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State-level unemployment and negative emotions throughout the Covid-19 pandemic in the United States

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A B S T R A C T

Although prior research has assessed public mental health in the U.S. throughout the COVID-19 pandemic, it is unclear how area-level unemployment impacted psychological well-being; moreover, studies that examine potential effect heterogeneity of the impact of area-level unemployment on well-being by employment status are lacking. To address these shortcomings, this study utilized data from Gallup's repeated cross-sectional, nationally representative COVID-19 web survey collected between April 2020 and July 2021 (n = 132,971). Survey modified Poisson regression models were estimated to determine the association between current unemployment rate in respondents' state of residence and experience of each of the following negative emotions during a lot of the prior day: sadness, worry, stress, anger, loneliness, depression, and anxiety. These models were stratified by employment status and sequentially adjusted for individual-level covariates, state fixed effects, and current state-level COVID-19 mortality. State-level unemployment was most strongly associated with sadness, followed by worry, anger, loneliness, stress, and anxiety; no associations were observed for depression. For sadness, worry, and stress, associations were strongest among full-time employed and retired individuals, and weakest among unemployed respondents and homemakers. Moreover, there was some evidence that state-level unemployment was negatively associated with the experience of anger in the early stages of the pandemic, and positively in its later stages. In sum, these findings suggest that Americans' emotional experience during the COVID-19 pandemic was considerably impacted by the state of the economy, highlighting the need for risk-buffering social policies.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic in the United States has caused not only high COVID-19-related and excess all-cause mortality (Bilinski and Emanuel, 2020), but also substantial social and economic consequences. In March 2020, fear of infection, stay-at-home orders, mandated business closures, and other measures to mitigate COVID-19 transmission resulted in massive layoffs and unemployment levels not observed since the Great Depression of 1929–1933, with over 22 million jobs lost between January and April (Congressional Research Service, 2021b; Organisation for Economic Co-operation and Development, 2020). Such levels of unemployment may have severe impact on public mental health due to psychosocial stress induced by perceived job insecurity and economic uncertainty (Brenner and Bhugra, 2020; Burgard et al., 2012; Modrek and Cullen, 2013). At the individual level, job loss and unemployment are negatively associated with overall health and mental health outcomes, even if the period of unemployment is

short (Cygan-Rehm et al., 2017; McKee-Ryan et al., 2005; Paul and Moser, 2009). At the population level, evidence from prior economic recessions suggests that high area-level unemployment is associated with elevated psychological distress and depressive symptoms, even among those who remain employed (Briody et al., 2020; Modrek et al., 2015). Although, by late 2021, the U.S. seasonally adjusted unemployment rate had declined from its peak of 14.8% in April 2020 to levels only slightly higher than pre-pandemic (U.S. Bureau of Labor Statistics, 2021a), the short- and longer-term impact of this economic shock on population mental health continues to be of public health concern.

Recent studies have highlighted the implications of a COVID-19-related economic downturn for public mental health (Brenner and Bhugra, 2020). These relationships appear even stronger than concerns that are related to COVID-19 itself; studies conducted in the second half of March 2020 found that worries about economic consequences or pre-existing economic challenges were more strongly associated with symptoms of poor mental health than fear of infection, the practice of

social distancing, or being at risk of severe illness from COVID-19 (Kämpfen et al., 2020). Based on data from the U.S. Census Household Pulse Survey collected in December 2020, 53% of adults in households that had experienced job loss since mid-March 2020 showed symptoms of depression or anxiety, compared to 32% of adults in households that had not (Panchal et al., 2021). Across countries, in a survey conducted between March and May 2020, U.S. respondents were more likely to self-report stress, anxiety, or great sadness since the beginning of the outbreak compared to respondents in other high-income countries. Moreover, the proportion of respondents who reported having lost a job or source of income (27%), or being unable to pay for basic necessities, having used up all or most of their savings, and/or having borrowed money or taken out a loan because of the pandemic (31%) was higher in the U.S. than in all other countries surveyed (Williams et al., 2020). This disproportionate economic and psychological impact of COVID-19 may be attributable to the lack of universal health coverage and the relative absence of effective social policies in the U.S. compared to its peer countries, despite various economic measures that were implemented throughout 2020 to buffer the impact of the pandemic on American households (Lynch, 2020).

