



## Social capital or vulnerability: Which has the stronger connection with selected U.S. health outcomes?

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### ABSTRACT

We tested associations between social capital or vulnerability and health outcome measures of adult obesity, adult diabetes, and life expectancy at the county level in the United States with data from 2015 to 2018. This ecological cross-sectional study utilized secondary data from four open access databases: The Geography of Social Capital (U.S. Congress, 2018), County Health Rankings (2018), CDC's Behavioral Risk Factor Surveillance System (BRFSS, 2018) and the Kaiser Family Foundation (KFF, 2015). Our dependent variables were adult obesity, adult diabetes, and life expectancy. We identified the highest and lowest states' prevalence for each of three health outcomes in each of the four U.S. regions—Northeast, South, Midwest, and West. Each dependent variable was assessed using a sample of 32 counties ( $N = 32$ ). Data analysis consisted of bivariate and regression analysis. Our results showed that the most consistent measure of “vulnerability” linked significantly to all three health conditions studied was percent births to unmarried women (Obesity  $p < .001$ ; Diabetes  $p = .049$ ; Life Expectancy  $p = .019$ ). The most consistent measure of “social capital” linked to all three health conditions was recreation establishments per 1,000 inhabitants (Obesity  $p = .006$ ; Diabetes  $p = .005$ ; Life Expectancy  $p = .018$ ). We concluded that measures of vulnerability were strongly associated with obesity, diabetes, and life expectancy when compared with social capital indicators. However, measures of social capital consistently accounted for the second-greatest proportion of the variance. Social and community contexts should be constantly addressed by both public health governmental- and scholarly-research agendas in the United States.

### Introduction

Research on health outcomes in the United States is booming—the bulk of which is concerned with social determinants of health. According to the U.S. Department of Health and Human Services, social determinants of health can be divided into five categories: economic stability, education, health and health care, neighborhood and built environment, and social and community context (Office of Disease Prevention and Health Promotion, n.d.). The majority of public health studies are concerned with the first four categories, examining how resource vulnerability impacts individual and group health outcomes. However, the fifth category, “social and community context”, with a

focus on levels of social capital, is relatively under-investigated. This current study seeks to fill that research gap. Our research specifically tested potential associations between measures of “vulnerability” (marginality, disadvantage), historically strongly linked with higher risks of disease and chronic conditions at the population level, and measures of social capital in their association with three selected health outcomes: adult obesity, adult diabetes, and life expectancy in the United States at the county level.

Social capital refers to features of social structure such as levels of interpersonal trust, norms of reciprocity, and mutual support that may act as resources for people and facilitate collective action (Coleman, 1990; Putnam, 1993). A related concept, social cohesion, is linked to the

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extent of connectedness and solidarity among groups in societies (Berkman & Kawachi, 2000). The erosion of social capital in a given population, increases the chances of social inequities to affect people's health. Similarly, a country with weak social cohesion tends to underinvest in social networks (Pellegrini-Filho et al., 2008). Researchers have been arguing that not all chapters of the story of public health and social capital have been written, highlighting the lack of research on either erosion or generation of social capital within organizations and not only inside the communities. This research gap could be addressed by studies looking towards intersectoral partnerships in favor of social capital generation at organizations (Makian, 2002).

Overall, social capital can be measured by indicators such as group membership, neighborliness, social trust, among others (Lee, 2014). Through their associations or groups, individuals with high stocks of social capital have greater access to shared resources that promote individual wellbeing and collective benefits (Pollock et al., 2020). Social capital was found to be a more reliable predictor of longevity and mortality than poverty or inequality alone (Kawachi et al., 1997). Rozer and colleagues (2016) examined whether the relationship between national income inequality and self-rated health is conditioned by social trust in a large dataset of 393,761 respondents across 89 countries. They concluded that national income inequality was bad for trustful citizens; the effect of income inequality is nearly absent among people with low social trust, but it is negative among people with high social trust. In terms of sub-dimensions of social capital, evidence suggests that community organizations (for white women) and group membership (for white men) were particularly strongly associated with lower suicide risk in 50 States in the U.S. (Smith & Kawachi, 2014).

