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Mary C. Daly

Federal Reserve Bank of San Francisco

Andrew J. Oswald

Department of Economics

University of Warwick

Daniel Wilson

Federal Reserve Bank of San Francisco

Stephen Wu

Department of Economics

Hamilton College

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Mary C. Daly
Federal Reserve Bank of San Francisco

Andrew J. Oswald
Department of Economics
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Daniel Wilson
Federal Reserve Bank of San Francisco

Stephen Wu
Department of Economics
Hamilton College

Corresponding author: Andrew J. Oswald, Department of Economics, University of Warwick, CV4 7AL, UK.

Tel: 44 2476 523510

Fax: 44 2476 523032

Email: andrew.oswald@warwick.ac.uk

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Abstract

Suicide is an important scientific phenomenon. Yet its causes remain poorly understood. This study documents a paradox: the happiest places have the highest suicide rates. The study combines findings from two large and rich individual-level data sets — one on life satisfaction and another on suicide deaths — to establish the paradox in a consistent way across U.S. states. It replicates the finding in data on Western industrialized nations and checks that the paradox is not an artifact of population composition or confounding factors. The study concludes with the conjecture that people may find it particularly painful to be unhappy in a happy place, so that the decision to commit suicide is influenced by relative comparisons.

Introduction

Human well-being is increasingly studied in science and social science [1-7]. A common claim of many countries and even states within the U.S. is that they are filled with happy and/or satisfied people. Rankings from the World Values Survey and the U.S. General Social Survey frequently appear in the press—and more scholarly outlets—where we learn that Danes, Swedes, and the Swiss are among the most satisfied people in Europe and that it may be better to reside in Alaska than in California [2,8].

A rarely-noted difficulty is that these notably ‘happy’ places have high rates of suicide. While this puzzling fact has been remarked on occasionally for individual nations, especially for the case of Denmark, it has been attributed in an anecdotal way to idiosyncratic features of the location in question (e.g., the dark winters in Scandinavia), problems or variations in measurement of well-being and/or suicide, or differences in culture and attitudes regarding happiness and taking one’s life. Few scholars have thought of the anecdotal observation as a systematic relationship robust to replication and investigation.

A further, and potentially related, empirical issue has been discussed but never resolved in the literature on the epidemiology of suicide. There is no known explanation for the statistical evidence that suicide rates drop during wartime [9-11].

A possible cross-country association between happiness and suicide has been mentioned, albeit in passing, in innovative previous work examining whether survey data on subjective well-being might be used as tractable markers of population mental health [12]. Other research has examined the spatial patterns in suicide [eg. 13].

This paper documents the existence of a happiness-suicide paradox. Happier places have more suicides. Figure 1 provides the first and simplest evidence. It uses raw, unadjusted data on subjective well-being rankings (from the World Values Survey) and suicide rates (from the World Health Organization). Although there are variations around the average (e.g., the Netherlands), the striking association in the scatter plot is the positive association between happiness ranking and suicide rate. This gradient is the opposite of that expected.

The positive gradient in Figure 1 is not driven by the Scandinavian nations alone. Nations such as Iceland, Ireland, Switzerland, Canada, and the U.S. each display relatively high happiness and yet high suicide rates. Moreover, the finding is not an anomaly of the World Values survey or a result merely of raw correlations between happiness and suicide. If we use the estimated relative happiness values across countries, taken from another study [14], which employed regression-equation methods to adjust for nations' demographic characteristics, the same positive relationship holds between subjective national well-being and national suicide rates (Figure 2). The data in these scatter plots suggest the presence of a robust relationship that holds in countries with harsh and less harsh winters, with more and less religious influence, and with a range of cultural identities. Nevertheless, because of the variation in culture and suicide-reporting conventions, cross-country scatter plots are no more than suggestive.

The Paradox in U.S. Data

The central contribution of this paper is to establish the happiness-suicide paradox across space within a single country, the United States. The scientific advantage of doing so is that cultural background, national institutions, language, and religion are then held constant in a way that is impossible in Figures 1 and 2.

