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Cognitive Habits Linked to Resilience: Surprising Commonalities across the United States

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Abstract

Background: Research has documented many geographic inequities in health. Research has also documented that the way one thinks about health and quality of life (QOL) affects one's experience of health, treatment, and one's ability to cope with health problems.

Purpose: We examined United-States (US) regional differences in QOL appraisal (i.e., the way one thinks about health and QOL), and whether resilience-appraisal relationships varied by region.

Methods: Secondary analysis of 3,955 chronic-disease patients and caregivers assessed QOL appraisal via the QOL Appraisal Profile-v2 and resilience via the Centers for Disease Control Healthy Days Core Module. Covariates included individual-level and aggregate-level socioeconomic status (SES) characteristics. Zone improvement plan (ZIP) code was linked to publicly available indicators of income inequality, poverty, wealth, population density, and rurality. Multivariate and hierarchical residual modeling tested study hypotheses that there are regional differences in QOL appraisal and in the relationship between resilience and appraisal.

Results: After sociodemographic adjustment, QOL appraisal patterns and the appraisal-resilience connection were virtually the same across regions. For resilience, sociodemographic variables explained 26 % of the variance; appraisal processes, an additional 17 %; and region and its interaction terms, just an additional 0.1 %.

Conclusion: The study findings underscore a geographic universality across the contiguous US in how people think about QOL, and in the relationship between appraisal and resilience. Despite the recent prominence of divisive rhetoric suggesting vast regional differences in values, priorities, and experiences, our findings support the commonality of ways of thinking and responding to life challenges. These findings support the wide applicability of cognitive-based interventions to boost resilience.

Keywords: appraisal; resilience; cognitive; quality of life; societal; geographic

Abbreviations: MANOVA = Multivariate Analysis of Variance; PCA = principal components analysis; QOL = quality of life; SES = socioeconomic status; US = United States; ZIP = Zone Improvement Plan (postal code)

Introduction

Over the past three decades, it has become increasingly evident that the way one thinks about health, healthcare, and quality of life (QOL) has a substantial impact on one's experience of health, healthcare, and QOL **[1- 4].** Appraisal assessment provides a lens to understanding patients' internal resources, including ways of thinking about QOL and goals, experience sampling, standards of comparison, and patterns of emphasis **[3,5,6].** By querying people about what they are thinking about when answering QOL questionnaires, appraisal-assessment tools are able to characterize what QOL means to different people, what goals are relevant to people's sense of QOL, to whom people compare themselves, what types of experiences they tend to think about when answering questions, and what aspects of all of the above (i.e., QOL definition, goals, standards of comparison, experiences sampled) are emphasized in deriving their responses.

Research on a range of patient groups has revealed that cognitive appraisal processes can mediate or moderate the impact of health-state changes on QOL and well-being **[7,8].** While there is no right or wrong way for people to appraise their own QOL, inter-individual differences can obscure the impact of health-state changes and can attenuate evidence for the effectiveness of treatment interventions [9,10]. Appraisal assessment can explain why two patients with the same objective outcome have vastly different perspectives and evaluations of their health or QOL **[9,11].**

Appraisal can, for example, shed light on differing patient expectations of treatment outcomes or of what "quality of healthcare" means to an individual **[4].** Appraisal assessment has provided a tool for helping patients and providers with medical decision-making and end-of-life care planning, by highlighting patient values and goals and

examining how the various treatment options fit those values and goals criteria **[5].**

While researchers generally agree that geography should not determine disease outcomes **[12]**, spatial epidemiological research has helped to highlight disparities in disease- clustering patterns **[13]**, access to public health, and healthcare services **[14,15]**. Research has also suggested that people from different socioeconomic groups may have very different ways of appraising their QOL **[9]**, health care **[4]**, and treatment-related changes **[16]**. Studies comparing people living with human immunodeficiency virus who received fee-for-service Medicaid versus a Medicaid program providing greater care management and access show divergences over time in appraisal processes that drove satisfaction ratings. For example, fee-for- service Medicaid patients' satisfaction ratings were driven by a continued focus on routine medical needs, whereas Care-Management Medicaid patients' satisfaction ratings were driven by focusing on greater access to specialists **[4].** It is also possible that theseappraisal differences reflect variations in health literacy and utilization of preventive healthcare **[1]**. While this growing evidence base supports the importance of appraisal assessment for medical care and medical decision-making **[11]**, it is not known whether QOL appraisal varies geographically within the United States (US); nor what the impact of such variation might be on resilience to health problems. In this context, "resilience" is the idea that people maintain engagement and functioning despite physical and/or mental health challenges. The present work examines US regional differences in the ways people with chronic conditions and their caregivers appraise QOL, and in the relationship between resilience and appraisal. Specifically, we sought to test two hypotheses: (1) that there are regional differences in QOL appraisal and; that there are regional differences in the relationship between resilience and appraisal.

Materials and Methods

Sample

This secondary analysis utilized data collected in 2016 from 3,955 US respondents from chronic/rare disease panels comprising patients representing about 350 diagnoses and their caregivers. Eligible participants were 18 years of age or older and able to complete an online questionnaire. Participants were excluded from participating if they were less than 18 years of age, and/or if they were unable to provide written informed consent. Participants included US patients and caregivers recruited from panels of Rare Patient Voice, LLC. Participants were invited to participate in this academic study aimed at developing new measures of reserve- building and of appraisal. Normally panel participants are paid for their participation. For this academic study, however, they were not offered compensation.

