Increased Reports of Depression in Hawaiʻi during the first wave of COVID-19

Katherine Aumer[1], Michael A. Erickson[2], Eli Tsukayama[1]

[1]University of Hawaiʻi-West Oʻahu, 91-1001 Farrington HWY, Kapolei, HI 96707

[2]University of California, Riverside, 900 University Ave, Riverside, CA 92521

Abstract

Introduction: Reports of mental health issues increased nationally in the USA during the COVID-19 pandemic, often attributed to the effects of quarantine, isolation, and restriction of travel. Given that Hawaiʻi State's population is unique in its largely ethnic minority population, geographic isolation, and economic dependence on tourism, it is important to document if similar mental health outcomes have occurred during the beginning of the COVID-19 pandemic.

Methods: This study compares Hawaiʻi's rates of depression using data from the National Center for Health Statistics collected in 2020 and the Hawaiʻi Behavioral Risk Factor Surveillance System collected in 2016.

Results: Hawaiʻi's rate of depression, like the rest of the nation, increased significantly during the first wave. A chi-square test of independence was conducted, and the results were significant, $x^2 (1, n = 20,261.42) = 582.48$, $p < .001$. Before COVID-19, typical rates of depression were at 11.03%, 95% CI [10.51%, 11.55%]. During the COVID-19 pandemic, reports of depression increased to 24.23%, 95% CI [23.16%, 25.31%].

Conclusion: Depressive symptoms doubled during the early stages of the pandemic in Hawaiʻi. Evidence-based strategies should be developed now to help prevent future possible mental health related issues that are attributable to pandemic related safety protocols.

Keywords: Depression, Hawaiʻi, COVID-19, NHPI, US, HBRFSS, PHQ-2, CDC Pulse, MDD

Corresponding author: Katherine Aumer (kaumer@hawaii.edu) is a social psychologist who uses mixed methods approaches to provide better models of health, emotions, and cultural experiences.

Michael A. Erickson (erickson@ucr.edu) is a cognitive scientist who investigates people's use of concepts and categories as they endeavour to understand themselves, the world, and their relation to it.

Introduction

The impact of Coronavirus Disease 2019 (COVID-19) on the health and safety of the world has been lasting, and many issues may become even more apparent as time goes on. As the pandemic evolves, researchers can observe and document issues, such as COVID-19's higher mortality rate for African American, Latinx, and Indigenous groups (Tai et al., 2021); greater risks and infection in the Native Hawaiian and Pacific Islander (NHPI) communities (Kaholokula et al., 2020); and its negative impact on the mental health of US communities (Twenge et al., 2020). Understanding and documenting the repercussions of pandemics is important in helping to prepare and plan for future health crises and pandemics. Additionally, the world is in a unique position to be able to better understand the relationship between certain environmental and social factors and those restrictions involved in helping limit the spread of COVID-19.

Hawai'i is composed of 8 major islands in relative isolation in the Pacific Ocean. Hawai'i has an ethnically and culturally diverse population, with no one group representing a clear majority (US Census Bureau, 2020). The variety of ethnic groups in Hawai'i consists of Asian, Multiracial, White, Hispanic, and NHPI, with over 21% of its population age 60 or older (US Census Bureau, 2020). Additionally, Hawai'i's population consists of many multigenerational households (Peterkin, 2017), where a family composed of many generations and of multiple ages can live in very modest spaces. Many people in Hawai'i are dependent on the tourism industry, which necessitates that visitors from other states and countries travel to Hawai'i and shop (Terrell, 2021).

At the onset of the COVID-19 pandemic, physical distancing, reduction in travel, and minimizing large gatherings were implemented in various states (CDC, 2021). Reducing shared spaces and movement has been used to mitigate the spread of contagious diseases in various places. For example, in Europe during the 14th century, effective mitigation and spreading of the plague was achieved through quarantine (CDC, 2012). In the US, the yellow-fever epidemic resulted in the creation of the 1878 National Quarantine Act (Michael, 2011). At various points throughout the waves of COVID-19, Hawai'i implemented similar strategies of containment. A stay-at-home order was implemented on March 25, 2020 in Hawai'i, and by mid-May, transmission was minimal to zero (Disease Outbreak Control Division, 2021).

