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Delay in Seeking Medical Care is Associated with Lack of Social Support

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Delay in Seeking Medical Care is Associated with Lack of Social Support

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Abstract

OBJECTIVE: Previous studies have demonstrated an association between social support and lower morbidity and mortality. Delay in seeking medical care is associated with poor health outcomes. The relationship between social support and delay in seeking medical care has not been established. We sought to determine whether lack of social support is associated with higher rates of delays in seeking needed medical care.

METHODS: This is a cross-sectional observational study using data from the 2013 and 2014 CDC Behavioral Risk Factor Surveillance System. Participants from Tennessee and Minnesota (N= 22,234) were asked questions about delays in medical care and social support and were included. The primary outcome was a self-reported delay in seeking needed medical care. The primary independent variable of interest was a dichotomized measure of social support. Multivariable logistic regression was performed, adjusting for demographics, socioeconomic status, comorbidities, and access to care.

RESULTS: Participants without social support were more likely to report delaying needed medical care when compared to participants with social support (38% vs 19%, p <0.001). The association between lack of social support and delays in care persisted after adjustment for demographics, socioeconomic status, comorbidities, and access to care (OR 1.72; 95% CI 1.45, 2.06; p < 0.001).

CONCLUSIONS: Lack of perceived social support is associated with patient reported delay of needed medical care. This association may contribute to the poor health outcomes experienced by those with a lack of social support.

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Strengths and limitations of this study

Strengths

-large sample size

-professionally collected and validated survey data from the Centers for Disease Control

Weaknesses

-sample population limited to two US states

-cross sectional data, we are able to find association but unable to determine causation

-survey questions do not specify what type of medical care was delayed

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INTRODUCTION

Social support refers to the process of interaction in relationships which improves coping, esteem, belonging and competence through actual or perceived exchanges of financial, physical, or psychosocial resources. Over the past several decades, a consistent association between social support and lower morbidity and mortality has been demonstrated.[1-6] This relationship exists across different populations and has been reported in disease specific mortality for cardiovascular disease and cancer.[7] The effect size of this association is substantial. The most socially isolated individuals may have a mortality rate 50% higher than the most socially integrated individuals. If viewed as a clinical risk factor, social isolation is comparable to smoking.[8]

The mechanism by which social support is protective is likely multifactorial. Social relationships improve our cognitive function, lower systolic blood pressure, enhance immune system function and gene expression.[9-14] In addition, social support impacts health related behaviors including increased physical exercise and decreased tobacco and alcohol use.[15,16] Despite a growing understanding of potential mechanisms that may mediate the poor health outcomes observed in those without social support, the association between the lack of social support and delays in seeking medical care has previously only been studied in small samples in disease specific contexts.[17-19]

The association between delays in seeking medical care and poor outcomes is well-established.[20,21] Time to antibiotics for sepsis, door to balloon time for acute coronary syndrome, and timing of cancer diagnosis are examples of the critical importance of prompt medical care.[22-24] Patient delay in seeking medical care is a complex process, with symptom recognition and access to care issues including lack of transportation, financial barriers, and lack of a primary care provider all contributing.[25-27] Lack of social support may play an

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important role in delays in care and this relationship could partially explain the protective effect of social support on health outcomes seen in previous studies. Using data from the 2013 and 2014 Behavioral Risk Factor Surveillance System, we sought to determine whether a self-reported lack social support confers higher perceived rates of delays in seeking needed medical care. Understanding this relationship could identify a high risk group where interventions targeted at addressing barriers to seeking care could lead to improved health outcomes.

METHODS

Study design, setting, and participants. We conducted a cross-sectional observational study using data from the Centers for Disease Control (CDC) Behavioral Risk Factor Surveillance System (BRFSS) survey. The BRFSS survey is a nationally representative telephone survey conducted annually by the Centers for Disease Control and Prevention. A random digit dialing algorithm targeting both landlines and cellular telephones is used to generate a nationally representative sample of adult respondents from all fifty states, the District of Columbia, and several United States territories. The survey includes a core component which is administered to all respondents. This core component contains questions about demographics, health care access, substance and alcohol use, health status, and socioeconomic status. There are also optional question modules which are administered at the discretion of each state. Tennessee and Minnesota asked questions about social support and delays in seeking medical care in the same survey in 2013 and 2014; these respondents constitute the sample for this study. This study using de-identified, publicly available data was reviewed by the Colorado Multiple Institutional Review Board and received an exemption.

Outcome variable. The primary outcome was a self-reported delay in seeking needed medical care. Two questions were combined to assess delays in seeking needed medical care. The first question asked participants, “Was there a time the past 12 months when you needed to see a doctor but could not because of cost?” The second question asked participants, “Other than cost, there are many other reasons people delay getting needed medical care. Have you

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delayed getting needed medical care for any of the following reasons in the last 12 months? Select the most important reason." Potential responses included an "other" option. Participants answering yes to either or both of these questions were considered to have delayed seeking medical care. Participants answering no to both questions were considered to not have delayed seeking needed care. The secondary outcome was the reason for delaying needed medical care. Potential responses included cost, couldn't reach the office, couldn't get an appointment, too long of a wait in the waiting room, office was closed, lack of transportation, and "other" reason.

Explanatory variables. Social support was defined by response to the question, "How often do you get the social and emotional support you need?" Respondents answering *always* or *usually* were categorized as having social support. Respondents answering *sometimes*, *rarely*, or *never* were categorized as not having social support, as previously described.[28,29]

Covariates. Covariates were included based on their potential or reported association with delays in seeking medical care. Demographic data included age considered as a continuous variable, gender, race/ethnicity, and marital status. Race/ethnicity was categorized as white non-Hispanic, African American, Hispanic, and other. Marital status was categorized as married or other. Socioeconomic status variables included education level and employment status. Education level was categorized as non-high school graduates, high school graduates, and college graduates according to the highest education level achieved. Employment status was categorized as employed, unemployed or student status, and retired. Comorbidity data included participant reported presence or absence of depression, diabetes mellitus, chronic obstructive pulmonary disease, coronary artery disease and perceived general health. Perceived health was reported as a general health status of fair or poor versus excellent, very good, or good. Alcohol misuse was determined by reported number of drinks per day using previously described cut-offs. Variables pertaining to access to care included whether or not the

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participant had an established primary care physician and whether they had any health insurance coverage in the last 12 months.

Statistical Analysis. Differences between participants with and without social support were evaluated using a t-test for continuous variables and a chi-square test for proportions. To determine whether delay in seeking medical treatment was associated with the level of perceived social support, we used a forward stepwise multivariable logistic regression model adding the following groups of covariates which were identified *a priori*: demographics, socioeconomic status, health factors, and access to healthcare. This approach was chosen because it would allow us to assess for confounding by clinically relevant groups of variables. Those who reported high levels of social support were used as a reference group. As previously described and recommended for this dataset, a weighting formula was applied in descriptive as well as multivariable analyses. Our main multivariable analysis included all respondents who were asked questions about delays in care and social support, which in 2013 and 2014 included respondents from Tennessee and Minnesota. In order to explore the generalizability of our findings as only two states administered the question modules required for inclusion, we performed a sensitivity analysis examining the association between social support and delays in seeking medical treatment separately in participants enrolled in Tennessee and Minnesota. A p-value of <0.05 was considered significant and the primary inference for the study was made based on the fully adjusted multivariable logistic regression model.

RESULTS

A total of 22,234 participants were asked questions about social support and delays in seeking medical care, and 18,980 (85%) had complete data (Figure 1). Of the 3,254 with incomplete data 2631 (81%) were missing answers to the question on social support, 14 (4%) were missing answers to questions about delays in care, and 481 (15%) had missing data for both social support and delays in care (Figure 1). Those with missing data were more likely to be male (53% vs 48%, p < 0.001), African American (15% vs 10%, p < 0.001), have no primary

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care physician (29% vs 22%, p < 0.001), and be uninsured (14% vs 9%, p < 0.001), but had similar levels of lack of perceived social support (16% vs 18%, p = 0.56) (Table S1). Respondents who participated in the BRFSS in 2013 and 2014 but who were not included in this analysis were more likely to be Hispanic (16% vs 3%, p < 0.001) and more likely to delay care (34% vs 23%, p < 0.001) (Table S2).

Respondents included in the analysis had an average age of 48 years and were predominately non-Hispanic whites (83%) (Table 1). The majority of the population had at least a high school education (88%) and were currently employed (58%), while 18% were retired and 24% were unemployed or students. Depression was the most common comorbidity (19%), while 10% had diabetes, 7% had COPD, 5% had coronary artery disease, and 15% had alcohol misuse. Nearly one quarter of respondents reported a lack of social support (23%). Participants without social support were of similar age but were more likely to be male (54% vs 46% p < 0.001), African American (17% vs 8% p < 0.001), and to not have a high school degree (21% vs 10% p < 0.001). Those with social support were more likely to be married (58% vs 42% p < 0.001) and employed (60% vs 50% p < 0.001). Respondents without social support had similar levels of alcohol misuse (14% vs 16% p = 0.11), but higher rates of medical comorbidities and were the more likely to report fair or poor state of general health (35% vs 14% p <0.001). Those without social support were also more likely to not have a primary care physician (28% vs 22%) and lack health insurance (17% vs 7%) (Table 1).

TABLE 1
Baseline Characteristics of Respondents

	Overall (N= 7,459)	With Support (N= 6,087)	No Support (N= 1,372)	P value
Age (mean)	48	48	48	
Gender (male)	3,551 (48)	2,811 (46)	739 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	6,158 (83)	5,168 (85)	990 (72)	<0.001
African American	717 (10)	478 (8)	239 (17)	<0.001
Hispanic	182 (2)	152 (3)	31 (2)	0.57
Other	180 (5)	127 (4)	53 (6)	0.06
Married	4,102 (55)	3,526 (58)	576 (42)	<0.001
Education				

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Non-High School Grad	896 (12)	609 (10)	286 (21)	<0.001
High School Grad	4,611 (62)	3,730 (61)	881 (64)	0.06
College Grad	1,943 (26)	1,743 (29)	200 (15)	<0.001
Employment				
Unemployed/Student	1,763 (24)	1,299 (21)	464 (34)	<0.001
Employed	4,340 (58)	3,652 (60)	688 (50)	<0.001
Retired	1,334 (18)	1,120 (18)	215 (16)	0.01
Comorbidity				
Depression	1,430 (19)	961 (16)	470 (34)	<0.001
Diabetes	759 (10)	581 (10)	178 (13)	<0.001
COPD	507 (7)	339 (6)	168 (12)	<0.001
CAD	379 (5)	283 (5)	96 (7)	<0.001
Alcohol Misuse	1,120 (15)	935 (16)	185 (14)	0.11
Perceived Health				
Fair/Poor	1,302 (18)	830 (14)	472 (35)	<0.001
Access				
No PCP	1,641 (22)	1,258 (21)	384 (28)	<0.001
Uninsured	643 (9)	418 (7)	224 (17)	<0.001
Delay				
Delay Cost	995 (13)	643 (11)	352 (26)	<0.001
Delay Non-Cost	996 (13)	686 (11)	310 (23)	<0.001
Delay†	1,673 (22)	1,153 (19)	520 (38)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 7,460,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

Overall, 22% of respondents reported a delay in seeking needed medical care. Participants without social support were twice as likely to report delaying needed medical care when compared to participants with social support (38% vs 19%, p <0.001). Among participants who reported a delay in seeking medical care, the most common reason was concern for the cost of care (59%), followed by unspecified reason (22%), inability to get a timely appointment (16%), and lack of transportation (10%). Those without social support were more likely to report a primary reason for delayed care due to cost (68% vs 56% p <0.001) (Figure 2). Respondents without social support were also significantly more likely to report delays because there was too long of a wait in the waiting room (8% vs 7%), they lacked transportation (11% vs 10%) or for another reason (24% vs 22%) (p < 0.001 for all comparisons).

The association between a lack of social support and a delay in seeking medical care was unchanged after adjustment for demographic variables (OR 2.64; 95% CI 2.26, 3.09, p <

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0.001) (Table 2). Further adjustment for socioeconomic status (adjusted OR 2.37; 95% CI 2.01, 2.81; p < 0.001) and health factors (adjusted OR 1.88; 95% CI 1.58, 2.23; p < 0.001) led to an attenuation of the association between lack of social support and delays in seeking medical care. There was little change in the magnitude of the association between a lack of social support and delays in seeking care after further adjustment for access to care (fully adjusted OR 1.72; 95% CI 1.45, 2.06; p < 0.001).

Table 2
Adjusted and Unadjusted Association Between Social Support and Delays in Seeking Medical Care

Social Support	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	1.00	1.00	1.00	1.00	Ref	Ref
Poor Social Support	2.61	2.64	2.37	1.88	1.72	1.45-2.06	<0.001
Demographics							
Age		1.02	1.01	1.01	1.01	1.01-1.02	<0.001
Gender (Male)		0.63	0.67	0.69	0.62	0.53-0.72	<0.001
Race							
White non-Hispanic		1.00	1.00	1.00	1.00	Ref	Ref
AA		1.01	1.07	0.97	1.01	0.78-1.31	0.92
Hispanic		1.37	1.18	1.31	1.21	0.73-2.01	0.45
Other		1.27	1.18	1.26	1.02	0.53-1.98	0.95
Marital Status (married)		0.76	0.79	0.85	0.93	0.80-1.07	0.31
Socioeconomic Status							
Education (Highest Level)							
Non High School Graduate			1.00	1.00	1.00	Ref	Ref
High School Graduate			0.61	0.71	0.76	0.58-0.99	0.046
College Graduate			0.53	0.66	0.80	0.59-1.07	0.13
Employment							
Employed			1.00	1.00	1.00	Ref	Ref
Unemployed/Student			1.59	1.19	1.11	0.94-1.32	0.22
Retired			0.50	0.47	0.50	0.40-0.63	<0.001
Health Factors							
Comorbidity							
Depression				1.93	1.99	1.72-2.31	<0.001
DM				1.14	1.22	0.97-1.53	0.09
COPD				1.49	1.53	1.18-1.97	0.001
CAD				1.00	1.01	0.74-1.40	0.94
Alcohol Misuse				1.09	1.11	0.93-1.33	0.24
Perceived Health							
Fair/Poor				2.11	2.14	1.75-2.62	<0.001
Access to Care							
No Primary Physician					1.18	0.99-1.42	0.07
No Insurance					4.21	3.24-5.48	<0.001

95% confidence intervals and p-values refer to model 5. All other values expressed as odds ratios

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In a sensitivity analysis examining the findings separately in Tennessee and Minnesota, a lack of social support was associated with delays in seeking medical care in respondents from both Tennessee and Minnesota (Table 3; Supplement Tables S3-8). However, after full adjustment for potential confounding variables, the association between a lack of perceived social support and delay in seeking medical care was stronger in Minnesota than in Tennessee (p-value for interaction term < 0.001). In Minnesota, the odds of delaying medical care were 2.16 times higher (95% CI 1.83, 2.56; p < 0.001) in participants without social support compared to those with social support. In Tennessee, the odds of delaying medical care was 1.50 times (95% CI 1.16, 1.94; p < 0.01) higher in participants without social support when compared to those with social support.

Table 3
Subgroup Analyses by State

	Minnesota			Tennessee		
Social Support	**Fully Adjusted OR**	**95% CI**	**p-value**	**Fully Adjusted OR**	**95% CI**	**p-value**
Good Social Support	1.00	Ref	Ref	1.00	Ref	Ref
Poor Social Support	2.16	1.83-2.56	<0.001	1.50	1.16-1.94	<0.01
Demographics						
Age	1.01	1.01-1.02	<0.001	1.01	1.00-1.02	0.04
Gender (Male)	0.66	0.58-0.75	<0.001	0.60	0.47-0.76	<0.001
Race						
White non-Hispanic	1.00	Ref	Ref	1.00	Ref	Ref
AA	0.58	0.42-0.80	<0.001	1.22	0.88-1.70	0.22
Hispanic	1.44	1.00-2.06	0.05	1.06	0.26-4.35	0.94
Other	1.08	0.56-1.68	0.73	0.93	0.48-1.80	0.84
Marital Status (married)	0.88	0.77-0.99	0.04	0.95	0.76-1.20	0.68
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate	1.00	Ref	Ref	1.00	Ref	Ref
High School Graduate	0.98	0.71-1.35	0.90	0.71	0.49-1.03	0.07
College Graduate	0.97	0.71-1.35	0.83	0.81	0.52-1.25	0.34
Employment						
Employed	1.00	Ref	Ref	1.00	Ref	Ref
Unemployed/Student	1.09	0.92-1.29	0.33	1.08	0.83-1.41	0.57
Retired	0.58	0.48-0.71	<0.001	0.45	0.31-0.64	<0.001
Health Factors						
Comorbidity						
Depression	2.02	1.75-2.32	<0.001	2.00	1.56-2.56	<0.001
DM	1.07	0.86-1.33	0.56	1.29	0.93-1.78	0.12

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COPD	1.70	1.35-2.15	<0.001	1.44	1.01-2.06	0.04
CAD	0.88	0.65-1.20	0.42	1.08	0.70-1.65	0.73
Alcohol Misuse	1.14	0.98-1.33	0.10	1.19	0.82-1.72	0.36
Perceived Health						
Fair/Poor	2.21	1.85-2.64	<0.001	2.04	1.51-2.75	<0.001
Access to Care						
No Primary Physician	1.10	0.93-1.29	0.27	1.28	0.95-1.74	0.11
No Insurance	1.75	0.41-7.53	0.45	3.90	2.88-5.28	<0.001

DISSCUSSION

This study demonstrates that a lack of social support is associated with delays in seeking medical care. The overall rate of reported delay in seeking needed medical care was 22% and respondents with a perceived lack of social support were twice as likely to report delays when compared to those with social support (38% vs 19%). While it is difficult to directly compare reported delays in care in this study to studies evaluating delays in care for specific conditions, similar rates have been previously reported.[30-32] This association persisted after adjustment for demographic variables, socioeconomic status, health factors, and access to care raising the possibility that a lack of social support is independently associated with delays in seeking care.