Procedure

This secondary analysis utilized data from a web-based questionnaire. The study was reviewed and approved by the New England Independent Review Board (NEIRB#15-254). All participants provided written informed consent.

Measures

Cognitive appraisal processes underlying responses to patient-reported outcomes (i.e., measures of health-related QOL and well-being) were assessed using the *QOL Appraisal Profile*–v2 **[17]**. This measure includes

85 closed-ended items and enables descriptive analyses of individual differences in frame of reference (e.g., goals they want to achieve, responsibilities they want to let go), ways of recalling experiences (e.g., the most recent, the most upsetting), standards of comparison (e.g., other patients, one's ideal health), and relative emphasis in reconciling discrepant experiences (e.g., positive versus negative, self-focused versus other- focused). It yields 12 composite scores: Wellness Focus, Health Focus, Recent Challenges, Spiritual Focus, Relationship Focus, Maintenance Roles, Independence, Reduction of Responsibilities, Pursuit of Dreams, Anticipation of Decline, Worry-Free state, and Lightness of Being (**see Appendix Table A.1. for definitions**).

Resilience was operationalized using residual modelling **[3,17,18]** with items from the *Centers for Disease Control (CDC) Healthy Days Core Module* **[19].** The first item (also the general health item of the PROMIS-10 described below) queries the respondent's general health. The second and third items ask the respondent to indicate how many days of the past 30 days their physical (Physical) or mental (Mental) health, respectively, was not good. The fourth item, Activities of Daily Living Impaired (ADL Impaired), asks how many days of the past 30 the respondent's poor physical or mental health kept them from doing their usual activities, such as self-care, work, or recreation. Resilience is exemplified by an individual endorsing a higher level of functioning or performance than would be expected given their health impairment. For example, one would expect that someone with two days of physical-health impairment and four days of mental-health impairment would have six days of ADL impairment. If they have in fact fewer than six days of ADL, then they would have a higher score on the Resilience metric. Our approach built on a precedent for using residual modeling to study epiphenomena **[3,18]**. Specifically, we computed a regression model with the CDC Healthy Days ADL Impaired as the dependent variable, and Physical Health, Mental Health, and their interaction as predictors. The residuals from the regression model were saved and multiplied by negative one (-1). Accordingly, a high Resilience score reflects fewer-than-expected days that the respondent is unable to function due to physical or mental health problems or their synergistic effect **[19]**.

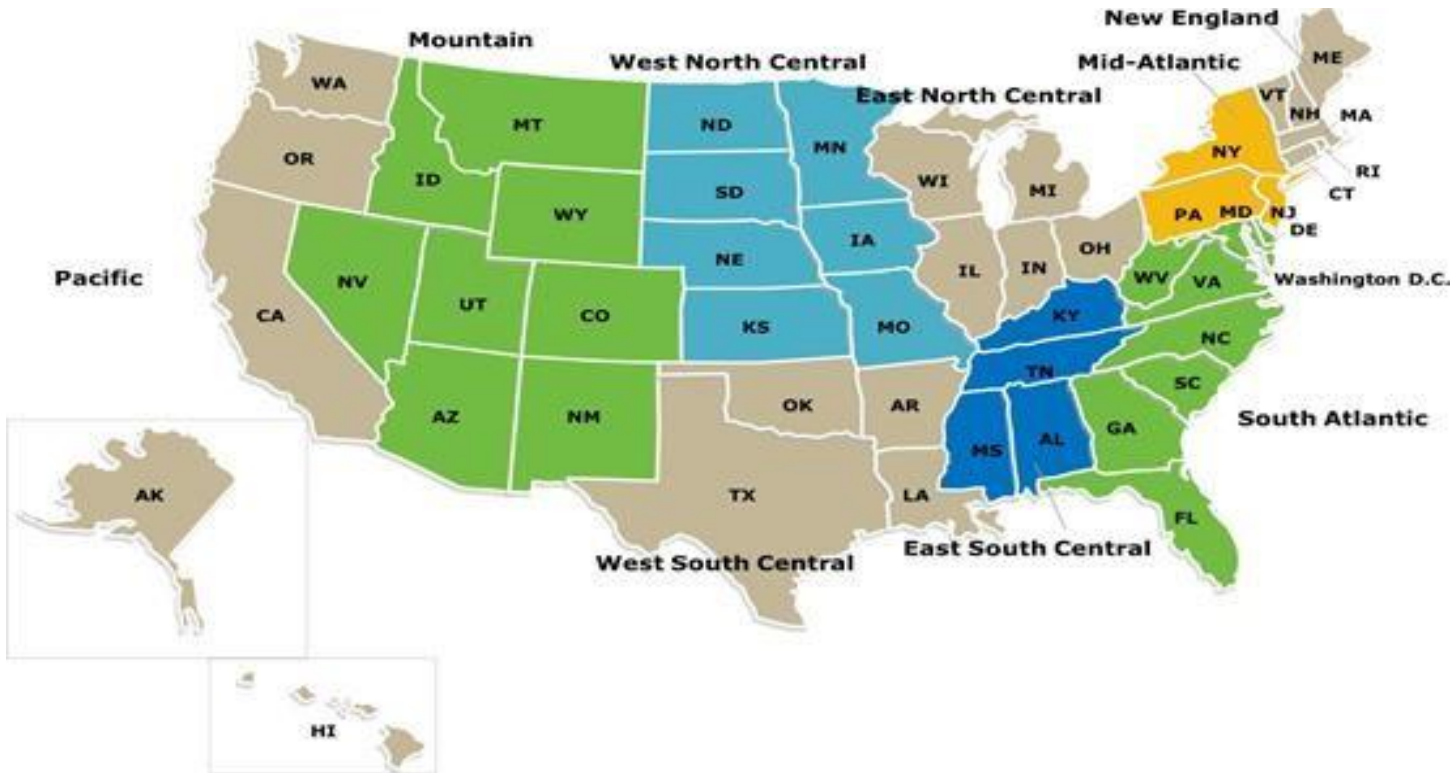
Covariates included individual-level and aggregate-level sociodemographic and socioeconomic status (SES) characteristics. These covariates were selected because they are objective indicators to be adjusted in our analyses of subjective variables' association with