Although studies have examined mental health conditions at various time points since the pandemic began (Breslau et al., 2021; Ettman et al., 2020; Jia et al., 2021; McGinty et al., 2020; Riehm et al., 2021b; Robinson et al., 2022), key gaps in the literature remain. Studies that assess the impact of economic factors on psychological well-being during this sustained disaster have focused on individual-level or household-level employment or economic status, and are largely based on data collected in the early phase of the pandemic (Breslau et al., 2021; Hertz-Palmor et al., 2021; Riehm et al., 2021b). However, policy efforts to mitigate the economic impact of the COVID-19 pandemic on individuals, families, businesses, and industries may have buffered the impact of unemployment on psychological well-being over time. In the U.S., the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which was signed into law on March 27, 2020 (U.S. Department of the Treasury, 2021), provided direct Economic Impact Payments to eligible individuals, substantially increased unemployment benefits, and a foreclosure and eviction moratorium. Moreover, forgivable loans were made available to businesses through the Paycheck Protection Program, which was specifically intended to help companies retain their workers despite dramatic demand shortfalls and escalating supply constraints (U.S. Small Business Administration, 2022). Given these trends and policy initiatives, evaluating how area-level unemployment has impacted public mental health and well-being throughout the pandemic is critical. Moreover, while the economic impact of the pandemic has disproportionately burdened individuals of lower socioeconomic status and racial/ethnic minoritized groups (Webb Hooper et al., 2020), studies that examine potential heterogeneity of the impact of area-level unemployment on well-being by employment status are lacking.

To address these gaps, the current study used data collected since the early pandemic period by Gallup, Inc. from a nationally representative sample of U.S. adults to examine the association of state-level unemployment rates with the self-reported experience of negative emotions (sadness, worry, stress, anger, loneliness, depression, anxiety). We hypothesized that higher state-level unemployment would be associated with greater likelihood of experiencing various negative emotions, particularly in the early stages of the pandemic.

2. Methods

2.1. Participants and data collection

Respondent data were obtained from Gallup's COVID-19 web survey (Gallup, 2022), a survey based on the Gallup Panel, a probability-based, nationally representative panel of U.S. adults residing in all 50 states and the District of Columbia. The Gallup Panel consists of approximately 80,000 eligible individuals; adults between 18 and 34 years, individuals

with lower educational attainment and from racial/ethnic minoritized groups are oversampled, and weights are assigned to each member to mirror the socio-demographic composition of the U.S. general population. Respondents had to have internet access and understand English in order to participate in the COVID-19 web survey; completion was incentivized with a $1 post-paid incentive. Response rates ranged from 42% and 51% in 2020, and 27% and 36% in 2021; the average survey completion rate was 94% (Gallup, 2022). For the COVID-19 web survey, a simple random sample of approximately 1200 panel members was drawn and interviewed on a daily basis until April 26, 2020; about 500 individuals were interviewed each day between April 27, 2020, and August 17, 2020, and approximately 3000 individuals per month thereafter (Gallup, 2022). The present analysis is based on 132,971 observations collected from 51,651 panel members between April 1, 2020, and July 26, 2021. Because this study involved secondary analysis of de-identified data, it was exempted from ethical review.

2.2. Measures

Study outcomes included seven negative emotions: sadness, worry, stress, anger, loneliness, depression, and anxiety. Respondents were asked whether they had experienced each of these emotions "during a lot of" the prior day (with response options Yes/No) (Eichstaedt et al., 2021). Questions on depression and anxiety were only added to the questionnaire on May 11, 2020. To measure the exposure of interest for this study, we extracted seasonally adjusted, state-level unemployment data from the Local Area Unemployment Statistics database (U.S. Bureau of Labor Statistics, 2021b). Study covariates included age, gender, race/ethnicity, educational attainment, household income, marital status, and number of children in the household, as well as average daily state-level COVID-19 mortality (confirmed and probable deaths due to COVID-19) per 100,000 during the respective data collection interval (Centers for Disease Control and Prevention (CDC) Surveillance Review and Response Group, 2021). Gallup COVID-19 web survey respondents were linked to these external data using their ZIP code information and United States Postal Service ZIP Code Crosswalk files (U.S. Department of Housing and Urban Development Office of Policy Development and Research, 2021).

2.3. Statistical analysis

Given the changing data collection intervals, we divided the data into 32 data collection intervals. Given the relatively small number of full-time students ($n = 974$, or 0.7% of the total sample), data for these respondents were excluded.

We described socio-demographic characteristics of the study sample and the prevalence of each of the seven negative emotions across the study period using frequencies and weighted percentages or medians and interquartile ranges (IQR), as applicable. Using unadjusted modified Poisson regression (Barros and Hirakata, 2003) models, we then analyzed the bivariate association of each emotion with age, gender, race/ethnicity, educational attainment, household income, marital status, presence of children in the household, state-level unemployment, and state-level average daily COVID-19 mortality. We subsequently used separate modified Poisson regression models to regress the experience of each emotion on the unemployment rate in respondents' state of residence at the time of data collection. In addition to unadjusted models, we fit models adjusted for the above individual-level covariates, and additionally adjusted for state-level COVID-19 mortality and state fixed effects to account for time-invariant state-specific characteristics. Because negative emotions and unemployment rate were associated with time (i.e., month of data collection), we considered additional adjustment of regression models for time. However, given the high correlation between time and unemployment rate (Spearman's rho = −0.78; $p < 0.001$), we did not include time as a covariate.