Previous studies have demonstrated that lack of social support is an important risk factor for mortality. This study identifies delays in seeking needed medical care as a potential mechanism by which a lack of social support may affect health outcomes. As recognition of the importance of social and behavioral determinants of health on health outcomes at the population level increases, the Institute of Medicine (IOM) has encouraged identification of these factors in the clinical setting and has recommended incorporation of standardized assessments of social isolation or connection into the electronic medical record (EMR).[33] Identification of patients with low levels of social support may provide opportunity to target a high risk population that could benefit from care management systems or group based interventions to build social support and encourage prompt medical care. Future studies might

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seek to provide a deeper understanding of what drives these delays in an effort to shape these interventions.

There are several limitations to our study. First, Tennessee and Minnesota were the only states in the BRFSS dataset that included all of the survey questions required for inclusion in our analysis. While these two states differ in racial composition compared to the national population, their populations are nationally representative in terms of socioeconomic status, rates of comorbidities and access to care. One exception is that the state of Minnesota had a very small uninsured population. While Minnesota does have one of the lowest rates of uninsured status in the United States, the extremely low rate (<1%) found in this study may represent a bias in the survey. Although our findings were consistent in both states, the magnitude of the association varied highlighting that these results should be generalized to the rest of the United States with caution.

Second, there may be a selection bias wherein those with low levels of social support may be less likely to participate in the survey. Therefore, the rates of poor social support may be underestimated. Third, our primary outcome of delay in needed medical care is patient reported and we were unable to determine what type of care was delayed. It is plausible that the likelihood of delay in seeking care or the reasons for seeking care vary by illness, symptom, and/or severity. Our outcome variable lacked sufficient specificity to explore this hypothesis. Fourth, assessment of the reason for care delay was determined by response to two separate questions, one of which solely addressed cost. While this inherently biases the responses towards reporting cost as a reason for care delay, other studies support that concern for cost of care is a common reason for care delay.[30] Fifth, this is a cross-sectional observational study which limits the ability to infer causation. Though we incorporated several demographic variables and measures of socioeconomic status, health factors, and access to care, it is possible that these results are explained by residual or unmeasured confounding and we are unable to establish a temporal relationship between lack of social support and treatment delays.

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Finally, this study likely underestimates the rates of delays in care. Respondents in this study were asked about delaying *needed* medical care and therefore care delay due to symptom appraisal, the process by which a patient recognizes that their condition requires medical attention, is not accounted for. While this may lead to an underestimation of care delay, delays due to symptom appraisal would likely be targeted by different types of interventions, such as education about the symptoms of specific conditions. Common examples of these types of interventions include educational campaigns about the symptoms of stroke or breast cancer. By eliminating symptom appraisal as a cause of care delay, this study likely better identifies care delays that may be modifiable by interventions targeting a lack of social support.

In conclusion, lack of perceived social support is associated with patient reported delay of needed medical care. Identification of patients with low levels of social support could help identify a high-risk population that may benefit from interventions targeted at reducing social isolation and improving access to care.

REFERENCES

1. Berkman LF, Syme SL. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. Am J Epidemiol 1979, 109(2):186-204.
2. Blazer DG. Social support and mortality in an elderly community population. Am J Epidemiol 1982, 115(5):684-694.
3. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. PLoS Med 2010, 7(7):e1000316.
4. House JS, Landis KR, Umberson D. Social relationships and health. Science 1988, 241(4865):540-545.
5. Lyyra TM, Heikkinen RL. Perceived social support and mortality in older people. J Gerontol B Psychol Sci Soc Sci 2006, 61(3):S147-152.

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6. Zhang X, Norris SL, Gregg EW, Beckles G. Social support and mortality among older persons with diabetes. Diabetes Educ 2007, 33(2):273-281.

7. Berkman LF, Melchior M, Chastang JF, et al. Social integration and mortality: a prospective study of French employees of Electricity of France-Gas of France: the GAZEL Cohort. Am J Epidemiol 2004, 159(2):167-174.

8. Pantell M, Rehkopf D, Jutte D, et al. Social isolation: a predictor of mortality comparable to traditional clinical risk factors. Am J Public Health 2013, 103(11):2056-2062.

9. Seeman TE, Lusignolo TM, Albert M, et al. Social relationships, social support, and patterns of cognitive aging in healthy, high-functioning older adults: MacArthur studies of successful aging. Health Psychol 2001, 20(4):243-255.

10. Yang YC, Boen C, Mullan Harris K. Social relationships and hypertension in late life: evidence from a nationally representative longitudinal study of older adults. J Aging Health 2015, 27(3):403-431.

11. Holt-Lunstad J, Uchino BN, Smith TW, et al. Social relationships and ambulatory blood pressure: structural and qualitative predictors of cardiovascular function during everyday social interactions. Health Psychol 2003, 22(4):388-397.

12. Lamkin, DM, Lutgendorf SK, McGinn S, et al. Positive psychosocial factors and NKT cells in ovarian cancer patients. Brain Behav Immun 2008, 22(1):65-73.

13. Miyazaki T, Ishikawa T, Nakata A, et al. Association between perceived social support and Th1 dominance. Biol Psychol 2005, 70(1):30-37.

14. Cole SW, Hawkley LC, Arevalo JM, et al. Social regulation of gene expression in human leukocytes. Genome Biol 2007, 8(9):R189.

15. Oka RK, King AC, Young DR. Sources of social support as predictors of exercise adherence in women and men ages 50 to 65 years. Womens Health 1995, 1(2):161-175.

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16. Steptoe A, Wardle J, Pollard TM, et al. Stress, social support and health-related behavior: a study of smoking, alcohol consumption and physical exercise. J Psychosom Res 1996, 41(2):171-180.

17. Pedersen AF, Olesen F, Hansen RP, et al. Social Support, gender and patient delay. Br J Cancer 2011, 104(8):1249-55.

18. Berkanovic E, Telesky C, Reeder S. Structural and social psychological factors in the decision to seek medical care for symptoms. Med Car 1981, 19(7): 693:709.

19. McCoy SI, Strauss RP, MacDonald PD, et al. Social support and delays seeking care after HIV diagnosis, North Carolina, 2000-2006. AIDS Care 2009, 21(9): 1148-56.

20. Yan J, Liu Y, Zhou B, Sun M. Pre-hospital delay in patients with diabetic foot problems: influencing factors and subsequent quality of care. Diabet Med 2014, 31(5):624-629.

21. Garbuz DS, Xu M, Duncan CP, Masri BA, et al. Delays worsen quality of life outcome of primary total hip arthroplasty. Clin Orthop Relat Res 2006, 447(79-84.

22. Ferrer R, Martin-Loeches I, Phillips G, et al. Empiric antibiotic treatment reduces mortality in severe sepsis and septic shock from the first hour: results from a guideline-based performance improvement program. Crit Care Med 2014, 42(8):1749-1755.

23. McNamara RL, Wang Y, Herrin J, Curtis JP, et al. Effect of door-to-balloon time on mortality in patients with ST-segment elevation myocardial infarction. J Am Coll Cardiol 2006, 47(11):2180-2186.

24. Martin S, Ulrich C, Munsell M, et al. Delays in cancer diagnosis in underinsured young adults and older adolescents. Oncologist 2007, 12(7):816-824.

25. Dracup K, Moser DK. Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction. Heart Lung 1997, 26(4):253-262.

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BMJ Open: first published as 10.1136/bmjopen-2017-018139 on 16 July 2018. Downloaded from http://bmjopen.bmj.com/ on April 10, 2024 by guest. Protected by copyright.

26. Esteva M, Leiva A, Ramos M, et al. Factors related with symptom duration until diagnosis and treatment of symptomatic colorectal cancer. BMC Cancer 2013, 13(87.

27. Raczynski JM, Finnegan JR, Zapka JG, et al. REACT theory-based intervention to reduce treatment-seeking delay for acute myocardial infarction. Rapid Early Action for Coronary Treatment. Am J Prev Med 1999, 16(4):325-334.

28. Schussler-Fiorenza Rose SM, Eslinger JG, Zimmerman L, et al. Adverse Childhood Experiences, Support, and the Perception of Ability to Work in Adults with Disability. PLoS One 2016, 11(7):e0157726.

29. Strine TW, Kroenke K, Dhingra S, et al. The associations between depression, health-related quality of life, social support, life satisfaction, and disability in community-dwelling US adults. J Nerv Ment Dis 2009, 197(1):61-64.

30. Kullgren JT, McLaughlin CG, Mitra N, et al. Nonfinancial barriers and access to care for U.S. adults. Health Serv Res 2012, 47(1):462-485.

31. Sabatino SA, Coates RJ, Uhler RJ, et al. Health insurance coverage and cost barriers to needed medical care among U.S. adult cancer survivors age<65 years. Cancer 2006, 106(11):2466-2475.

32. Weissman JS, Stern R, Fielding SL, et al. Delayed access to health care: risk factors, reasons, and consequences. Ann Intern Med 1991, 114(4):325-331.

33. Adler NE, Stead WW. Patients in context--EHR capture of social and behavioral determinants of health. N Engl J Med 2015, 372(8):698-701.

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Figure 1. Selection of sample for this study

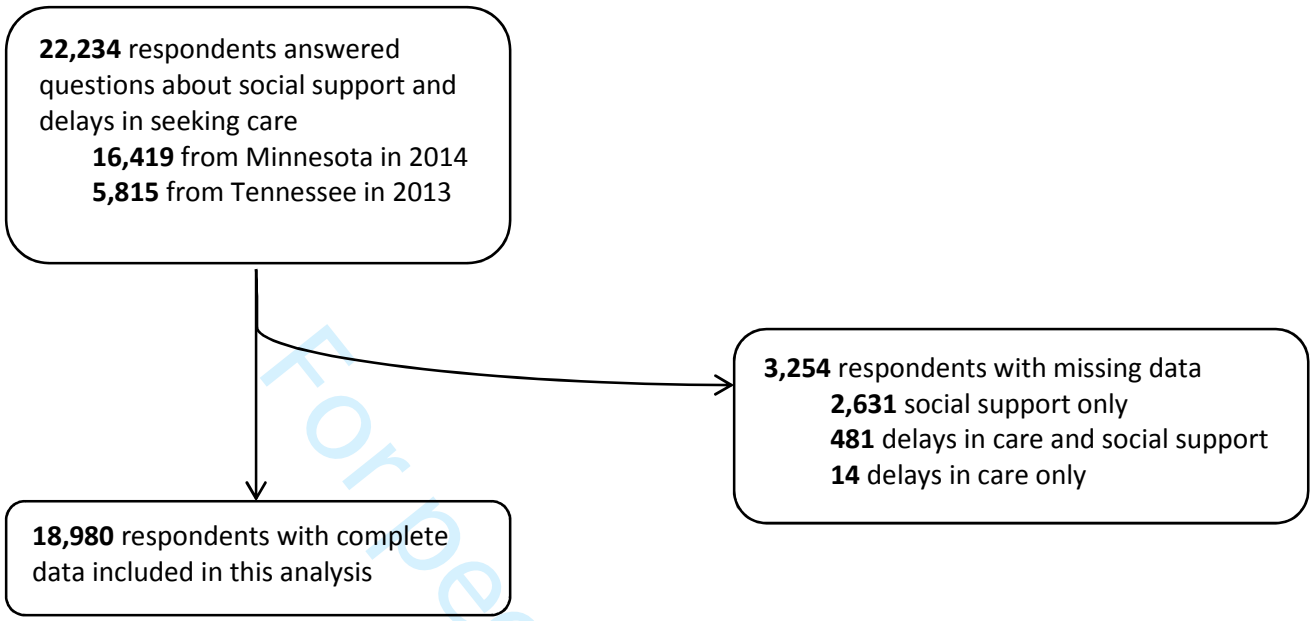

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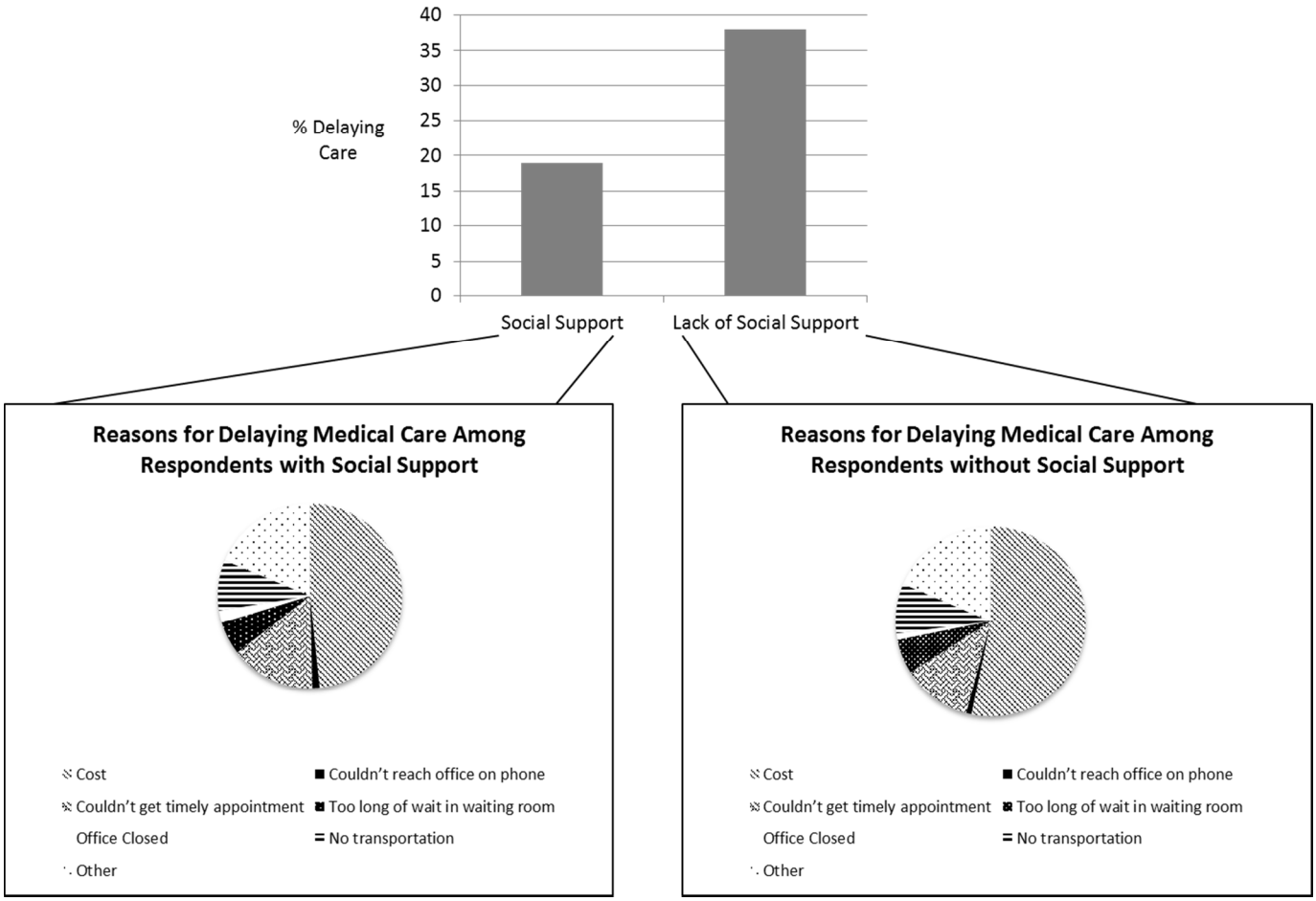
Figure 2. Reasons for Delaying Medical Care



