Prevalence of Psychological Distress in Hawai'i during the COVID-19 Pandemic: Exploring Disparities Using 11 Waves of Data from the Household Pulse Survey

Wei Zhang PhD; Yan Yan Wu PhD; and Margaret Walkover MPH

Abstract

Utilizing 11 waves of data from the Household Pulse Survey collected between April and November 2020, this study examines disparities in psychological distress (defined as having symptoms of anxiety/depression) among adult residents of Hawai'i during the COVID-19 pandemic. Results showed that 36.4% of the respondents reported symptoms of distress. Younger age, female, and lower household income were associated with higher levels of psychological distress than older age, male, and higher household income. The prevalence ratios of distress for those aged 18-24, 25-34, 35-44 and females were 43.1%, 47.3%, 44.1%, and 39.3% respectively. Asians experienced lower prevalence compared to other racial/ethnic groups. Two practical implications are offered. First, the economic sequelae of COVID-19 impact psychological distress even when the community infection rate is stable. Second, disparities in psychosocial distress demonstrate that social and economic resources are needed by social groups such as young adults, females, and racial/ethnic minorities that have experienced the highest impact. Strategies need to be developed to mitigate the unavoidable local consequences of a pandemic.

Keywords

Depression, Anxiety, Psychological Distress, COVID-19, Adults, Hawai'i

Acronyms

aPRs = adjusted prevalence ratios
BRFSS = Behavioral Risk Factor Surveillance System
CIs = confidence intervals
COVID-19 = coronavirus disease of 2019
cPRs = crude prevalence ratios
GAD-2 = two-item Generalized Anxiety Disorder
HPS = Household Pulse Survey
PHQ-2 = two-item Patient Health Questionnaire
PRs = prevalence ratios
SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2
US = United States

Highlights

- *Results show 36.4% of the respondents reported symptoms of distress in Hawai'i.*
- *Disparities in distress were found by age, gender, household income, and race.*
- *More resources should be directed to social groups like young adults and females.*
- *nterventions should address unavoidable consequences of public health measures.*

Introduction

COVID-19 brings human societies face-to-face with the introduction of a new biological stressor that challenges the well-being of populations without immunity who also experience a range of preexisting health conditions.[1] The success of the SARS-CoV-2 virus is increased by conditions that allow for proximity between human hosts, allowing in some circumstances for exponential reproduction within populations. This has consequences for Hawai'i, a state whose economy relies heavily on tourism, with a large number of travelers visiting its various islands on a regular basis. Governor David Ige announced Hawai'i's first case on March 6, 2020. This was followed by his initial "stay at home" order, that took effect on March 25, 2020, and by a series of social distancing and quarantine measures. This public health response to COVID-19 infection, by necessity, shut down the economy. By mid-May 2020, the community infection rate decreased to near zero.[2] As the stay at home order was lifted however, community infection rates started to climb. The second exponential wave of COVID-19 cases started to emerge in July 2020,[3] and then a follow-up stay at home order was issued in August.

The impact of multi-staged policies designed to restrict social activity to support community infection management under COVID-19 created 2 breaches in the rhythm of daily life in Hawai'i. First, social, cultural, educational, and business gatherings that are central to the life of Hawai'i's diverse communities were sharply curtailed. This introduced patterns of social isolation within and across networks of families and friends that deviated from an island culture characterized by multigenerational households and close social associations.[4] Second, a high proportion of residents experienced an unexpected loss of employment income. The seasonally adjusted unemployment rate in Hawai'i was 2.4% in March 2020 and climbed to 22.3% just 1 month later, in April.[5] Unemployment, in turn, is closely related to housing and food insecurity.[6] A statewide survey completed during the last week of August 2020 reported that more than 78% of the respondents believed that the impact of COVID-19 would lead to long term changes in their lives and their community.[7]

With this in mind, it is not surprising that social distancing and quarantine policies have been associated with a reported increase of mental health symptoms.[8] Compared to results in

2019, American adults assessed in April and May 2020 after the onset of the pandemic were 3 times as likely to screen positive for symptoms of depression and/or anxiety.[9] Using data from a national sample of US adults, it is found that close to 15% of respondents were categorized as having high risk of suicidality during the pandemic and the risk factors included food insecurity as well as physical and depressive symptoms.[10] Psychological distress produced by experiencing anxiety and depression together is described by Mirowsky and Ross as a feeling of powerlessness "generated by the objective conditions of disadvantage."[11] Therefore, symptoms of distress were theorized in the current study as a byproduct of social and economic disorganization emerging from strategies designed to manage COVID-19 community infection.