We stratified these models by 6 employment categories: full-time

employed; part-time employed; unemployed, looking for work; unemployed, not looking for work; retired; and homemaker. We presented results as prevalence ratios (PR) and associated 95% confidence intervals (CI) based on a 10-point increase in the state-level unemployment rate. We also fit models including cross-level interaction terms between state-level unemployment and respondent employment status, and performed pairwise comparison tests between the predicted probabilities for each employment group. Finally, we evaluated potential modification of the effect of unemployment by time (month of data collection) using cross-product terms in unstratified models; in addition to multiplicative interaction, additive interaction was evaluated based on the predicted probabilities.

We conducted all analyses using Stata/SE 17.0 and complex survey methodology with respondent IDs as primary sampling units to obtain accurate standard errors (Gallup, 2022). Statistical significance was evaluated at $p < 0.05$ throughout.

3. Results

Table 1 contains the socio-demographic characteristics of the weighted study sample. Approximately half of the sample was female (51.5%), and the majority non-Hispanic white (71.8%). The largest proportion had some high school or less education (37.8%), were married (63.2%), lived in a household without children (68.5%), and had an annual household income of $60,000–$89,999 (20.9%). Over half were

Table 1
Socio-demographic characteristics of the study sample based on the Gallup COVID-19 web survey, April 01, 2020 – July 26, 2021 ($n = 132,971$).

	N (%)[†] / med [IQR]
Gender	
Male	68.587 (48.5)
Female	64,377 (51.5)
Age	51 [35;64]
Race/ethnicity	
Non-Hispanic white	113,454 (71.8)
Other	19,311 (28.2)
Educational attainment	
Some high school or less	17,360 (37.8)
Some college	44,620 (29.3)
College graduate	29,222 (15.2)
Postgraduate	40,333 (17.8)
Marital status	
Single, never married	13,721 (15.8)
Married	89,445 (63.2)
Cohabitating	13,442 (8.7)
Separated	7141 (3.7)
Widowed	6916 (8.7)
Children living in household	
No	89,984 (68.5)
Yes	32,375 (31.5)
Annual household income	
Less than $12,000	2211 (2.6)
$12,000 to $23,999	5521 (5.5)
$24,000 to $35,999	9097 (8.8)
$36,000 to $47,999	9406 (8.6)
$48,000 to $59,999	12,327 (11.0)
$60,000 to $89,999	25,501 (20.9)
$90,000 to $119,999	22,954 (16.9)
$120,000 to $179,999	21,841 (15.1)
$180,000 to $239,999	8799 (5.6)
$240,000 and over	9032 (4.9)
Employment status	
Full-time employed	55,837 (51.5)
Part-time employed	11,431 (9.1)
Unemployed, looking for work	4615 (4.7)
Unemployed, not looking for work	4639 (4.5)
Retired	49,795 (23.9)
Homemaker	5898 (6.4)

† Unweighted counts and weighted percentages, or weighted medians and interquartile ranges.
Acronyms: Med (Median); IQR (interquartile range).

employed full-time (51.5%).

The prevalence of each negative emotion and their bivariate associations with covariates are shown in Table 2. During the study period (April 2020–July 2021), estimates ranged from 19.6% for depression to 52.0% for stress. Across the study period, state-level unemployment was positively associated with every emotion except depression, and average daily state-level COVID-19 mortality was positively associated with all emotions except depression and anxiety. All emotions were negatively associated with age, household income, and being married (vs. single and never married), and positively associated with female gender (except anger, for which there was no association). Non-white race/ethnicity (vs. non-Hispanic white) was associated with higher prevalence of sadness and worry. Having children under 18 in the household showed a positive association with worry, stress, and anxiety, and a negative relationship with sadness and loneliness. Compared to full-time employment, all emotions were positively associated with being unemployed and, with the exception of stress, part-time employment; being retired was positively associated with sadness, and negatively associated with worry, stress, and anxiety; and being a homemaker was positively associated with sadness and negatively with stress.

Table 3 contains the results of modified Poisson regression analyses for each of the seven negative emotions based on data from the total sample and subsamples characterized by employment status, without covariate adjustment (Model 1), adjusted for individual-level covariates (Model 2), and additionally adjusted for average daily state-level COVID-19 mortality (Model 3). In Model 1, all negative emotions except depression were significantly and positively associated with state-level unemployment rates in the overall sample, with prevalence ratios ranging from 1.17 (stress and anxiety) to 1.34 (sadness). When stratified by employment status, all negative emotions were significantly and positively associated with unemployment rates in some employment groups, with prevalence ratios ranging from 1.11 to 1.40. State-level unemployment was associated with every negative emotion except depression among the full-time employed, and every emotion except depression and anxiety among the part-time employed. Among the unemployed, associations were observed only for worry and anxiety among those who were not currently looking for work; among those looking for work at the time of data collection, no statistically significant associations with unemployment were observed. Among retired respondents, unemployment was associated with every negative emotion including depression, while among homemakers only sadness and worry were associated with the exposure. In Models 2 and 3, which account for the effect of individual-level covariates, COVID-19 mortality, the associations when compared to Model 1 were slightly amplified in the overall sample and among most employment groups for all emotions except depression; in the overall sample, associations with unemployment ranged from 1.15 (anxiety) to 1.37 (sadness).