Building on two channels of previous work, it has very recently become possible to examine data on both happiness and suicide risk across the 50 U.S. states and the District of Columbia [2, 15]. The paper's data are drawn from (i) the Behavioral Response Factor Surveillance System, which are based on individual reports of subjective well-being for 1.3 million Americans, (ii) published state suicide rates, and (iii) the National Longitudinal Mortality Study, which matches death certificate data to individual records from the U.S. Census Bureau's Current Population Surveys from 1978 through 2001. This paper uses these data to obtain average life satisfaction and average suicide risk for each of the 50 U.S. states, and repeats the form of analysis performed above on Western industrialized countries.

Spatial U.S. data allow us to address two questions related to the possible existence of a happiness—suicide paradox. First, is it real? Since the potential bias embedded in cross-country comparisons are minimized, any observed positive association is likely to be the result of a true positive correlation as opposed to a spurious outcome of omitted variables. Second, and importantly, it is possible with the paper's two large individual-level data sets, on life satisfaction and on US suicides, to establish that the observed association between happiness and suicide in the United States is robust to the inclusion of controls for the demographic and socioeconomic characteristics known to be correlated with happiness and suicide risk.

The analysis first examines the correlation between reported happiness and raw suicide rates. It then calculates regression-adjusted correlations, where the adjustments here are for a full set of demographic and socioeconomic controls using multivariate regressions. The regression controls include age, race, gender, marital status, education, income, and employment/labor-force status as well as year fixed effects to control for any changes over

time. [For a full discussion of the data and methods, see the section at the end of the manuscript.]

Results

Figure 3 provides a scatter plot of raw (ie, unadjusted) suicide rates and raw 'happiness' scores for the 50 U.S. states. These unadjusted suicide rates and raw life satisfaction scores are positively related (Pearson's correlation=0.249, $p = 0.06$; rank correlation=0.255, $p = 0.05$). This association is consistent with the pattern observed for the Western industrialized nations. States which are happiest have higher suicide rates than those which are less happy. For example, Utah is ranked number 1 in life-satisfaction, but has the 9th highest suicide rate. Meanwhile, New York is the 45th happiest state, yet has the lowest suicide rate in the USA.

A natural question is to what extent the paradox holds when controls for population composition are included. Figure 4 plots the results of this analysis, where the average life satisfaction and suicide risk by state are adjusted for differences in age, gender, race, education, income, marital status and employment status. The Pearson correlation coefficient is positive (correlation = 0.127, $p\text{-value} > 0.1$). However, this apparently lower correlation coefficient is disproportionately affected by suicide outliers such as Nevada, Alaska, New Hampshire, and California. A more reliable Spearman rank correlation, which is robust to outliers, is 0.271, which is positive and significant ($p\text{-value} < 0.05$). Hence the paradoxical positive relationship seen in raw, unadjusted data is not due to confounding caused by differences in population characteristics across states.

Table 1 shows more details on these scatter plots and allows a focus on the patterns across states. The table reveals that Hawaii ranks #1 in adjusted average life satisfaction, yet

remarkably has the fifth highest suicide rate in the country. At the other end of this spectrum, New Jersey ranks near the bottom in adjusted life satisfaction (47th) yet has one of the lowest adjusted suicide risks (coincidentally, the 47th highest risk).

Discussion

The paradox holds in data for western nations, but it is its occurrence in data from the intrinsically more homogeneous setting of the U.S. states (both in raw correlations and adjusted correlations) that makes it more persuasive empirically. The explanation for the pattern found is currently unknown; that must await future research. However, looking beyond culture and differences in the reporting of happiness and suicide scores, one possible account draws on studies of comparisons. Unhappy people in a happy place may feel particularly harshly treated by life, thereby increasing their risk of suicide. If humans are subject to mood swings, the lows may be most tolerable in an environment -- whether a time of war or a geographical area -- in which other humans are unhappy. Whether such relative comparisons work by producing discord due to unmet aspirations, or reflect a real inability to integrate into the broader society and gain access to key supports [16], remains to be understood.