Quarantine and isolation are used to prevent infection and spread of infectious disease, which can protect physical health; however, it is also important to consider the impact of these measures on mental health. Previous studies have shown that people who have quarantined to prevent outbreaks of infectious disease have reported deleterious impacts on mental health. In 2003, the Severe Acute Respiratory Syndrome (SARS) outbreak in Canada, found an increase in

post-traumatic stress disorder (PTSD) symptoms among healthcare providers who had to quarantine and isolate (Reynolds et al., 2008). Similarly, symptoms of post-traumatic stress disorder (PTSD) were found in 30% of children and 25% of parents of children who had to undergo isolation or quarantine to prevent spread of disease (Sprang & Sillman, 2013). Other symptoms of psychological distress, such as anxiety and experiences of anger, were exacerbated for adults who were isolated during the Middle East Respiratory Syndrome (MERS) epidemic (Jeong et al. 2016). Several researchers have predicted increases in anxiety, depression, and suicide related to COVID-19 and the measures intended to stop its spread (Pfefferbaum & North, 2016; Reger et al., 2020). Recent research has demonstrated that adults in the US from April to May of 2020 were three times more likely to screen positive for depressive disorders and/or anxiety disorders than they were in 2019 (Twenge et al. 2020). The impact of quarantine and isolation on mental health issues is important to document and this evidence may be useful in informing policy-makers, clinicians, and mental health practitioners about potential mental health outcomes associated with pandemic measures.

Hawai'i may also face unique challenges when it comes to pandemics in general. As previously stated, the current economy of Hawai'i is largely tourist driven, with families accustomed to sharing modest spaces to meet the high cost of living. Quarantine and isolation measures naturally require minimizing distance and travel, and thus implementing these methods during pandemics in Hawai'i will likely be challenging. Exacerbating the issue is that access to mental health resources in Hawai'i is often limited. Access to care as measured by Mental Health America (2022) demonstrates that in relation to the rest of the nation, Hawai'i ranks 19th in the nation in access to mental health services. Before the pandemic, the supply of qualified mental health practitioners was not sufficient to meet the demand in Hawai'i (Aronson & Withy, 2017). Additionally, rural areas in Hawai'i have traditionally been underserved by mental health practitioners (Levin, 2010). Given the ethnically diverse population of Hawai'i, any mental health treatments may also require that mental health practitioners be both culturally sensitive and fluent in understanding the unique issues surrounding Hawai'i (Chan & Wong, 2004). Given that studies have estimated that limiting social gatherings may increase COVID-19 related mental health issues, it is important to investigate whether Hawai'i has also seen a comparable increase in mental health issues (Pfefferbaum & North, 2016; Reger et al. 2020). To this end, the authors review general trends of depression in Hawai'i and investigate the impact COVID-19 and pandemic related social restraints have had on these mental health issues at the beginning of the COVID-19 pandemic. This targeted review may expand and bolster research regarding pandemic related mental health issues, helping to inform decision-making policies that can minimize harm to the mental well-being of impacted individuals. It is especially important to focus attention at the beginning of the pandemic, as that is the time in which many health and safety protocols are initiated and constructed. Data regarding

the possible increase in mental health illness should be considered when constructing such policies in Hawaiʻi.

Methods

Pre-COVID-19 - 2011-2014 Measure of Depression in Hawaii

The Hawaiʻi Behavioral Risk Factor Surveillance System (HBRFSS, 2021) asked respondents, "Have you ever been told you had a depressive disorder?" each year from 2011-2014. This survey used the Disproportionate Stratified Sample (DSS) method to randomly select landline-based telephone numbers of people living in Hawaiʻi. We accessed these data via the Hawaii Health Data Warehouse (2021).