Pairwise comparisons of predicted probabilities based on Model 3 (not shown in tables) yielded significantly lower predicted probabilities of sadness associated with increasing state-level unemployment for part-time and unemployed than among full-time employed respondents, and higher predicted probabilities among retired compared to part-time employed and unemployed respondents. For worry, predicted probabilities were lower among unemployed respondents who were looking for work than among full-time employed and retired respondents. Predicted probabilities of stress were higher among retired than among respondents who were full-time employed, unemployed, or homemakers, and lower among respondents who were unemployed and looking for work than among the part-time employed. For depression and anxiety, predicted probabilities were slightly higher among retired respondents than among those who were unemployed and looking for work. All other pairwise comparisons were not statistically significant.

Finally, we found some evidence of effect modification by time for anger, which, in the early stages of the pandemic, was negatively associated but subsequently positively associated with state-level unemployment as the pandemic persisted into 2021 (*p* for additive interaction

Table 2

Bivariate associations[1] with negative emotions, Gallup COVID-19 web survey, April 01, 2020 – July 26, 2021.

	Sadness	Worry	Stress	Anger	Loneliness	Depression	Anxiety
	PR [95% CI]	PR [95% CI]	PR [95% CI]	PR [95% CI]	PR [95% CI]	PR [95% CI]	PR [95% CI]
Sample prevalence [95% CI]	28.6% [27.9%;29.2%]	47.1% [46.4%;47.8%]	52.0% [51.2%;52.6%]	23.3% [22.7%;23.8%]	22.7% [22.1%;23.3%]	19.6% [19.0%;20.2%]	38.4% [37.7%;39.2%]
State-level unemployment rate (per 10%)	1.34 [1.29;1.40] ***	1.27 [1.23;1.30] ***	1.17 [1.14;1.20] ***	1.29 [1.24;1.35] ***	1.18 [1.13;1.24] ***	1.06 [0.99;1.15]	1.17 [1.11;1.22] ***
Average daily state-level COVID-19 mortality rate (per 100,000)	1.08 [1.06;1.10***]	1.05 [1.04;1.07] ***	1.03 [1.01;1.04] ***	1.04 [1.02;1.07] **	1.05 [1.03;1.08] ***	1.04 [0.98;1.11]	0.99 [0.95;1.03]
Female gender (vs. male)	1.40 [1.34;1.46] ***	1.19 [1.16;1.23] ***	1.15 [1.12;1.18] ***	1.01 [0.96;1.06]	1.22 [1.15;1.28] ***	1.24 [1.16;1.33] ***	1.33 [1.28;1.39] ***
Age (per 10 yrs)	0.97 [0.95;0.98] ***	0.91 [0.91;0.92] ***	0.86 [0.86;0.87] ***	0.95 [0.94;0.96] ***	0.90 [0.89;0.92] ***	0.88 [0.86;0.90] ***	0.84 [0.84;0.85] ***
Non-white race/ethnicity (vs. non-Hispanic white)	1.05 [1.00;1.11]*	1.05 [1.01;1.08]*	1.01 [0.98;1.05]	1.03 [0.97;1.09]	1.02 [0.96;1.08]	0.93 [0.86;1.00]	1.05 [1.00;1.09]
Educational attainment							
High school or less	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*
Some college	1.06 [1.00;1.12]*	1.14 [1.10;1.19] ***	1.24 [1.20;1.29] ***	1.06 [1.00;1.13]	1.20 [1.12;1.28] ***	1.16 [1.07;1.26] ***	1.33 [1.26;1.40] ***
College graduate	1.06 [1.00;1.13]	1.22 [1.17;1.28] ***	1.33 [1.28;1.38] ***	0.99 [0.92;1.06]	1.19 [1.10;1.29] ***	1.04 [0.95;1.14]	1.46 [1.38;1.55] ***
Postgraduate	1.05 [0.98;1.11]	1.21 [1.16;1.27] ***	1.30 [1.25;1.35] ***	0.89 [0.83;0.95] **	1.08 [1.00;1.16]*	0.88 [0.80;0.97]*	1.41 [1.33;1.49] ***
Marital status							
Single, never married	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*
Married	0.76 [0.71;0.80] ***	0.83 [0.80;0.86] ***	0.83 [0.80;0.86] ***	0.87 [0.81;0.02] ***	0.42 [0.39;0.45] ***	0.57 [0.52;0.62] ***	0.73 [0.70;0.76] ***