Data and Methods

To measure state level life satisfaction, we draw upon data collected under the auspices of the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a state-based system of health surveys that gathers information on risky behaviors, preventive health practices, and access to health care. The BRFSS was established in 1984 by the Centers for Disease Control and Prevention (CDC); currently data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. The data set is meant to “identify emerging

health problems, establish and track health objectives, and develop and evaluate public health policies and programs.” More than 350,000 adults are interviewed each year; the BRFSS is the largest telephone health survey in the world.

We study a sample of respondents between the ages of 18 and 85 with non-missing information. The data set’s annual samples provide statistically representative¹[1] cross-sectional snapshots of the U.S. Information on individual life-satisfaction was collected in BRFSS for the first time in 2005. Hence there has been little published research on life-satisfaction using this data set.

In addition to questions on health behaviors, access to health care, and physical health status, the survey also contains questions about mental health and subjective well-being. We rely on one particular survey question. It provides information about how satisfied people feel about the quality of their lives. The exact wording of the BRFSS life-satisfaction question is: “In general, how satisfied are you with your life?” Here people are able to answer one of the following: Very Satisfied, Satisfied, Dissatisfied, or Very Dissatisfied [Questionnaire line code 206].

To measure state-level suicide risk, we first obtain crude suicide rates from the report "Ranking America's Mental Health: An Analysis of Depression Across the States." We then estimate adjusted average suicide risk by state using data from the National Longitudinal Mortality Study, which is constructed by and housed at the U.S. Census Bureau. The adjusted suicide risks are the hazard ratios corresponding to the estimated coefficients on state dummy variables in a suicide Cox Proportional Hazards model which includes age, race, gender,

education, income, marital status, and employment/labor-force status – the same set of controls used to adjust the life satisfaction estimates. See Daly, Wilson, and Johnson (2008) and Daly and Wilson (2009) for more details about the NLMS and the Hazards model we use here.

For the cross-country comparisons, suicide rates are taken from the WHO: http://www.who.int/mental_health/prevention/suicide_rates/en/. Country happiness coefficients are taken from Table 3 of Blanchflower and Oswald [14]. Controls in the underlying regressions include age, gender, education, marital and employment status and age left schooling.

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Figure Legends

Figure 1. Unadjusted Suicide Rates vs. Happiness Rankings across Western Countries
Unadjusted Suicide Rates per 100,000 (y-axis); 2002 WVS Happiness Rankings (x-axis)