Globally, the impacts of COVID-19 have been disproportionately experienced across diverse social groups. In Cyprus it is found that women and young adults, aged 18-29, and those facing socio-economic and health disparities reported increased anxiety and depression symptoms.[12] In Spain, it is found that over 25% of the respondents reported symptoms of depression, anxiety, and stress during lockdown, with men reporting comparable levels of anxiety and stress but higher levels of depression than women.[13] For differences by race/ethnicity, studies conducted in the US revealed that racial inequalities became magnified during the pandemic with African American, Latino, and Native American communities disproportionately impacted physically and mentally.[14]

The SARS-CoV-2 virus spreads through aerosols emitted from a person who is talking, coughing, or sneezing.[15,16] COVID-19 is transmitted through social contact and is known to severely affect individuals with preexisting underlying health conditions, creating disproportionate harm in communities made vulnerable by social economic stressors.[17-19] Of particular concern is the prevalence of COVID-19 in Native Hawaiian and Pacific Islander communities, who experience infection rates significantly higher than the general population in Hawai'i and across the United States.[20,21] Using 11 waves of weekly data from the 2020 Household Pulse Survey, this study aims to explore the prevalence of psychological distress in Hawai'i during the pandemic and identify differences in prevalence by demographic groups such as age, gender, and race/ethnicity.

Methods

Data

This study describes how the trends of psychological distress follow the patterns of COVID-19 incidence and mortality during the pandemic. National COVID-19 incidence and death rate data between March 10 and December 10, 2020 were retrieved from Centers for Disease Control and Prevention (CDC).[22] Following this, the Household Pulse Survey (HPS) data were used to analyze psychological distress between April 23 and November 23, 2020 and disparities in distress by demographic groups.

The HPS was developed by the National Center for Health Statistics and the US Census Bureau to document the complex social and economic impact of COVID-19. The HPS utilizes the Census Bureau's Master Address File as the source of sampled housing units. The sample design was a systematic sample of all eligible housing units, with adjustments applied to the sampling intervals to select a large enough sample to create state level estimates. The final HPS survey weights are designed to produce weekly estimates for the total adults aged 18 and older living within housing units. These survey weights were created by adjusting the household level sampling base weights by various factors to account for nonresponse, adults per household, and coverage. Sampled households were contacted by email and/or text. One adult in each household was recruited to answer a 20-minute survey that included questions about the impact of COVID-19 on their entire household such as loss of employment income, food insecurity, housing, and disruptions in education for school age children. The survey also includes questions documenting changes in respondents' access to health insurance, delays in receiving medical care for coronavirus, and their physical and mental well-being.

As of December 30, 2020, the HPS had collected 3 phases of data during 3 time periods. Phase 1 contained 12 waves of weekly data between April 23 and July 21. Phase 2 and 3 data were collected biweekly with 5 waves between August 19 to October 26, and 4 waves between October 28 to December 21. Phase 1 respondents remained in the sample for up to 3 consecutive weeks, whereas Phase 2 and 3 data contain independent respondents.[23] Eleven waves of independent samples were used in the current regression analysis (because some respondents in phase 1 remained in the sample for up to 3 weeks) and 19 waves of data were analyzed for the prevalence study. The sample sizes per wave are between 529 and 1385, and 11 873 and 27 610, for the State of Hawai'i and for the United States, respectively.

Measures

The HPS uses the 2-item Patient Health Questionnaire (PHQ-2) and 2-item Generalized Anxiety Disorder (GAD-2) to measure psychological distress. The National Center for Health Statistics modified the PHQ-2 and GAD-2 measures to decrease the timeframe from 2 weeks to 7 days. This step synced these measures with the 7-day data collection timeframe for the HPS.[24] The PHQ-2 measure of depressive symptoms asks how often respondents have experienced "having little interest or pleasure in doing things" and "feeling down, depressed, or hopeless." The GAD-2 anxiety measure asks how often participants have experienced "feeling nervous, anxious, or on edge" and "not being able to stop or control worrying." Answer choices indicating how often the respondent experienced depression or anxiety included: not at all = 0; several days = 1; more than half the days = 2; and nearly every day = 3. The 2 responses for the PHQ-2 were summed together and the 2 responses for the GAD-2 were summed together. A sum equal to 3 or greater on the PHQ-2 is indicative of major depressive disorder and separately, and on

the GAD-2 is indicative of generalized anxiety disorder.[25] Our dependent variable, psychological distress, was defined as the respondent reporting symptoms of either depression or anxiety.