Cohabitating	0.92 [0.85;1.01]	0.86 [0.81;0.92] ***	0.83 [0.79;0.88] ***	0.94 [0.86;1.04]	0.86 [0.79;0.93] ***	0.78 [0.69;0.88] ***	0.76 [0.70;0.82] ***
Separated	0.99 [0.88;1.10]	0.71 [0.65;0.79] ***	0.60 [0.54;0.66] ***	0.73 [0.65;0.84] ***	0.94 [0.84;1.04]	0.70 [0.58;0.84] ***	0.52 [0.46;0.59] ***
Widowed	0.91 [0.83;0.99]*	1.01 [0.96;1.07]	1.02 [0.98;1.06]	1.05 [0.96;1.15]	0.57 [0.51;0.63] ***	0.87 [0.78;1.00]*	1.02 [0.95;1.10]
Children living in household (yes vs. no)	0.90 [0.85;0.94] ***	1.06 [1.03;1.10] ***	1.21 [1.17;1.24] ***	1.01 [0.96;1.06]	0.85 [0.80;0.91] ***	0.94 [0.87;1.01]	1.10 [1.06;1.15] ***
Annual household income[2]							
Less than $12,000	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*
$12,000 to $23,999	0.88 [0.79;0.99]*	0.87 [0.80;0.95] **	0.84 [0.78;0.91] ***	0.84 [0.73;0.97]*	0.86 [0.76;0.98]*	0.78 [0.68;0.90] **	0.80 [0.71;0.89] ***
$24,000 to $35,999	0.81 [0.73;0.90] ***	0.87 [0.80;0.94] ***	0.84 [0.78;0.91] ***	0.82 [0.71;0.94] **	0.77 [0.68;0.87] ***	0.68 [0.59;0.78] ***	0.75 [0.68;0.83] ***
$36,000 to $47,999	0.67 [0.60;0.75] ***	0.78 [0.72;0.84] ***	0.77 [0.71;0.83] ***	0.71 [0.62;0.82] ***	0.68 [0.60;0.77] ***	0.56 [0.48;0.64] ***	0.71 [0.64;0.79] ***
$48,000 to $59,999	0.65 [0.58;0.72] ***	0.75 [0.70;0.82] ***	0.78 [0.72;0.84] ***	0.69 [0.60;0.79] ***	0.59 [0.52;0.67] ***	0.50 [0.44;0.58] ***	0.70 [0.63;0.77] ***
$60,000 to $89,999	0.57 [0.52;0.63] ***	0.72 [0.67;0.87] ***	0.77 [0.72;0.83] ***	0.64 [0.57;0.73] ***	0.50 [0.45;0.57] ***	0.40 [0.35;0.46] ***	0.65 [0.59;0.72] ***
$90,000 to $119,999	0.53 [0.48;0.59] ***	0.71 [0.66;0.76] ***	0.76 [0.71;0.82] ***	0.62 [0.54;0.71] ***	0.42 [0.38;0.48] ***	0.37 [0.32;0.42] ***	0.64 [0.58;0.70] ***
$120,000 to $179,999	0.50 [0.45;0.55] ***	0.72 [0.67;0.78] ***	0.79 [0.73;0.84] ***	0.60 [0.52;0.69] ***	0.37 [0.33;0.42] ***	0.34 [0.29;0.39] ***	0.64 [0.58;0.70] ***
$180,000 to $239,999	0.53 [0.46;0.60] ***	0.80 [0.73;0.87] ***	0.85 [0.79;0.92] ***	0.60 [0.52;0.70] ***	0.37 [0.31;0.43] ***	0.31 [0.25;0.37] ***	0.69 [0.61;0.77] ***
$240,000 and over	0.51 [0.45;0.58] ***	0.72 [0.66;0.79] ***	0.82 [0.76;0.89] ***	0.60 [0.51;0.70] ***	0.34 [0.29;0.40] ***	0.27 [0.22;0.32] ***	0.66 [0.59;0.75] ***
Employment status							
Full-time employed	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*	*(ref)*
Part-time employed	1.21 [1.13;1.30] ***	1.10 [1.05;1.15] ***	0.99 [0.95;1.03]	1.14 [1.05;1.23] **	1.14 [1.05;1.23] **	1.25 [1.12;1.38] ***	1.10 [1.04;1.17] **
Unemployed, looking for work	1.92 [1.79;2.05] ***	1.48 [1.42;1.54] ***	1.24 [1.20;1.30] ***	1.61 [1.47;1.75] ***	1.91 [1.76;2.07] ***	2.29 [2.09;2.52] ***	1.53 [1.45;1.63] ***
Unemployed, not looking for work	1.56 [1.44;1.69] ***	1.29 [1.22;1.36] ***	1.07 [1.02;1.13] **	1.42 [1.29;1.56] ***	1.56 [1.42;1.72] ***	1.92 [1.71;2.16] ***	1.31 [1.21;1.42] ***
Retired	1.18 [1.12;1.25] ***	0.86 [0.83;0.90] ***	0.63 [0.60;0.65] ***	1.02 [0.96;1.08]	1.00 [0.94;1.07]	1.04 [0.96;1.12]	0.72 [0.68;0.76] ***
Homemaker	1.23 [1.12;1.35] ***	0.99 [0.92;1.06]	0.93 [0.88;0.99]*	1.06 [0.95;1.18]	0.93 [0.83;1.05]	1.08 [0.94;1.24]	1.05 [0.97;1.13]

Abbreviations: PR, prevalence ratio; CI, confidence interval.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

[1] Results of unadjusted survey modified Poisson regression models.