Social capital gives individuals access to social support and encourages health-inducing social norms (Lee, 2014). At the individual level, social capital is linked to reduced risk for chronic diseases. A cohort study that recruited 2.8 million people confirmed this association in 2006 (Sundquist et al., 2006). More recently, a study investigated social capital and chronic diseases among older adults in eight different countries, analyzing data from 42,487 households. It concluded that improving the social capital of older adults with chronic diseases could potentially improve their subjective well-being (Christian et al., 2020). Obesity (Legh-Jones & Moore, 2012; Legh-Jones & Moore, 2012) and physical inactivity have been associated with low levels of social capital (Ueshima et al., 2010). A systematic review addressing obesity and social capital also confirmed an expected link between them, however pointing out that methods should be evaluated with caution. In terms of life expectancy, results are less conclusive (Kennelly et al., 2003).

Measures such as religious adherence, attendance at religious organizations, and number of churches or congregations located within communities have been used as social capital indicators in studies that investigated health related outcomes and social capital (Irwin et al., 2008). Religious social capital is defined as the social resources available to individuals and groups through their social connections with a religious community, including membership, social integration, values/norms, bonding/bridging trust as well as social support (Maselko et al., 2011). Dauner and Wilmot (2019) focused on women's health and the potential effects of religious adherence and social capital from a cohort of about 5000 children born to low-income parents in 20 major U.S. cities in 15 states. Their results showed that religious adherence at the community level was positive statistically significant - every 1% increase in area religiosity corresponds to a 1.2% increase in the odds of good health of women from the study.

Regarding non-religious and non-profit associations, membership organizations, and civic engagement, they have been investigated as indicators of social capital for decades (Grootaert et al., 2004; Campos et al., 2015). Groups and networks refer to the nature, extent and diversity of the participation of a member of a household in various types of social organizations and informal networks, including how household members have worked on joint projects for the community (Grootaert et al., 2004). Studies have shown mixed results about the impact of

membership in organizations and health in both directions. Membership in organizations was reported associated with increased chances of physical health problems among adults in one study (Musalia, 2016), but also positively associated with better oral health outcomes among adults in another study (Borges et al., 2014).

The amplitude of the term vulnerability has received attention in the health literature (De Groot et al., 2019). For the present study, vulnerability is understood as a condition of disadvantage, underprivilege, and risk associated with poverty, unemployment, crime, and similar circumstances (Pollock, 2007). Evidence has shown that vulnerability in health might be attenuated by social capital. A study conducted in Mexico showed that regardless of the level of marginalization a person experiences, relatives' and friends' networks lead into alternative and additional resources to solve health issues. Bonding-type social capital integrates the material and emotional support to deal with health situations. In the case of accidents or illnesses, these networks are useful to raise funds for the patient's treatment. Likewise, networks provide necessary emotional support to improve the health of a sick individual (Martinez-Martinez & Rodrigues-Brito, 2020).

This present study sought to test associations between social capital or vulnerability and three health outcomes of adult obesity, adult diabetes, and life expectancy at the county level in the United States using data from the years 2015 and 2018.

## Materials and methods

This ecological cross-sectional study utilized secondary data from six open access databases: The Geography of Social Capital (U.S. Congress, 2018), County Health Rankings (2019), CDC's Behavioral Risk Factor Surveillance System (2018), and the Kaiser Family Foundation (2015). The research team used these six databases to collect data on all 14 independent variables and three dependent variables, building a single dataset.

### Dependent variables

When selecting dependent variables, three specific health outcomes were examined: adult obesity, adult diabetes, and life expectancy at birth (hereafter simply "life expectancy"). Despite its status as a world leader, the United States ranks comparatively lower in these health outcomes than other developed nations. According to *The World Factbook*, the United States ranked 12th in adult obesity prevalence in the world (Central Intelligence Agency, 2020b). Canada, a neighboring nation, is 26th in the world, with the United Kingdom, Israel, Spain, Germany, and China respectively ranking as 36th, 45th, 62nd, 79th, and 169th (Central Intelligence Agency, 2020b). Similarly, Americans aged 20 years or older have the highest prevalence rates of diabetes (and high plasma glucose levels) among peer countries (Woolf & Aron, 2013). And, despite overall improvements in American life expectancy, the U.S. still ranks 43rd in the world, compared to Japan (2nd), Israel (12th), Canada (21st), Spain (22nd), Germany (34th), and the United Kingdom (35th) (Central Intelligence Agency, 2020a). Because the US lags seriously behind other countries with comparable industrial success, we have identified these three health outcomes as critical areas of study.

We identified the highest and lowest states for each of three health outcomes in each of the four U.S. regions—Northeast, South, Midwest, and West, resulting in two states per region per health outcome using data from the CDC's Behavioral Risk Factor Surveillance System (BRFSS) and the Kaiser Family Foundation (KFF). From there, we used the Robert Wood Johnson Foundation Program's *County Health Rankings & Roadmaps* database to determine the two highest and lowest counties per state for each of the three health outcomes, resulting in four counties per state, or eight counties per region per health outcome. In total, each health outcome was assessed using a sample of 32 counties (N = 32).