region **[20]**. Individual-level characteristics included age, age at diagnosis, whether the person received help completing the questionnaire, gender, number of comorbidities, marital status, ethnicity, race, income, employment status, occupational complexity (past or present), education, mother's education, father's education, and Zone Improvement Plan (ZIP) Code ("postal code"). Aggregate-level characteristics were linked via individual ZIP Codes to the analytic data set using the most recent publicly-available data that wecould obtain from the US Census Bureau's American Community Survey **[21]** and the Inter- university Consortium for Political and Social Research **[22]**. Recency varied by topic: these ZIP Code data included US region, population @ 2013, population density @ 2013, urban-rural characterization @ 2003 [1 = urban, 5 = rural], median household income @ 2013, percent of households below poverty level @ 2017. We also obtained Gini coefficient @ 2010 by state **[23]** [higher numbers indicate a more unequal distribution of income] **[24,25]**. We also created a variable to assess relative wealth ("Keeping up with the Joneses") which reflected the individual's income relative to the typical level of wealth in their ZIP Code.

Statistical Analysis

Frequency distributions examined the prevalence of ZIP Codes by state in the sample and led to a decision to aggregate at the regional level to examine geospatial differences, to have enough sample size for multivariate comparisons **(Figure 1)**. Descriptive statistics characterized the sample sociodemographic characteristics at the individual and aggregated regional levels. Due to small sample sizes of participants from Alaska and Hawaii (n = 24), data only from the 48 contiguous states were included in the multivariate analyses[2].

Figure 1: United States by Region. Image Source. States that are contiguous and within the same region have the same color for ease of distinguishing the regions used in analysis.



Principal components analysis with an Oblimin rotation and Kaiser Normalization was used for data reduction of the aggregate-level SES characteristics. Pearson correlation coefficients were used to examine the association between appraisal scores and resilience by region. Multivariate Analysis of Variance (MANOVA) using listwise deletion tested the hypothesis that region (the key independent variable) was associated with appraisal scores (12 dependent Model I included the individual- and aggregate-level sociodemographic covariates and saved the residuals for use in the subsequent model. Model II included the 12 appraisal scores to predict the covariate residuals from Model I and saved the new residuals for use in the subsequent model. Model III included the categorical variable for region to predict the residuals from Model II and saved the new residuals for use in the subsequent model. Model IV included 12 region-by-appraisal interactions to predict the Model III residuals. variables, after adjusting for individual- and aggregate-level sociodemographic characteristics (covariates). A hierarchical series of general linear models tested the hypothesis that region, appraisal variables, and their interactions explained variance in resilience (dependent variable), after adjusting for individual- and aggregate-level sociodemographic characteristics (covariates). These models were implemented in four stages.

Due to the relatively large sample size and the many comparisons considered to test our hypotheses, we decided to focus on effect sizes that were "small" or larger using Cohen's criteria **[26]** rather than on p-values. Accordingly, individual predictors' eta-squared (η^2) statistics had to be at least 0.01 (1% of variance explained) for us to consider them noteworthy. Statistical analyses were implemented using IBM SPSS version 26 **[27]**.

Results

Individual-Level Sample Demographics

The analytic sample included between 2,853 and 3,955 people who had complete data on the relevant measures for a given analysis. This sample represented between 68% and 95% of the 4,174 respondents. In other words, due to sporadic missing data, different subsets of the 4,174 were kept in the analyses. **Table 1** provides the individual-level sociodemographic characteristics. The sample was comprised mostly of patients (82%), with a mean age of 48 years, and mean age at diagnosis was 41 years. The sample was predominantly female (86%), White (91%), married or cohabitating (67%), and not currently employed (53%). While 53% of respondents had completed college or more education, only about 28% of their parents had. The median income range was $ 50,000-100,000.