Table 3

Multivariable associations[1] of state-level unemployment rates with negative emotions, overall and stratified by employment status, Gallup COVID-19 web survey, April 01, 2020 – July 26, 2021[2].

	Model 1: PR[3] [95% CI] unadjusted	Model 2: PR[3] [95% CI] adjusted for individual-level covariates[4]	Model 3: PR[2] [95% CI] adjusted for individual-level and macro-level covariates[4,5]
Sadness			
Total sample	1.34 [1.31;1.37]***	1.35 [1.29;1.40]***	1.37 [1.31;1.43]***
Full-time employed	1.40 [1.32;1.49]***	1.43 [1.35.1.52]***	1.43 [1.33;1.54]***
Part-time employed	1.18 [1.05.1.33]**	1.20 [1.07;1.36]**	1.14 [0.99;1.32]
Unemployed, looking for work	1.11 [0.98;1.25]	1.17 [1.02;1.33]*	1.13 [0.96;1.34]
Unemployed, not looking for work	0.99 [0.85;1.15]	1.04 [0.89;1.21]	0.99 [0.84;1.18]
Retired	1.40 [1.30;1.50]***	1.42 [1.32;1.53]***	1.56 [1.44;1.69]***
Homemaker	1.25 [1.07;1.47]**	1.23 [1.04;1.45]*	1.32 [1.11;1.57]**
Worry			
Total sample	1.27 [1.23;1.32]***	1.27 [1.24;1.30]***	1.30 [1.26;1.34]***
Full-time employed	1.27 [1.23;1.32]***	1.28 [1.23;1.33]***	1.33 [1.28;1.39]***
Part-time employed	1.18 [1.09;1.28]***	1.21 [1.12;1.31]***	1.19 [1.09;1.30]***
Unemployed, looking for work	1.08 [0.99;1.17]	1.13 [1.03;1.23]**	1.15 [1.03;1.27]**
Unemployed, not looking for work	1.13 [1.02;1.26]*	1.16 [1.04;1.29]**	1.21 [1.07;1.37]**
Retired	1.31 [1.24;1.38]***	1.35 [1.27;1.42]***	1.38 [1.30;1.47]***
Homemaker	1.22 [1.09;1.37]**	1.21 [1.08;1.36]**	1.21 [1.07;1.36]**
Stress			
Total sample	1.17 [1.14;1.20]***	1.18 [1.15;1.21]***	1.21 [1.18;1.24]***
Full-time employed	1.16 [1.12;1.20]***	1.17 [1.13;1.21]***	1.22 [1.18;1.26]***
Part-time employed	1.18 [1.10;1.27]***	1.21 [1.13;1.30]***	1.18 [1.09;1.28]***
Unemployed, looking for work	1.04 [0.96;1.13]	1.06 [0.97;1.16]	1.10 [1.00;1.22]
Unemployed, not looking for work	1.10 [0.99;1.21]	1.11 [1.00;1.23]	1.13 [0.99;1.28]
Retired	1.28 [1.20;1.36]***	1.33 [1.25;1.41]***	1.32 [1.24;1.41]***
Homemaker	1.05 [0.95;1.17]	1.08 [0.97;1.20]	1.12 [1.00;1.25]*
Anger			
Total sample	1.29 [1.24;1.35]***	1.30 [1.24;1.36]***	1.30 [1.24;1.36]***
Full-time employed	1.28 [1.20;1.37]**	1.32 [1.23;1.41]***	1.32 [1.23;1.41]***
			1.24 [1.08;1.43]**

Table 3 (*continued*)