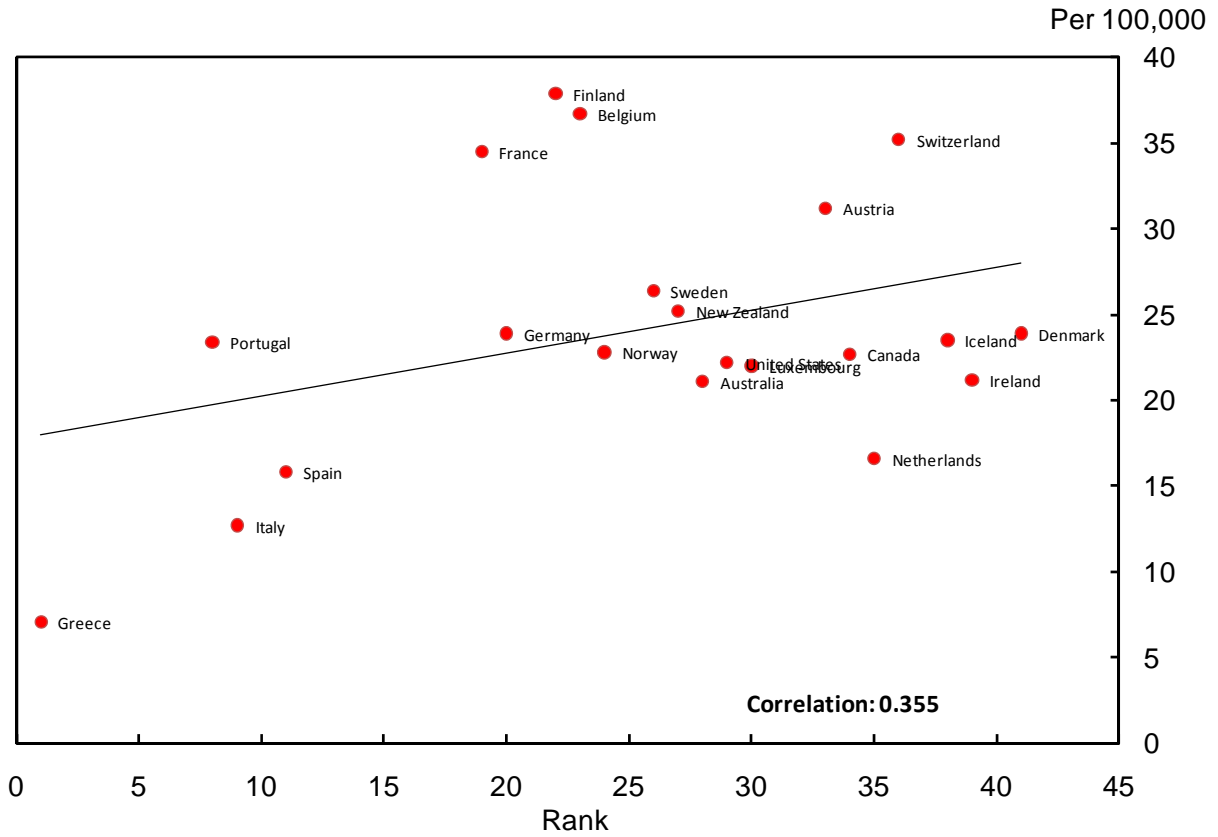
Figure 2. Unadjusted Suicide Rates vs. Adjusted Happiness Scores across European Countries
Unadjusted Suicide Rates per 100,000 (y-axis); Happiness Score Regression Coefficients (x-axis)

Figure 3. Unadjusted Suicide Rates vs. Unadjusted Life Satisfaction across U.S. States
Unadjusted Suicide Rates per 100,000 (y-axis); Unadjusted Life Satisfaction (x-axis)

Figure 4. Adjusted Suicide Risk vs. Adjusted Life Satisfaction across U.S. States
Adjusted Suicide Hazard Ratios (y-axis); Adjusted Life Satisfaction (x-axis)

Table 1: Suicide Rates and Happiness across U.S. States

Figure 1. Unadjusted Suicide Rates vs. Happiness Rankings across Western Countries
 Unadjusted Suicide Rates per 100,000 (y-axis); 2002 WVS Happiness Rankings (x-axis)



Note: The 2002 WVS Rankings were reordered from a descending level of happiness rank to an ascending ranking (higher rank = higher level of happiness).

Figure 2. Unadjusted Suicide Rates vs. Adjusted Happiness Scores across European Countries
Unadjusted Suicide Rates per 100,000 (y-axis); Happiness Score Regression Coefficients (x-axis)