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Supplemental Tables

Table S1
Missing data analysis

	Not Missing (n= 18,890)	Missing (n = 3,254)	p-value
Age (mean)	48	45	< 0.001
Gender (male)	48	53	< 0.001
Race			
White non-Hispanic	83	72	<0.001
African American	10	15	<0.001
Hispanic	2	5	<0.001
Other	5	6	0.30
Married	55	51	<0.01
Education (Highest level)			
Non High School Graduate	12	17	<0.001
High School Graduate	62	62	0.90
College Graduate	26	21	<0.001
Employment			
Unemployed/Student	24	27	0.01
Employed	58	55	0.07
Retired	18	17	0.47
Comorbidity			
Depression	19	17	0.08
DM	10	11	0.31
COPD	7	9	0.02
CAD	5	4	0.34
Alcohol Misuse	15	15	0.93
Perceived Health			
Fair/Poor	18	20	<0.01
Coverage/Utilization			
No Primary Physician	22	29	<0.001
No Insurance Coverage	9	14	<0.001
Delay Care Due to Cost	13	16	0.04
Delay Care for Non-Cost Reason	13	15	0.18
Any Reason for Delay in Care	22	28	<0.001
Lack of Perceived Social Support	18	16	0.56

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Table S2
Differences between participants in the 2013-2014 BRFSS sample who were and were not assigned social support and treatment delay modules

	Not assigned social support and treatment delay modules (n = 934,203)	Assigned social support and treatment delay modules (n = 22,234)
Age (mean)	47	47
Gender (male, %)	49	49
Race		
White non-Hispanic	81	64
African American	11	12
Hispanic	3	16
Other	6	8
Married	54	51
Education (Highest level)		
Non High School Graduate	13	15
High School Graduate	62	59
College Graduate	25	26
Employment		
Unemployed/Student	24	27
Employed	58	56
Retired	18	17
Comorbidity		
Depression	19	18
DM	10	10
COPD	7	7
CAD	5	4
Alcohol Misuse	15	17
Perceived Health		
Fair/Poor	18	18
Social Network		
Single adult household	22	19
Coverage/Utilization		
No Primary Physician	23	23
No Insurance Coverage	10	12
Delay Care Due to Cost	14	15
Delay Care for Non-Cost Reason	14	20
Any Reason for Delay in Care	23	34

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TABLE S3
Baseline Characteristics of Tennessee Respondents

	Overall (N= 3,773)	With Support (N= 2,908)	No Support (N= 865)	P value
Age (mean)	48	48	48	
Gender (male)	1,768 (47)	1,302 (45)	466 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	2,998 (79)	2,374 (82)	624 (72)	<0.001
African American	554 (15)	367 (13)	187 (22)	<0.001
Hispanic	41 (1)	39 (1)	2 (<1)	0.03
Other	180 (5)	127 (4)	53 (6)	0.30
Married	2,032 (54)	1,654 (57)	379 (43)	<0.001
Single Adult Household *	490 (23)	361 (21)	129 (29)	<0.001
Education				
Non-High School Grad	574 (15)	373 (13)	202 (23)	<0.001
High School Grad	2,354 (63)	1,801 (62)	552 (64)	0.40
College Grad	835 (22)	729 (25)	106 (12)	<0.001
Employment				
Unemployed/Student	1,103 (29)	774 (21)	329 (38)	<0.001
Employed	1,954 (52)	1,555 (53)	399 (46)	<0.01
Retired	708 (19)	572 (20)	137 (16)	0.02
Comorbidity				
Depression	747 (20)	438 (15)	309 (36)	<0.001
Diabetes	462 (12)	332 (11)	130 (15)	0.02
COPD	346 (9)	215 (7)	131 (15)	<0.001
CAD	252 (7)	176 (6)	76 (9)	0.02
Alcohol Misuse	355 (10)	265 (9)	90 (11)	0.42
Perceived Health				
Fair/Poor	865 (23)	525 (18)	341 (40)	<0.001
Access				
No PCP	783 (21)	559 (19)	224 (26)	<0.01
Uninsured	638 (17)	414 (14)	223 (26)	<0.001
Delay				
Delay Cost	664 (18)	415 (14)	249 (29)	<0.001
Delay Non-Cost	552 (15)	361 (12)	192 (22)	<0.001
Delay†	1,014 (27)	669 (23)	345 (40)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 3,773,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

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TABLE S4
Baseline Characteristics of Minnesota Respondents

	Overall (N= 3,686)	With Support (N= 3,179)	No Support (N= 507)	P value
Age (mean)	47	47	46	
Gender (male)	1,782 (48)	1,510 (47)	273 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	3,160 (86)	2,793 (88)	367 (72)	<0.001
African American	163 (4)	111 (3)	52 (10)	<0.001
Hispanic	142 (4)	113 (4)	30 (6)	<0.01
Other	221 (6)	162 (5)	58 (11)	<0.001
Married	2,070 (56)	1,872 (59)	198 (39)	<0.001
Single Adult Household *	314 (20)	256 (18)	58 (32)	<0.001
Education				
Non-High School Grad	322 (9)	237 (7)	85 (17)	<0.001
High School Grad	2,257 (61)	1,929 (61)	329 (65)	<0.01
College Grad	1,108 (30)	1,014 (32)	94 (18)	<0.001
Employment				
Unemployed/Student	660 (18)	525 (17)	136 (27)	<0.001
Employed	2,387 (65)	2,097 (66)	290 (58)	<0.001
Retired	626 (17)	548 (17)	78 (15)	0.07
Comorbidity				
Depression	684 (19)	523 (16)	161 (32)	<0.001
Diabetes	298 (8)	249 (8)	49 (10)	0.03
COPD	161 (4)	124 (4)	37 (7)	<0.001
CAD	127 (3)	107 (3)	20 (4)	0.20
Alcohol Misuse	766 (21)	670 (21)	95 (19)	0.07
Perceived Health				
Fair/Poor	437 (12)	305 (10)	132 (26)	<0.001
Access				
No PCP	858 (23)	699 (22)	160 (32)	<0.001
Uninsured	5 (<1)	5 (<1)	1 (<1)	0.60
Delay				
Delay Cost	331 (9)	228 (7)	103 (20)	<0.001
Delay Non-Cost	444 (12)	325 (10)	119 (23)	<0.001
Delay†	659 (18)	484 (15)	175 (34)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 3,686,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

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Table S5
Reasons for Delaying Medical Care Among Tennessee Respondents

Reason for delaying care	Overall (N= 1,014)	With Support (N= 669)	Without Support (N= 345)	P-value
Cost	664 (65)	415 (62)	249 (72)	<0.001
Couldn't reach office on phone	3 (<1)	2 (<1)	1 (<1)	0.50
Couldn't get timely appointment	115 (11)	72 (11)	44 (13)	<0.01
Too long of wait in waiting room	56 (6)	36 (5)	20 (6)	0.046
Office Closed	14 (1)	12 (2)	2 (1)	0.32
No transportation	85 (8)	63 (9)	22 (6)	0.56
Other Reason	279 (28)	176 (26)	103 (30)	<0.001

Weighted Data. Multiplication by 1,000 gives weighted frequency (N). Total Weighted N Delays = 1,014,000

Patients who delayed care due to cost could also report one additional reason for delaying medical care, therefore percentages for reasons for delay in care are greater than total percentage of patients who delayed care.

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Table S6
Multivariate Modeling Tennessee

Social Support	**Model 1**	**95% CI**	**p-value**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	n/a	n/a	1.00	n/a	n/a
Poor Social Support	2.22	1.78-2.77	<0.001	1.50	1.16-1.94	<0.01
Demographics						
Age				1.01	1.00-1.02	0.04
Gender (Male)				0.60	0.47-0.76	<0.001
Race						
White non-Hispanic				1.00	n/a	n/a
AA				1.22	0.88-1.70	0.22
Hispanic				1.06	0.26-4.35	0.94
Other				0.93	0.48-1.80	0.84
Marital Status (married)				0.95	0.76-1.20	0.68
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate				1.00	n/a	n/a
High School Graduate				0.71	0.49-1.03	0.07
College Graduate				0.81	0.52-1.25	0.34
Employment						
Employed				1.00	n/a	n/a
Unemployed/Student				1.08	0.83-1.41	0.57
Retired				0.45	0.31-0.64	<0.001
Health Factors						
Comorbidity						
Depression				2.00	1.56-2.56	<0.001
DM				1.29	0.93-1.78	0.12
COPD				1.44	1.01-2.06	0.04
CAD				1.08	0.70-1.65	0.73
Alcohol Misuse				1.19	0.82-1.72	0.36
Perceived Health						
Fair/Poor				2.04	1.51-2.75	<0.001
Access to Care						
No Primary Physician				1.28	0.95-1.74	0.11
No Insurance				3.90	2.88-5.28	<0.001

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Table S7
Reasons for Delaying Medical Care Among Minnesota Respondents

Reason for delaying care	Overall (N=659)	With Support (N= 484)	Without Support (N= 175)	P-value
Cost	331 (50)	228 (47)	103 (59)	<0.001
Couldn't reach office on phone	19 (3)	14 (3)	5 (3)	<0.01
Couldn't get timely appointment	160 (24)	125 (4)	35 (20)	<0.001
Too long of wait in waiting room	60 (9)	41 (26)	19 (11)	<0.001
Office Closed	23 (3)	17 (4)	6 (3)	0.01
No transportation	88 (13)	54 (11)	34 (19)	<0.001
Other Reason	95 (14)	74 (15)	21 (12)	<0.001

Weighted Data. Multiplication by 1,000 gives weighted frequency (N). Total Weighted N Delays = 659,000

Patients who delayed care due to cost could also report one additional reason for delaying medical care, therefore percentages for reasons for delay in care are greater than total percentage of patients who delayed care.

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Table S8
Multivariate Modeling Minnesota

Social Support	**Model 1**	**95% CI**	**p-value**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	n/a	n/a	1.00	n/a	n/a
Poor Social Support	2.93	2.55-3.36	<0.001	2.16	1.83-2.56	<0.001
Demographics						
Age				1.01	1.01-1.02	<0.001
Gender (Male)				0.66	0.58-0.75	<0.001
Race						
White non-Hispanic				1.00	n/a	n/a
AA				0.58	0.42-0.80	<0.001
Hispanic				1.44	1.00-2.06	0.05
Other				1.08	0.56-1.68	0.73
Marital Status (married)				0.88	0.77-0.99	0.04
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate				1.00	n/a	n/a
High School Graduate				0.98	0.71-1.35	0.90
College Graduate				0.97	0.71-1.35	0.83
Employment						
Employed				1.00	n/a	n/a
Unemployed/Student				1.09	0.92-1.29	0.33
Retired				0.58	0.48-0.71	<0.001
Health Factors						
Comorbidity						
Depression				2.02	1.75-2.32	<0.001
DM				1.07	0.86-1.33	0.56
COPD				1.70	1.35-2.15	<0.001
CAD				0.88	0.65-1.20	0.42
Alcohol Misuse				1.14	0.98-1.33	0.10
Perceived Health						
Fair/Poor				2.21	1.85-2.64	<0.001
Access to Care						
No Primary Physician				1.10	0.93-1.29	0.27
No Insurance				1.75	0.41-7.53	0.45

95% confidence intervals and p-values given refer to model 5

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	Page 2- (*a*) Indicate the study's design with a commonly used term in the title or the abstract
		Page 2- (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Page 4- Explain the scientific background and rationale for the investigation being reported
Objectives	3	Page 5- State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Pages 5, 6- Present key elements of study design early in the paper
Setting	5	Pages 5, 6- Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	Page 5- (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Pages 5, 6- Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	Pages 5, 6- For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Page 7- Describe any efforts to address potential sources of bias
Study size	10	Pages 5, 7- Explain how the study size was arrived at
Quantitative variables	11	Pages 5, 6- Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	Pages 5, 6-(*a*) Describe all statistical methods, including those used to control for confounding
		Pages 5, 6- (*b*) Describe any methods used to examine subgroups and interactions
		Page 7- (*c*) Explain how missing data were addressed
		Page 5- *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		Page 7- (*e*) Describe any sensitivity analyses

Continued on next page

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Results		
Participants	13*	Page 7- (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		Page 7- (b) Give reasons for non-participation at each stage
		Figure 1- (c) Consider use of a flow diagram
Descriptive data	14*	Pages 7, 8- (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		Pages 7- (b) Indicate number of participants with missing data for each variable of interest
		n/a- (c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	n/a- *Cohort study*—Report numbers of outcome events or summary measures over time
		n/a- *Case-control study*—Report numbers in each exposure category, or summary measures of exposure
		Page 9- *Cross-sectional study*—Report numbers of outcome events or summary measures
Main results	16	Pages 9, 10- (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		Pages 9, 10- (*b*) Report category boundaries when continuous variables were categorized
		n/a- (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Page 11- Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Page 12- Summarise key results with reference to study objectives
Limitations	19	Page 13- Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Pages 13, 14- Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Page 13- Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Page 1- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Is Lack of Social Support Associated with a Delay in Seeking Medical Care? A cross-sectional study using data from the Behavioral Risk Factor Surveillance System

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Contributorship Statement: All authors listed have contributed sufficiently to the project to be included as authors, and all those who are qualified to be authors are listed in the author byline. Dr. Matthew Reisinger drafted the manuscript and performed the statistical analysis. Dr.

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Brendan Clark and Dr. Marc Moss each assisted in the study design, interpretation of data, and revisions of the manuscript. All authors have approved the final version of the manuscript.

Abstract

OBJECTIVE: Previous studies have demonstrated an association between social support and lower morbidity and mortality. Delay in seeking medical care is associated with poor health outcomes. The relationship between social support and delay in seeking medical care has not been established. We sought to determine whether lack of social support is associated with higher rates of delays in seeking needed medical care.

METHODS: This is a cross-sectional observational study using data from the 2013 and 2014 CDC Behavioral Risk Factor Surveillance System. Participants who were asked questions about delays in medical care and social support and were included. The primary outcome was a self-reported delay in seeking needed medical care. The primary independent variable of interest was a dichotomized measure of social support. Multivariable logistic regression was performed, adjusting for demographics, socioeconomic status, comorbidities, and access to care.

RESULTS: Participants without social support were more likely to report delaying needed medical care when compared to participants with social support (38% vs 19%, p <0.001). The association between lack of social support and delays in care persisted after adjustment for demographics, socioeconomic status, comorbidities, and access to care (OR 1.72; 95% CI 1.45, 2.06; p < 0.001).

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CONCLUSIONS: Lack of perceived social support is associated with patient reported delay of needed medical care. This association may contribute to the poor health outcomes experienced by those with a lack of social support.

Strengths and limitations of this study

Strengths

-large sample size

-professionally collected and validated survey data from the Centers for Disease Control

Weaknesses

-sample population limited to two US states

-cross sectional data, we are able to find association but unable to determine causation

-survey questions do not specify what type of medical care was delayed

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INTRODUCTION

Social support refers to the process of interaction in relationships which improves coping, esteem, belonging and competence through actual or perceived exchanges of financial, physical, or psychosocial resources. Over the past several decades, a consistent association between social support and lower morbidity and mortality has been demonstrated.[1-6] This relationship exists across different populations and has been reported in disease specific mortality for cardiovascular disease and cancer.[7] The effect size of this association is substantial. The most socially isolated individuals may have a mortality rate 50% higher than the most socially integrated individuals. If viewed as a clinical risk factor, social isolation is comparable to smoking.[8]

The mechanism by which social support is protective is likely multifactorial. Social relationships improve our cognitive function, lower systolic blood pressure, enhance immune system function and gene expression.[9-14] In addition, social support impacts health related behaviors including increased physical exercise and decreased tobacco and alcohol use.[15 16] Despite a growing understanding of potential mechanisms that may mediate the poor health outcomes observed in those without social support, the association between the lack of social support and delays in seeking medical care has previously only been studied in small samples, in specific populations such as the elderly, or in disease specific contexts such as HIV.[17-20]

The association between delays in seeking medical care and poor outcomes is well-established.[21 22] Time to antibiotics for sepsis, door to balloon time for acute coronary

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syndrome, and timing of cancer diagnosis are examples of the critical importance of prompt medical care.[23-25] Patient delay in seeking medical care is a complex process, with symptom recognition and access to care issues including lack of transportation, financial barriers, and lack of a primary care provider all contributing.[26-29] Lack of social support may play an important role in delays in care and this relationship could partially explain the protective effect of social support on health outcomes seen in previous studies. Using data from the 2013 and 2014 Behavioral Risk Factor Surveillance System, we sought to determine whether a self-reported lack social support confers higher perceived rates of delays in seeking needed medical care. Understanding this relationship could identify a high risk group where interventions targeted at addressing barriers to seeking care could lead to improved health outcomes.

METHODS

Study design, setting, and participants. We conducted a cross-sectional observational study using data from the Centers for Disease Control (CDC) Behavioral Risk Factor Surveillance System (BRFSS) survey. The BRFSS survey is a nationally representative telephone survey conducted annually by the Centers for Disease Control and Prevention. A random digit dialing algorithm targeting both landlines and cellular telephones is used to generate a nationally representative sample of adult respondents from all fifty states, the District of Columbia, and several United States territories. Adults age 18 or older not living in vacation homes, group homes, institutions, and households located outside of the state where the particular BRFSS questionnaire is being administered are excluded. For landline calls, an adult member of the household is randomly selected to complete the survey; cellular telephone respondents are treated as a single household. The survey includes a core component which is administered to all respondents. This core component contains questions about demographics, health care access, substance and alcohol use, health status, and socioeconomic status. There are also optional question modules which are administered at the discretion of each state. Respondents from Tennessee in 2013 and respondents from Minnesota in 2014 were asked

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questions about social support and delays in seeking medical care; these respondents constitute the sample for this study. This study using de-identified, publicly available data was reviewed by the Colorado Multiple Institutional Review Board and received an exemption.