Independent variables included age group (18-24; 25-34; 35-44; 45-54; 55-64; 65-74; and 75-88 years), gender (male, female), and race/ethnicity (White, Black, Hispanic, Asian, and Other). The HPS defines Asian as respondents who chose 1 of the following: Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Asian. The Other Asian category includes American Indian or Alaskan Native, Native Hawaiian, Chamorro, Samoan or other Pacific Islander, as well as other races and those self-identified as being multiracial.[26] The US Census Bureau does not make data for subgroups within the categories of Other and Asian available for public analysis.

The current study controlled for socio-demographics including education [high school or lower, some college (in progress or associate's degree), and bachelor's degree or higher], marital status (married, divorced/separated, never married, and widowed), household income (less than $49 000, $50 000-$99 000, $100 000-$149 000, and $150 000 or higher), and number of adults (1, 2, or 3+) and children younger than 18 in the household (Yes or No). Those who did not report household income were categorized as "unknown" to minimize missing data.

Analysis

Statistical software R version 3.6.2 was used for the analysis. We computed the 7-day moving averages of COVID-19 daily cases and deaths per 1,000,000 populations between March 10 and December 10, 2020 for both US and Hawai'i. We performed statistical analysis using the HPS survey data for Hawai'i only. Descriptive statistics were used to summarize sample characteristics and bivariate analysis of the prevalence of psychological distress with 95% confidence intervals (CIs) for all explanatory variables (Table 1). Chi-square tests were used to examine the associations between all covariates and psychological distress. Poisson regression analyses were performed to compute crude prevalence ratios (cPRs) and adjusted prevalence ratios (aPRs) with 95% CIs. Prevalence ratios were estimated because odds ratios can substantially over-estimate the prevalence ratios for common outcomes (when prevalence >10%). Results were summarized in Table 2. Survey data analysis accounted for survey weights. For Poisson regression analysis of 11 waves of data, average survey weights were used with each wave weighted equally.

Results

Prevalence of Psychological Distress in Hawai'i and in the US

Figure 1 compares the prevalence of self-reported psychological distress in Hawai'i and the US between April 23 and November 23, 2020 with the 7-day moving average of new COVID-19 cases and deaths per 1 000 000 between March 10 and December 10, 2020. At the national level, the prevalence of psychological distress largely mirrored the waves of COVID-19 incidence. In April and May, Hawai'i experienced a steeper drop in prevalence compared to the national trend. Hawai'i's pattern of psychological distress then rose steeply in June, which preceded the state's exponential second wave of COVID-19 incidence. This second wave of COVID-19 incidence peaked in September and eventually stabilized, but at a rate 4 times as high as the rate at the end of the first wave. Concurrently, the prevalence of psychological distress, after reaching its peak in August, declined slightly, stabilizing at a rate of 38%.

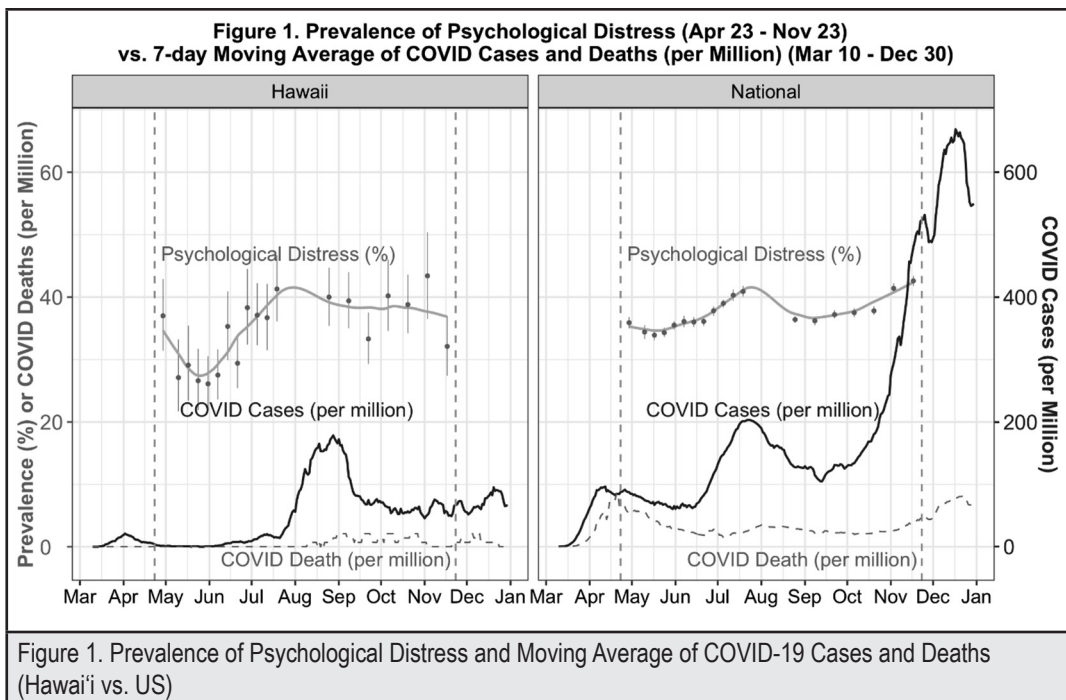**Disparities in Psychological Distress in Hawai'i**