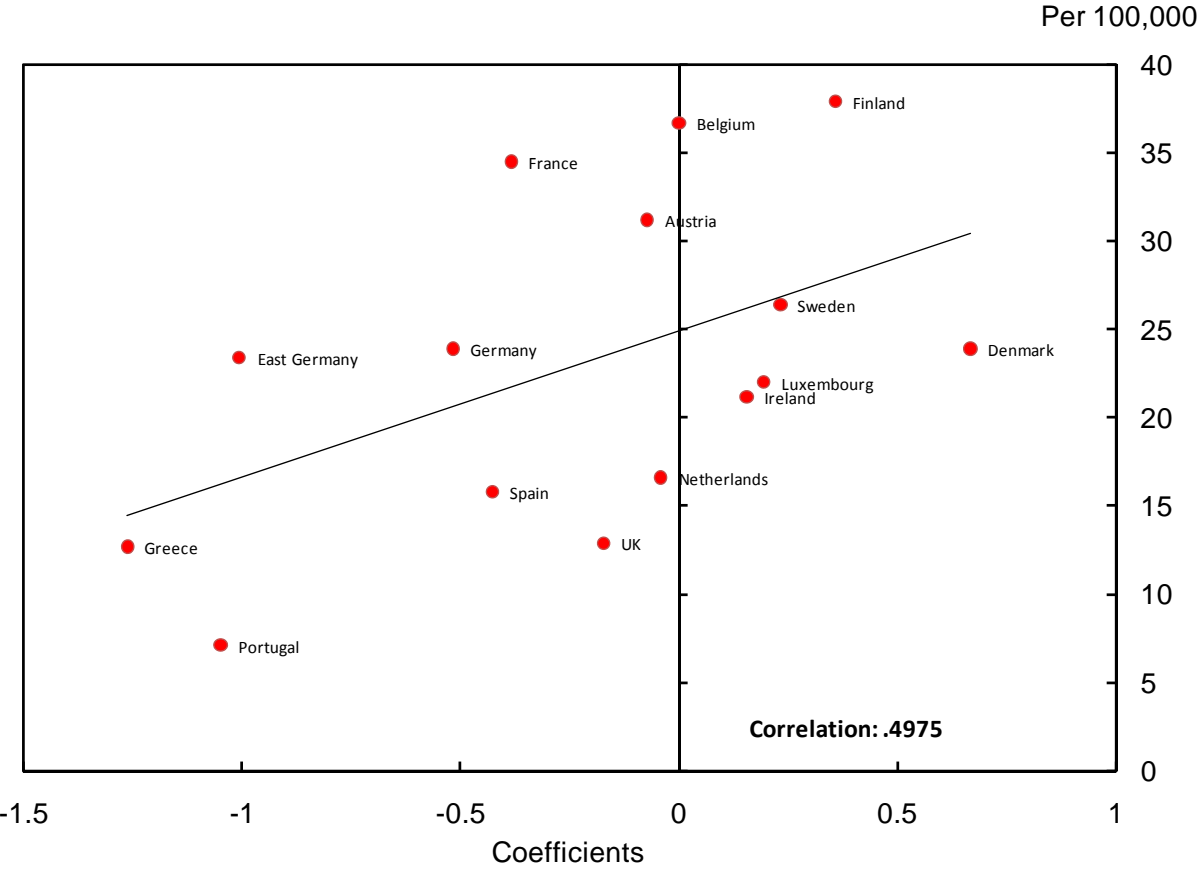


Figure 3. Unadjusted Suicide Rates vs. Unadjusted Life Satisfaction across U.S. States
 Unadjusted Suicide Rates per 100,000 (y-axis); Unadjusted Life Satisfaction (x-axis)