Patient involvement. Survey respondents were selected as described above and were not involved in the design of this study.

Outcome variable. The primary outcome was a self-reported delay in seeking needed medical care. Two questions were combined to assess delays in seeking needed medical care. The first question asked participants, "Was there a time the past 12 months when you needed to see a doctor but could not because of cost?" The second question asked participants, "Other than cost, there are many other reasons people delay getting needed medical care. Have you delayed getting needed medical care for any of the following reasons in the last 12 months? Select the most important reason." Potential responses included cost, couldn't reach the office, couldn't get an appointment, too long of a wait in the waiting room, office was closed, lack of transportation, and "other" reason. . Participants answering yes to either or both of these questions were considered to have delayed seeking medical care. Participants answering no to both questions were considered to not have delayed seeking needed care. The secondary outcome was the reason for delaying needed medical care.

Explanatory variables. Social support was defined by response to the question, "How often do you get the social and emotional support you need?" Respondents answering *always* or *usually* were categorized as having social support. Respondents answering *sometimes*, *rarely*, or *never* were categorized as not having social support, as previously described.[28,29] Because there was no assessment of the actual social support received by survey participants, the response to this question is best viewed as perceived social support.

Covariates. Covariates were included based on their potential or reported association with delays in seeking medical care. Demographic data included age considered as a continuous variable, gender, race/ethnicity, and marital status. Race/ethnicity was categorized

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as white non-Hispanic, African American, Hispanic, and other. Marital status was categorized as married or other. Socioeconomic status variables included education level and employment status. Education level was categorized as non-high school graduates, high school graduates, and college graduates according to the highest education level achieved. Employment status was categorized as employed, unemployed or student status, and retired. Comorbidity data included whether the participant had ever been told they had depression, diabetes mellitus, chronic obstructive pulmonary disease, coronary artery disease and perceived general health. Perceived health was reported as a general health status of fair or poor versus excellent, very good, or good. Alcohol misuse was determined by reported number of drinks per day using previously described cut-offs.[30] Variables pertaining to access to care included whether or not the participant had an established primary care physician and whether they had any health insurance coverage in the last 12 months.

Statistical Analysis. Differences between participants with and without social support were evaluated using a t-test for continuous variables and a chi-square test for proportions. To determine whether delay in seeking medical treatment was associated with the level of perceived social support, we used a forward stepwise multivariable logistic regression model adding the following groups of covariates which were identified *a priori*: demographics (age, gender, race/ethnicity, and marital status), socioeconomic status (education level, employment status), health factors (depression, diabetes mellitus, chronic obstructive pulmonary disease, coronary artery disease, alcohol misuse, perceived general health), and access to healthcare (health insurance coverage, established primary care physician). This approach was chosen because it would allow us to assess for confounding by clinically relevant groups of variables. Those who reported high levels of social support were used as a reference group. As previously described and recommended for this dataset, a weighting formula was applied in descriptive as well as multivariable analyses.[31] Weighting assures that data are representative of the population on several characteristics including age, sex, race, education, marital status, home

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ownership, phone ownership, and sub-state region.[31] Our main multivariable analysis included all respondents who were asked questions about delays in care and social support, which in 2013 and 2014 included respondents from Tennessee and Minnesota. In order to explore the generalizability of our findings as only two states administered the question modules required for inclusion, we performed a sensitivity analysis examining the association between social support and delays in seeking medical treatment separately in participants enrolled in Tennessee and Minnesota. Respondents with missing variables were dropped from the multivariable analyses. A p-value of <0.05 was considered significant and the primary inference for the study was made based on the fully adjusted multivariable logistic regression model.

RESULTS

A total of 22,234 participants were asked questions about social support and delays in seeking medical care, and 18,980 (weighted n = 7,459,000) (85%) had complete data (Figure 1). Of the 3,254 with incomplete data 2631 (81%) were missing answers to the question on social support, 14 (4%) were missing answers to questions about delays in care, and 481 (15%) had missing data for both social support and delays in care (Figure 1). Those with missing data were more likely to be male (53% vs 48%, p < 0.001), African American (15% vs 10%, p < 0.001), have no primary care physician (29% vs 22%, p < 0.001), and be uninsured (14% vs 9%, p < 0.001), but had similar levels of lack of perceived social support (16% vs 18%, p = 0.56) (Table S1). Respondents who participated in the BRFSS in 2013 and 2014 but who were not included in this analysis because they were not asked the appropriate moduleswere more likely to be Hispanic (16% vs 3%, p < 0.001) and more likely to delay care (34% vs 23%, p < 0.001) (Table S2).

Respondents included in the analysis had an average age of 48 years and were predominately non-Hispanic whites (83%) (Table 1). The majority of the population had at least a high school education (88%) and were currently employed (58%), while 18% were retired and 24% were unemployed or students. Depression was the most common comorbidity (19%),

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while 10% had diabetes, 7% had COPD, 5% had coronary artery disease, and 15% had alcohol misuse. Nearly one quarter of respondents reported a lack of social support (23%). Participants without social support were of similar age but were more likely to be male (54% vs 46% p < 0.001), African American (17% vs 8% p < 0.001), not have a high school degree (21% vs 10% p < 0.001), to report fair or poor state of general health (35% vs 14% p <0.001), to not have a primary care physician (28% vs 22%) and lack health insurance (17% vs 7%). Those with social support were more likely to be married (58% vs 42% p < 0.001) and employed (60% vs 50% p < 0.001). (Table 1).

TABLE 1
Baseline Characteristics of Respondents

	Overall (N= 7,459*)	With Support (N= 6,087*)	No Support (N= 1,372*)	P value
Age (mean, range)	48 (18, 80)	48 (18,80)	48 (18, 80)	
Gender (male)	3,551 (48)	2,811 (46)	739 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	6,158 (83)	5,168 (85)	990 (72)	<0.001
African American	717 (10)	478 (8)	239 (17)	<0.001
Hispanic	182 (2)	152 (3)	31 (2)	0.57
Other	180 (5)	127 (4)	53 (6)	0.06
Married	4,102 (55)	3,526 (58)	576 (42)	<0.001
Education				
Non-High School Grad	896 (12)	609 (10)	286 (21)	<0.001
High School Grad	4,611 (62)	3,730 (61)	881 (64)	0.06
College Grad	1,943 (26)	1,743 (29)	200 (15)	<0.001
Employment				
Unemployed/Student	1,763 (24)	1,299 (21)	464 (34)	<0.001
Employed	4,340 (58)	3,652 (60)	688 (50)	<0.001
Retired	1,334 (18)	1,120 (18)	215 (16)	0.01
Comorbidity				
Depression	1,430 (19)	961 (16)	470 (34)	<0.001
Diabetes	759 (10)	581 (10)	178 (13)	<0.001
COPD**	507 (7)	339 (6)	168 (12)	<0.001
CAD***	379 (5)	283 (5)	96 (7)	<0.001
Alcohol Misuse	1,120 (15)	935 (16)	185 (14)	0.11
Perceived Health				
Fair/Poor	1,302 (18)	830 (14)	472 (35)	<0.001
Access				
No PCP****	1,641 (22)	1,258 (21)	384 (28)	<0.001
Uninsured	643 (9)	418 (7)	224 (17)	<0.001
Delay				
Delay Cost	995 (13)	643 (11)	352 (26)	<0.001
Delay Non-Cost	996 (13)	686 (11)	310 (23)	<0.001
Delay†	1,673 (22)	1,153 (19)	520 (38)	<0.001

*All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 7,459,000

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** Chronic Obstructive Pulmonary Disease
*** Coronary Artery Disease
**** Primary Care Physician
† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

Overall, 22% of respondents reported a delay in seeking needed medical care. Participants without social support were twice as likely to report delaying needed medical care when compared to participants with social support (38% vs 19%, p <0.001). Among participants who reported a delay in seeking medical care, the most common reason was concern for the cost of care (59%), followed by unspecified reason (22%), inability to get a timely appointment (16%), and lack of transportation (10%). Those without social support were more likely to report a primary reason for delayed care due to cost (68% vs 56% p <0.001) (Figure 2). Respondents without social support were also significantly more likely to report delays because there was too long of a wait in the waiting room (8% vs 7%), they lacked transportation (11% vs 10%) or for another reason (24% vs 22%) (p < 0.001 for all comparisons).

The association between a lack of social support and a delay in seeking medical care was unchanged after adjustment for demographic variables (OR 2.64; 95% CI 2.26, 3.09, p < 0.001) (Table 2). Further adjustment for socioeconomic status (adjusted OR 2.37; 95% CI 2.01, 2.81; p < 0.001) and health factors (adjusted OR 1.88; 95% CI 1.58, 2.23; p < 0.001) led to an attenuation of the association between lack of social support and delays in seeking medical care. There was little change in the magnitude of the association between a lack of social support and delays in seeking care after further adjustment for access to care (fully adjusted OR 1.72; 95% CI 1.45, 2.06; p < 0.001).

Table 2
Adjusted and Unadjusted Association Between Social Support and Delays in Seeking Medical Care¥

Social Support	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	1.00	1.00	1.00	1.00	Ref	Ref
Poor Social Support	2.61*	2.64*	2.37*	1.88*	1.72	1.45-2.06	<0.001
Demographics							

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Age	1.02*	1.01*	1.01*	1.01	1.01-1.02	<0.001
Gender (Male)	0.63*	0.67*	0.69*	0.62	0.53-0.72	<0.001
Race						
White non-Hispanic	1.00	1.00	1.00	1.00	Ref	Ref
African American	1.01	1.07	0.97	1.01	0.78-1.31	0.92
Hispanic	1.37	1.18	1.31	1.21	0.73-2.01	0.45
Other	1.27	1.18	1.26	1.02	0.53-1.98	0.95
Marital Status (married)	0.76*	0.79*	0.85*	0.93	0.80-1.07	0.31
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate		1.00	1.00	1.00	Ref	Ref
High School Graduate		0.61*	0.71*	0.76	0.58-0.99	0.046
College Graduate		0.53*	0.66*	0.80	0.59-1.07	0.13
Employment						
Employed		1.00	1.00	1.00	Ref	Ref
Unemployed/Student		1.59*	1.19*	1.11	0.94-1.32	0.22
Retired		0.50*	0.47*	0.50	0.40-0.63	<0.001
Health Factors						
Comorbidity						
Depression			1.93*	1.99	1.72-2.31	<0.001
Diabetes			1.14	1.22	0.97-1.53	0.09
Chronic Obstructive Pulmonary Disease			1.49*	1.53	1.18-1.97	0.001
Coronary Artery Disease			1.00	1.01	0.74-1.40	0.94
Alcohol Misuse			1.09	1.11	0.93-1.33	0.24
Perceived Health						
Fair/Poor			2.11*	2.14	1.75-2.62	<0.001
Access to Care						
No Primary Physician				1.18	0.99-1.42	0.07
No Insurance				4.21	3.24-5.48	<0.001

¥95% confidence intervals and p-values refer to model 5. All other values expressed as odds ratios.
*denotes p-value for variables in models other than model 5.

In a sensitivity analysis examining the findings separately in Tennessee and Minnesota, a lack of social support was associated with delays in seeking medical care in respondents from both Tennessee and Minnesota (Table 3; Supplement Tables S3-8). However, after full adjustment for potential confounding variables, the association between a lack of perceived social support and delay in seeking medical care was stronger in Minnesota than in Tennessee (p-value for interaction term < 0.001). In Minnesota, the odds of delaying medical care were 2.16 times higher (95% CI 1.83, 2.56; p < 0.001) in participants without social support compared to those with social support. In Tennessee, the odds of delaying medical care was 1.50 times

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(95% CI 1.16, 1.94; p < 0.01) higher in participants without social support when compared to those with social support.

Table 3
Subgroup Analyses by State

	Minnesota (N= 3,686*)			Tennessee (N= 3,773*)		
Social Support	**Fully Adjusted OR**	**95% CI**	**p-value**	**Fully Adjusted OR**	**95% CI**	**p-value**
Good Social Support	1.00	Ref	Ref	1.00	Ref	Ref
Poor Social Support	2.16	1.83-2.56	<0.001	1.50	1.16-1.94	<0.01
Demographics						
Age	1.01	1.01-1.02	<0.001	1.01	1.00-1.02	0.04
Gender (Male)	0.66	0.58-0.75	<0.001	0.60	0.47-0.76	<0.001
Race						
White non-Hispanic	1.00	Ref	Ref	1.00	Ref	Ref
African American	0.58	0.42-0.80	<0.001	1.22	0.88-1.70	0.22
Hispanic	1.44	1.00-2.06	0.05	1.06	0.26-4.35	0.94
Other	1.08	0.56-1.68	0.73	0.93	0.48-1.80	0.84
Marital Status (married)	0.88	0.77-0.99	0.04	0.95	0.76-1.20	0.68
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate	1.00	Ref	Ref	1.00	Ref	Ref
High School Graduate	0.98	0.71-1.35	0.90	0.71	0.49-1.03	0.07
College Graduate	0.97	0.71-1.35	0.83	0.81	0.52-1.25	0.34
Employment						
Employed	1.00	Ref	Ref	1.00	Ref	Ref
Unemployed/Student	1.09	0.92-1.29	0.33	1.08	0.83-1.41	0.57
Retired	0.58	0.48-0.71	<0.001	0.45	0.31-0.64	<0.001
Health Factors						
Comorbidity						
Depression	2.02	1.75-2.32	<0.001	2.00	1.56-2.56	<0.001
Diabetes	1.07	0.86-1.33	0.56	1.29	0.93-1.78	0.12
COPD**	1.70	1.35-2.15	<0.001	1.44	1.01-2.06	0.04
CAD***	0.88	0.65-1.20	0.42	1.08	0.70-1.65	0.73
Alcohol Misuse	1.14	0.98-1.33	0.10	1.19	0.82-1.72	0.36
Perceived Health						
Fair/Poor	2.21	1.85-2.64	<0.001	2.04	1.51-2.75	<0.001
Access to Care						
No Primary Physician	1.10	0.93-1.29	0.27	1.28	0.95-1.74	0.11
No Insurance	1.75	0.41-7.53	0.45	3.90	2.88-5.28	<0.001

* All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 7,459,000
** Chronic Obstructive Pulmonary Disease
*** Coronary Artery Disease

DISSCUSSION

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This study demonstrates that a lack of social support is associated with delays in seeking medical care. The overall rate of reported delay in seeking needed medical care was 22% and respondents with a perceived lack of social support were twice as likely to report delays when compared to those with social support (38% vs 19%). While it is difficult to directly compare reported delays in care in this study to studies evaluating delays in care for specific conditions, similar rates have been previously reported.[32-34] This association persisted after adjustment for demographic variables, socioeconomic status, health factors, and access to care raising the possibility that a lack of social support is independently associated with delays in seeking care.

Previous studies have demonstrated that lack of social support is an important risk factor for mortality. This study identifies delays in seeking needed medical care as a potential mechanism by which a lack of social support may affect health outcomes. As recognition of the importance of social and behavioral determinants of health on health outcomes at the population level increases, the Institute of Medicine (IOM) has encouraged identification of these factors in the clinical setting and has recommended incorporation of standardized assessments of social isolation or connection into the electronic medical record (EMR).[33] Identification of patients with low levels of social support may provide opportunity to target a high risk population that could benefit from care management systems or group based interventions to build social support and encourage prompt medical care. Specifically, patient navigators may be uniquely suited to address the needs of patients with low levels of social support. Previously described roles of patient navigators include facilitating access to and coordination of healthcare, helping patients select the best insurance plan for their health needs, and providing emotional and informational support. These roles may be particularly important in reducing unnecessary delays in care for patients with low levels of social support. [35]

There are several limitations to our study. First, Tennessee and Minnesota were the only states in the BRFSS dataset that included all of the survey questions required for inclusion

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in our analysis. While these two states differ in racial composition compared to the national population, the analysis presented in Table S2 demonstrated that they are nationally representative in terms of socioeconomic status, rates of comorbidities and access to care. One exception is that the state of Minnesota had a very small uninsured population. While Minnesota does have one of the lowest rates of uninsured status in the United States, the extremely low rate (<1%) found in this study may represent a bias in the survey. Although our findings were consistent in both states, the magnitude of the association varied highlighting that these results should be generalized to the rest of the United States with caution.

Second, there may be a selection bias wherein those with low levels of social support may be less likely to participate in the survey. Therefore, the rates of poor social support may be underestimated. Third, our primary outcome of delay in needed medical care is patient reported and we were unable to determine what type of care was delayed. It is plausible that the likelihood of delay in seeking care or the reasons for seeking care vary by illness, symptom, and/or severity. Our outcome variable lacked sufficient specificity to explore this hypothesis. Fourth, assessment of the reason for care delay was determined by response to two separate questions, one of which solely addressed cost. While this inherently biases the responses towards reporting cost as a reason for care delay, other studies support that concern for cost of care is a common reason for care delay.[32] Fifth, this is a cross-sectional observational study which limits the ability to infer causation. Though we incorporated several demographic variables and measures of socioeconomic status, health factors, and access to care, it is possible that these results are explained by residual or unmeasured confounding. Examples may include personality factors or unmeasured mental health conditions.