Independent variables

Social Capital and Vulnerability measures were collected from a nationwide social capital database—a product of the United States Congress’s Joint-Economic Committee’s project to grow the country’s social capital data pool titled *The Geography of Social Capital in America*. The project expanded on the Penn State index, an earlier social capital index and contains county- and state-level data on a range of social economic, demographic, health, religious and other indicators (U.S Congress, 2018). From this database, we selected nine measures of “social capital”: religious congregations per 1,000, non-religious non-profits organizations per 1,000, percent women currently married, recreation establishments per 1,000, associations per 1,000, membership organizations per 1,000, mail back census response rate, religious adherents per 1000 and inversely (a self-report measure) percent who get emotional support sometimes, rarely, or never.

The concept of “vulnerability” used in this study was derived from its use as an umbrella term to describe conditions of disadvantage, under-privilege, and risk associated with poverty, unemployment, crime, and similar circumstances in *Tilted Mirrors: Media Alignment with Political and Social Change – A Community Structure Approach*: Pollock, 2007, pp. 137–156. Five measures of “vulnerability” were investigated: percent births to unmarried women, percent children with a single parent, poverty rate, unemployment rate, and violent crimes per 100,000. Only one self-report measure was used in the sample, resulting in a comprehensive selection of aggregate data. Definitions and variables composition investigated in our study are listed in Table 1.

Statistical analysis

The first step of the statistical analysis was a descriptive Pearson bivariate analysis of the social capital and vulnerability indicators and each dependent variable. For the bivariate analysis, correlations were considered significant at the 0.05 level. After concluding the bivariate analysis, only the indicators with a significance level equal to or lower than 0.2 were included in the regression. Individual stepwise regressions were used to compare social capital and vulnerability measures separately with county-level adult obesity prevalence, adult diabetes, and life expectancy. Final results considered association significant at or lower than  $p = 0.05$ .

Results

Results uncovered four significant measures of vulnerability linked to obesity: percent births to unmarried women ( $r = 0.672, p = .000$ ), percent children with a single parent ( $r = 0.612, p = .000$ ), poverty rate ( $r = 0.579, p = .000$ ), and unemployment rate ( $r = 0.379, p = .016$ ). All of these measures have direct relationships with obesity prevalence. Four measures of social capital were also robustly related to obesity prevalence. One measure was connected to higher levels of obesity: religious congregations per 1000 ( $r = 0.657, p = .000$ ). Three other measures of social capital were connected to lower levels of obesity: non-religious non-profit organizations per 1000 ( $r = -0.584, p = .000$ ), percent women currently married ( $r = -0.468, p = .003$ ), and recreation/leisure establishments per 1000 ( $r = -0.435, p = .006$ ). Measures of vulnerability and social capital were compared with county-level obesity, diabetes prevalence and life expectancy using Pearson correlations (Table 1) (see Table 2). Regression analysis found that percent births to unmarried women (45.2% of the variance) and religious congregations per 1000 (8.7%) collectively accounted for 53.9% of the variance associated with higher obesity prevalence. By contrast, percent of women currently married (11.0% of the variance) and non-religious non-profit organizations per 1000 (6.4%) collectively accounted for 17.4% of the variance associated with a lower obesity prevalence (Table 3). Measures of vulnerability were significantly associated with adult diabetes at the county-level, in particular poverty level ( $r = 0.342,$