During-COVID-19 - 2020 Measure of Depression in Hawaii

The National Center for Health Statistics (NCHS, 2021) partnered with the Census Bureau to deploy the Household Pulse Survey in 2020 (CDC Pulse). This 20-minute online survey included the Patient Health Questionnaire (PHQ-2; Kroenke et al, 2003), a two-item measure of depression. The PHQ-2 asks, "Over the last 2 weeks, how often have you been bothered by the following problems?" This was modified in the CDC Pulse questionnaire to ask, "Over the last **7 days**,…" (emphasis added). The problems listed were, "Little interest or pleasure in doing things," and, "Feeling down, depressed or hopeless." The possible responses and scores were, "Not at all," (0) "Several days," (+1) "More than half the days," (+2) and "Nearly every day" (+3). The scores for the two questions were summed, and in the CDC Pulse data, the percentage of scores that summed to 3 or more were reported. A score of 3 or more on the PHQ-2 is considered an optimal cut off point for screening for depression (Kroenke et al, 2003). We accessed the data for the state of Hawaii at 19 time points (see Figures 1 & 2) over seven months after the onset of the COVID-19 pandemic, April 23 – November 23, 2020, via the CDC website (Centers for Disease Control, 2022). This timeline was chosen to spotlight the impact on mental health that can occur when pandemic protocols are first implemented.

Analytic Approach

Depression prevalence estimates (i.e., proportions) with 95% confidence intervals at each time point are displayed in Figure 1. We computed overall Pre-COVID-19 and during COVID-19 depression prevalence estimates, and then conducted a chi-square test to examine whether depression prevalence has increased. Neither the HBRFSS (2021) nor the CDC Pulse (2022) data appear to report sample size directly. At the time of this analysis, the data were collected at the state level. They did, however, report 95% confidence intervals. Sample size was inferred from the confidence intervals in the HBRFSS (2021) data using the Wald method (Agresti & Coull, 1998). Because the HBRFSS (2021) did not specify how 95% confidence intervals were computed, the more common Wald method was

utilized to infer sample sizes. Parker et al. (2017), however, specify that 95% confidence intervals in the CDC (2022) data were computed using the Clopper-Pearson method. For those data, therefore, that same method was used to infer sample sizes from the reported confidence intervals All analyses were completed using R (R Core Team, 2021).

Table 1. *Sample size estimates of those who were diagnosed Pre-COVID-19 vs. During COVID-19 using the Wald Method. Percentages are in parentheses.*

Depression	Pre-COVID-19	During COVID-19
Yes	1562.345 (11.03%)	1478.124 (24.23%)
No	12599.367 (88.97%)	4621.587 (75.77%)

Surveillance System. CDC = Centers for Disease Control. Error bars represent 95% confidence intervals of the proportions.

This study used the question from the HBRFSS, "Have you **ever** been told you had a depressive disorder?" (emphasis added) to measure depression before the COVID-19 pandemic. As administered in the CDC Pulse survey, the PHQ-2 examines indicators of a depressive disorder in the past week. Because the HBRFSS measures depression for a longer duration than the past week, estimates from the HBRFSS should be greater in a population than estimates from the CDC Pulse survey. Nevertheless, we use the values from the HBRFSS to estimate a base rate of depressive disorders in Hawai'i. We realize that there is a limitation to comparing data regarding having a diagnosis of depression ever (HBRFSS) with the current PHQ-2 data which measures depressive symptoms currently (CDC Pulse survey). These types of depression are not equivalent; however, percentage differences may provide indication of a trend, especially at this early phase of the COVID-19 pandemic.