	Model 1: PR[3] [95% CI] unadjusted	Model 2: PR[3] [95% CI] adjusted for individual-level covariates[4]	Model 3: PR[2] [95% CI] adjusted for individual-level and macro-level covariates[4,5]
Part-time employed	1.22 [1.07;1.39]**	1.24 [1.08;1.43]**	
Unemployed, looking for work	1.22 [1.03;1.44]	1.27 [1.07;1.51]**	1.27 [0.97;1.49]
Unemployed, not looking for work	1.11 [0.93;1.32]	1.07 [0.89;1.29]	1.10 [0.89;1.37]
Retired	1.37 [1.26;1.48]***	1.38 [1.26;1.50]***	1.43 [1.31;1.57]***
Homemaker	1.19 [0.98;1.44]	1.15 [0.95;1.39]	1.28 [1.02;1.60]***
Loneliness			
Total sample	1.18 [1.13;1.24]***	1.20 [1.15;1.26]***	1.23 [1.17;1.29]***
Full-time employed	1.19 [1.11;1.28]***	1.25 [1.16;1.34]***	1.31 [1.21;1.42]***
Part-time employed	1.17 [1.00;1.36]*	1.23 [1.06;1.43]**	1.27 [1.07;1.50]**
Unemployed, looking for work	1.10 [0.95;1.28]	1.16 [0.99;1.36]	1.15 [0.95;1.38]
Unemployed, not looking for work	1.01 [0.85;1.19]	1.08 [0.91;1.28]	1.06 [0.88;1.28]
Retired	1.11 [1.01;1.21]*	1.12 [1.02;1.23]*	1.09 [0.99;1.19]
Homemaker	1.17 [0.95;1.44]	1.27 [1.04;1.56]*	1.28 [1.01;1.62]*
Depression			
Total sample	1.06 [0.99;1.15]	1.09 [1.01;1.18]*	1.00 [0.92;1.09]
Full-time employed	1.03 [0.92;1.16]	1.09 [0.97;1.23]	1.06 [0.93;1.21]
Part-time employed	0.82 [0.64;1.05]	0.96 [0.76;1.22]	0.86 [0.65;1.15]
Unemployed, looking for work	0.89 [0.72;1.10]	0.92 [0.74;1.15]	0.81 [0.62;1.05]
Unemployed, not looking for work	0.89 [0.67;1.19]	1.01 [0.76;1.35]	0.94 [0.68;1.31]
Retired	1.17 [1.00;1.36]*	1.25 [1.07;1.47]**	1.12 [0.95;1.30]
Homemaker	1.01 [0.71;1.43]	1.08 [0.78;1.51]	1.17 [0.81;1.68]
Anxiety			
Total sample	1.17 [1.11;1.22]***	1.17 [1.12;1.23]***	1.15 [1.09;1.21]***
Full-time employed	1.15 [1.08;1.23]***	1.15 [1.08;1.23]***	1.13 [1.05;1.21]**
Part-time employed	1.05 [0.92;1.21]	1.13 [0.99;1.29]	1.08 [0.92;1.26]
Unemployed, looking for work	0.97 [0.84;1.11]	1.02 [0.88;1.18]	1.02 [0.87;1.21]
Unemployed, not looking for work	1.25 [1.04;1.49]*	1.30 [1.09;1.55]**	1.27 [1.01;1.59]*
Retired	1.23 [1.11;1.37]***	1.29 [1.16;1.44]***	1.30 [1.16;1.46]***
Homemaker	1.08 [0.90;1.31]	1.11 [0.92;1.34]	1.07 [0.85;1.35]

Abbreviations: PR, prevalence ratio; CI, confidence interval.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

[1] Results of survey modified Poisson regression models

[2] Depression and anxiety: May 11, 2020 – July 26, 2021

[3] Estimates given for 10-point increase in monthly state-level unemployment rate

[4] Individual-level covariates: gender (female vs. male); age (continuous); race/ethnicity (Other vs. Non-Hispanic White); educational attainment (high

school or less; some college; college graduate, postgraduate); children living in household (yes vs. no); marital status (single and never married; married; cohabitating; separated or divorced; widowed); income (continuous); employment status (full-time employed; part-time employed; unemployed, looking for work; unemployed, not looking for work; retired; homemaker)

[5] Macro-level covariates: state fixed effects; average daily state-level COVID-19 mortality

$= 0.02$; p for multiplicative interaction $= 0.072$). There were no signs of effect modification by time for any of the other emotions.

4. Discussion

This study is, to the authors' best knowledge, the first to systematically examine the link between area-level unemployment and psychological well-being in the U.S. during the COVID-19 pandemic by evaluating the association between state-level unemployment and several negative emotions in a nationally representative survey of U.S. adults. In the overall sample, all emotions except depression were significantly and positively associated with state-level unemployment between April 2020 and July 2021. Associations with unemployment were most pronounced for sadness, followed by worry, anger, loneliness, and stress. These emotions may be more easily evoked and may have a more acute onset than anxiety or depression, which are associated with sustained exposure to chronic psychosocial stressors (Coulter et al., 2017). The lack of association of state-level unemployment with the experience of depression may also point to a widespread psychological resilience towards the manifestation of psychological distress as a mental disorder (Bonanno, 2004), consistent with recent studies suggesting that over 80% of the U.S. population exhibited high or normal levels of resilience, which in turn were associated with lower odds of depression or anxiety symptoms in the early pandemic period (Riehm et al., 2021a).

Associations with state-level unemployment were statistically significant for most emotions among respondents who were employed full-time or part-time, or were retired. This may reflect concerns about individual job insecurity and associated economic strain, as well as the effect of a potential recession on retirement savings accounts and asset incomes. Additionally, some retired respondents may have been forced to leave the workforce prematurely due to COVID-19-related lay-offs (Congressional Research Service, 2021a). In contrast, job-seekers received relatively generous unemployment benefits during the pandemic (Karpman and Acs, 2020), which may have buffered the impact of area-level unemployment in this group. Indeed, anxiety was positively associated with state-level unemployment among unemployed respondents who were not looking for work, but not among those who reported to be job-seeking. With the exception of anxiety, the unemployment rate also seemed to have some impact on homemakers, who may have been more indirectly affected by the macroeconomic outlook during COVID-19.