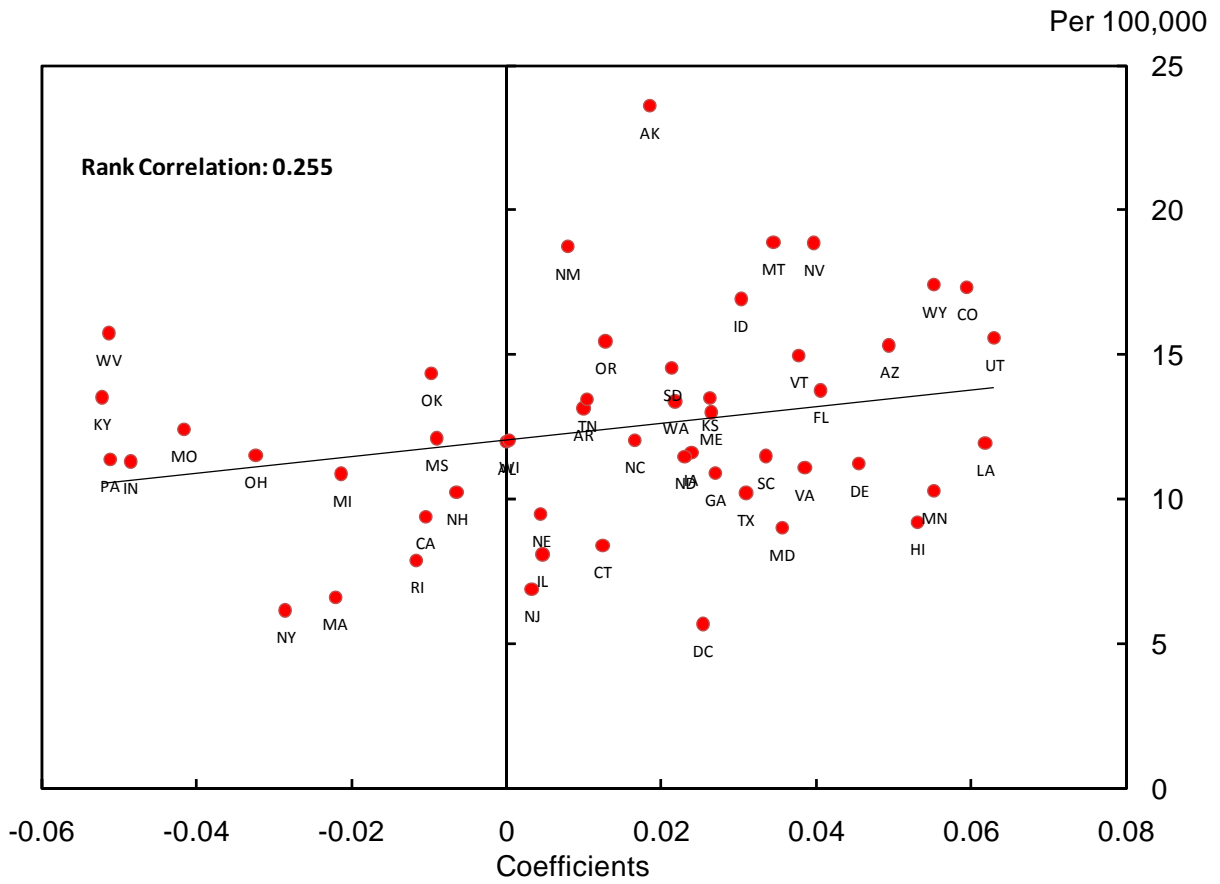


Table 1: Suicide Rates and Happiness Across U.S. States

State	Suicide Rate (Unadjusted)	Adjusted Suicide Hazard Ratio	Adjusted Suicide Rank	Raw Coefficients on Life Satisfaction	Adjusted Coefficients on Life Satisfaction	Adjusted Life Satisfaction Rank
Alabama	11.98	0.134	45	0	0	9
Alaska	23.6	1.955	2	0.0185221	-0.0130092	12
Arizona	15.32	0.702	16	0.0493716	0.0017149	5
Arkansas	13.14	0.522	23	0.0099526	-0.0173219	18
California	9.4	1.634	4	-0.010424	-0.0758851	46
Colorado	17.33	0.742	13	0.0594714	-0.0270579	23
Connecticut	8.41	0.326	36	0.0124054	-0.0811446	50
Delaware	11.22	0.527	22	0.0454979	-0.0268907	22
District of Columbia	5.69	-0.033	49	0.0253698	-0.0480357	37
Florida	13.76	0.688	18	0.0405791	0.0041158	3
Georgia	10.89	0.455	29	0.0269513	-0.0214549	19
Hawaii	9.21	1.554	5	0.0530756	0.0111783	2
Idaho	16.92	0.705	15	0.0302691	-0.0141471	16
Illinois	8.09	0.348	35	0.0046879	-0.0712013	45
Indiana	11.31	0.215	42	-0.0485675	-0.0785005	48
Iowa	11.61	0.661	19	0.0238617	-0.0408878	31
Kansas	13.51	0.172	44	0.0262973	-0.0433084	32
Kentucky	13.53	0.215	43	-0.0522251	-0.0450508	35
Louisiana	11.94	0.291	40	0.0618289	0.0328016	1
Maine	13.01	0.960	10	0.0264101	-0.0060124	10
Maryland	9	0.756	12	0.0355865	-0.0663173	40
Massachusetts	6.6	-0.155	50	-0.0220967	-0.0700712	44
Michigan	10.88	0.298	39	-0.0213069	-0.078772	49
Minnesota	10.29	0.307	37	0.0552504	-0.0304928	26
Mississippi	12.1	0.532	21	-0.0090073	0.0008344	7
Missouri	12.43	0.224	41	-0.0416866	-0.0637721	38
Montana	18.89	0.474	26	0.0344648	0.0007023	8
Nebraska	9.5	0.472	27	0.0044156	-0.0439223	33
New Hampshire	10.25	1.656	3	-0.0064468	-0.06437	39
Nevada	18.86	2.824	1	0.039696	-0.033304	28
New Jersey	6.88	0.067	47	0.0032406	-0.0784707	47
New Mexico	18.73	0.713	14	0.0079173	-0.0287865	24
New York	6.15	1.000	9	-0.0285934	-0.0877726	51
North Carolina	12.04	0.432	32	0.0165689	-0.0132164	13