Results/Discussion

Prevalence estimates and sample sizes of depression Pre-COVID-19 and During COVID-19 are reported in Table 1. From these estimates, a chi-square test of independence was conducted, and the results were significant, x^2 (1, n = 20, 261.42) = 582.48, p < .001. Before COVID-19, typical rates of depression were at 11.03%, 95% CI [10.51%, 11.55%]. During COVID-19 reports of depression increased to 24.23%, 95% CI [23.16%, 25.31%]. Figure 2 provides a more refined illustration of the depression or psychological distress rates in Hawai'i before the pandemic and at specific timepoints after the pandemic began. With Figure 2, it is clear that the rise in depressive symptoms was sharp and steady throughout the first wave of the pandemic.
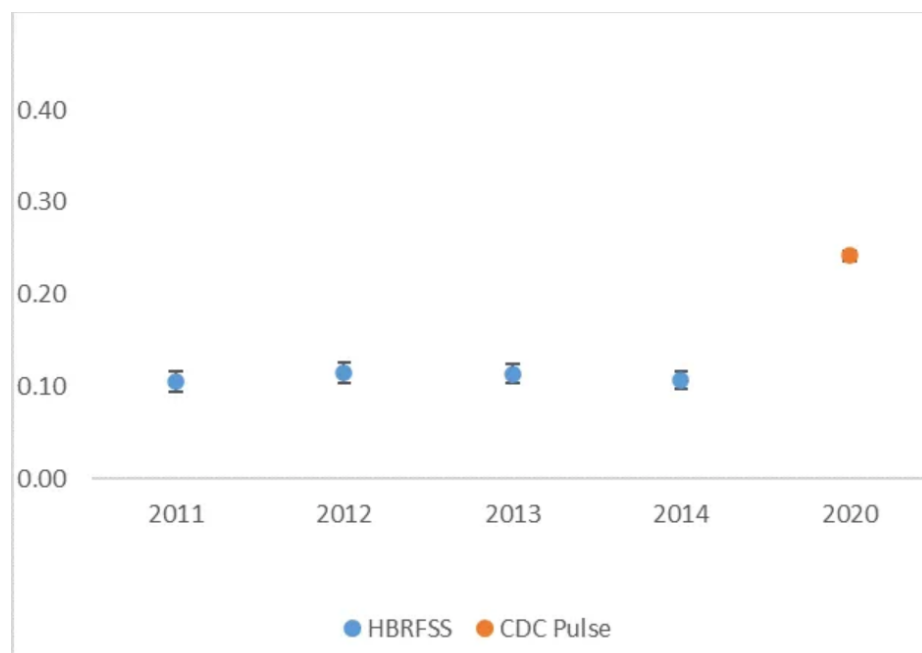
Figure 1 Depression Prevalence (i.e., Proportion) in Hawaii from 2011-2014 to 2020. *Note.* HBRFSS = Hawaii Behavioral Risk Factor
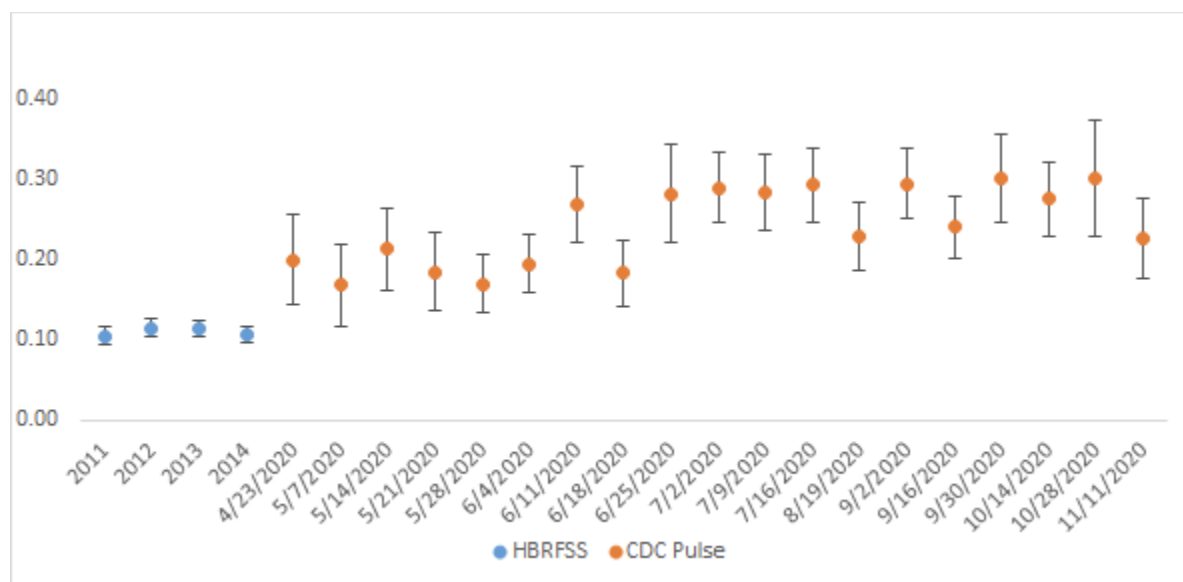
Figure 2. Depression Prevalence (i.e., Proportion) in Hawaii over all available time points. *Note.* HBRFSS = Hawaii Behavioral Risk Factor Surveillance System. CDC = Centers for Disease Control. Error bars represent 95% confidence intervals of the proportions.

