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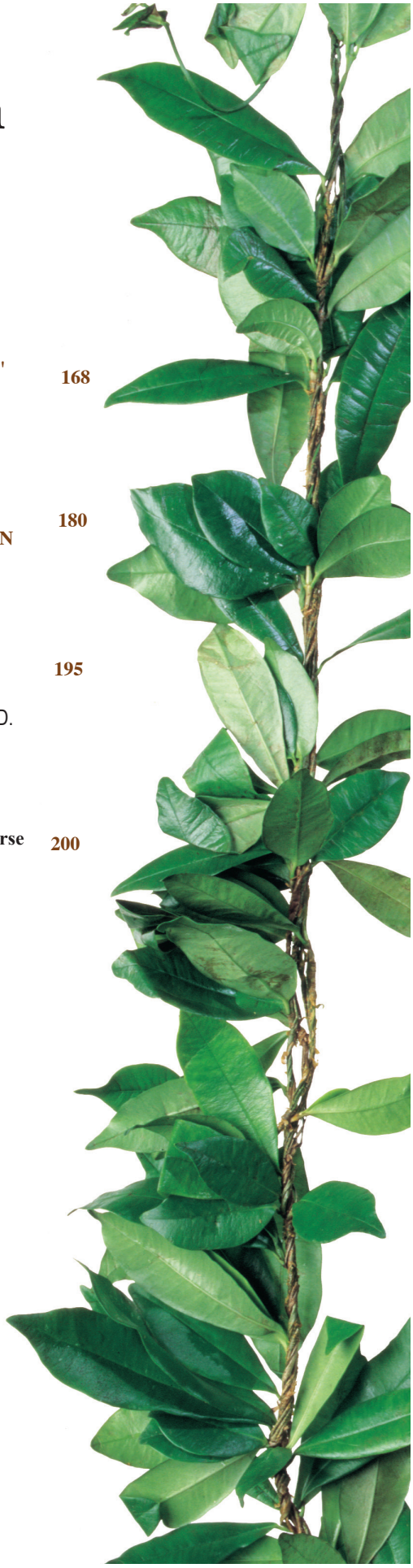

Hawai‘i Journal of Health & Social Welfare

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Aim:

The aim of the Hawai‘i Journal of Health & Social Welfare is to advance knowledge about health and social welfare, with a focus on the diverse peoples and unique environments of Hawai‘i and the Pacific region.

History:

In 1941, a journal then called The Hawai‘i Medical Journal was founded by the Hawai‘i Medical Association (HMA). The HMA had been incorporated in 1856 under the Hawaiian monarchy. In 2008, a separate journal called the Hawai‘i Journal of Public Health was established by a collaborative effort between the Hawai‘i State Department of Health and the University of Hawai‘i at Mānoa Office of Public Health Studies. In 2012, these two journals merged to form the Hawai‘i Journal of Medicine & Public Health, and this journal continued to be supported by the Hawai‘i State Department of Health and the John A. Burns School of Medicine.

In 2018, the number of partners providing financial backing for the journal expanded, and to reflect this expansion the name of the journal was changed in 2019 to the Hawai‘i Journal of Health & Social Welfare. The lead academic partners are now the six units of the UH College of Health Sciences and Social Welfare, including the John A. Burns School of Medicine, Office of Public Health Studies, the Thompson School of Social Work & Department of of Public Health Sciences, School of Nursing and Dental Hygiene, the UH Cancer Center, and the Daniel K. Inouye College of Pharmacy other partners are the Hawai‘i State Department of Health. The journal is fiscally managed by University Health Partners of Hawai‘i.

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Hawai'i Journal of Health & Social Welfare
General Recommendations on Data Presentation and Statistical Reporting (Biostatistical Guideline for HJH&SW)
[Adapted from Annals of Internal Medicine & American Journal of Public Health]

The following guidelines are developed based on many common errors we see in manuscripts submitted to HJH&SW. They are not meant to be all encompassing, or be restrictive to authors who feel that their data must be presented differently for legitimate reasons. We hope they are helpful to you; in turn, following these guidelines will reduce or eliminate the common errors we address with authors later in the publication process.

Percentages: Report percentages to one decimal place (eg, 26.7%) when sample size is >=200. For smaller samples (<200), do not use decimal places (eg, 27%, not 26.7%), to avoid the appearance of a level of precision that is not present.

Standard deviations (SD)/standard errors (SE): Please specify the measures used: using "mean (SD)" for data summary and description; to show sampling variability, consider reporting confidence intervals, rather than standard errors, when possible, to avoid confusion.

Population parameters versus sample statistics: Using Greek letters to represent population parameters and Roman letters to represent estimates of those parameters in tables and text. For ex ample, when reporting regression analysis results, Greek symbol (ß), or Beta (b) should only be used in the text when describing the equations or parameters being estimated, never in reference to the results based on sample data. Instead, one can use "b" or ß for unstandardized regression parameter estimates, and "B" or ß for standardized regression parameter estimates.