Additionally, because this is a cross-sectional study, we are unable to establish a temporal relationship between lack of social support and treatment delays. Finally, this study likely underestimates the rates of delays in care. Respondents in this study were asked about delaying *needed* medical care and therefore care delay due to symptom appraisal, the process

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by which a patient recognizes that their condition requires medical attention, is not accounted for. While this may lead to an underestimation of care delay, delays due to symptom appraisal would likely be targeted by different types of interventions, such as education about the symptoms of specific conditions. Common examples of these types of interventions include educational campaigns about the symptoms of stroke or breast cancer. By eliminating symptom appraisal as a cause of care delay, this study likely better identifies care delays that may be modifiable by interventions targeting a lack of social support.

In conclusion, lack of perceived social support is associated with patient reported delay of needed medical care in a sample of residents from two states in the U.S.. Identification of patients with low levels of social support could help identify a high-risk population that may benefit from interventions targeted at reducing social isolation and improving access to care.

REFERENCES

1. Berkman LF. Social networks, support, and health: taking the next step forward. *Am J Epidemiol* 1986;123(4):559-62.

2. Blazer DG. Social support and mortality in an elderly community population. *Am J Epidemiol* 1982;115(5):684-94.

3. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med* 2010;7(7):e1000316.

4. House JS, Landis KR, Umberson D. Social relationships and health. *Science* 1988;241(4865):540-5.

5. Lyyra TM, Heikkinen RL. Perceived social support and mortality in older people. *J Gerontol B Psychol Sci Soc Sci* 2006;61(3):S147-52.

6. Zhang X, Norris SL, Gregg EW, et al. Social support and mortality among older persons with diabetes. *Diabetes Educ* 2007;33(2):273-81.

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7. Berkman LF, Melchior M, Chastang JF, et al. Social integration and mortality: a prospective study of French employees of Electricity of France-Gas of France: the GAZEL Cohort. *Am J Epidemiol* 2004;159(2):167-74.

8. Pantell M, Rehkopf D, Jutte D, et al. Social isolation: a predictor of mortality comparable to traditional clinical risk factors. *Am J Public Health* 2013;103(11):2056-62.

9. Cole SW, Hawkley LC, Arevalo JM, et al. Social regulation of gene expression in human leukocytes. *Genome Biol* 2007;8(9):R189.

10. Holt-Lunstad J, Uchino BN, Smith TW, et al. Social relationships and ambulatory blood pressure: structural and qualitative predictors of cardiovascular function during everyday social interactions. *Health Psychol* 2003;22(4):388-97.

11. Lamkin DM, Lutgendorf SK, McGinn S, et al. Positive psychosocial factors and NKT cells in ovarian cancer patients. *Brain Behav Immun* 2008;22(1):65-73.

12. Miyazaki T, Ishikawa T, Nakata A, et al. Association between perceived social support and Th1 dominance. *Biol Psychol* 2005;70(1):30-7.

13. Seeman TE, Lusignolo TM, Albert M, et al. Social relationships, social support, and patterns of cognitive aging in healthy, high-functioning older adults: MacArthur studies of successful aging. *Health Psychol* 2001;20(4):243-55.

14. Yang YC, Boen C, Mullan Harris K. Social relationships and hypertension in late life: evidence from a nationally representative longitudinal study of older adults. *J Aging Health* 2015;27(3):403-31.

15. Oka RK, King AC, Young DR. Sources of social support as predictors of exercise adherence in women and men ages 50 to 65 years. *Womens Health* 1995;1(2):161-75.

16. Steptoe A, Wardle J, Pollard TM, et al. Stress, social support and health-related behavior: a study of smoking, alcohol consumption and physical exercise. *J Psychosom Res* 1996;41(2):171-80.

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17. Berkanovic E, Telesky C, Reeder S. Structural and social psychological factors in the decision to seek medical care for symptoms. *Med Care* 1981;19(7):693-709.

18. Henning-Smith CE, Gonzales G, Shippee TP. Barriers to Timely Medical Care for Older Adults by Disability Status and Household Composition. *J Disabil Policy Stu* 2016;27(2):116-27.

19. McCoy SI, Strauss RP, MacDonald PD, et al. Social support and delays seeking care after HIV diagnosis, North Carolina, 2000-2006. *AIDS Care* 2009;21(9):1148-56.

20. Pedersen AF, Olesen F, Hansen RP, et al. Social support, gender and patient delay. *Br J Cancer* 2011;104(8):1249-55.

21. Garbuz DS, Xu M, Duncan CP, et al. Delays worsen quality of life outcome of primary total hip arthroplasty. *Clin Orthop Relat Res* 2006;447:79-84.

22. Yan J, Liu Y, Zhou B, et al. Pre-hospital delay in patients with diabetic foot problems: influencing factors and subsequent quality of care. *Diabet Med* 2014;31(5):624-9.

23. Ferrer R, Martin-Loeches I, Phillips G, et al. Empiric antibiotic treatment reduces mortality in severe sepsis and septic shock from the first hour: results from a guideline-based performance improvement program. *Crit Care Med* 2014;42(8):1749-55.

24. Martin S, Ulrich C, Munsell M, et al. Delays in cancer diagnosis in underinsured young adults and older adolescents. *Oncologist* 2007;12(7):816-24.

25. McNamara RL, Wang Y, Herrin J, et al. Effect of door-to-balloon time on mortality in patients with ST-segment elevation myocardial infarction. *J Am Coll Cardiol* 2006;47(11):2180-6.

26. Dracup K, Moser DK. Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction. *Heart Lung* 1997;26(4):253-62.

27. Esteva M, Leiva A, Ramos M, et al. Factors related with symptom duration until diagnosis and treatment of symptomatic colorectal cancer. *BMC Cancer* 2013;13:87.

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28. MacLeod KE, Ragland DR, Prohaska TR, et al. Missed or Delayed Medical Care Appointments by Older Users of Nonemergency Medical Transportation. *Gerontologist* 2015;55(6):1026-37.

29. Raczynski JM, Finnegan JR, Jr., Zapka JG, et al. REACT theory-based intervention to reduce treatment-seeking delay for acute myocardial infarction. Rapid Early Action for Coronary Treatment. *Am J Prev Med* 1999;16(4):325-34.

30. Woerle S, Roeber J, Landen MG. Prevalence of alcohol dependence among excessive drinkers in New Mexico. *Alcohol Clin Exp Res* 2007;31(2):293-8.

31. CDC. 2013 [Available from: https://www.cdc.gov/brfss/data_documentation/pdf/UserguideJune2013.pdf.

32. Kullgren JT, McLaughlin CG, Mitra N, et al. Nonfinancial barriers and access to care for U.S. adults. *Health Serv Res* 2012;47(1 Pt 2):462-85.

33. Sabatino SA, Coates RJ, Uhler RJ, et al. Health insurance coverage and cost barriers to needed medical care among U.S. adult cancer survivors age<65 years. *Cancer* 2006;106(11):2466-75.

34. Weissman JS, Stern R, Fielding SL, et al. Delayed access to health care: risk factors, reasons, and consequences. *Ann Intern Med* 1991;114(4):325-31.

35. Natale-Pereira A, Enard KR, Nevarez L, et al. The role of patient navigators in eliminating health disparities. *Cancer* 2011;117(15 Suppl):3543-52.

Figure Legends

Figure 1. Selection of sample for this study

Figure 2. Reasons for Delaying Medical Care

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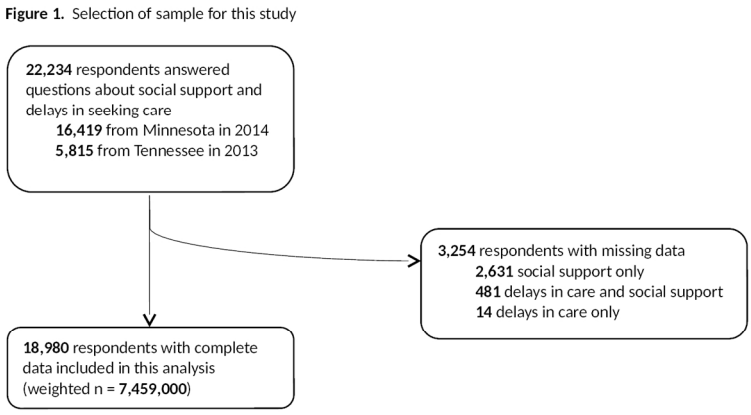

Figure 1. Selection of sample for this study

215x279mm (200 x 200 DPI)

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Figure 2. Reasons for Delaying Medical Care

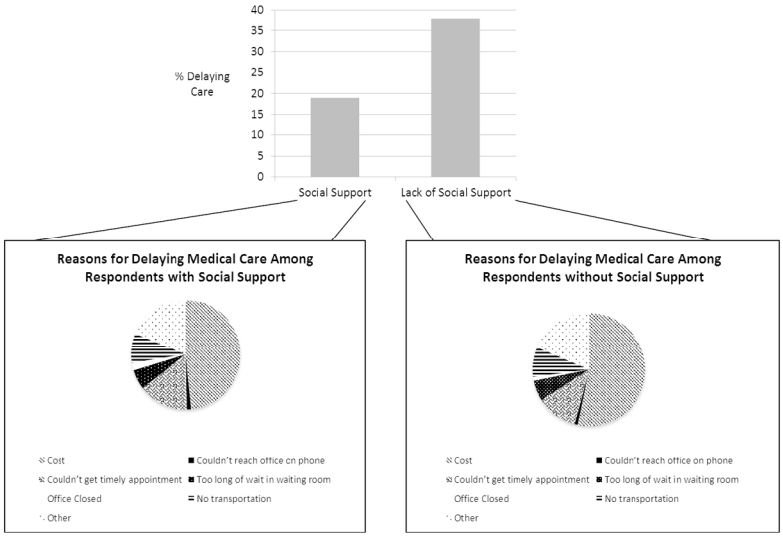

Figure 2. Reasons for Delaying Medical Care

215x279mm (200 x 200 DPI)

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Supplemental Tables

Table S1
Missing data analysis

	Not Missing (n= 18,890)	Missing (n = 3,254)	p-value
Age (mean)	48	45	< 0.001
Gender (male)	48	53	< 0.001
Race			
White non-Hispanic	83	72	<0.001
African American	10	15	<0.001
Hispanic	2	5	<0.001
Other	5	6	0.30
Married	55	51	<0.01
Education (Highest level)			
Non High School Graduate	12	17	<0.001
High School Graduate	62	62	0.90
College Graduate	26	21	<0.001
Employment			
Unemployed/Student	24	27	0.01
Employed	58	55	0.07
Retired	18	17	0.47
Comorbidity			
Depression	19	17	0.08
DM	10	11	0.31
COPD	7	9	0.02
CAD	5	4	0.34
Alcohol Misuse	15	15	0.93
Perceived Health			
Fair/Poor	18	20	<0.01
Coverage/Utilization			
No Primary Physician	22	29	<0.001
No Insurance Coverage	9	14	<0.001
Delay Care Due to Cost	13	16	0.04
Delay Care for Non-Cost Reason	13	15	0.18
Any Reason for Delay in Care	22	28	<0.001
Lack of Perceived Social Support	18	16	0.56

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Table S2

Differences between participants in the 2013-2014 BRFSS sample who were and were not assigned social support and treatment delay modules

	Not assigned social support and treatment delay modules (n = 934,203)	**Assigned social support and treatment delay modules** (n = 22,234)
Age (mean)	47	47
Gender (male, %)	49	49
Race		
White non-Hispanic	81	64
African American	11	12
Hispanic	3	16
Other	6	8
Married	54	51
Education (Highest level)		
Non High School Graduate	13	15
High School Graduate	62	59
College Graduate	25	26
Employment		
Unemployed/Student	24	27
Employed	58	56
Retired	18	17
Comorbidity		
Depression	19	18
DM	10	10
COPD	7	7
CAD	5	4
Alcohol Misuse	15	17
Perceived Health		
Fair/Poor	18	18
Social Network		
Single adult household	22	19
Coverage/Utilization		
No Primary Physician	23	23
No Insurance Coverage	10	12
Delay Care Due to Cost	14	15
Delay Care for Non-Cost Reason	14	20
Any Reason for Delay in Care	23	34

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TABLE S3
Baseline Characteristics of Tennessee Respondents

	Overall (N= 3,773)	With Support (N= 2,908)	No Support (N= 865)	P value
Age (mean)	48	48	48	
Gender (male)	1,768 (47)	1,302 (45)	466 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	2,998 (79)	2,374 (82)	624 (72)	<0.001
African American	554 (15)	367 (13)	187 (22)	<0.001
Hispanic	41 (1)	39 (1)	2 (<1)	0.03
Other	180 (5)	127 (4)	53 (6)	0.30
Married	2,032 (54)	1,654 (57)	379 (43)	<0.001
Single Adult Household *	490 (23)	361 (21)	129 (29)	<0.001
Education				
Non-High School Grad	574 (15)	373 (13)	202 (23)	<0.001
High School Grad	2,354 (63)	1,801 (62)	552 (64)	0.40
College Grad	835 (22)	729 (25)	106 (12)	<0.001
Employment				
Unemployed/Student	1,103 (29)	774 (21)	329 (38)	<0.001
Employed	1,954 (52)	1,555 (53)	399 (46)	<0.01
Retired	708 (19)	572 (20)	137 (16)	0.02
Comorbidity				
Depression	747 (20)	438 (15)	309 (36)	<0.001
Diabetes	462 (12)	332 (11)	130 (15)	0.02
COPD	346 (9)	215 (7)	131 (15)	<0.001
CAD	252 (7)	176 (6)	76 (9)	0.02
Alcohol Misuse	355 (10)	265 (9)	90 (11)	0.42
Perceived Health				
Fair/Poor	865 (23)	525 (18)	341 (40)	<0.001
Access				
No PCP	783 (21)	559 (19)	224 (26)	<0.01
Uninsured	638 (17)	414 (14)	223 (26)	<0.001
Delay				
Delay Cost	664 (18)	415 (14)	249 (29)	<0.001
Delay Non-Cost	552 (15)	361 (12)	192 (22)	<0.001
Delay†	1,014 (27)	669 (23)	345 (40)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 3,773,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

TABLE S4

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Baseline Characteristics of Minnesota Respondents

	Overall (N= 3,686)	With Support (N= 3,179)	No Support (N= 507)	P value
Age (mean)	47	47	46	
Gender (male)	1,782 (48)	1,510 (47)	273 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	3,160 (86)	2,793 (88)	367 (72)	<0.001
African American	163 (4)	111 (3)	52 (10)	<0.001
Hispanic	142 (4)	113 (4)	30 (6)	<0.01
Other	221 (6)	162 (5)	58 (11)	<0.001
Married	2,070 (56)	1,872 (59)	198 (39)	<0.001
Single Adult Household *	314 (20)	256 (18)	58 (32)	<0.001
Education				
Non-High School Grad	322 (9)	237 (7)	85 (17)	<0.001
High School Grad	2,257 (61)	1,929 (61)	329 (65)	<0.01
College Grad	1,108 (30)	1,014 (32)	94 (18)	<0.001
Employment				
Unemployed/Student	660 (18)	525 (17)	136 (27)	<0.001
Employed	2,387 (65)	2,097 (66)	290 (58)	<0.001
Retired	626 (17)	548 (17)	78 (15)	0.07
Comorbidity				
Depression	684 (19)	523 (16)	161 (32)	<0.001
Diabetes	298 (8)	249 (8)	49 (10)	0.03
COPD	161 (4)	124 (4)	37 (7)	<0.001
CAD	127 (3)	107 (3)	20 (4)	0.20
Alcohol Misuse	766 (21)	670 (21)	95 (19)	0.07
Perceived Health				
Fair/Poor	437 (12)	305 (10)	132 (26)	<0.001
Access				
No PCP	858 (23)	699 (22)	160 (32)	<0.001
Uninsured	5 (<1)	5 (<1)	1 (<1)	0.60
Delay				
Delay Cost	331 (9)	228 (7)	103 (20)	<0.001
Delay Non-Cost	444 (12)	325 (10)	119 (23)	<0.001
Delay†	659 (18)	484 (15)	175 (34)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 3,686,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

Table S5

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Reasons for Delaying Medical Care Among Tennessee Respondents

Reason for delaying care	Overall (N= 1,014)	With Support (N= 669)	Without Support (N= 345)	P-value
Cost	664 (65)	415 (62)	249 (72)	<0.001
Couldn't reach office on phone	3 (<1)	2 (<1)	1 (<1)	0.50
Couldn't get timely appointment	115 (11)	72 (11)	44 (13)	<0.01
Too long of wait in waiting room	56 (6)	36 (5)	20 (6)	0.046
Office Closed	14 (1)	12 (2)	2 (1)	0.32
No transportation	85 (8)	63 (9)	22 (6)	0.56
Other Reason	279 (28)	176 (26)	103 (30)	<0.001

Weighted Data. Multiplication by 1,000 gives weighted frequency (N). Total Weighted N Delays = 1,014,000

Patients who delayed care due to cost could also report one additional reason for delaying medical care, therefore percentages for reasons for delay in care are greater than total percentage of patients who delayed care.