Table 1: Person-Level Demographic Characteristics (N = 3,955), United States, 2016

Variable		
Role	Patient	80 %
	Caregiver	18 %
	Both	2 %
	Missing	0 %
Age	Mean (SD)	48.2 (13.3)
Age at diagnosis	Mean (SD)	40.8 (16.9)
Had help completing questionnaire		3 %
Gender	Male	14 %
	Female	86 %
	Missing	0 %
Number of comorbidities	0	4 %
	1	11 %
	2	14 %
	3	17 %
	4	17 %
	5	13 %
	6	11 %
	7 or more	7 %
	Missing	0 %
Marital Status	Never Married	14 %
	Married	61 %
	Cohabitation/ Domestic Partnership	6 %
	Separated	2 %
	Divorced	12 %
	Widowed	4 %
	Missing	1 %
Ethnicity (%)	Not Hispanic or Latino	91 %
	Hispanic or Latino	5 %
	Missing	3 %
Race (%)	Black or African American	5 %
	White	91 %
	Other	2 %
	Missing	2 %
Income (%)	Less than $ 15,000	9 %
	$ 15,001 to $ 30,000	14 %

	$ 30,001 to $ 50,000	17 %
	$ 50,001 to $ 100,000	28 %
	$ 100,001 to $ 150,000	12 %
	$ 150,001 to 200,000	4 %
	Over $ 200,000	3 %
	Missing	0 %
Employment Status	Employed	47 %
	Unemployed	12 %
	Retired	13 %
	Disabled Due to Medical Condition	26 %
	Missing	2 %
Work Complexity (past or present)	Mean (SD), 1-5 scale	3.3 (1.0)
Education	Some high school	2 %
	High school diploma/GED	25 %
	Technical or trade school degree	19 %
	Bachelor's degree	31 %
	Graduate or professional degree	22 %
	Missing	2 %
Mother's Education	Some high school	14 %
	High school diploma/GED	46 %
	Technical or trade school degree	12 %
	Bachelor's degree	16 %
	Graduate or professional degree	9 %
	Missing	3 %
Father's Education	Some high school	16 %
	High school diploma/GED	36 %
	Technical or trade school degree	13 %
	Bachelor's degree	16 %
	Graduate or professional degree	13 %
	Missing	6 %

Some sets of percentages may not add up to 100 % due to rounding.

GED = General Educational Development (i.e., high-school equivalency test)

SD = standard deviation

Aggregate-Level Sample Demographics

Table 2 provides the aggregate-level sociodemographic characteristics considered in the analysis. Nine of the ten regions had sufficient sample sizes to be retained in subsequent multivariate analyses (i.e., non- contiguous states were excluded from analysis). The majority of respondents lived in a metropolitan area **[22]**, with mean population natural log [Ln] of 9.9 (i.e., about 20,000 people in their ZIP Code) and a mean Ln density of 6.8 (i.e., about 900 people per square mile). The median household income by ZIP Code was about $60,000, and 9% of the people in the ZIP codes included in our sample were below the poverty level. The mean Gini coefficient by state was 0.47, which is mid-range in the worldwide empirical distribution of 0.24-0.63 **[24,25]**, where zero indicates a perfectly uniform distribution of population wealth.

Table 2: Aggregate-Level Demographic Characteristics (N=3,955)

Aggregate-Level Demographic Characteristics (N = 3,955)				
Variable	**Region**	**States included**		
US Region: N, %	East North Central	Illinois, Indiana, Michigan, Ohio, Wisconsin	755	19 %
	East South Central	Alabama, Kentucky, Mississippi, Tennessee	218	6 %
	Middle Atlantic	Maryland, New Jersey, New York, Pennsylvania	464	12 %
	Mountain	Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico	317	8 %
	New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	215	5 %
	Non-Contiguous	Alaska, Hawaii	24	1 %
	Pacific	California, Oregon, Washington	549	14 %
	South Atlantic	Delaware, Florida, Georgia, North Carolina, South Carolina, Virginia, Washington DC, West Virginia	809	20 %
	West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota	286	7 %
	West South Central	Arkansas, Louisiana, Oklahoma, Texas	342	42 %
ZIP-Code-Based Societal Variables	Mean Ln Population, 2013 (SD)	NA	9.9	(0.9)
	Mean Ln Population Density, 2013 (SD)	NA	6.8	(1.7)
	Median Urban-Rural Continuum code, 2003 (%), 1 = urban, 9 = rural	NA	1	53 %
	Median Household income, 2013 (SD)	NA	$ 59,970	(23,067)
	% of households below poverty level, 2017	NA	9%	
		NA		
State-Based Societal Variable	Mean Gini coefficient (SD) (range 0%-100%; higher no. indicates worse income inequality)	NA	0.47	(0.02)
Some sets of percentages may not add up to 100% due to rounding. *Ln=natural log; SD=standard deviation*				

The principal components analysis (PCA) yielded four components that we labeled as Wealth, Population, Poverty, and Rural; these explained 65% of the variance (**Appendix Table A.2.**). Wealth had small correlations with Population (r = 0.21) and Poverty (r = -0.25), and a medium correlation with Rural (r = -0.32). Poverty was uncorrelated with Population (r = -0.03) and had a small correlation with Rural (r = 0.16).

Regional Differences in Appraisal?

Table 3 show results of the MANOVA investigating the importance of region (independent variable) in predicting the 12 appraisal scores (dependent variables), after adjusting for individual- and aggregate-level sociodemographic covariates. The overall model explained nearly 34 % of the variance (sum of all partial $\eta^2 = 0.339$). Among the sociodemographic covariates, significant multivariate effects predicting appraisal were detected for marital status, race, income, being employed, education, mother's education, number of comorbidities, age, age at diagnosis, and area population (data not shown). In predicting appraisal variables, all of the models had eta-squared coefficients that qualified as "small" using Cohen's criteria. Over and above the afore mentioned sociodemographic covariates, region had a multivariate effect that was statistically significant (omnibus results for Pillai's Trace F = 1.81, df = 96, 22,440; p < 0.0001) but practically insignificant.