Table 1 shows the sample characteristics of 11 194 survey respondents in Hawai'i and prevalence of psychological distress by all variables. There are 36.4% of survey respondents reported experiencing symptoms of psychological distress. White respondents experienced higher psychological distress rates (37.5%) compared to the Asian subsample (30.7%). Disparities in psychological distress rates were demonstrated for other race/ethnic groups: Other (40%), Hispanic (41.7%), and Black (42.7%). The category "other" includes respondents identifying as Native Hawaiian, Other Pacific Islander or other races.

Table 2 shows that the younger age groups (18-24, 25-34, and 35-44) had the highest prevalence of psychological distress, ranging between 43.1% and 47.3%, almost twice the prevalence of the 2 oldest age groups (65-74: 26.8%, and 75-88: 17.6%). More women reported psychological distress (39.3%) than men (33.3%), with an aPR of 1.19 (95%CI: 1.08 to 1.32, *P*<0.001). Households with children, and those with 1 adult in particular, reported a higher prevalence of distress (44.9%) than households without children. However, the differences were not statistically significant after adjusting for covariates. Higher education and household income were also associated with lower prevalence of distress, and household income remained statistically significant in the adjusted model.

Discussion

This study examined the psychological impact of COVID-19 on adults in Hawai'i. Using 11 waves of data from the Household Pulse Survey, we documented a high prevalence of psychological distress among surveyed respondents. The 2018 Hawai'i Behavioral Risk Factor Surveillance System (BRFSS) survey showed that 16.4% of the adult US population reported psychological distress for at least 6 days in the past 30 days.[27] During our study's timeframe, however, over a third of Hawai'i residents reported distress during the last 7 days due to any combination of symptoms related to anxiety or depression (36.4%).

Disparities in psychological distress by age, gender, and household income were identified in the adjusted models. The 3

**Figure 1. Prevalence of Psychological Distress (Apr 23 - Nov 23)
vs. 7-day Moving Average of COVID Cases and Deaths (per Million) (Mar 10 - Dec 30)**

Figure 1. Prevalence of Psychological Distress and Moving Average of COVID-19 Cases and Deaths (Hawaiʻi vs. US)

Legend labels for psychological stress (%) and COVID-19 deaths (per 1 million) are on the left y-axis;
Legend label for COVID-19 daily new cases (per million) is on the right y-axis;
Legend scales for the 3 measures are different.

younger age groups (18-24, 25-34, and 35-44) reported higher prevalence of distress than all older age groups, suggesting that young adults may have experienced larger psychosocial impacts than their older counterparts. Losing income places greater pressure on all of these groups, but our findings particularly highlight the psychological challenges faced by young adults in Hawaiʻi. It is possible that COVID-19-related government policies and public health measures may lead to significant changes in young adults' daily routines, possibly including transitioning into online classes, remote working, no social gatherings, and job loss. These shifts may have generated social isolation, and for some, feelings of loneliness and helplessness which may trigger or intensify symptoms of depression and anxiety.[8]

The prevalence of psychological distress is significantly higher in females than in males. This remained true in the adjusted model that controlled for other sociodemographic covariates and is consistent with findings before the pandemic and findings from other countries.[28,29] The stay-at-home orders associated with COVID-19 are likely to add additional stress for both gender groups but perhaps more so for females. One recent survey conducted in Hawaiʻi revealed that 62% of respondents with children reported that child care responsibilities during the pandemic have been very or somewhat difficult.[7] Females, especially mothers, were often more concerned about childcare and were also found to take on a larger burden with homeschooling at the expense of paid work time than fathers.[30,31] It is also found that some demographic groups such as females, the foreign-born,

families with children, and married individuals reported higher levels of COVID-19 fear than their corresponding counterparts.[32]

Levels of psychological distress varied by race with the prevalence being 37.5% for Whites, 41.7% for Hispanics, 42.7% for Blacks, and 30.7% for Asians. The exceptionally low prevalence of psychological distress for the Asian group might, to some extent, be explained by their cultural pattern of avoiding extremes and staying in the middle in questionnaire response styles.[33] Access to disaggregated racial/ethnic data are needed to make meaningful racial/ethnic comparisons. It is not surprising that respondents with higher levels of education and income reported less psychosocial impacts compared to their counterparts. This suggests that residents with more resources may have more social and economic options to cope with the pandemic than others.