**Table 1**  
Selected variables used for the measurement of Social Capital and Vulnerability investigated.

Social Capital	
Variable	Definition
Religious Congregations per 1000	Congregations may be churches, mosques, temples, or other meeting places. A congregation may generally be defined as a group of people who meet regularly (typically weekly or monthly) at a pre-announced time and location.
Non-religious Nonprofit Organizations per 1000	A secular organization that does not distribute surplus funds to its owners or shareholders, but instead uses surplus funds to help pursue its goals. Most non-profit organizations are exempt from taxes.
Percent Women Currently Married	Share of women ages 35–44 who are currently married and are not separated.
Recreation Establishment per 1000	The number of recreation and leisure establishments in a county per 1000 population. For example, bowling centers and golf clubs would be considered a recreation and leisure establishment. This indicator is distinct from similar variables such as Membership Organizations per 1000.
Associations per 1000	The aggregate for all of the following variables divided by population per 1000: percent religious congregations, percent civic and social associations, percent business associations, percent political organizations, percent professional organizations, percent labor organizations, percent bowling centers, percent recreational establishments, percent golf establishments, and percent sports establishments. This variable is derived from the Penn State Social Capital index.
Membership Organizations per 1000	The number of membership organizations per 1000 population. A membership organization allows individuals to subscribe and often requires them to pay a membership fee or subscription. This variable concerns organizations with a particular purpose, including but not limited to industry, activity, interest, mission, or geographical location organizations.
Mail Back Census Response Rate	The mail return rate is defined as the number of unduplicated nonblank mail returns divided by the number of housing units in the mailback universe that were not deleted, identified as vacant, or had an address identified as undeliverable as addressed.
Religious Adherents per 1000	The adherent figure is meant to be the most complete count of people affiliated with a congregation, and the most comparable count of people across all participating groups. Adherents may include all those with an affiliation to a congregation (children, members, and attendees who are not members).
Percent who get Emotional Support Sometimes, Rarely, or Never	This indicator reports the percentage of adults aged 18 and older who self-report the frequency with which they receive sufficient emotional support. The indicator is relevant because emotional support is critical for navigating challenges of daily life as well as for good mental health. Emotional support is linked to educational achievement and economic stability.
Vulnerability Variable	Definition
Percent Births to Unmarried Women	The share of births over one year to women who were unmarried, divided by the total share of births to women, regardless of marital status, over that same year.
Percent Children with Single Parent	Single-parent households are classified as “other families.” The U.S. government

(continued on next page)

**Table 1** (continued)

Social Capital	
Variable	Definition
	accounts for two kinds of “other families”: a family with a male householder and no spouse of a householder present and a family with a female householder and no spouse of householder present.
Unemployment Rate	The percentage of the county’s civilian labor force, ages 16 or older, that is unemployed but seeking work.
Violent Crimes per 100,000	The number of violent crimes reported per 100,000 population. Violent crimes are defined as offenses that involve face-to-face confrontation between a victim and a perpetrator, including homicide, rape, robbery, and aggravated assault. Crimes are counted in the police precinct where they occur, rather than the residence of the victim or the perpetrator. This measure only includes the crimes reported to police that are then reported to the FBI.
Percent Births to Unmarried Women	The share of births over one year to women who were unmarried, divided by the total share of births to women, regardless of marital status, over that same year.

p = .03) and percent births to unmarried women (r = 0.298, p = .049). County-level findings on social capital, specifically non-religious non-profit organizations per 1000 (r = -0.515, p = .001) and recreation establishments per 1000 (r = -0.449, p = .005), were robustly linked with lower levels of adult diabetes. Two of the three most powerful correlations connecting county-level demographics and lower adult diabetes prevalence were measures of social capital. By contrast, religious congregations per 1000 (r = 0.543, p = .001) correlated positively with higher levels of diabetes. The three most significant are indicators

**Table 2**

Bivariate analysis, Pearson Correlations. All Variables and each investigated outcome.

All County Variables	Obesity		Diabetes		Life Expectancy	
	Pearson	Significance	Pearson	Significance	Pearson	Significance
Percent Births to Unmarried Women	0.672	000 < 0.001	0.298	0.049	-0.374	0.019
Religious Congregations per 1000	0.657	<0.001	0.543	0.001	-0.254	0.081
Percent Children with Single Parent	0.612	<0.001	0.034	0.427	-0.621	<0.001
Non-religious Nonprofit Organizations per 1000	-0.584	<0.001	-0.515	0.001	0.271	0.067
Poverty Rate	0.579	<0.001	0.341	0.030	-0.292	0.053
Percent Women Currently Married	-0.468	0.003	0.185	0.155	-0.064	0.364
Recreation Establishment per 1000	-0.435	0.006	-0.449	0.005	0.370	0.018
Unemployment Rate	0.379	0.016	0.105	0.286	-0.544	0.001
Violent Crimes per 100,000	0.271	0.067	0.029	0.440	-0.102	0.295
Membership Organizations per 1000	-0.233	0.099	-0.193	0.145	0.204	0.132
Percent Who Get Emotional Support Sometimes, Rarely, or Never	0.193	0.154	0.342	0.005	-0.309	0.062
Mailback Census Response Rate	0.132	0.236	0.159	0.193	-0.011	0.478
Religious Adherents per 1000	-0.101	0.292	0.233	0.099	0.234	0.062
Associations per 1000	0.088	0.316	0.273	0.065	-0.024	0.447

**Table 3**

Bivariate analysis, Pearson Correlations. Social Capital indicators only and each investigated outcome.