This current study has demonstrated that depressive symptoms doubled in Hawai'i at the early stages of the COVID-19 pandemic. This aligns with other studies that have shown a similar trend across the continental US during the beginning of COVID-19 pandemic when quarantine and lock-down measures were also instigated (Twenge & Joiner, 2020). Although the results are only taken from samples of those who responded to the respective surveys and extrapolation of these results to the general population should be approached conservatively, one could estimate that depressive symptoms are likely to rise or increase during times of quarantine and isolation in Hawai'i.

Limitations

Our results are limited by estimating sample sizes, as neither the Hawai'i Behavioral Risk Factor Surveillance System (HBRFSS, 2021) nor the CDC Pulse (2022) data appear to report sample size directly, nor specific demographics at the time of collection. At the time of the analysis, the ability to obtain more specific data was unavailable and we recognize that online data dashboards and websites are updated routinely to allow for such changes. A recent study looking at similar data from Hawai'i over several waves has concluded that there is a similar increase in mental health issues in Hawai'i (Zhang et al, 2021). This current study's emphasis was at the first wave of the pandemic and both studies concur that significant mental distress is evident at the initial impact in Hawai'i. This may reflect a broad reaction to sudden social and lifestyle changes initiated by pandemic protocols, health impacts of the virus, and fear of contraction. Hawai'i has significant cultural and geographical considerations that may foster more health concerns for its population.

Conclusion

The long-term impact of these increased symptoms of depression is still not completely clear. As stated previously, isolation and quarantine measures can have deleterious impacts on mental health (Soon et al. 2013; Gammon, 1998). Given that Hawai'i has a unique geographical, cultural, and economic place in the world, it is important to consider effective mitigation efforts to control for any negative mental health impacts that future pandemics may entail. Recent advancements in telehealth interventions may address issues regarding access to mental health providers that involve minimal physical requirements and can help reach people in rural areas and neighboring islands of Hawai'i (Grist et al. 2017; Grist et al. 2019). Future studies and research should explore the effectiveness of implementing such strategies to improve mental health outcomes, especially during infectious disease outbreaks.

The rise in depressive symptoms in Hawai'i is likely to be attributable to many factors, and individual and cultural differences should be considered. For example, Zhang and colleagues (2021) found that Asians in Hawai'i were likely to show the lowest rise in mental health issues. Ehsan et al. (2019) found that

social support, social networks, and interpersonal relationships are all essential components in predicting health outcomes. A better understanding of cultural and individual level differences in social support may allow for targeted support and more efficient use of resources to mitigate mental health problems.

Finally, a better awareness of the mental health issues that are faced during isolation and quarantine can reduce stigma surrounding mental health issues and help promote preventative care and resiliency training (Wainberg et al. 2017). Co-occurring infectious disease and mental health issues may negatively impact health outcomes and overwhelm a health system that, especially during a pandemic, may be already strained (Supady et al. 2021). It is recommended that future research and health policies include psychosocial preparedness guidelines and consider mental health issues to help mitigate the negative health impacts of future pandemics.

References

Aaronson, A., & Withy, K. (2017). Does Hawai ʻi Have Enough Psychiatrists? Assessing Mental Health Workforce Versus Demand in the Aloha State. *Hawai'i Journal of Medicine & Public Health, 76*(3 Suppl 1), 15-17. PMID: 28435753

Agresti, A., & Coull, B. A. (1998). Approximate is better than "exact" for interval estimation of binomial proportions. *The American Statistician, 52*(2), 119-126. https://doi.org/10.2307/2685469

Chan, P. S., & Wong, M. M. (2004). Physicians and complementary-alternative medicine: training, attitudes, and practices in Hawaii. *Hawaii medical journal, 63*(6),176-181. PMID: 15298087