Table 3: Results of MANOVA investigating regional differences in appraisal (N = 2853)

Results of MANOVA investigating regional differences in appraisal (N = 2853)				
Multivariate Test				
		F	**Sig.**	**(Partial) η^{2}***
Region Effect	**Pillai's Trace**	1.821	0.000	0.008
Tests of Between-Subjects Effects				
Corrected Model	Wellness Focus	8.53	0.00	**0.116**
	Health Worries	8.60	0.00	**0.116**
	Recent Challenges	6.52	0.00	**0.091**
	Spiritual Focus	5.17	0.00	**0.073**
	Relationship Focus	3.28	0.00	**0.048**
	Maintain Roles	11.30	0.00	**0.148**
	Independence	2.60	0.00	**0.038**
	Reduce Responsibilities	3.74	0.00	**0.054**
	Pursue Dreams	5.39	0.00	**0.076**
	Anticipating Decline	4.95	0.00	**0.070**
	Worry Free	3.21	0.00	**0.047**
	Lightness of Being	2.47	0.00	**0.036**
Region	Wellness Focus	2.14	0.03	0.006
	Health Worries	2.55	0.01	0.007
	Recent Challenges	0.78	0.62	0.002
	Spiritual Focus	4.55	0.00	**0.013**
	Relationship Focus	0.83	0.58	0.002
	Maintain Roles	0.86	0.55	0.002
	Independence	0.49	0.86	0.001
	Reduce Responsibilities	2.89	0.00	0.008
	Pursue Dreams	2.70	0.01	0.008
	Anticipating Decline	1.46	0.17	0.004
	Worry Free	1.02	0.42	0.003
	Lightness of Being	1.03	0.41	0.003
Parameter Estimates				
Dependent Variable	Region	**B**	**Sig.**	**Partial η^{2}***
Wellness Focus	East North Central	0.01	0.90	0.000
	East South Central	-0.16	0.13	0.001
	Middle Atlantic	-0.15	0.15	0.001
	New England	0.02	0.88	0.000
	Pacific	0.08	0.39	0.000
	South Atlantic	0.05	0.58	0.000

	West North Central	0.12	0.22	0.001
	West South Central	-0.07	0.46	0.000
	Mountain	*(Referent for Deviation Contrast)*		
Recent Challenges	East North Central	0.10	0.22	0.001
	East South Central	0.04	0.70	0.000
	Middle Atlantic	0.16	0.12	0.001
	New England	0.02	0.83	0.000
	Pacific	0.03	0.74	0.000
	South Atlantic	0.07	0.40	0.000
	West North Central	-0.02	0.85	0.000
	West South Central	0.11	0.28	0.000
	Mountain	*(Referent for Deviation Contrast)*		
Spiritual Focus	East North Central	-0.12	0.12	0.001
	East South Central	0.21	0.06	0.001
	Middle Atlantic	-0.17	0.10	0.001
	New England	-0.17	0.11	0.001
	Pacific	-0.07	0.43	0.000
	South Atlantic	0.06	0.49	0.000
	West North Central	0.00	0.99	0.000
	West South Central	0.15	0.13	0.001
	Mountain	*(Referent for Deviation Contrast)*		
Relationship Focus	East North Central	0.09	0.29	0.000
	East South Central	-0.04	0.75	0.000
	Middle Atlantic	0.12	0.25	0.000
	New England	0.09	0.39	0.000
	Pacific	0.04	0.68	0.000
	South Atlantic	0.02	0.81	0.000
	West North Central	-0.06	0.54	0.000
	West South Central	0.04	0.70	0.000
	Mountain	*(Referent for Deviation Contrast)*		
Maintain Roles	East North Central	-0.07	0.36	0.000
	East South Central	-0.12	0.27	0.000
	Middle Atlantic	-0.17	0.08	0.001
	New England	-0.18	0.08	0.001
	Pacific	-0.13	0.14	0.001
	South Atlantic	-0.11	0.18	0.001
	West North Central	-0.02	0.86	0.000
	West South Central	-0.02	0.82	0.000
	Mountain	*(Referent for Deviation Contrast)*		
Independence	East North Central	0.00	0.97	0.000
	East South Central	-0.04	0.74	0.000
	Middle Atlantic	0.08	0.45	0.000
	New England	0.04	0.69	0.000
	Pacific	0.01	0.95	0.000
	South Atlantic	0.02	0.82	0.000
	West North Central	-0.08	0.40	0.000
	West South Central	-0.05	0.62	0.000
	Mountain	*(Referent for Deviation Contrast)*		
Reduce	East North Central	0.16	0.05	0.001