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Table S6
Multivariate Modeling Tennessee

Social Support	**Model 1**	**95% CI**	**p-value**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	n/a	n/a	1.00	n/a	n/a
Poor Social Support	2.22	1.78-2.77	<0.001	1.50	1.16-1.94	<0.01
Demographics						
Age				1.01	1.00-1.02	0.04
Gender (Male)				0.60	0.47-0.76	<0.001
Race						
White non-Hispanic				1.00	n/a	n/a
AA				1.22	0.88-1.70	0.22
Hispanic				1.06	0.26-4.35	0.94
Other				0.93	0.48-1.80	0.84
Marital Status (married)				0.95	0.76-1.20	0.68
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate				1.00	n/a	n/a
High School Graduate				0.71	0.49-1.03	0.07
College Graduate				0.81	0.52-1.25	0.34
Employment						
Employed				1.00	n/a	n/a
Unemployed/Student				1.08	0.83-1.41	0.57
Retired				0.45	0.31-0.64	<0.001
Health Factors						
Comorbidity						
Depression				2.00	1.56-2.56	<0.001
DM				1.29	0.93-1.78	0.12
COPD				1.44	1.01-2.06	0.04
CAD				1.08	0.70-1.65	0.73
Alcohol Misuse				1.19	0.82-1.72	0.36
Perceived Health						
Fair/Poor				2.04	1.51-2.75	<0.001
Access to Care						
No Primary Physician				1.28	0.95-1.74	0.11
No Insurance				3.90	2.88-5.28	<0.001

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Table S7
Reasons for Delaying Medical Care Among Minnesota Respondents

Reason for delaying care	Overall (N=659)	With Support (N= 484)	Without Support (N= 175)	P-value
Cost	331 (50)	228 (47)	103 (59)	<0.001
Couldn't reach office on phone	19 (3)	14 (3)	5 (3)	<0.01
Couldn't get timely appointment	160 (24)	125 (4)	35 (20)	<0.001
Too long of wait in waiting room	60 (9)	41 (26)	19 (11)	<0.001
Office Closed	23 (3)	17 (4)	6 (3)	0.01
No transportation	88 (13)	54 (11)	34 (19)	<0.001
Other Reason	95 (14)	74 (15)	21 (12)	<0.001

Weighted Data. Multiplication by 1,000 gives weighted frequency (N). Total Weighted N Delays = 659,000
Patients who delayed care due to cost could also report one additional reason for delaying medical care, therefore percentages for reasons for delay in care are greater than total percentage of patients who delayed care.

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Table S8
Multivariate Modeling Minnesota

Social Support	**Model 1**	**95% CI**	**p-value**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	n/a	n/a	1.00	n/a	n/a
Poor Social Support	2.93	2.55-3.36	<0.001	2.16	1.83-2.56	<0.001
Demographics						
Age				1.01	1.01-1.02	<0.001
Gender (Male)				0.66	0.58-0.75	<0.001
Race						
White non-Hispanic				1.00	n/a	n/a
AA				0.58	0.42-0.80	<0.001
Hispanic				1.44	1.00-2.06	0.05
Other				1.08	0.56-1.68	0.73
Marital Status (married)				0.88	0.77-0.99	0.04
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate				1.00	n/a	n/a
High School Graduate				0.98	0.71-1.35	0.90
College Graduate				0.97	0.71-1.35	0.83
Employment						
Employed				1.00	n/a	n/a
Unemployed/Student				1.09	0.92-1.29	0.33
Retired				0.58	0.48-0.71	<0.001
Health Factors						
Comorbidity						
Depression				2.02	1.75-2.32	<0.001
DM				1.07	0.86-1.33	0.56
COPD				1.70	1.35-2.15	<0.001
CAD				0.88	0.65-1.20	0.42
Alcohol Misuse				1.14	0.98-1.33	0.10
Perceived Health						
Fair/Poor				2.21	1.85-2.64	<0.001
Access to Care						
No Primary Physician				1.10	0.93-1.29	0.27
No Insurance				1.75	0.41-7.53	0.45

95% confidence intervals and p-values given refer to model 5

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	Page 2- (*a*) Indicate the study's design with a commonly used term in the title or the abstract
		Page 2- (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Page 4- Explain the scientific background and rationale for the investigation being reported
Objectives	3	Page 5- State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Pages 5, 6- Present key elements of study design early in the paper
Setting	5	Pages 5, 6- Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	Page 5- (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Pages 5, 6- Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	Pages 5, 6- For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Page 7- Describe any efforts to address potential sources of bias
Study size	10	Pages 5, 7- Explain how the study size was arrived at
Quantitative variables	11	Pages 5, 6- Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	Pages 5, 6-(*a*) Describe all statistical methods, including those used to control for confounding
		Pages 5, 6- (*b*) Describe any methods used to examine subgroups and interactions
		Page 7- (*c*) Explain how missing data were addressed
		Page 5- *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		Page 7- (*e*) Describe any sensitivity analyses

Continued on next page

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Results		
Participants	13*	Page 7- (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		Page 7- (b) Give reasons for non-participation at each stage
		Figure 1- (c) Consider use of a flow diagram
Descriptive data	14*	Pages 7, 8- (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		Pages 7- (b) Indicate number of participants with missing data for each variable of interest
		n/a- (c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	n/a- *Cohort study*—Report numbers of outcome events or summary measures over time
		n/a- *Case-control study*—Report numbers in each exposure category, or summary measures of exposure
		Page 9- *Cross-sectional study*—Report numbers of outcome events or summary measures
Main results	16	Pages 9, 10- (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		Pages 9, 10- (*b*) Report category boundaries when continuous variables were categorized
		n/a- (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Page 11- Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Page 12- Summarise key results with reference to study objectives
Limitations	19	Page 13- Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Pages 13, 14- Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Page 13- Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Page 1- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Is Lack of Social Support Associated with a Delay in Seeking Medical Care? A cross-sectional study of Minnesota and Tennessee residents using data from the Behavioral Risk Factor Surveillance System

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Is Lack of Social Support Associated with a Delay in Seeking Medical Care? A cross-sectional study of Minnesota and Tennessee residents using data from the Behavioral Risk Factor Surveillance System

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Brendan Clark and Dr. Marc Moss each assisted in the study design, interpretation of data, and revisions of the manuscript. All authors have approved the final version of the manuscript.

Abstract

OBJECTIVE: Previous studies have demonstrated an association between social support and lower morbidity and mortality. Delay in seeking medical care is associated with poor health outcomes. The relationship between social support and delay in seeking medical care has not been established. We sought to determine whether lack of social support is associated with higher rates of delays in seeking needed medical care.

METHODS: This is a cross-sectional observational study using data from the 2013 and 2014 CDC Behavioral Risk Factor Surveillance System. Participants who were asked questions about delays in medical care and social support were included. The primary outcome was a self-reported delay in seeking needed medical care. The primary independent variable of interest was a dichotomized measure of social support. Multivariable logistic regression was performed, adjusting for demographics, socioeconomic status, comorbidities, and access to care.

RESULTS: Participants without social support were more likely to report delaying needed medical care when compared to participants with social support (38% vs 19%, p <0.001). The association between lack of social support and delays in care persisted after adjustment for demographics, socioeconomic status, comorbidities, and access to care (OR 1.72; 95% CI 1.45, 2.06; p < 0.001).

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CONCLUSIONS: Lack of perceived social support is associated with patient reported delay of needed medical care. This association may contribute to the poor health outcomes experienced by those with a lack of social support.

Strengths and limitations of this study

Strengths

-large sample size

-professionally collected and validated survey data from the Centers for Disease Control

Weaknesses

-sample population limited to two US states

-cross sectional data, we are able to find association but unable to determine causation

-survey questions do not specify what type of medical care was delayed

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INTRODUCTION

Social support refers to the process of interaction in relationships which improves coping, esteem, belonging and competence through actual or perceived exchanges of financial, physical, or psychosocial resources. Over the past several decades, a consistent association between social support and lower morbidity and mortality has been demonstrated.[1-6] This relationship exists across different populations and has been reported in disease specific mortality for cardiovascular disease and cancer.[7] The effect size of this association is substantial. The most socially isolated individuals may have a mortality rate 50% higher than the most socially integrated individuals. If viewed as a clinical risk factor, social isolation is comparable to smoking.[8]

The mechanism by which social support is protective is likely multifactorial. Social relationships improve our cognitive function, lower systolic blood pressure, enhance immune system function and gene expression.[9-14] In addition, social support impacts health related behaviors including increased physical exercise and decreased tobacco and alcohol use.[15 16] Despite a growing understanding of potential mechanisms that may mediate the poor health outcomes observed in those without social support, the association between the lack of social support and delays in seeking medical care has previously only been studied in small samples, in specific populations such as the elderly, or in disease specific contexts such as HIV.[17-20]

The association between delays in seeking medical care and poor outcomes is well-established.[21 22] Time to antibiotics for sepsis, door to balloon time for acute coronary syndrome, and timing of cancer diagnosis are examples of the critical importance of prompt medical care.[23-25] Patient delay in seeking medical care is a complex process, with symptom recognition and access to care issues including lack of transportation, financial barriers, and lack of a primary care provider all contributing.[26-29] Lack of social support may play an important role in delays in care and this relationship could partially explain the protective effect of social support on health outcomes seen in previous studies. Using data from the 2013 and

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2014 Behavioral Risk Factor Surveillance System, we sought to determine whether a self-reported lack social support confers higher perceived rates of delays in seeking needed medical care. Understanding this relationship could identify a high risk group where interventions targeted at addressing barriers to seeking care could lead to improved health outcomes.

METHODS

Study design, setting, and participants. We conducted a cross-sectional observational study using data from the Centers for Disease Control (CDC) Behavioral Risk Factor Surveillance System (BRFSS) survey. The BRFSS survey is a nationally representative telephone survey conducted annually by the Centers for Disease Control and Prevention. A random digit dialing algorithm targeting both landlines and cellular telephones is used to generate a nationally representative sample of adult respondents from all fifty states, the District of Columbia, and several United States territories. Adults age 18 or older not living in vacation homes, group homes, institutions, and households located outside of the state where the particular BRFSS questionnaire is being administered are included. For landline calls, an adult member of the household is randomly selected to complete the survey; cellular telephone respondents are treated as a single household. The survey includes a core component which is administered to all respondents. This core component contains questions about demographics, health care access, substance and alcohol use, health status, and socioeconomic status. There are also optional question modules which are administered at the discretion of each state. Respondents from Tennessee in 2013 and respondents from Minnesota in 2014 were asked questions about social support and delays in seeking medical care; these respondents constitute the sample for this study. This study using de-identified, publicly available data was reviewed by the Colorado Multiple Institutional Review Board and received an exemption.

Patient involvement. Survey respondents were selected as described above and were not involved in the design of this study.

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Outcome variable. The primary outcome was a self-reported delay in seeking needed medical care. Two questions were combined to assess delays in seeking needed medical care. The first question asked participants, "Was there a time the past 12 months when you needed to see a doctor but could not because of cost?" The second question asked participants, "Other than cost, there are many other reasons people delay getting needed medical care. Have you delayed getting needed medical care for any of the following reasons in the last 12 months? Select the most important reason." Potential responses included cost, couldn't reach the office, couldn't get an appointment, too long of a wait in the waiting room, office was closed, lack of transportation, and "other" reason. . Participants answering yes to either or both of these questions were considered to have delayed seeking medical care. Participants answering no to both questions were considered to not have delayed seeking needed care. The secondary outcome was the reason for delaying needed medical care.

Explanatory variables. Social support was defined by response to the question, "How often do you get the social and emotional support you need?" Respondents answering *always* or *usually* were categorized as having social support. Respondents answering *sometimes*, *rarely*, or *never* were categorized as not having social support, as previously described.[28,29] Because there was no assessment of the actual social support received by survey participants, the response to this question is best viewed as perceived social support.

Covariates. Covariates were included based on their potential or reported association with delays in seeking medical care. Demographic data included age considered as a continuous variable, gender, race/ethnicity, and marital status. Race/ethnicity was categorized as white non-Hispanic, African American, Hispanic, and other. Marital status was categorized as married or other. Socioeconomic status variables included education level and employment status. Education level was categorized as non-high school graduates, high school graduates, and college graduates according to the highest education level achieved. Employment status was categorized as employed, unemployed or student status, and retired. Comorbidity data

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included whether the participant had ever been told by a healthcare professional that they had depression, diabetes mellitus, chronic obstructive pulmonary disease, coronary artery disease and perceived general health. Perceived health was reported as a general health status of fair or poor versus excellent, very good, or good. Alcohol misuse was determined by reported number of drinks per day using previously described cut-offs.[30] Variables pertaining to access to care included whether or not the participant had an established primary care physician and whether they had any health insurance coverage in the last 12 months.

Statistical Analysis. Differences between participants with and without social support were evaluated using a t-test for continuous variables and a chi-square test for proportions. To determine whether delay in seeking medical treatment was associated with the level of perceived social support, we used a forward stepwise multivariable logistic regression model adding the following groups of covariates which were identified *a priori*: demographics (age, gender, race/ethnicity, and marital status), socioeconomic status (education level, employment status), health factors (depression, diabetes mellitus, chronic obstructive pulmonary disease, coronary artery disease, alcohol misuse, perceived general health), and access to healthcare (health insurance coverage, established primary care physician). This approach was chosen because it would allow us to assess for confounding by clinically relevant groups of variables. Those who reported high levels of social support were used as a reference group. As previously described and recommended for this dataset, a weighting formula was applied in descriptive as well as multivariable analyses.[31] Weighting assures that data are representative of the population on several characteristics including age, sex, race, education, marital status, home ownership, phone ownership, and sub-state region.[31] Our main multivariable analysis included all respondents who were asked questions about delays in care and social support, which in 2013 and 2014 included respondents from Tennessee and Minnesota. In order to explore the generalizability of our findings as only two states administered the question modules required for inclusion, we performed a sensitivity analysis examining the association between social

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support and delays in seeking medical treatment separately in participants enrolled in Tennessee and Minnesota. Respondents with missing variables were dropped from the multivariable analyses. A p-value of <0.05 was considered significant and the primary inference for the study was made based on the fully adjusted multivariable logistic regression model.

RESULTS

A total of 22,234 participants were asked questions about social support and delays in seeking medical care, and 18,980 (weighted n = 7,459,000) (85%) had complete data (Figure 1). Of the 3,254 with incomplete data 2631 (81%) were missing answers to the question on social support, 14 (4%) were missing answers to questions about delays in care, and 481 (15%) had missing data for both social support and delays in care (Figure 1). Those with missing data were more likely to be male (53% vs 48%, p < 0.001), African American (15% vs 10%, p < 0.001), have no primary care physician (29% vs 22%, p < 0.001), and be uninsured (14% vs 9%, p < 0.001), but had similar levels of lack of perceived social support (16% vs 18%, p = 0.56) (Table S1). Respondents who participated in the BRFSS in 2013 and 2014 but who were not included in this analysis because they were not asked the appropriate modules were more likely to be Hispanic (16% vs 3%, p < 0.001) and more likely to delay care (34% vs 23%, p < 0.001) (Table S2).

Respondents included in the analysis had an average age of 48 years and were predominately non-Hispanic whites (83%) (Table 1). The majority of the population had at least a high school education (88%) and were currently employed (58%), while 18% were retired and 24% were unemployed or students. Depression was the most common comorbidity (19%), while 10% had diabetes, 7% had COPD, 5% had coronary artery disease, and 15% had alcohol misuse. Nearly one quarter of respondents reported a lack of social support (23%). Participants without social support were of similar age but were more likely to be male (54% vs 46% p < 0.001), African American (17% vs 8% p < 0.001), not have a high school degree (21% vs 10% p < 0.001), to report fair or poor state of general health (35% vs 14% p <0.001), to not

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have a primary care physician (28% vs 22%) and lack health insurance (17% vs 7%). Those with social support were more likely to be married (58% vs 42% p < 0.001) and employed (60% vs 50% p < 0.001). (Table 1).