This study has several limitations. First, the dataset is cross-sectional, which prevents the determining of causal relationships. Second, the HPS distress measure was based on a time period of 1 week, which differed from the time period of 2 weeks used in the validated instruments. Because surveys administered before the pandemic tended to use the validated tools, comparisons with the current data were limited. Finally, 40% of survey answers were aggregated by HPS in the race category of "Other," which includes Native Hawaiian and Pacific Islanders. The HPS will not provide Hawaiʻi specific racial/ethnic disaggregated data, so the current study could not identify trends in distress for

Table 1. Sample characteristics and weighted prevalence of psychological distress and 95% confidence intervals (CIs) (N=11 194)				
Variables	**Sample Characteristics**		**Weighted prevalence of psychological distress (%) and 95% CI**	**P-value**
	N	**%**		
Total	11 194	100	36.4 (34.5, 38.2)	
Age				
18-24	287	6.6	43.1 (34.1, 52.7)	
25-34	1010	16.4	47.3 (41.6, 53.2)	
35-44	1909	17.9	44.1 (39.7, 48.6)	
45-54	2085	16.2	36.0 (32.1, 40.0)	<.001
55-64	2503	17.3	33.3 (30.0, 36.9)	
65-74	2400	18.8	26.8 (23.4, 30.5)	
75-88	1000	6.7	17.6 (13.3, 22.9)	
Gender				
Male	4754	49.0	33.3 (30.5, 36.1)	.001
Female	6440	51.0	39.3 (36.9, 41.8)	
Race/ethnicity				
White	3692	37.5	37.5 (34.0, 41.2)	
Black	127	42.7	42.7 (27.9, 59.0)	
Hispanic	996	41.7	41.7 (35.6, 48.0)	<.001
Asian	3815	30.7	30.7 (27.7, 33.9)	
Other	2564	40.0	40.0 (36.6, 43.5)	
Education				
HS/GED or lower	1506	33.7	37.5 (33.8, 41.4)	
Some college	3805	33.6	38.6 (35.6, 41.7)	.033
Bachelor or higher	5883	32.7	32.9 (30.3, 35.6)	
Marital status				
Married	6311	57.6	32.6 (30.3, 35.1)	
Divorced/separated	1955	12.8	39.1 (34.7, 43.7)	<.001
Never Married	2386	25.5	44.8 (40.8, 48.9)	
Widowed	542	4.1	27.5 (20.8, 35.5)	
Household income				
Less than $49,000	2895	28.4	43.8 (40.2, 47.6)	
$50,000-$99,000	3683	33.5	35.5 (32.4, 38.8)	
$100,000-$149,000	1987	16.2	32.6 (28.4, 37.0)	<.001
$150,000 or higher	1874	14.8	28.1 (23.5, 33.1)	
Unknown	755	7.1	36.2 (30.4, 42.4)	
N adults and children in household				
2 adults, no children	3519	25.8	33.2 (30.0, 36.6)	
1 adult, no children	1888	6.8	36.0 (32.2, 40.0)	
3+ adults, no children	1913	26.8	37.4 (33.5, 41.6)	.234
2 adults, 1+ children	1838	15.6	37.2 (32.9, 41.8)	
1 adults, 1+ children	483	1.7	44.9 (38.2, 51.8)	
3+ Adults, 1+ Children	1553	23.39	37.5 (33.4, 41.8)	