Responsibilities				
	East South Central	-0.05	0.65	0.000
	Middle Atlantic	0.12	0.22	0.001
	New England	0.19	0.07	0.001
	Pacific	0.26	0.00	0.003
	South Atlantic	0.20	0.02	0.002
	West North Central	0.14	0.16	0.001
	West South Central	0.00	0.97	0.000
	Mountain	*(Referent for Deviation Contrast)*		
Pursue Dreams	East North Central	-0.19	0.02	0.002
	East South Central	-0.37	0.00	0.004
	Middle Atlantic	-0.20	0.05	0.001
	New England	-0.01	0.93	0.000
	Pacific	-0.06	0.53	0.000
	South Atlantic	-0.16	0.06	0.001
	West North Central	-0.18	0.07	0.001
	West South Central	-0.22	0.02	0.002
	Mountain	*(Referent for Deviation Contrast)*		
Anticipating Decline	East North Central	0.02	0.83	0.000
	East South Central	-0.06	0.59	0.000
	Middle Atlantic	0.11	0.28	0.000
	New England	0.21	0.04	0.001
	Pacific	0.08	0.39	0.000
	South Atlantic	0.09	0.28	0.000
	West North Central	-0.05	0.57	0.000
	West South Central	0.12	0.24	0.001
	Mountain	*(Referent for Deviation Contrast)*		
Worry Free	East North Central	-0.05	0.51	0.000
	East South Central	0.02	0.89	0.000
	Middle Atlantic	0.01	0.90	0.000
	New England	0.01	0.92	0.000
	Pacific	-0.07	0.43	0.000
	South Atlantic	-0.12	0.17	0.001
	West North Central	-0.04	0.70	0.000
	West South Central	-0.15	0.13	0.001
	Mountain	*(Referent for Deviation Contrast)*		
Lightness of Being	East North Central	0.05	0.51	0.000
	East South Central	0.12	0.30	0.000
	Middle Atlantic	0.03	0.78	0.000
	New England	-0.10	0.36	0.000
	Pacific	0.00	0.96	0.000
	South Atlantic	0.04	0.64	0.000
	West North Central	0.13	0.17	0.001
	West South Central	0.12	0.23	0.001
	Mountain	*(Referent for Deviation Contrast)*		

***Bolded** if $\eta 2 > .020$ for overall model or if partial $\eta 2 > 0.010$ for region variable or for individual regions.

Appraisal scores did not differ substantially by region. After adjusting for covariates, no regional appraisal difference accounted for an η^2 larger than 0.013. Even for the domain that best distinguished regions (Spiritual Focus), mean differences were so small as to be barely

visible, even when regions were sorted by mean (see dotted line of the overall mean in **Figure 2).**

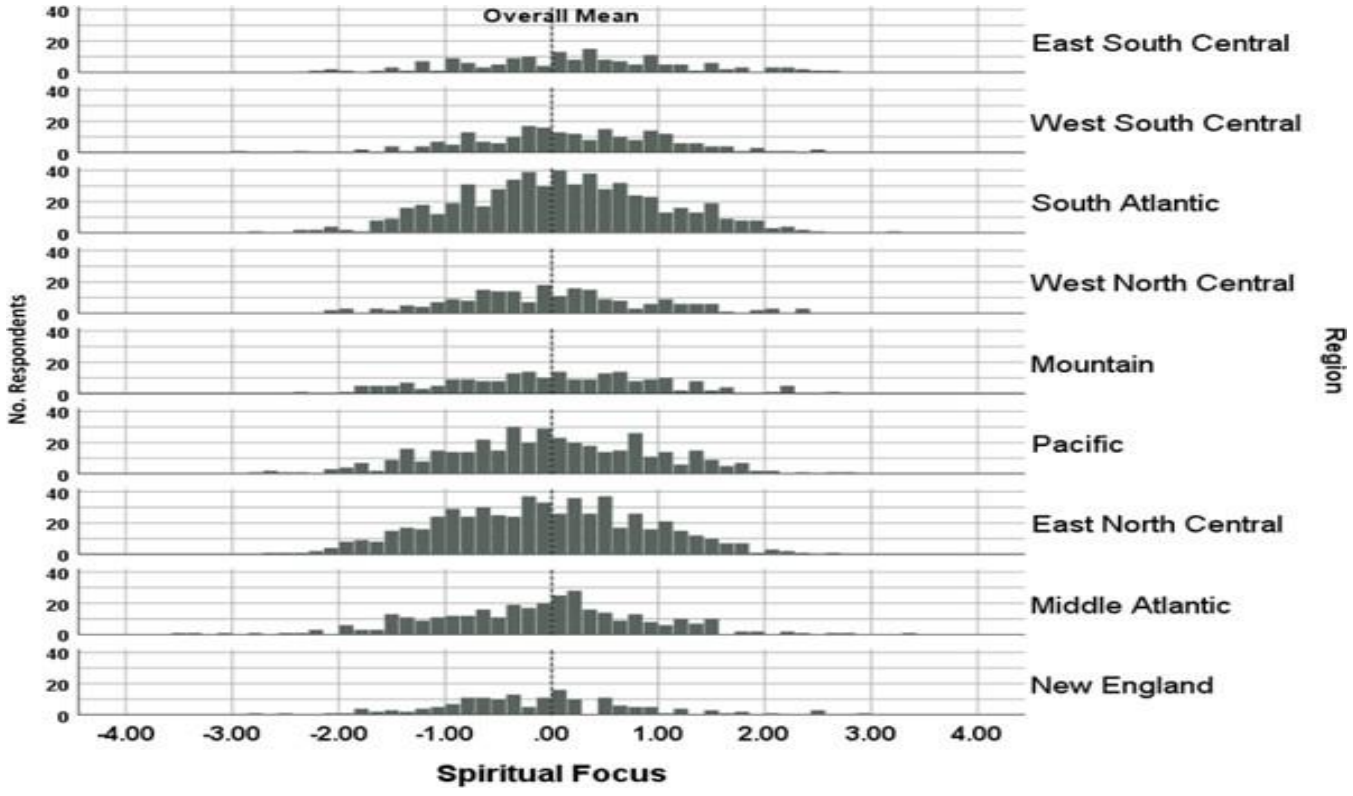


Figure 2: Spiritual Focus Means by Region

Histogram panel shows the distribution of Spiritual Focus appraisal scores by region in descending order. Contrast results revealed a small effect size ($\eta^2 = 0.013$) such that compared to the overall US mean East South Central and West South Central had higher Spiritual Focus scores; East North Central, Middle Atlantic, and New England had lower Spiritual Focus scores.