TABLE 1
Baseline Characteristics of Respondents

	Overall (N= 7,459*)	With Support (N= 6,087*)	No Support (N= 1,372*)	P value
Age (mean, range)	48 (18, 80)	48 (18,80)	48 (18, 80)	
Gender (male)	3,551 (48)	2,811 (46)	739 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	6,158 (83)	5,168 (85)	990 (72)	<0.001
African American	717 (10)	478 (8)	239 (17)	<0.001
Hispanic	182 (2)	152 (3)	31 (2)	0.57
Other	180 (5)	127 (4)	53 (6)	0.06
Married	4,102 (55)	3,526 (58)	576 (42)	<0.001
Education				
Non-High School Grad	896 (12)	609 (10)	286 (21)	<0.001
High School Grad	4,611 (62)	3,730 (61)	881 (64)	0.06
College Grad	1,943 (26)	1,743 (29)	200 (15)	<0.001
Employment				
Unemployed/Student	1,763 (24)	1,299 (21)	464 (34)	<0.001
Employed	4,340 (58)	3,652 (60)	688 (50)	<0.001
Retired	1,334 (18)	1,120 (18)	215 (16)	0.01
Comorbidity				
Depression	1,430 (19)	961 (16)	470 (34)	<0.001
Diabetes	759 (10)	581 (10)	178 (13)	<0.001
COPD	507 (7)	339 (6)	168 (12)	<0.001
CAD	379 (5)	283 (5)	96 (7)	<0.001
Alcohol Misuse	1,120 (15)	935 (16)	185 (14)	0.11
Perceived Health				
Fair/Poor	1,302 (18)	830 (14)	472 (35)	<0.001
Access				
No PCP	1,641 (22)	1,258 (21)	384 (28)	<0.001
Uninsured	643 (9)	418 (7)	224 (17)	<0.001
Delay				
Delay Cost	995 (13)	643 (11)	352 (26)	<0.001
Delay Non-Cost	996 (13)	686 (11)	310 (23)	<0.001
Delay†	1,673 (22)	1,153 (19)	520 (38)	<0.001

*All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 7,490,000
† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

Overall, 22% of respondents reported a delay in seeking needed medical care. Participants without social support were twice as likely to report delaying needed medical care when compared to participants with social support (38% vs 19%, p <0.001). Among participants

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who reported a delay in seeking medical care, the most common reason was concern for the cost of care (59%), followed by unspecified reason (22%), inability to get a timely appointment (16%), and lack of transportation (10%). Those without social support were more likely to report a primary reason for delayed care due to cost (68% vs 56% p <0.001) (Figure 2). Respondents without social support were also significantly more likely to report delays because there was too long of a wait in the waiting room (8% vs 7%), they lacked transportation (11% vs 10%) or for another reason (24% vs 22%) (p < 0.001 for all comparisons).

The association between a lack of social support and a delay in seeking medical care was unchanged after adjustment for demographic variables (OR 2.64; 95% CI 2.26, 3.09) (Table 2). Further adjustment for socioeconomic status (adjusted OR 2.37; 95% CI 2.01, 2.81) and health factors (adjusted OR 1.88; 95% CI 1.58, 2.23) led to an attenuation of the association between lack of social support and delays in seeking medical care. There was little change in the magnitude of the association between a lack of social support and delays in seeking care after further adjustment for access to care (fully adjusted OR 1.72; 95% CI 1.45, 2.06).

Table 2
Adjusted and Unadjusted Association Between Social Support and Delays in Seeking Medical Care[¥]

Social Support	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	1.00	1.00	1.00	1.00	Ref	Ref
Poor Social Support	2.61*	2.64*	2.37*	1.88*	1.72	1.45-2.06	<0.001
Demographics							
Age		1.02*	1.01*	1.01*	1.01	1.01-1.02	<0.001
Gender (Male)		0.63*	0.67*	0.69*	0.62	0.53-0.72	<0.001
Race							
White non-Hispanic		1.00	1.00	1.00	1.00	Ref	Ref
AA		1.01	1.07	0.97	1.01	0.78-1.31	0.92
Hispanic		1.37	1.18	1.31	1.21	0.73-2.01	0.45
Other		1.27	1.18	1.26	1.02	0.53-1.98	0.95
Marital Status (married)		0.76*	0.79*	0.85*	0.93	0.80-1.07	0.31
Socioeconomic Status							
Education (Highest Level)							
Non High School Graduate			1.00	1.00	1.00	Ref	Ref
High School Graduate			0.61*	0.71*	0.76	0.58-0.99	0.046
College Graduate			0.53*	0.66*	0.80	0.59-1.07	0.13

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Employment					
Employed	1.00	1.00	1.00	Ref	Ref
Unemployed/Student	1.59*	1.19*	1.11	0.94-1.32	0.22
Retired	0.50*	0.47*	0.50	0.40-0.63	<0.001
Health Factors					
Comorbidity					
Depression		1.93*	1.99	1.72-2.31	<0.001
DM		1.14	1.22	0.97-1.53	0.09
COPD		1.49*	1.53	1.18-1.97	0.001
CAD		1.00	1.01	0.74-1.40	0.94
Alcohol Misuse		1.09	1.11	0.93-1.33	0.24
Perceived Health					
Fair/Poor		2.11*	2.14	1.75-2.62	<0.001
Access to Care					
No Primary Physician			1.18	0.99-1.42	0.07
No Insurance			4.21	3.24-5.48	<0.001

[¥]95% confidence intervals and p-values refer to model 5. All other values expressed as odds ratios.
*denotes $p < 0.05$ for variables in models other than model 5.

In a sensitivity analysis examining the findings separately in Tennessee and Minnesota, a lack of social support was associated with delays in seeking medical care in respondents from both Tennessee and Minnesota (Table 3; Supplement Tables S3-8). However, after full adjustment for potential confounding variables, the association between a lack of perceived social support and delay in seeking medical care was stronger in Minnesota than in Tennessee (p-value for interaction term < 0.001). In Minnesota, the odds of delaying medical care were 2.16 times higher (95% CI 1.83, 2.56) in participants without social support compared to those with social support. In Tennessee, the odds of delaying medical care was 1.50 times (95% CI 1.16, 1.94) higher in participants without social support when compared to those with social support.

Table 3
Subgroup Analyses by State

	Minnesota			Tennessee		
Social Support	**Fully Adjusted OR**	**95% CI**	**p-value**	**Fully Adjusted OR**	**95% CI**	**p-value**
Good Social Support	1.00	Ref	Ref	1.00	Ref	Ref
Poor Social Support	2.16	1.83-2.56	<0.001	1.50	1.16-1.94	<0.01
Demographics						
Age	1.01	1.01-1.02	<0.001	1.01	1.00-1.02	0.04
Gender (Male)	0.66	0.58-0.75	<0.001	0.60	0.47-0.76	<0.001
Race						
White non-Hispanic	1.00	Ref	Ref	1.00	Ref	Ref

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AA	0.58	0.42-0.80	<0.001	1.22	0.88-1.70	0.22
Hispanic	1.44	1.00-2.06	0.05	1.06	0.26-4.35	0.94
Other	1.08	0.56-1.68	0.73	0.93	0.48-1.80	0.84
Marital Status (married)	0.88	0.77-0.99	0.04	0.95	0.76-1.20	0.68
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate	1.00	Ref	Ref	1.00	Ref	Ref
High School Graduate	0.98	0.71-1.35	0.90	0.71	0.49-1.03	0.07
College Graduate	0.97	0.71-1.35	0.83	0.81	0.52-1.25	0.34
Employment						
Employed	1.00	Ref	Ref	1.00	Ref	Ref
Unemployed/Student	1.09	0.92-1.29	0.33	1.08	0.83-1.41	0.57
Retired	0.58	0.48-0.71	<0.001	0.45	0.31-0.64	<0.001
Health Factors						
Comorbidity						
Depression	2.02	1.75-2.32	<0.001	2.00	1.56-2.56	<0.001
DM	1.07	0.86-1.33	0.56	1.29	0.93-1.78	0.12
COPD	1.70	1.35-2.15	<0.001	1.44	1.01-2.06	0.04
CAD	0.88	0.65-1.20	0.42	1.08	0.70-1.65	0.73
Alcohol Misuse	1.14	0.98-1.33	0.10	1.19	0.82-1.72	0.36
Perceived Health						
Fair/Poor	2.21	1.85-2.64	<0.001	2.04	1.51-2.75	<0.001
Access to Care						
No Primary Physician	1.10	0.93-1.29	0.27	1.28	0.95-1.74	0.11
No Insurance	1.75	0.41-7.53	0.45	3.90	2.88-5.28	<0.001

DISSCUSSION

This study demonstrates that a lack of social support is associated with delays in seeking medical care. The overall rate of reported delay in seeking needed medical care was 22% and respondents with a perceived lack of social support were twice as likely to report delays when compared to those with social support (38% vs 19%). While it is difficult to directly compare reported delays in care in this study to studies evaluating delays in care for specific conditions, similar rates have been previously reported.[32-34] This association persisted after adjustment for demographic variables, socioeconomic status, health factors, and access to care raising the possibility that a lack of social support is independently associated with delays in seeking care.

Previous studies have demonstrated that lack of social support is an important risk factor for mortality.[1-6] This study identifies delays in seeking needed medical care as a potential

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mechanism by which a lack of social support may affect health outcomes. As recognition of the importance of social and behavioral determinants of health on health outcomes at the population level increases, the Institute of Medicine (IOM) has encouraged identification of these factors in the clinical setting and has recommended incorporation of standardized assessments of social isolation or connection into the electronic medical record (EMR). Identification of patients with low levels of social support may provide opportunity to target a high risk population that could benefit from care management systems or group based interventions to build social support and encourage prompt medical care. Specifically, patient navigators may be uniquely suited to address the needs of patients with low levels of social support. Previously described roles of patient navigators include facilitating access to and coordination of healthcare, helping patients select the best insurance plan for their health needs, and providing emotional and informational support. These roles may be particularly important in reducing unnecessary delays in care for patients with low levels of social support. [35]

There are several limitations to our study. First, Tennessee and Minnesota were the only states in the BRFSS dataset that included all of the survey questions required for inclusion in our analysis. While these two states differ in racial composition compared to the national population, the analysis presented in Table S2 demonstrated that they are nationally representative in terms of socioeconomic status, rates of comorbidities and access to care. One exception is that the state of Minnesota had a very small uninsured population. While Minnesota does have one of the lowest rates of uninsured status in the United States, the extremely low rate (<1%) found in this study may represent a bias in the survey. Although our findings were consistent in both states, the magnitude of the association varied highlighting that these results should be generalized to the rest of the United States with caution.

Second, there may be a selection bias wherein those with low levels of social support may be less likely to participate in the survey. Therefore, the rates of poor social support may be underestimated. Third, our primary outcome of delay in needed medical care is patient

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reported and we were unable to determine what type of care was delayed. It is plausible that the likelihood of delay in seeking care or the reasons for seeking care vary by illness, symptom, and/or severity. Our outcome variable lacked sufficient specificity to explore this hypothesis. Fourth, assessment of the reason for care delay was determined by response to two separate questions, one of which solely addressed cost. While this inherently biases the responses towards reporting cost as a reason for care delay, other studies support that concern for cost of care is a common reason for care delay.[32] Fifth, although we incorporated several demographic variables and measures of socioeconomic status, health factors, and access to care, it is possible that these results are explained by residual or unmeasured confounding. Examples may include personality factors or unmeasured mental health conditions.

Additionally, because this is a cross-sectional study, we are unable to establish a temporal relationship between lack of social support and treatment delays, and thus the ability to infer causality is limited. Finally, this study likely underestimates the rates of delays in care. Respondents in this study were asked about delaying *needed* medical care and therefore care delay due to symptom appraisal, the process by which a patient recognizes that their condition requires medical attention, is not accounted for. While this may lead to an underestimation of care delay, delays due to symptom appraisal would likely be targeted by different types of interventions, such as education about the symptoms of specific conditions. Common examples of these types of interventions include educational campaigns about the symptoms of stroke or breast cancer. By eliminating symptom appraisal as a cause of care delay, this study likely better identifies care delays that may be modifiable by interventions targeting a lack of social support.

In conclusion, lack of perceived social support is associated with patient reported delay of needed medical care in a sample of residents from two states in the U.S.. Identification of patients with low levels of social support could help identify a high-risk population that may benefit from interventions targeted at reducing social isolation and improving access to care.

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REFERENCES

1. Berkman LF. Social networks, support, and health: taking the next step forward. *Am J Epidemiol* 1986;123(4):559-62.

2. Blazer DG. Social support and mortality in an elderly community population. *Am J Epidemiol* 1982;115(5):684-94.

3. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med* 2010;7(7):e1000316.

4. House JS, Landis KR, Umberson D. Social relationships and health. *Science* 1988;241(4865):540-5.

5. Lyyra TM, Heikkinen RL. Perceived social support and mortality in older people. *J Gerontol B Psychol Sci Soc Sci* 2006;61(3):S147-52.

6. Zhang X, Norris SL, Gregg EW, et al. Social support and mortality among older persons with diabetes. *Diabetes Educ* 2007;33(2):273-81.

7. Berkman LF, Melchior M, Chastang JF, et al. Social integration and mortality: a prospective study of French employees of Electricity of France-Gas of France: the GAZEL Cohort. *Am J Epidemiol* 2004;159(2):167-74.

8. Pantell M, Rehkopf D, Jutte D, et al. Social isolation: a predictor of mortality comparable to traditional clinical risk factors. *Am J Public Health* 2013;103(11):2056-62.

9. Cole SW, Hawkley LC, Arevalo JM, et al. Social regulation of gene expression in human leukocytes. *Genome Biol* 2007;8(9):R189.

10. Holt-Lunstad J, Uchino BN, Smith TW, et al. Social relationships and ambulatory blood pressure: structural and qualitative predictors of cardiovascular function during everyday social interactions. *Health Psychol* 2003;22(4):388-97.

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11. Lamkin DM, Lutgendorf SK, McGinn S, et al. Positive psychosocial factors and NKT cells in ovarian cancer patients. *Brain Behav Immun* 2008;22(1):65-73.

12. Miyazaki T, Ishikawa T, Nakata A, et al. Association between perceived social support and Th1 dominance. *Biol Psychol* 2005;70(1):30-7.

13. Seeman TE, Lusignolo TM, Albert M, et al. Social relationships, social support, and patterns of cognitive aging in healthy, high-functioning older adults: MacArthur studies of successful aging. *Health Psychol* 2001;20(4):243-55.

14. Yang YC, Boen C, Mullan Harris K. Social relationships and hypertension in late life: evidence from a nationally representative longitudinal study of older adults. *J Aging Health* 2015;27(3):403-31.

15. Oka RK, King AC, Young DR. Sources of social support as predictors of exercise adherence in women and men ages 50 to 65 years. *Womens Health* 1995;1(2):161-75.

16. Steptoe A, Wardle J, Pollard TM, et al. Stress, social support and health-related behavior: a study of smoking, alcohol consumption and physical exercise. *J Psychosom Res* 1996;41(2):171-80.

17. Berkanovic E, Telesky C, Reeder S. Structural and social psychological factors in the decision to seek medical care for symptoms. *Med Care* 1981;19(7):693-709.

18. Henning-Smith CE, Gonzales G, Shippee TP. Barriers to Timely Medical Care for Older Adults by Disability Status and Household Composition. *J Disabil Policy Stu* 2016;27(2):116-27.

19. McCoy SI, Strauss RP, MacDonald PD, et al. Social support and delays seeking care after HIV diagnosis, North Carolina, 2000-2006. *AIDS Care* 2009;21(9):1148-56.

20. Pedersen AF, Olesen F, Hansen RP, et al. Social support, gender and patient delay. *Br J Cancer* 2011;104(8):1249-55.

21. Garbuz DS, Xu M, Duncan CP, et al. Delays worsen quality of life outcome of primary total hip arthroplasty. *Clin Orthop Relat Res* 2006;447:79-84.

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22. Yan J, Liu Y, Zhou B, et al. Pre-hospital delay in patients with diabetic foot problems: influencing factors and subsequent quality of care. *Diabet Med* 2014;31(5):624-9.

23. Ferrer R, Martin-Loeches I, Phillips G, et al. Empiric antibiotic treatment reduces mortality in severe sepsis and septic shock from the first hour: results from a guideline-based performance improvement program. *Crit Care Med* 2014;42(8):1749-55.

24. Martin S, Ulrich C, Munsell M, et al. Delays in cancer diagnosis in underinsured young adults and older adolescents. *Oncologist* 2007;12(7):816-24.

25. McNamara RL, Wang Y, Herrin J, et al. Effect of door-to-balloon time on mortality in patients with ST-segment elevation myocardial infarction. *J Am Coll Cardiol* 2006;47(11):2180-6.

26. Dracup K, Moser DK. Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction. *Heart Lung* 1997;26(4):253-62.

27. Esteva M, Leiva A, Ramos M, et al. Factors related with symptom duration until diagnosis and treatment of symptomatic colorectal cancer. *BMC Cancer* 2013;13:87.

28. MacLeod KE, Ragland DR, Prohaska TR, et al. Missed or Delayed Medical Care Appointments by Older Users of Nonemergency Medical Transportation. *Gerontologist* 2015;55(6):1026-37.

29. Raczynski JM, Finnegan JR, Jr., Zapka JG, et al. REACT theory-based intervention to reduce treatment-seeking delay for acute myocardial infarction. Rapid Early Action for Coronary Treatment. *Am J Prev Med* 1999;16(4):325-34.

30. Woerle S, Roeber J, Landen MG. Prevalence of alcohol dependence among excessive drinkers in New Mexico. *Alcohol Clin Exp Res* 2007;31(2):293-8.

31. CDC. 2013 [Available from: https://www.cdc.gov/brfss/data_documentation/pdf/UserguideJune2013.pdf.

32. Kullgren JT, McLaughlin CG, Mitra N, et al. Nonfinancial barriers and access to care for U.S. adults. *Health Serv Res* 2012;47(1 Pt 2):462-85.