CDC. COVID-19 travel recommendations by destination. Cdc.gov. Published April 5, 2021. Accessed April 8, 2021. https://www.cdc.gov/coronavirus/2019-ncov/travelers/map-and-travel-notices.html

Centers for Disease Control and Prevention [Internet]. CDC Data. [cited 2022Mar23]. Available from: https://data.cdc.gov/api/views/8pt5-q6wp/rows.rdf?accessType=DOWNLOAD

Centers for Disease Control and Prevention History of Quarantine. 2012 [cited 2020 Mar 12]. Available from: https://www.cdc.gov/quarantine/historyquarantine.html

Disease Outbreak Control Division, COVID-19, Hawaii State Department of Health, Hawaii Epi Control Curve-2021, author. Data spread between March 2 and May 29th, 2020. How is Hawaiʻi doing at flattening the epidemic curve? Updated Nov 12, 2021. Accessed May 31. https://health.hawaii.gov/coronavirusdisease2019/what-you-should-know/current-situation-in-hawaii/#epicurve

Ehsan, A., Klaas, H. S., Bastianen, A., & Spini, D. (2019). Social capital and health: a systematic review of systematic reviews. *SSM-population health, 8*, 100425. https://doi.org/10.1016/j.ssmph.2019.100425

Gammon, J. (1998). Analysis of the stressful effects of hospitalisation and source isolation on coping and psychological constructs. *International journal of nursing practice, 4*(2), 84-96. https://doi.org/10.1046/j.1440-172X.1998.00084.x

Grist, R., Porter, J., & Stallard, P. (2017). Mental health mobile apps for preadolescents and adolescents: a systematic review. *Journal of medical internet research*, *19*(5), e7332. https://doi.org/10.2196/jmir.7332

Grist, R., Croker, A., Denne, M., & Stallard, P. (2019). Technology delivered interventions for depression and anxiety in children and adolescents: a systematic review and meta-analysis. *Clinical Child and Family Psychology Review*, *22*(2), 147-171. https://doi.org/10.1007/s10567-018-0271-8

Hawaii Health Data Warehouse. Hawaii State Department of Health; 2021 [cited 2022Mar22]. Available from: http://hhdw.org/

HBRFSS: Hawaii Health Data Warehouse; Hawaii State Department of Health, Behavioral Risk Factor Surveillance System. HHDW.org. Accessed April 6, 2021. http://hhdw.org/wp-content/uploads/BRFSS_Depression_IND_00002_2011-1.pdf

Jeong, H., Yim, H. W., Song, Y. J., Ki, M., Min, J. A., Cho, J., & Chae, J. H. (2016). Mental health status of people isolated due to Middle East Respiratory Syndrome. *Epidemiology and health*, *38, e2016048*. https://doi.org/10.4178/epih.e2016048

Kaholokula, J. K. A., Samoa, R. A., Miyamoto, R. E., Palafox, N., & Daniels, S. A. (2020). COVID-19 special column: COVID-19 hits Native Hawaiian and Pacific Islander communities the hardest. *Hawai'i Journal of Health & Social Welfare*, *79*(5), 144-146. PMID: 32432218

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2003). The Patient Health Questionnaire-2: validity of a two-item depression screener. *Medical care*, 1284-1292. https://doi.org/10.1097/01.MLR.0000093487.78664.3C

Levin, B. L., & Hanson, A. (2001). Rural mental health services. In *Handbook of rural health* (pp. 241-256). Springer, Boston, MA.

Mental Health America. (n.d.). *Ranking the states 2022*. Mental Health America. Retrieved October 27, 2022, from https://mhanational.org/issues/2022/ranking-states

Michael JM. The National Board of Health: 1879-1883. Public Health Rep. 2011;126:123–129 and Centers for Disease Control and Prevention History of quarantine. 2012 [cited 2020 Mar 12]. Available from: https://www.cdc.gov/quarantine/historyquarantine.html

NCHS: Mental health - Household Pulse Survey - COVID-19. Cdc.gov. Published March 24, 2021. Accessed April 6, 2021. https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm

Parker, J. D. T. M., Talih, M., Malec, D. J., Beresovsky, V., Carroll, M. D., Gonzalez, J. F., Hamilton, B.E., Ingram, D.D., Kochanek, K., McCarty, F., Moriarity, C., Shimizu, I., Strashny, A., & Ward, B. W. (2017). National Center for Health Statistics data presentation standards for proportions, *Vital and health statistics. Series 2, Data evaluation and methods research, (175), 1-22*. PMID: 30248016

Peterkin O. Why Hawaii trends toward large and extended families - Honolulu civil beat. Civilbeat.org. Published November 21, 2017. Accessed April 6, 2021. https://www.civilbeat.org/2017/11/why-hawaii-trends-toward-large-and-extended-families/

Pfefferbaum, B., & North, C. S. (2020). Mental health and the Covid-19 pandemic. *New England Journal of Medicine, 383*(6), 510-512. https://doi.org/10.1056/NEJMp2008017

Reger, M. A., Stanley, I. H., & Joiner, T. E. (2020). Suicide mortality and coronavirus disease 2019—a perfect storm?. *JAMA psychiatry, 77*(11), 1093-1094. https://doi.org/10.1001/jamapsychiatry.2020.1060

Reynolds, D. L., Garay, J. R., Deamond, S. L., Moran, M. K., Gold, W., & Styra, R. (2008). Understanding, compliance and psychological impact of the SARS quarantine experience. *Epidemiology & Infection, 136*(7), 997-1007. https://doi.org/10.1017/s0950268807009156

R Core Team (2021). R: A language and environment for statistical computing. [Computer software]. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Soon, M. M. L., Madigan, E., Jones, K. R., & Salata, R. A. (2013). An exploration of the psychologic impact of contact isolation on patients in Singapore. *American journal of infection control, 41*(10), e111-e113. https://doi.org/10.1016/j.ajic.2013.01.037

Sprang, G., & Silman, M. (2013). Posttraumatic stress disorder in parents and youth after health-related disasters. *Disaster medicine and public health preparedness, 7*(1), 105-110. https://doi.org/10.1017/dmp.2013.22

Supady, A., Curtis, J. R., Abrams, D., Lorusso, R., Bein, T., Boldt, J., ... & Brodie, D. (2021). Allocating scarce intensive care resources during the COVID-19 pandemic: practical challenges to theoretical frameworks. *The Lancet*

Respiratory Medicine, *9*(4), 430-434. https://doi.org/10.1016/s2213-2600(20)30580-4

Tai, D. B. G., Shah, A., Doubeni, C. A., Sia, I. G., & Wieland, M. L. (2021). The disproportionate impact of COVID-19 on racial and ethnic minorities in the United States. *Clinical Infectious Diseases*, *72*(4), 703-706. https://doi.org/10.1093/cid/ciaa815

Terrell, J. (2020). Will Hawaiʻi Finally Be Able to Break Its Dependence on Tourism. *Honolulu Civil Beat*, *12.* Retrieved from https://www.civilbeat.org/2020/10/will-hawaii-finally-be-able-to-break-its-dependence-on-tourism/

Twenge, J. M., & Joiner, T. E. (2020). US Census Bureau-assessed prevalence of anxiety and depressive symptoms in 2019 and during the 2020 COVID-19 pandemic. *Depression and anxiety*, *37*(10), 954-956. https://doi.org/10.1002/da.23077

United States Census Bureau. QuickFacts: Hawaii. Accessed December 18, 2020, from https://www.census.gov/quickfacts/HI

Wainberg, M. L., Scorza, P., Shultz, J. M., Helpman, L., Mootz, J. J., Johnson, K. A., ... & Arbuckle, M. R. (2017). Challenges and opportunities in global mental health: a research-to-practice perspective. *Current psychiatry reports*, *19*(5), 1-10. https://doi.org/10.1007/s11920-017-0780-z

Zhang, W., Wu, Y. Y., & Walkover, M. (2021). Prevalence of Psychological Distress in Hawaiʻi during the COVID-19 Pandemic: Exploring Disparities Using 11 Waves of Data from the Household Pulse Survey. *Hawaiʻi journal of health & social welfare*, *80*(10 Suppl 2), 10-17. PMID: 34704063