Regional Differences in Relationship between Resilience and Appraisal

As a basic indicator of the way relationships did or did not differ by region, **Table 4** shows correlation coefficients between appraisal and resilience by region, with conditional formatting to indicate the effect size. Of note, Wellness Focus, Health Worries, and Recent Challenges had consistent medium or small correlations across regions with one or two exceptions by region. Relationship Focus and Maintain Roles generally had correlations less than ± 0.10, with a few exceptions that were between 0.10 and 0.30 (i.e., small effect size). The next model, with Model I residuals as a dependent variable (i.e., resilience adjusted for sociodemographic), explained 17% of the variance by including the 12 appraisal composite scores. Appraisal patterns associated with greater resilience were characterized by a greater emphasis on Wellness and Spiritual Focus, and less on Health Worries, Recent Challenges, Anticipating Decline, and Being Worry-Free ($p < 0.0001$ to 0.02). The next model, with Model II residuals as a dependent variable (i.e., resilience adjusted for sociodemographic and appraisal), explained just 0.1% of the variance by including Region. The final model, with Model III residuals (i.e., resilience adjusted for sociodemographic, appraisal, and region) as a dependent variable, explained even less of the variance (0.05%) by including Appraisal-by-Region interactions.

Discussion

The study findings underscore a geographic universality across the contiguous US in the connections between appraisal and resilience. Despite the recent prominence of divisive rhetoric suggesting vast regional differences in values, priorities, and experiences, our findings support the commonality of ways of thinking and responding to life challenges. While our content focuses on health, we believe these findings generalize to other life domains and societal priorities. The universality we observed in the QOL appraisal-resilience connection has distinct clinical implications. It suggests ways in which cognitive- coaching interventions could help patients and caregivers increase their resilience. Our results support the kind of interventions that help individuals to pursue a calm, healthy lifestyle; practice self-acceptance; and maintain activities that help them remain positive and balanced. Our results also support de-emphasizing rumination about "worst moments." In parallel, our results support the benefit of a "spiritual focus," one that prioritizes helping others, leaving a legacy of a positive impact on the world, and finding ways to feel part of something greater than oneself. All these cognitive appraisal processes were distinctly associated with greater resilience in the face of health problems. While the study sample is large and heterogeneous in its illness representation, some limitations must be acknowledged. First, the data are cross-sectional, limiting our ability to make causal inference. Second, the sample disproportionately reflects some demographic

characteristics (i.e., middle-aged, white, female, married, and/or living with family members), which may affect external validity. Third, some aggregate-level demographic indicators were limited by the public unavailability of more recent data. Fourth, it is possible that the listwise deletion in the MANOVA analyses (i.e., from 3,955 to 2,853 cases) biased coefficients. Fifth, our regional comparisons were limited by the available sample sizes, which reduced our power to detect small effect sizes.

Generally speaking, researchers do not like to report null results. In this case, however, our null results underscore important commonalities in appraisal, resilience, and the appraisal- resilience connection across diverse geographic regions.

They also suggest a wide applicability of relatively standardized interventions to support resilience. We did find that resilience was negatively associated with being disabled from work, having more comorbidities, and being older. Such sociodemographic factors as well as SES factors *per se* can present potent barriers to treatment adherence, which is increasingly the focus of attention among healthcare providers promoting person-centered healthcare **[28,29]**. Social-service initiatives that can help individuals with such challenges may by extension better enable clinical interventions aimed at strengthening resilience. With pragmatic solutions to such barriers, we see great promise in appraisal-based approaches to helping individuals become more resilient in the face of health challenges.

Table 4: Pearson Correlation Coefficients Summarizing Resilience-Appraisal Association by Region

Pearson Correlation Coefficients Summarizing Resilience-Appraisal Association by Region												
	Wellness Focus	Health Worries	Recent Challenges	Spiritual Focus	Relationship Focus	Maintain Roles	Independence	Reduce Responsibilitie	Pursue Dreams	Anticipating Decline	Worry-Free	Lightness of Being
East North Central	0.41	-0.28	-0.18	0.02	0.06	0.13	0.02	-0.03	0.04	-0.08	-0.04	0.05
East South Central	0.42	-0.37	-0.24	0.04	0.15	-0.01	0.08	0.12	0.03	-0.03	0.07	0.05
Middle Atlantic	0.39	-0.36	-0.13	0.07	0.07	0.16	-0.08	-0.04	-0.03	-0.09	-0.01	0.16
Mountain	0.48	-0.35	-0.20	0.08	0.05	0.17	0.02	-0.02	-0.02	-0.13	-0.01	-0.05
New England	0.44	-0.39	-0.17	0.04	0.02	0.08	-0.03	-0.02	0.06	0.00	0.04	-0.03
Non-Contiguous	0.51	-0.50	-0.27	0.05	0.26	0.16	0.12	-0.15	0.02	0.03	0.23	0.05
Pacific	0.38	-0.37	-0.22	-0.02	0.01	0.08	0.04	-0.01	-0.02	-0.04	0.00	0.05
South Atlantic	0.40	-0.36	-0.24	0.11	0.07	0.03	-0.01	0.02	0.05	-0.03	-0.01	0.05
West North Central	0.30	-0.31	- 0.09	-0.04	0.12	0.21	-0.08	0.01	-0.08	-0.03	0.00	0.02
West South Central	0.33	-0.38	- 0.24	0.03	- 0.01	0.06	0.00	-0.01	0.16	-0.13	0.01	0.09