Variables	Bivariate Model		Multivariate Model	
	cPR (95% CI)	*P*-value	aPR (95% CI)	*P*-value
Age				
18-24	Reference			
25-34	1.10 (0.86, 1.41)	.465	1.21 (0.97, 1.51)	.093
35-44	1.02 (0.80, 1.30)	.854	1.22 (0.98, 1.53)	.081
45-54	0.83 (0.65, 1.06)	.145	0.97 (0.77, 1.23)	.797
55-64	0.77 (0.61, 0.98)	.036	0.88 (0.69, 1.11)	.286
65-74	0.62 (0.48, 0.80)	<.001	0.68 (0.53, 0.89)	.004
75-88	0.41 (0.29, 0.58)	<.001	0.47 (0.33, 0.67)	<.001
Gender				
Male	Reference			
Female	1.18 (1.06, 1.31)	.002	1.19 (1.08, 1.32)	<.001
Race/ethnicity				
White	Reference			
Black	1.14 (0.77, 1.67)	.512	0.95 (0.65, 1.39)	.804
Hispanic	1.11 (0.93, 1.33)	.247	0.92 (0.77, 1.11)	.398
Asian	0.82 (0.71, 0.94)	.005	0.78 (0.69, 0.89)	<.001
Other	1.07 (0.94, 1.21)	.336	0.92 (0.81, 1.05)	.228
Education				
HS/GED or lower	Reference			
Some college	1.03 (0.90, 1.17)	.670	0.99 (0.87, 1.12)	.846
Bachelor or higher	0.88 (0.77, 1.00)	.045	0.91 (0.80, 1.04)	.179
Marital status				
Married	Reference			
Divorced/separated	1.20 (1.05, 1.37)	.009	1.16 (1.01, 1.34)	.038
Never Married	1.37 (1.22, 1.54)	<.001	1.11 (0.96, 1.27)	.161
Widowed	0.84 (0.64, 1.11)	.232	1.01 (0.76, 1.35)	.952
Household income				
Less than $49,000	Reference			
$50,000-$99,000	0.81 (0.72, 0.92)	<.001	0.86 (0.76, 0.97)	.013
$100,000-$149,000	0.74 (0.63, 0.87)	<.001	0.80 (0.68, 0.94)	.006
$150,000 or higher	0.64 (0.53, 0.77)	<.001	0.70 (0.58, 0.84)	<.001
Unknown	0.83 (0.69, 0.99)	.043	0.85 (0.71, 1.02)	.073
N adults and children in household				
2 adults, no children	Reference			
1 adult, no children	1.08 (0.94, 1.26)	.285	1.02 (0.87, 1.19)	.807
3+ adults, no children	1.13 (0.97, 1.31)	.110	1.11 (0.97, 1.28)	.122
2 adults, 1+ children	1.12 (0.96, 1.31)	.152	0.91 (0.77, 1.07)	.263
1 adults, 1+ children	1.35 (1.13, 1.62)	.001	1.04 (0.86, 1.25)	.674
3+ adults, 1+ children	1.13 (0.97, 1.31)	.113	1.00 (0.86, 1.16)	.972

Table 2. Weighted crude prevalence ratios (cPRs) and adjusted prevalence ratios (aPRs) of psychological distress and 95% confidence intervals (CI) in Hawaiʻi

Native Hawaiians and Pacific Islanders who were disproportionately impacted by COVID-19.[21] Despite these limitations, the current findings are consistent with trends presented in a systematic review of global experience with COVID-19, which identified the risk factors associated with psychological distress as female gender, younger age group (≤40 years), and unemployment status.[34]

Practical Implications

COVID-19, a biological stressor, exerts a complex impact on social stability. This study documented the association of COVID-19 morbidity with high levels psychological distress across Hawaiʻi's population, including its disproportionate impact on vulnerable social groups. However, COVID-19 appears to increase psychological distress even when local morbidity is stable. As documented in Figure 1, Hawaiʻi's second wave of psychological distress began to rise in June 2020. This rise in psychological distress happened before the second wave of COVID-19 community infection. This suggests that psychological distress was impacted not only by COVID-19 morbidity, but also by other factors. Our study's observation that COVID-19 is a medical, economic, and social issue comes into play here. It remains unclear what might explain a rise in psychological distress during the summer. One answer is a severe economic downturn. Visitor arrivals to Hawaiʻi fell by 97.8% in 2020 during June, July and August.[35] The rise in psychological distress, occurred during one of Hawaiʻi's high seasons for tourism, suggesting that COVID-19's economic and social sequelae may have contributed to the steep rise in distress during a period when COVID-19 morbidity had plateaued.

Second, these findings provide further evidence that trends in Hawaiʻi's levels of psychological distress are connected to an economy that is largely dependent upon tourism. Initial COVID-19 prevention measures implemented between March and April 2020 resulted in 20% of Hawaiʻi residents experiencing a sudden loss of employment income.[5] The impact of this trend on the ongoing economic instability of families was demonstrated here, with 43% percent of survey respondents reporting incomes within a financially vulnerable range of $49,000 or less (Table 2). High rates of unemployment magnify preexisting structural inequalities among vulnerable social groups, resulting in disproportionate risk of psychological distress.[36] By May 2021, access to COVID-19 vaccines have become widely available to the general population in Hawaiʻi. However, variants of this virus are emerging and access to vaccines is primarily located in the Global North. As long as management of COVID-19 infection remains unstable around the world, local risk of community infection increases with each influx of travelers. To lower current high levels of psychological distress, strategies will need to be developed that mitigate the unavoidable local consequences of this global pandemic.