Social Capital Variables	Obesity		Diabetes		Life Expectancy	
	Pearson	Significance	Pearson	Significance	Pearson	Significance
Religious Congregations per 1000	0.657	<0.001	0.543	0.001	-0.254	0.081
Non-religious Nonprofit Organizations per 1000	-0.584	<0.001	-0.515	0.001	0.271	0.067
Percent Women Currently Married	-0.468	0.003	0.185	0.155	-0.064	0.364
Recreation Establishment per 1000	-0.435	0.006	-0.449	0.005	0.370	0.018
Membership Organizations per 1000	-0.233	0.099	-0.193	0.145	0.204	0.132
Percent Who Get Emotional Support Sometimes, Rarely, or Never	0.193	0.154	0.342	0.051	-0.309	0.062
Mailback Census Response Rate	0.132	0.236	0.159	0.193	-0.011	0.478
Religious Adherents per 1000	-0.101	0.292	0.233	0.099	0.234	0.062
Associations per 1000	0.088	0.316	0.273	0.065	-0.024	0.447

of social capital were non-religious non-profit organizations (r = -0.515, p = .001), religious congregations per 1000 (r = 0.543, p = .001), and recreation establishments per 1000 (r = -0.449, p = .005). The remaining measure was an indicator of vulnerability: percent births to unmarried women (r = 0.298, p = .049). It is useful to notice that non-religious non-profit organizations per 1000 (r = -0.515, p = .001), and recreation establishments per 1000 (r = -0.449, p = .005) correlated negatively with adult diabetes, associated with lower levels of that condition (Table 3) (see Table 4).

Among the significant measures associated with vulnerability and lower life expectancies were: percent children with single parents (r = -0.621, p = .000), unemployment rate (r = -0.544, p = .0001), percent births to unmarried women (r = -0.374, p = .019), and poverty rate (r = -0.292, p = .053). The significant social capital findings are as follows. Recreation establishments per 1000 (r = 0.370 p = .018) followed by (directionally) religious adherents per 1000 (r = 0.234, p = .062) and non-religious nonprofit organizations per 1000 (r = 0.271, p = .067).

**Discussion**

*Vulnerability and social capital both robustly connected to health outcomes*

Measures of vulnerability are usually more potent than measures of social capital in their association with obesity, diabetes, and life expectancy. However, measures of social capital consistently account for the second-greatest proportion of the variance. Measures of vulnerability—percent births to unmarried women and percent children with single parents—were strongly associated with, respectively, more obesity (45.2% of variance) and lower life expectancy (42.7% of variance). A presumed measure of social capital, religious congregations, was linked strongly (29.1% of variance) with levels of diabetes, but contrary to expectation, with “higher” levels of diabetes.

It is worthwhile exploring possible reasons for finding, contrary to

**Table 4**  
Regression Analysis. Models for obesity, diabetes, life expectancy separately for each outcome.

Model (Predictors)	Obesity					Diabetes					Life Expectancy			
	R	R Square Cumulative.	RSquare Change	F Change	Sig F Change	R	R Square Cum.	R Square Change	F Change	Sig F Change	R	R Square Cum.	R Square Change	F Change (Sig F)
Percent Births to Unmarried Women	0.672	0.452	0.452	23.924	0	-	-	-	-	-	-	-	-	-
Percent Births to Unmarried Women, Percent Women Currently Married	0.749	0.562	0.110	6.999	0.013	-	-	-	-	-	-	-	-	-
Percent Births to Unmarried Women, Percent Women Currently Married, Nonreligious Nonprofit Organizations per 1000	0.791	0.636	0.064	4.627	0.041	-	-	-	-	-	-	-	-	-
Percent Births to Unmarried Women, Percent Women Currently Married, Nonreligious Nonprofit Organizations per 1000, Religious Congregations per 1000	0.844	0.669	0.087	7.905	0.009	-	-	-	-	-	-	-	-	-
Religious Congregations per1000	-	-	-	-	-	.540	.291	.291	11.925	.002	-	-	-	-
Religious Congregations per1000, Non-Religious Non-Profit Organization Per1000	-	-	-	-	-	.725	.526	.234	13.844	.001	-	-	-	-
Percent Children with Single Parent	-	-	-	-	-	-	-	-	-	-	.653	.427	.427	21.595 (<0.001)
Percent Children with Single Parent, Recreation Establishment Per1000	-	-	-	-	-	-	-	-	-	-	.718	.516	.089	5.153 (0.031)
Percent Children with Single Parent, Recreation Establishment Per1000, Percent Births to Unmarried Women	-	-	-	-	-	-	-	-	-	-	.760	.578	.062	3.942 (0.057)