Cohen's ES small med large

Table 5. Summary of Results of Hierarchical Series of Regressions Predicting Resilience

Summary of Results of Hierarchical Series of Regressions Predicting Resilience							
Model	**Dependent variable**	**Adjusted for**	**F statistic**	**df**	**p-value**	**Adjusted R^2**	**Cumulative R^2**
I.	Resilience	Sociodemographic Covariates	80.5	16	0.0001	0.255	0.000
II.	Model I residuals	Appraisal Main Effects	64.1	12	0.0001	0.173	0.428
III.	Model II residuals	Region	1.5	8	0.15	0.001	0.429
IV.	Model III residuals	Appraisal-by-Region Interactions	1.01	108	0.45	0.000	0.429

Declarations

Ethics approval and consent to participate. The study was reviewed and approved by the New England Review Board (NEIRB#15-254), and all participants provided informed consent. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Availability of Data and Material: The study data are confidential and thus not able to be shared.

Competing Interests: All authors declare that they have no potential conflicts of interest and report no disclosures.

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Authors' Contributions

CES and TJS discussed the idea of looking at associations between appraisal and resilience from a geographic perspective. CES and RBS designed the research study.

WM provided access to the sample.

CES performed the research. CES, RBS, and BDR analyzed the data. CES wrote the paper and WM, RBS, BDR, SS, and TJS edited the manuscript. All authors read and approved the final manuscript.

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Appendix Table A.1. Description of QOLAPv2 Appraisal Component Scores*

	Second-Order Component Name	Meaning of QOL	Goals	Experience Sampling	Standards of Comparison	Combinatory Algorithm	First-Order Components Included	PCA Variance Explained
1	Wellness Focus		x	x	x		Calm, healthy lifestyle, self acceptance, keep up activities and health care, focused on improvements, used to how things are, remain positive and balanced - do not think of the worst moments	6.6
2	Health Worries		x	x	x		Health worries - concern about what doctors say, high frequency of social comparison	6.1
3	Recent Challenges		x	x		x	Recall relevant episodes and recent challenges, accept people, let go of self-expectations, make multiple comparisons	5.9
4	Spiritual Focus	x	x				Faith and generativity	5.1
5	Relationship Focus	x	x				Romance improved relationships, self-acceptance	4.7
6	Maintain Roles	x	x				Accomplishments and maintaining community and work roles (versus getting rid of family problems, self-acceptance, calm, no regrets)	4.6
7	Independence	x	x				Independence - resolve problems - stay at home - no regrets, resolve recent money problems and other negative circumstances, keep active and fully participate	4.5
8	Reduce Responsibilities	x	x	x			Let go of responsibilities for house, others, self-expectations, spend time with family, influence by questionnaire	4.2
9	Pursue Dreams		x		x		Pursue dreams and goals, change living situation versus focus on comparisons to others my age and stay in current living situation	4.2
10	Anticipating Decline		x			x	Prepare loved ones and living situations for declines - ups and downs, compare self to what MD told them	4.0
11	Worry-Free		x		x		Compare to others without health limits versus those who have had similar illness, be worry free, solve money, living, practical problems versus accept people and roles, let go of self-expectations	3.9
12	Lightness of Being			x	x		Spontaneous - not complain - how I saw myself before illness, how others see me	3.8
								Total 57.6

*Adopted with permission from Rapkin et al., [17].

Appendix Table A.2. Pattern Matrix of Aggregate-level SES Principal Components Analysis

Component Loadings				
	Wealth	*Population*	*Poverty*	*Rural*
% of Households >=$200,000	0.9			
Mean Income	0.8			
Median Income	0.7		-0.4	
% of Households $150,000 to $199,999	0.7			
% of Households $100,000 to $149,999	0.5		-0.4	
% of Households $35,000 to $49,999	-0.5			
% of Households $25,000 to $34,999				
Population		1		
Households, 2017		1		
Ln Population		0.8		
Ln Population Density		0.5		-0.4
% of Households <$10,000			0.7	
% of Households with Income in the past 12 months below poverty level, 2017			0.7	
% of Households $50,000 to $74,999	-0.5		-0.6	
% of Households $10,000 to $14,999			0.6	
% of Households $75,000 to $99,999			-0.6	
% of Households $15,000 to $24,999			0.5	
Urban Influence code, 2003				1
% of Commuters Working in Metropolitan Areas				-1
Urban-Rural Continuum code, 2003				0.9
Extraction: Principal Components. Rotation: Oblimin with Kaiser Normalization.				
Eigenvalue	6.76	3.46	1.57	1.30
Total % of variance explained				65.41