77)	0.4026
BMI 2 vs. 1	1.21 (0.86, 1.69)	0.2688
BMI 3 vs. 1	1.06 (0.70, 1.61)	0.7710
Blood Pressure 2 vs. 1	0.88 (0.63, 1.24)	0.4629
Blood Pressure 3 vs. 1	0.92 (0.60, 1.42)	0.7251
Total Cholesterol 2 vs. 1	0.72 (0.46, 1.12)	0.1439
Total Cholesterol 3 vs. 1	0.76 (0.42, 1.39)	0.3807
Fasting Blood Glucose 2 vs. 1	0.77 (0.49, 1.21)	0.2646
Fasting Blood Glucose 3 vs. 1	0.65 (0.47, 0.91)	0.0117
Smoking 2 vs. 1	1.39 (0.39, 4.88)	0.6112
Smoking 3 vs. 1	0.57 (0.38, 0.85)	0.0061
Physical Activity 2 vs. 1	0.73 (0.54, 0.99)	0.0446
Physical Activity 3 vs. 1	0.53 (0.37, 0.76)	0.0006

3 = ideal; 2 = intermediate; 1 = poor (reference)

rent smokers were 57 % ($p < 0.01$) as likely to be socially isolated. Those who were at an ideal level of physical activity were 53 % ($p < 0.001$) as likely and intermediate levels of physical activity to be 73 % as likely ($p < 0.05$) to be socially isolated. While age and sex did not relate significantly to the likelihood of social isolation, in adjusted analyses, compared to whites, Hispanics were 4 times more likely and other races 2.9 times more likely to be social isolated (both $p < 0.01$).

Discussion

This study is the first to examine and analyse the relation between AHA's LS7 metrics and social isolation (also defined within the literature as "lack of social support"), in a representative sample of the US population. The primary finding of this study was that lack of social isolation (presence of social support) was associated with greater levels of cardiovascular health measured

by LS7. In particular, it was found that among the LS7 components, social isolation is associated with poorer fasting blood glucose, smoking, and physical activities. Moreover, Hispanics were four times as likely as whites to be socially isolated.

Smoking is strongly associated with social isolation and current smokers are more likely to be socially isolated. Although there are discrepancies in the findings,²² social support has been shown to be associated with successful smoking cessation.²³ With a smoking prevalence of 15.2 % among adults age ≥ 18 in 2015,²⁴ the presence of social support will be quite beneficial at the reduction of smoking prevalence among the population thus contributing to an improved general cardiovascular health. While smoking is a critical risk factor, the reduction of smoking prevalence in the recent years has been counterproductive by the increase of poor blood pressure, BMI, and absence of healthy diet²⁵ resulting in the need to consider other factors for primary prevention of CVD.

Physical activity is an important factor of LS7 and hold a significant correlation with SI where those with intermediate and ideal level of physical activities are less likely to be socially isolated. Many prior studies have established that physical activity is positively related to social support.²⁶⁻²⁹ Females with high physical activity social support were twice as likely to be active at least 30 minutes for 5 or more days per week.³⁰ Absence of friend or family support has been shown 23-55 % more likely to be inadequately active comparing to those with high family or friend support.³¹ The influence of physical activity on other factors such as blood glucose are rather essential in the primary prevention of CVD, thus the presence of social support influencing physical behaviour may be advantageous in the reduction of blood glucose indirectly through the increase of physical activity.

Previous studies have indicated that social support is associated with better diabetes self-management.³²⁻³⁴ Furthermore, social support at higher levels are related with improved glycaemic control, enhanced adherence of treatment, and strengthened life's quality; although the relationship is controversial and debated.³⁵⁻³⁹ While the relation between social support and blood glucose is indirect, the significance of social support in diabetes care remains a prominent factor as it has been shown to be valuable in diagnosis acceptance, adjusting emotionally, and stress alleviation.^{39, 40}

The clinical implication of this study is that the promotion of social support is essential to CVH. These findings may help to explain the link between SI and increased CVD risk, but further study is warranted to confirm this. The individualist culture within the US population may interfere with effective and sufficient prevention of diseases such as CVD. The findings should be an encouragement for the general public to seek out and maintain strong social relationships, as it yields improvement with respect to quality of life. Additionally, clinicians may be able to improve patient outcomes by assessing social support and intervening more aggressively in those who are socially isolated.

This study only assessed the presence of SI and not the degree or specific type of SI, thus future study is needed to examine the relation between the type of social support or SI and CVH. To some individuals, having a family member is considered as social support but others may find having a peer equally, if not more, beneficial; the discrepancies between the relationships pose potential challenges when it comes to quantifying social support. Depending on the individual's personality and preferences, some may prefer to have a large group of friends while others enjoy a small intimate group of peers, but both are perceived as sufficient support. Quantity of social connections does not convey quality.

This study has strengths and limitations. The key strength of the National Health and Nutrition Examination Survey is the inclusion of a US-population representative sample of adults with data generalisable to the greater US population. However, due to the limitation of the NHANES social support variable, there was no ability to analyse quality vs quantity of social support, thus warranting future studies. Furthermore, the measure of SI used in this study was only based on one NHANES question with respect to self-reported presence of social support due to significant missing values. This information was only available from the 2007-2008 NHANES survey and not more recent ones; however, the association between social isolation and cardiovascular health factors is not anticipated to depend on the survey year (unlike assessing prevalence information of risk factors). Finally, the cross-sectional nature of the study remains a limitation of the study. This warrants further longitudinal studies in individuals initially free of SI at baseline to determine the prospective relation of CVH such as LS7 with the actual development of SI.

Conclusion

This study shows a higher level of CVH in those with social support compared to those with social isolation, with non-smoking status, ideal physical activity, and glucose levels components independently associated a lower likelihood of SI, warranting the consideration of screening for SI as a possible determinant of CVD risk. Prospective study should examine how social isolation may lead to a declining cardiovascular risk factor profile.

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Conflict of interest

None.

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