We found some evidence that for anger, the relationship between negative emotions and state-level unemployment varied over time. This finding mirrors prior research suggesting that fear of infection was a driver of psychological distress during the early phase of the COVID-19 pandemic (Brülhart et al., 2021), and that rising unemployment levels as a consequence of stay-at-home orders and mandated business closures were supported by a large part of the U.S. population due to their perceived effectiveness in mitigating COVID-19 transmission (McFadden et al., 2020). In contrast, concerns about the economic aftermath of the pandemic may have become more salient in the wake of growing emotional adaptation to the virus itself (Daly and Robinson, 2021).

4.1. Public health implications

This research suggests that area-level unemployment impacted Americans' emotional experience during the COVID-19 pandemic. Such

effects can be mitigated by social policies such as income protection, job retention, and other social policy schemes (Brenner and Bhugra, 2020; Organisation for Economic Co-operation and Development, 2020). Indeed, recent cross-national surveys indicate that the prevalence of both economic worries and psychological distress was considerably lower in countries with established social protection policies such as short-time work benefits, even if their epidemic situation was comparable to or worse than in the U.S. (Williams et al., 2020), mirroring vast differences between high-income countries in the extent to which the onset of the pandemic affected unemployment rates (Cohen-Setton and Pisani-Ferry, 2020). Having said that, the 2020 CARES Act substantially expanded eligibility and replacement rates of unemployment insurance, and funded economic stimulus checks to U.S. households, demonstrably alleviating household economic insecurity (Karpman and Acs, 2020). Subsequent federal and state legislations may have also buffered the public mental health impact of rapidly rising unemployment in spring 2020. However, although the Paycheck Protection Program was intended to prevent mass layoffs, it has since been shown to have resulted only in comparatively modest employment retention, given its relatively untargeted design and implementation (Cho et al., 2022; Cohen-Setton and Pisani-Ferry, 2020). Moreover, the vast majority of these legislations were temporary, and as of early 2022 the key features of the political economy of the U.S., including its relatively low levels of welfare provision compared to other high-income countries (Bambra, 2019; Lynch, 2020), remain unchanged.

4.2. Limitations

This study is subject to two major limitations. First, data based on validated psychometric instruments for symptoms of psychological distress or mental disorder were not available. The negative emotions measured in this study may not indicate poor mental well-being, and their experience was ascertained using binary response options and with respect to the prior day only, which limits information available on severity or frequency of these emotions. Even for emotions that specifically refer to common mental health conditions (depression and anxiety), findings should be interpreted with particular caution and not be mistaken for a positive screening for clinical disorders. It is also important to note that experience and expression of negative emotions reflect challenging personal situations that require attention and are not necessarily indicative of impaired mental health. Research suggests that acceptance and expression of such emotions, as compared to their suppression and/or avoidance, are positively associated with well-being (Gross and John, 2003; Hayes et al., 2012). However, experience of negative emotions in response to chronic stressors can contribute to the development of mental disorders such as major depression, particularly among individuals with a predisposition to psychopathology (Monroe and Simons, 1991). Moreover, emotions such as sadness, worry, or anger are not psychopathological in nature; therefore, their assessment based on self-report is likely to be valid, even though the ascertainment of emotions with a binary scale does not allow for any gradations and may have resulted in an inflated prevalence of these emotions. Having said that, this is unlikely to bias the effect estimates for the association of these emotions with state-level unemployment.

Second, several states enacted additional COVID-19-related relief legislation (National Conference of State Legislatures, 2021), which may have buffered the public mental health impact of unemployment in states to varying degrees. Given the large number and dynamic nature of state legislation since the beginning of the pandemic, it was not possible to control for its potential confounding effect. However, the use of state fixed effects in this analysis accounts for variation between states, though not for policy changes within states over time.

The key strength of this analysis lies in the representative nature of the underlying survey panel, which is recruited using address-based sampling methods and random digit-dial phone interviews covering both landline and cell phones. This study extends the prior research by

demonstrating a strong positive association of area-level unemployment with a wide range of negative emotions across most employment groups. Continual monitoring of public mental health and further research of this kind – particularly studies that assess these emotions longitudinally to better understand chronicity and evaluate their impact on functioning – will be required as the COVID-19 pandemic continues to evolve, as well as in its aftermath.

CRediT authorship contribution statement

Daniel Hagen: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft. **Alden Yuanhong Lai:** Conceptualization, Methodology, Writing – review & editing, Project administration. **Emily Goldmann:** Conceptualization, Methodology, Writing – review & editing, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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