social capital expectations, that congregations/1000 is linked to “more” rather than “less” obesity. Perhaps this measure of religious presence, rather than register social capital or social cohesion, may instead simply record the number of houses of worship, no matter how many or few parishioners attend them. According to the Gallup polling organization, some houses of worship have enjoyed growing attendance over the last

twenty years (in the US, Evangelicals), while others have suffered substantial losses (Catholics and Mainline Protestants). In a poll released on April 19, 2019, the Gallup organization announced that church membership was down 70%–50% between 1999 and 2019, a twenty-year period (Jones, 2019). Congregation density may therefore represent less an indicator of religious vitality than of decline. It is not surprising

that another measure of social capital, religious congregants/1000, or density of parishioners rather than density of houses of worship, has no significant association with any of the health conditions studied in this survey: obesity, diabetes, or life expectancy.

Overall, only a few measures of both vulnerability and social capital (four each) were associated consistently and significantly with levels of obesity, diabetes, and life expectancy. Comparing average significance levels for the “top four” most significant variables indicating vulnerability or social capital, collectively social capital measures compared favorably with vulnerability ones as “most significant”. The average of the significance levels for the “top four” most significant vulnerability indicators is .073, while the average for the “top four” significant social capital indicators is 0.058. The comparison of average significance levels suggests that, comparing the “top four” most significant measures of vulnerability and social capital with the three health conditions of obesity, diabetes, and life expectancy, “social capital” measures overall compare favorably with “vulnerability” measures, representing robust “consistency” in association with health conditions.

#### *Four significant measures of vulnerability, four of social capital*

Obesity may be linked to an individual’s ability to afford and prepare healthy meals, which tend to be expensive. Children with a single parent are likely to live in single-income households, which leaves the parent less time and financial resources to purchase ingredients and prepare healthy meals. These expectations are consistent with a systematic review of ten studies that found higher BMIs among children in single-parent households (Duriancik & Goff, 2019). The review asserts that adults in single-parent households have more time constraints due to a lack of shared household responsibilities, causing these households to be less likely to have homemade meals, shared family meals, and physical activity, all of which can contribute to obesity (Duriancik & Goff, 2019). Similarly, those who live in poverty or are unemployed are likely to face significant barriers to health—like lack of transportation to grocery stores or inability to afford fresh fruits and vegetables—leaving them more vulnerable to obesity. A review of neighborhood nutrition disparities found that low-income communities have more access to unhealthy food sources, such as fast-food outlets and convenience stores (Hilmers et al., 2012). The study also determined that low-income neighborhoods are less likely to contain supermarkets and grocery stores, which may explain the higher prevalence of obesity found in these communities (Hilmer et al., 2012). Hughes and Kumari (2017) found that unemployment is associated with obesity in nonsmokers. This association may exist because unemployed individuals experience higher stress levels and may be more likely to eat energy-dense, nutrient-poor foods to stretch limited resources (Hughes & Kumari, 2017).

#### *Vulnerability, social capital, and adult obesity*

The prevalence of obesity in the United States is a key concern for public health scholars and for the general public. The Centers for Disease Control (CDC) estimates that almost 40% of Americans are obese (National Center for Health Statistics, 2018). Social capital is a critical determinant of health outcomes, including obesity. At the collective level, the broader social environment can contribute to obesity (Yoon & Brown, 2011). Research by Yoon and Brown suggests that “the promotion of CSC [community social capital] may lower the obesity risk among U.S. adults, facilitating efforts to control body weight through reducing calorie/fat consumed and increasing physical activity” (2011). Other studies have also confirmed the connection between social capital and reduced obesity (Firouzbakht et al., 2019; Huffman et al., 2010). Compared to previous studies emphasizing traditional social determinants of health—such as vulnerability, the current county-level study reveals that social capital has a robust association with obesity prevalence.