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33. Sabatino SA, Coates RJ, Uhler RJ, et al. Health insurance coverage and cost barriers to needed medical care among U.S. adult cancer survivors age<65 years. *Cancer* 2006;106(11):2466-75.

34. Weissman JS, Stern R, Fielding SL, et al. Delayed access to health care: risk factors, reasons, and consequences. *Ann Intern Med* 1991;114(4):325-31.

35. Natale-Pereira A, Enard KR, Nevarez L, et al. The role of patient navigators in eliminating health disparities. *Cancer* 2011;117(15 Suppl):3543-52.

Figure Legends

Figure 1. Selection of sample for this study

Figure 2. Reasons for Delaying Medical Care

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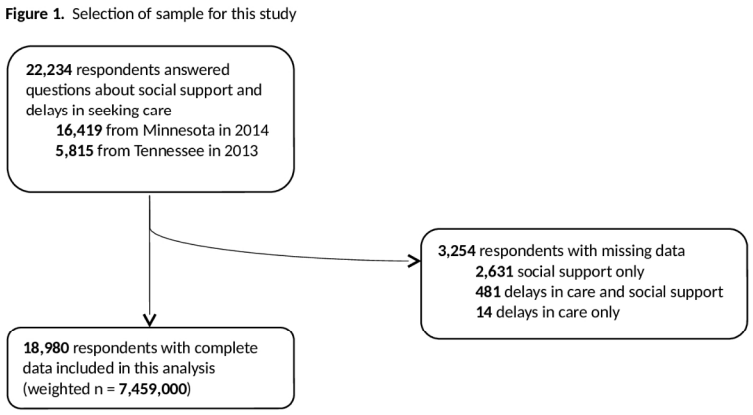

Figure 1. Selection of sample for this study

215x279mm (300 x 300 DPI)

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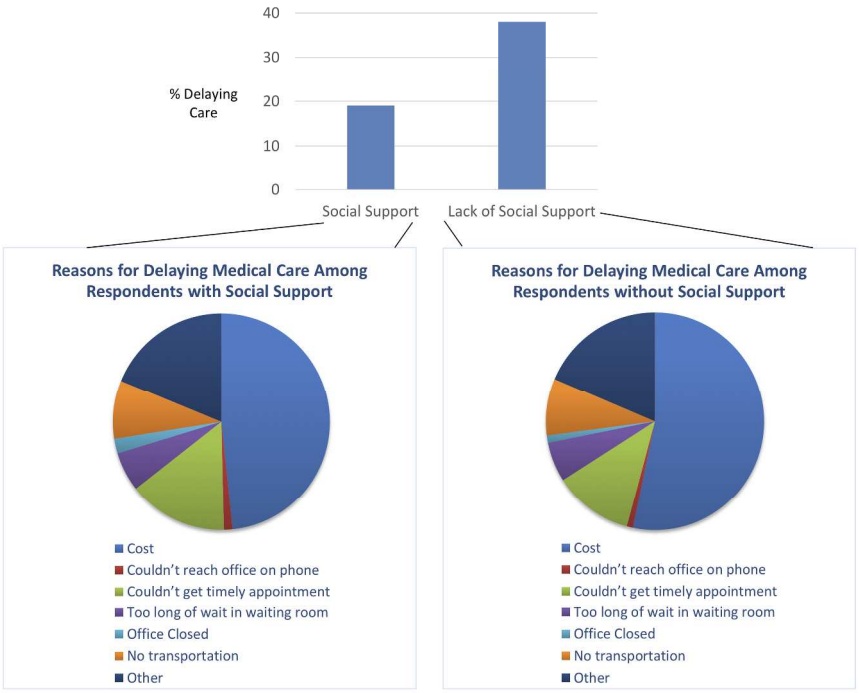

Figure 2. Reasons for Delaying Medical Care

254x190mm (300 x 300 DPI)

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Supplemental Tables

Table S1
Missing data analysis

	Not Missing (n= 18,890)	Missing (n = 3,254)	p-value
Age (mean)	48	45	< 0.001
Gender (male)	48	53	< 0.001
Race			
White non-Hispanic	83	72	<0.001
African American	10	15	<0.001
Hispanic	2	5	<0.001
Other	5	6	0.30
Married	55	51	<0.01
Education (Highest level)			
Non High School Graduate	12	17	<0.001
High School Graduate	62	62	0.90
College Graduate	26	21	<0.001
Employment			
Unemployed/Student	24	27	0.01
Employed	58	55	0.07
Retired	18	17	0.47
Comorbidity			
Depression	19	17	0.08
DM	10	11	0.31
COPD	7	9	0.02
CAD	5	4	0.34
Alcohol Misuse	15	15	0.93
Perceived Health			
Fair/Poor	18	20	<0.01
Coverage/Utilization			
No Primary Physician	22	29	<0.001
No Insurance Coverage	9	14	<0.001
Delay Care Due to Cost	13	16	0.04
Delay Care for Non-Cost Reason	13	15	0.18
Any Reason for Delay in Care	22	28	<0.001
Lack of Perceived Social Support	18	16	0.56

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Table S2

Differences between participants in the 2013-2014 BRFSS sample who were and were not assigned social support and treatment delay modules

	Not assigned social support and treatment delay modules (n = 934,203)	**Assigned social support and treatment delay modules** (n = 22,234)
Age (mean)	47	47
Gender (male, %)	49	49
Race		
White non-Hispanic	81	64
African American	11	12
Hispanic	3	16
Other	6	8
Married	54	51
Education (Highest level)		
Non High School Graduate	13	15
High School Graduate	62	59
College Graduate	25	26
Employment		
Unemployed/Student	24	27
Employed	58	56
Retired	18	17
Comorbidity		
Depression	19	18
DM	10	10
COPD	7	7
CAD	5	4
Alcohol Misuse	15	17
Perceived Health		
Fair/Poor	18	18
Social Network		
Single adult household	22	19
Coverage/Utilization		
No Primary Physician	23	23
No Insurance Coverage	10	12
Delay Care Due to Cost	14	15
Delay Care for Non-Cost Reason	14	20
Any Reason for Delay in Care	23	34

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TABLE S3
Baseline Characteristics of Tennessee Respondents

	Overall (N= 3,773)	With Support (N= 2,908)	No Support (N= 865)	P value
Age (mean)	48	48	48	
Gender (male)	1,768 (47)	1,302 (45)	466 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	2,998 (79)	2,374 (82)	624 (72)	<0.001
African American	554 (15)	367 (13)	187 (22)	<0.001
Hispanic	41 (1)	39 (1)	2 (<1)	0.03
Other	180 (5)	127 (4)	53 (6)	0.30
Married	2,032 (54)	1,654 (57)	379 (43)	<0.001
Single Adult Household *	490 (23)	361 (21)	129 (29)	<0.001
Education				
Non-High School Grad	574 (15)	373 (13)	202 (23)	<0.001
High School Grad	2,354 (63)	1,801 (62)	552 (64)	0.40
College Grad	835 (22)	729 (25)	106 (12)	<0.001
Employment				
Unemployed/Student	1,103 (29)	774 (21)	329 (38)	<0.001
Employed	1,954 (52)	1,555 (53)	399 (46)	<0.01
Retired	708 (19)	572 (20)	137 (16)	0.02
Comorbidity				
Depression	747 (20)	438 (15)	309 (36)	<0.001
Diabetes	462 (12)	332 (11)	130 (15)	0.02
COPD	346 (9)	215 (7)	131 (15)	<0.001
CAD	252 (7)	176 (6)	76 (9)	0.02
Alcohol Misuse	355 (10)	265 (9)	90 (11)	0.42
Perceived Health				
Fair/Poor	865 (23)	525 (18)	341 (40)	<0.001
Access				
No PCP	783 (21)	559 (19)	224 (26)	<0.01
Uninsured	638 (17)	414 (14)	223 (26)	<0.001
Delay				
Delay Cost	664 (18)	415 (14)	249 (29)	<0.001
Delay Non-Cost	552 (15)	361 (12)	192 (22)	<0.001
Delay†	1,014 (27)	669 (23)	345 (40)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 3,773,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

TABLE S4

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Baseline Characteristics of Minnesota Respondents

	Overall (N= 3,686)	With Support (N= 3,179)	No Support (N= 507)	P value
Age (mean)	47	47	46	
Gender (male)	1,782 (48)	1,510 (47)	273 (54)	<0.001
Race/Ethnicity				
White Non-Hispanic	3,160 (86)	2,793 (88)	367 (72)	<0.001
African American	163 (4)	111 (3)	52 (10)	<0.001
Hispanic	142 (4)	113 (4)	30 (6)	<0.01
Other	221 (6)	162 (5)	58 (11)	<0.001
Married	2,070 (56)	1,872 (59)	198 (39)	<0.001
Single Adult Household *	314 (20)	256 (18)	58 (32)	<0.001
Education				
Non-High School Grad	322 (9)	237 (7)	85 (17)	<0.001
High School Grad	2,257 (61)	1,929 (61)	329 (65)	<0.01
College Grad	1,108 (30)	1,014 (32)	94 (18)	<0.001
Employment				
Unemployed/Student	660 (18)	525 (17)	136 (27)	<0.001
Employed	2,387 (65)	2,097 (66)	290 (58)	<0.001
Retired	626 (17)	548 (17)	78 (15)	0.07
Comorbidity				
Depression	684 (19)	523 (16)	161 (32)	<0.001
Diabetes	298 (8)	249 (8)	49 (10)	0.03
COPD	161 (4)	124 (4)	37 (7)	<0.001
CAD	127 (3)	107 (3)	20 (4)	0.20
Alcohol Misuse	766 (21)	670 (21)	95 (19)	0.07
Perceived Health				
Fair/Poor	437 (12)	305 (10)	132 (26)	<0.001
Access				
No PCP	858 (23)	699 (22)	160 (32)	<0.001
Uninsured	5 (<1)	5 (<1)	1 (<1)	0.60
Delay				
Delay Cost	331 (9)	228 (7)	103 (20)	<0.001
Delay Non-Cost	444 (12)	325 (10)	119 (23)	<0.001
Delay†	659 (18)	484 (15)	175 (34)	<0.001

All data weighted according to BRFSS formula. Multiplication by 1,000 gives weighted N. Total weighted N= 3,686,000

* large proportion of missing data (50%) for single adult household status

† respondents reported both cost and non-cost reasons for delaying care, therefore total number of delays is less sum of cost and non-cost delays

Table S5

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Reasons for Delaying Medical Care Among Tennessee Respondents

Reason for delaying care	Overall (N= 1,014)	With Support (N= 669)	Without Support (N= 345)	P-value
Cost	664 (65)	415 (62)	249 (72)	<0.001
Couldn't reach office on phone	3 (<1)	2 (<1)	1 (<1)	0.50
Couldn't get timely appointment	115 (11)	72 (11)	44 (13)	<0.01
Too long of wait in waiting room	56 (6)	36 (5)	20 (6)	0.046
Office Closed	14 (1)	12 (2)	2 (1)	0.32
No transportation	85 (8)	63 (9)	22 (6)	0.56
Other Reason	279 (28)	176 (26)	103 (30)	<0.001

Weighted Data. Multiplication by 1,000 gives weighted frequency (N). Total Weighted N Delays = 1,014,000

Patients who delayed care due to cost could also report one additional reason for delaying medical care, therefore percentages for reasons for delay in care are greater than total percentage of patients who delayed care.

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Table S6
Multivariate Modeling Tennessee

Social Support	**Model 1**	**95% CI**	**p-value**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	n/a	n/a	1.00	n/a	n/a
Poor Social Support	2.22	1.78-2.77	<0.001	1.50	1.16-1.94	<0.01
Demographics						
Age				1.01	1.00-1.02	0.04
Gender (Male)				0.60	0.47-0.76	<0.001
Race						
White non-Hispanic				1.00	n/a	n/a
AA				1.22	0.88-1.70	0.22
Hispanic				1.06	0.26-4.35	0.94
Other				0.93	0.48-1.80	0.84
Marital Status (married)				0.95	0.76-1.20	0.68
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate				1.00	n/a	n/a
High School Graduate				0.71	0.49-1.03	0.07
College Graduate				0.81	0.52-1.25	0.34
Employment						
Employed				1.00	n/a	n/a
Unemployed/Student				1.08	0.83-1.41	0.57
Retired				0.45	0.31-0.64	<0.001
Health Factors						
Comorbidity						
Depression				2.00	1.56-2.56	<0.001
DM				1.29	0.93-1.78	0.12
COPD				1.44	1.01-2.06	0.04
CAD				1.08	0.70-1.65	0.73
Alcohol Misuse				1.19	0.82-1.72	0.36
Perceived Health						
Fair/Poor				2.04	1.51-2.75	<0.001
Access to Care						
No Primary Physician				1.28	0.95-1.74	0.11
No Insurance				3.90	2.88-5.28	<0.001

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Table S7
Reasons for Delaying Medical Care Among Minnesota Respondents

Reason for delaying care	Overall (N=659)	With Support (N= 484)	Without Support (N= 175)	P-value
Cost	331 (50)	228 (47)	103 (59)	<0.001
Couldn't reach office on phone	19 (3)	14 (3)	5 (3)	<0.01
Couldn't get timely appointment	160 (24)	125 (4)	35 (20)	<0.001
Too long of wait in waiting room	60 (9)	41 (26)	19 (11)	<0.001
Office Closed	23 (3)	17 (4)	6 (3)	0.01
No transportation	88 (13)	54 (11)	34 (19)	<0.001
Other Reason	95 (14)	74 (15)	21 (12)	<0.001

Weighted Data. Multiplication by 1,000 gives weighted frequency (N). Total Weighted N Delays = 659,000
Patients who delayed care due to cost could also report one additional reason for delaying medical care, therefore percentages for reasons for delay in care are greater than total percentage of patients who delayed care.

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Table S8
Multivariate Modeling Minnesota

Social Support	**Model 1**	**95% CI**	**p-value**	**Model 5**	**95% CI**	**p-value**
Good Social Support	1.00	n/a	n/a	1.00	n/a	n/a
Poor Social Support	2.93	2.55-3.36	<0.001	2.16	1.83-2.56	<0.001
Demographics						
Age				1.01	1.01-1.02	<0.001
Gender (Male)				0.66	0.58-0.75	<0.001
Race						
White non-Hispanic				1.00	n/a	n/a
AA				0.58	0.42-0.80	<0.001
Hispanic				1.44	1.00-2.06	0.05
Other				1.08	0.56-1.68	0.73
Marital Status (married)				0.88	0.77-0.99	0.04
Socioeconomic Status						
Education (Highest Level)						
Non High School Graduate				1.00	n/a	n/a
High School Graduate				0.98	0.71-1.35	0.90
College Graduate				0.97	0.71-1.35	0.83
Employment						
Employed				1.00	n/a	n/a
Unemployed/Student				1.09	0.92-1.29	0.33
Retired				0.58	0.48-0.71	<0.001
Health Factors						
Comorbidity						
Depression				2.02	1.75-2.32	<0.001
DM				1.07	0.86-1.33	0.56
COPD				1.70	1.35-2.15	<0.001
CAD				0.88	0.65-1.20	0.42
Alcohol Misuse				1.14	0.98-1.33	0.10
Perceived Health						
Fair/Poor				2.21	1.85-2.64	<0.001
Access to Care						
No Primary Physician				1.10	0.93-1.29	0.27
No Insurance				1.75	0.41-7.53	0.45

95% confidence intervals and p-values given refer to model 5

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	Page 2- (*a*) Indicate the study's design with a commonly used term in the title or the abstract
		Page 2- (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Page 4- Explain the scientific background and rationale for the investigation being reported
Objectives	3	Page 5- State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Pages 5, 6- Present key elements of study design early in the paper
Setting	5	Pages 5, 6- Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	Page 5- (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Pages 5, 6- Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	Pages 5, 6- For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Page 7- Describe any efforts to address potential sources of bias
Study size	10	Pages 5, 7- Explain how the study size was arrived at
Quantitative variables	11	Pages 5, 6- Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	Pages 5, 6-(*a*) Describe all statistical methods, including those used to control for confounding
		Pages 5, 6- (*b*) Describe any methods used to examine subgroups and interactions
		Page 7- (*c*) Explain how missing data were addressed
		Page 5- *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		Page 7- (*e*) Describe any sensitivity analyses

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Results		
Participants	13*	Page 7- (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		Page 7- (b) Give reasons for non-participation at each stage
		Figure 1- (c) Consider use of a flow diagram
Descriptive data	14*	Pages 7, 8- (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		Pages 7- (b) Indicate number of participants with missing data for each variable of interest
		n/a- (c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	n/a- *Cohort study*—Report numbers of outcome events or summary measures over time
		n/a- *Case-control study*—Report numbers in each exposure category, or summary measures of exposure
		Page 9- *Cross-sectional study*—Report numbers of outcome events or summary measures
Main results	16	Pages 9, 10- (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		Pages 9, 10- (*b*) Report category boundaries when continuous variables were categorized
		n/a- (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Page 11- Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Page 12- Summarise key results with reference to study objectives
Limitations	19	Page 13- Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Pages 13, 14- Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Page 13- Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Page 1- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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