North Dakota	11.48	0.300	38	0.0230207	-0.0296804	25
Ohio	11.51	0.486	25	-0.0323678	-0.0694797	43
Oklahoma	14.36	0.465	28	-0.009718	-0.026477	21
Oregon	15.46	1.307	6	0.012761	-0.0400734	30
Pennsylvania	11.39	0.438	31	-0.0511653	-0.0670964	41
Rhode Island	7.88	-0.018	48	-0.01163	-0.0683337	42
South Carolina	11.49	0.691	17	0.0335299	0.0014269	6
South Dakota	14.54	0.597	20	0.0213743	-0.0133957	14
Tennessee	13.46	0.448	30	0.010376	0.0026267	4
Texas	10.21	0.867	11	0.0309428	-0.0139671	15
Utah	15.57	0.488	24	0.0629503	-0.0256149	20
Vermont	14.98	0.086	46	0.0377624	-0.0171947	17
Virginia	11.08	0.381	34	0.038553	-0.0332978	27
Washington	13.38	1.155	7	0.0217956	-0.0456155	36
West Virginia	15.74	-0.189	51	-0.0514003	-0.0440579	34
Wisconsin	12.04	0.428	33	0.0003551	-0.0374646	29
Wyoming	17.41	1.061	8	0.0551404	-0.0126597	11
Pearson Correlation between Unadjusted Suicide Rate and Unadjusted Life Sat Coefficients						0.249
Spearman Rank Correlation between Unadjusted Suicide Risk and Unadjusted Life Sat Coefficients						0.255
Pearson Correlation between Adjusted Suicide Risk and Adjusted Life Sat Coefficients						0.127
Spearman Rank Correlation between Adjusted Suicide Risk and Adjusted Life Sat Coefficients						0.271

Notes: Crude suicide rates are taken from the report "Ranking America's Mental Health: An Analysis of Depression Across the States." Adjusted suicide risks are the hazard ratios corresponding to the estimated coefficients on state fixed effects from a Cox Proportional Hazards regression using the National Longitudinal Mortality Study data. Coefficients for dissatisfaction with life are taken from regressions using data from the Behavioral Risk Factor Surveillance System (survey years between 2005-2008). Controls for income, education, age, race, gender, and marital and employment status are included in both the NLMS and BRFSS regressions.