Despite their many benefits, religious congregations may encourage conformity. A community that is too cohesive can lead to pressure to conform as well as ostracism of individuals who behave differently from the others, which can lead to adverse health outcomes (Borges et al., 2010). A systematic review of quantitative studies on the relationship between religion and health uncovered a significant positive association between religiosity and body weight in cross-section and longitudinal studies (Yeary et al., 2017). In contrast with religious congregations per 1000, the number of non-religious non-profit organizations per 1000 and the number of recreation/leisure establishments per 1000 were linked to lower obesity prevalence. Non-religious non-profit organizations ( $r = -0.584$ ,  $p = .000$ ) in a county indicate an interest in acting collectively to improve a community. It follows that communities with a collectivist mindset will cultivate stronger bonds that encourage resource sharing, emotional support, and other mechanisms that promote health. A study by Fuentes et al. (2019) found that community organizations and community groups are associated with adoption of a positive diet and physical behaviors. Recreation and leisure establishments ( $r = -0.435$ ,  $p = .006$ ) indicate an environment that supports lower stress levels and regular physical activity, which lower obesity risk. Individuals who live in communities where the majority of residents participate in formal group activities are more likely to be under informal social control that discourages them from engaging in unhealthy behaviors (Morgan, 2009).

#### *Obesity linked to the experience of women*

It is notable that two of the most significant findings are linked to women. The percentage of births to unmarried women ( $r = 0.672$ ,  $p = .000$ ), a measure of vulnerability, has a strong direct relationship with obesity prevalence, while the percentage of women currently married ( $r = -0.468$ ,  $p = .003$ ), a measure of social capital, has a strong inverse relationship with obesity prevalence. We speculate that measures linked to women influence obesity prevalence because women typically make nutrition and food-planning decisions for a household. Unmarried women, especially those with children, may be more likely to be part of a single-income household. They may, therefore, need to dedicate more time to working or caring for young children than married women do, leaving them less time and financial resources to provide healthy meals for their households. Consequently, it follows that communities with more married women (social capital) manifest lower levels of obesity, while those with more births to unmarried women (vulnerability) correspond with higher obesity prevalence. According to Sobel and Hanson (2011), never married women are more at risk for obesity than married women, possibly due to increased stress associated with living in a single-income household, which may also explain the relationship between births to unmarried women and higher obesity prevalence observed.

These regression results suggest that, although vulnerability measures are strongly associated with obesity prevalence, at least two measures of social capital are clearly linked to lower levels of obesity. It is noteworthy that the most significant indicators of vulnerability (percent births to unmarried women) and of social capital (percent women currently married), both linked to obesity prevalence, are each connected to the status of women.

#### *Social capital, vulnerability, and diabetes*

Adult diabetes is a continuing social concern. The CDC estimates that 34.2 million people have diabetes (10.5% of the US population) and 88 million adults aged 18 years or older have prediabetes (34.5% of the adult US population) (CDC, 2019). Similarly, comparing health outcomes with different measures of social capital in different U.S. states, Kawachi, et al. (1997) found that social capital measures were often superior to measures of vulnerability (poverty level or income inequality) in their association with diabetes, heart disease, and life

expectancy.

It was not surprising to learn that measures of vulnerability were significantly associated with adult diabetes at the county-level, in particular poverty level and percent births to unmarried women. However, confirming social capital expectations, county-level findings on social capital, specifically non-religious non-profit organizations per 1000 and recreation establishments per 1000 were robustly linked with lower levels of adult diabetes. Two of the three most powerful correlations connecting county-level demographics and lower adult diabetes prevalence were measures of social capital. By contrast, religious congregations per 1000 ( $r = 0.543$ ,  $p = .001$ ) correlated positively with higher levels of diabetes. Overall, activity in non-religious non-profit organizations or recreational activities was connected to lower levels of diabetes.

Regression analysis yielded religious congregations per 1000 accounted for 29.1% of the variance associated with more adult diabetes, whereas non-religious non-profit organizations per 1000 accounted for 23.4% associated with less adult diabetes. Religious congregations per 1000 proves contrary to the narrative in existing social capital research where religious congregations and affiliations are linked with better glycemic control and healthier lifestyles; religious congregations serve as a support system and educational system for their parishioners (Darvyri, 2018, p. 1). It is to no surprise that non-religious non-profit organizations per 1000 were associated with less adult diabetes. Non-profit organizations such as the American Diabetes Association “seek to educate the public about diabetes and to help those affected by it through funding research to manage, cure and prevent diabetes” (American Diabetes Association, 2020, p. 1). Heightened prevalence of nonprofits may indicate promotion for healthier lifestyles and better ways of life, which in turn can result in lower levels of diabetes among populations.