Conflict of Interest

None of the authors identify any conflict of interest.

Authors' Affiliations:
- Department of Sociology, University of Hawaiʻi at Mānoa, Honolulu, HI (WZ, MW)
- Office of Public Health Studies, Thompson School of Social Work & Public Health, University of Hawaiʻi at Mānoa, Honolulu, HI (YYW)

Correspondence to:
Wei Zhang PhD; Department of Sociology, University of Hawaiʻi at Mānoa, Honolulu, HI; Email: weizhang@hawaii.edu

References

1. Clark A, Jit M, Warren-Gash C, et al. Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study. *Lancet Glob Health*. 2020;8(8):e1003-e1017. doi:10.1016/S2214- 109X(20)30264-3
2. Disease Outbreak Control Division, COVID-19, Hawaii State Department of Health, Hawaii Epi Control Curve-2021, Data spread between March 2 and May 29th, 2020. How is Hawaiʻi doing at flattening the epidemic curve? Updated June 7. Accessed June 7th. https://health.hawaii.gov/coronavirusdisease2019/what-you-should-know/current-situation-in-hawaii/#epicurve
3. Disease Outbreak Control Division, COVID-19, Hawaii State Department of Health, Hawaii Epi Control Curve-2021, Data spread between July 1 and July 31, 2020. How is Hawaiʻi doing at flattening the epidemic curve? Updated June 7. Accessed June 7th. https://health.hawaii.gov/coronavirusdisease2019/what-you-should-know/current-situation-in-hawaii/#epicurve
4. Hawaii Data Collaborative, Family ties: are Hawaii's multigenerational households more at risk? Published May 26th 2021. Accessed June 7th 2021. https://www.hawaiidata.org/ideas/2020/5/21/are-hawaiis-multigenerational-households-more-at-risk
5. Office of the Governor. *Beyond Recovery: Reopening* Hawaiʻi *Detailed Strategy May 29 2020 Final*. State of Hawaiʻi; 2020.
6. Restrepo BJ, Rabbitt MP, Gregory CA. The effects of unemployment on food spending and adequacy: Evidence from Coronavirus-induced firm closure. *Appl Econ Perspect and Policy*. 2021;43(1):185-204. doi: 10.1002/aepp.13143
7. Moore C, Hayashida S, Lanfranchi R. *Hawaiʻi during COVID-19: A Community Impact Survey*. Public Policy Center, University of Hawaiʻi-Manoa; 2020:10.
8. de Lima CVC, Cândido EL, da Silva JA, et al. Effects of quarantine on mental health of populations affected by Covid-19. *J Affect Disord*. 2020;275:253-254. doi:10.1016/j.jad.2020.06.063
9. Twenge JM, Joiner TE. U.S. Census Bureau-assessed prevalence of anxiety and depressive symptoms in 2019 and during the 2020 COVID-19 pandemic. *Depress Anxiety*. Published online July 15, 2020. doi:10.1002/da.23077
10. Fitzpatrick KM, Harris C, Drawve G. How bad is it? Suicidality in the middle of the COVID-19 pandemic. *Suicide Life Threat Behav*. Published online July 14, 2020. doi:10.1111/sltb.12655
11. Mirowsky J, Ross CE. *Social Causes of Psychological Distress*. 2nd ed. Routledge; 2003.
12. Solomou I, Constantinidou F. Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: age and sex matter. *Int J Environ Res Public Health*. 2020;17(14):4924. doi:10.3390/ijerph17144924
13. Ozamiz-Etxebarria N, Idoiaga Mondragon N, Dosil Santamaría M, Picaza Gorrotxategi M. Psychological symptoms during the two stages of lockdown in response to the COVID-19 outbreak: an investigation in a sample of citizens in northern Spain. *Front Psychol*. 2020;11. doi:10.3389/fpsyg.2020.01491
14. Fortuna LR, Tolou-Shams M, Robles-Ramamurthy B, Porche MV. Inequity and the disproportionate impact of COVID-19 on communities of color in the United States: The need for a trauma-informed social justice response. *Psychol Trauma Theory Res Pract Policy*. 2020;12(5):443-445. doi:10.1037/tra0000889
15. Gandhi M, Yokoe DS, Havlir DV. Asymptomatic transmission, the Achilles' heel of current strategies to control COVID-19. *N Engl J Med*. 2020;382(22):2158-2160. doi:10.1056/NEJMe2009758
16. Zhang R, Li Y, Zhang AL, Wang Y, Molina MJ. Identifying airborne transmission as the dominant route for the spread of COVID-19. *Proc Natl Acad Sci*. 2020;117(26):14857-14863. doi:10.1073/pnas.2009637117
17. He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. *Nat Med*. 2020;26(5):672-675. doi:10.1038/s41591-020-0869-5
18. Tartof SY, Qian L, Hong V, et al. Obesity and mortality among patients diagnosed with COVID-19: results from an integrated health care organization. *Ann Intern Med*. Published online August 12, 2020. doi:10.7326/M20-3742
19. Abedi V, Olulana O, Avula V, et al. Racial, economic, and health inequality and COVID- 19 infection in the United States. *J Racial Ethn Health Disparities*. Published online September 1, 2020. doi:10.1007/s40615-020-00833-4
20. Keawe J, Palafox N, Daniels S-A. COVID-19 special column: COVID-19 hits native Hawaiian and Pacific Islander communities the hardest. *Soc Welf*. 2020;79(5):4.
21. Quint J, Kaholokula JK, Watkins-Victorino L, et al. COVID-19 in Hawaiʻi: addressing health equity in diverse populations. Published March 2021. Accessed March 16, 2021. https://hawaiicovid19.com/wp-content/uploads/2021/03/COVID-19-Race-Ethnicity-Equity-Report.pdf
22. Centers for Disease Control and Prevention. COVID Data Tracker. Trends in Number of COVID-19 Cases and Deaths in the US Reported to CDC, by State/Territory. Updated daily by 8pm ET. Accessed April 15th 2021. https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendsdeaths

23. Fields JF, Hunter-Childs J, Tersine A, et al. 2020 Household Pulse Survey Interagency Federal Statistical Rapid Response Survey to Measure Effects of the Coronavirus (COVID-19) Pandemic on the United States Household Population. U.S. Census Bureau; 2020.

24. National Center for Health Statistics. Anxiety and depression - Household Pulse Survey. National Center for Health Statistics, CDC. Published September 25, 2020. Accessed September 25, 2020. https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm)

25. Staples LG, Dear BF, Gandy M, et al. Psychometric properties and clinical utility of brief measures of depression, anxiety, and general distress: the PHQ-2, GAD-2, and K-6. *Gen Hosp Psychiatry*. 2019;56:13-18. doi:10.1016/j.genhosppsych.2018.11.003

26. US Census Bureau. House Plus Survey: Phase 2 questionnaire Sept, 9 2020 English. Published online 2020.https://www2.census.gov/programs-surveys/demo/technical documentation/hhp/Phase3_Questionnaire_11_4_20_English.pdf

27. Hawai'i Department of Health. Hawai'i Health Data Warehouse. Query results for Hawai'i behavioral risk factor surveillance system. Hawai'i Indicator Based Information System. Published September 2020. Accessed September 25, 2020. http://ibis.hhdw.org/ibisph-view/query/result/brfss/MentHlth6/MentHlth6AA11_.html

28. Hyland P, Shevlin M, McBride O, et al. Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic. *Acta Psychiatr Scand*. Published online August 9, 2020. doi:10.1111/acps.13219

29. Mirowsky J, Ross CE. Sex differences in distress: real or artifact? *Am Sociol Rev*. 1995;60(3):449-468. doi:10.2307/2096424

30. Czymara CS, Langenkamp A, Cano T. Cause for concerns: gender inequality in experiencing the COVID-19 lockdown in Germany. *Eur Soc*. Published online August 27, 2020:1-14. doi:10.1080/14616696.2020.1808692

31. Collins C, Landivar LC, Ruppanner L, Scarborough WJ. COVID-19 and the gender gap in work hours. *Gend Work Organ*. Published online August 4, 2020. doi:10.1111/gwao.12506

32. Fitzpatrick KM, Harris C, Drawve G. Fear of COVID-19 and the mental health consequences in America. *Psychol Trauma Theory Res Pract Policy*. 2020;12(S1):S17-S21. doi:10.1037/tra0000924

33. Hamamura T, Heine SJ, Paulhus DL. Cultural differences in response styles: the role of dialectical thinking. *Pers. Individ. Differ*. 2008;44(4):932-942

34. Xiong J, Lipsitz O, Nasri F, et al. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *J Affect Disord*. 2020;277:55-64. doi:10.1016/j.jad.2020.08.001

35. Hawaii Tourism Authority. Monthly Visitor Statistics. June, July and August 2020. https://www.hawaiitourismauthority.org/research/monthly-visitor-statistics/?year=2020

36. Bavel JJV, Baicker K, Boggio PS, et al. Using social and behavioural science to support COVID-19 pandemic response. *Nat Hum Behav*. 2020;4(5):460-471. doi:10.1038/s41562- 020-0884-z