#### *Social capital, vulnerability, and life expectancy*

Life expectancy at birth for individuals in the United States varies greatly, but what causes these differences is worth studying. Where you live in the United States factors into not only how long, but also how healthy of a life one is projected to enjoy (Pollock et al., 2020). It has long been accepted that income inequality impacts life expectancy (Kennelly et al., 2003). However, data now indicate a correlation between low levels of social capital and low levels of health outcomes (Kennelly et al., 2003). Compared to previous studies emphasizing traditional social determinants of health, such as vulnerability, the current county-level study reveals that social capital has a prominent effect on life expectancy. Comparing health outcomes with different measures of social capital in different U.S. states, Kawachi et al. (1997) found that social capital measures revealed a strong association with life expectancy, rivaling associations with poverty. Social capital has been “proposed as one of, if not the most, important mediators for the association between inequity and health” (Lynch et al., 2000, Abstract).

In order to accurately analyze the intersection of measures of vulnerability and social capital in the United States with the health outcome of life expectancy, the public health database PubMed was explored in April, 2020, where, the term “life expectancy” yielded 40,769 results, and “social capital” yielded 9367. Using “life expectancy” AND “social capital” yielded no results. Since it is evident that the public health field lacks significant research on the intersection of these topics, this case study addresses that research gap.

#### *Unmarried/single parents powerfully connected to lower life expectancy*

Vulnerability is a more powerful predictor of life expectancy than social capital. Two indicators of vulnerability, percent children with single parents (42.7% of the variance) and percent births to unmarried women (6.2%) collectively account for 48.9% of the variance, associated with lower life expectancy. By contrast, a single measure of social

capital, recreation establishments per 1000, accounted for 8.9% of the variance, associated with higher life expectancy. Based on the findings, we speculate measures linked to one’s home environment affect life expectancy prevalence. Two of the indicators are correlated to children being raised outside of the traditional two-parent home, and one indicator suggests a lack of recreation in a particular area, meaning it could be a low-income area. It seems that when an area has disadvantaged children, life expectancy decreases. These data are supported by other studies that also reveal a substantial difference in the life expectancy of children in single-parent homes versus two-parent homes (Singh et al., 2006).

#### *Implications of major findings*

Our evidence shows that both measures of social capital and vulnerability can help researchers determine some possibilities in terms of preparing specific programs that promote social capital and map community vulnerability. The findings also indicate the significance of women’s marital status and recreational centers in their associations with health outcomes.

#### **Conclusion**

Several patterns emerge from an exploration of the relative power of measures of vulnerability and social capital in their association with county-level measures of obesity, diabetes, and life expectancy. The strongest indicators linked to the three investigated health conditions according to percent of variance were as follows. Percent births to unmarried women and percent women currently married accounted respectively for 45.2% and 11% of variance in obesity prevalence distribution. Religious congregations and Non-religious Nonprofit organizations/1000 inhabitants accounted respectively for 29.1% and 23.4% of variance in diabetes prevalence distribution. Regarding life expectancy the highest variance was explained by percent children with single parents (42.7%) and number of recreation establishments/1000 people in the 32 investigated counties in the U.S (8.9%).

#### *Limitations*

This study has a number of limitations. Because it employs a cross-sectional design, this study cannot assert causality between measures of social capital or vulnerability and any of the three health outcomes—adult obesity, adult diabetes, and life expectancy. At best, it can hypothesize the nature of the relationship between two variables. Also, because it uses secondary data, or rather, aggregate data, the study cannot infer specific information regarding individuals, resulting in a potential ecological fallacy. Finally, this study faces a number of data collection challenges. The social capital database used to collect county-level social capital and vulnerability data is an invaluable resource. However, this study cannot control the quality of the data collection methods used to amass that aggregate data. Similar criticisms apply to the CDC’s BRFSS survey, RWJ’s County Health Rankings website, and KFF’s life expectancy database. Also, because data were taken from multiple sources, the study cannot confirm that data collection measures, standards, and time frames were consistent across all sources. Moreover, within the field of social capital research, no set standards reflect a consensus regarding which indicators to test to measure social capital and vulnerability. This study selected adult obesity, adult diabetes, and life expectancy as health outcomes because they were found relevant in a number of prior research studies in the same field. Despite the study’s limitations, it remains an innovative research endeavor in the field of social capital research. The study’s strength lies in its use of county-level data collection and an ambitious decision to test three health outcomes simultaneously. Hopefully, this paper will engender similar county-level research, testing the comparable significance of measures of both social capital and vulnerability.

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## Declaration of competing interest

We authors declare that there is no conflict of interest related to this present research.

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