***P* values:** Using *P* values to present statistical significance, the actual observed *P* value should be presented. For *P* values between .001 and .20, please report the value to the nearest thousandth (eg, *P*=.123). For *P* values greater than .20, please report the value to the nearest hundredth (eg, *P* =.34). If the observed *P* value is great than *.999*, it should be expressed as "*P* > *.99*". For a *P* value less than .001, report as "*P*<.001". Under no circumstance should the symbol "NS" or "ns" (for not significant) be used in place of actual *P* values.

"Trend": Use the word trend when describing a test for trend or dose-response. Avoid using it to refer to *P* values near but not below .05. In such instances, simply report a difference and the confidence interval of the difference (if appropriate), with or without the *P* value.

One-sided tests: There are very rare circumstances where a "one sided" significance test is appropriate, eg, non-inferiority trials. Therefore, "two-sided" significance tests are the rule, not the ex ception. Do not report one-sided significance test unless it can be justified and presented in the experimental design section.

Statistical software: Specify in the statistical analysis section the statistical software used for analysis (version, manufacturer, and manufacturer's location), eg, SAS software, version 9.2 (SAS Institute Inc., Cary, NC).

Comparisons of interventions: Focus on between-group differ ences, with 95% confidence intervals of the differences, and not on within-group differences.

***Post-hoc* pairwise comparisons**: It is important to first test the overall hypothesis. One should conduct *post-hoc* analysis if and only if the overall hypothesis is rejected.

Clinically meaningful estimates: Report results using meaningful metrics rather than reporting raw results. For example, instead of the log odds ratio from a logistic regression, authors should transform coefficients into the appropriate measure of effect size, eg, odds ratio. Avoid using an estimate, such as an odds ratio or relative risk, for a one unit change in the factor of interest when a 1-unit change lacks clinical meaning (age, mm Hg of blood pressure, or any other continuous or interval measurement with small units). Instead, reporting effort for a clinically meaningful change (eg, for every 10 years of increase of age, for an increase of one standard deviation (or interquartile range) of blood pressure), along with 95% confidence intervals.

Risk ratios: Describe the risk ratio accurately. For instance, an odds ratio of 3.94 indicates that the outcome is almost 4 times as likely to occur, compared with the reference group, and indicates a nearly 3-fold increase in risk, not a nearly 4-fold increase in risk.

Longitudinal data: Consider appropriate longitudinal data analyses if the outcome variables were measured at multiple time points, such as mixed-effects models or generalized estimating equation approaches, which can address the within-subject variability.

Sample size, response rate, attrition rate: Please clearly indicate in the methods section: the total number of participants, the time period of the study, response rate (if any), and attrition rate (if any).

Tables (general): Avoid the presentation of raw parameter estimates, if such parameters have no clear interpretation. For instance, the results from Cox proportional hazard models should be presented as the exponentiated parameter estimates, (ie, the hazard ratios) and their corresponding 95% confidence intervals, rather than the raw estimates. The inclusion of *P*-values in tables is unnecessary in the presence of 95% confidence intervals.

Descriptive tables: In tables that simply describe characteristics of 2 or more groups (eg, Table 1 of a clinical trial), report averages with standard deviations, not standard errors, when data are nor mally distributed. Report median (minimum, maximum) or median (25th, 75th percentile [interquartile range, or IQR]) when data are not normally distributed.

Figures (general): Avoid using pie charts; avoid using simple bar plots or histograms without measures of variability; provide raw data (numerators and denominators) in the margins of meta-analysis forest plots; provide numbers of subjects at risk at different times in survival plots.

Missing values: Always report the frequency of missing variables and how missing data was handled in the analysis. Consider add ing a column to tables or a footnote that makes clear the amount of missing data.

Removal of data points: Unless fully justifiable, all subjects included in the study should be analyzed. Any exclusion of values or subjects should be reported and justified. When influential observations exist, it is suggested that the data is analyzed both with and without such influential observations, and the difference in results discussed.

Firouzbakht S, Wong Z, Ronquillo T, Tschann M, Choi SY, Soon R. Factors Influencing Obstetrics and Gynecology Residents' Intentions to Provide Abortion Care after Training. *Hawaii J Health Soc Welf*. 2025;84(9):168-179. doi:10.62547/XKDJ9021

Factors Influencing Obstetrics and Gynecology Residents' Intentions to Provide Abortion Care after Training

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Abstract

Many counties in the US do not have an abortion provider despite abortion being one of the most common medical procedures among reproductive aged women. Increasing the number of abortion providers in the country is a multi-faceted endeavor. Understanding the factors that influence obstetrics and gynecology residents to include abortion in their future practice is an essential component. This study sought to determine the relationship between knowledge and attitudes about abortion during residency training and the intention to provide abortion care after residency training completion. An anonymous online survey was distributed to obstetrics and gynecology residents via an invitation to program directors at accredited obstetrics and gynecology residency programs in the US. Eligible participants were obstetrics and gynecology residents enrolled at accredited residency programs in the US at the time of distribution. Survey data were collected from August 2019-February 2020 and were compiled online. Our multivariable analysis found that participation or planned participation in abortion training during residency positively influenced residents' intention to provide abortion care post-residency which supports the importance of abortion training during residency thereby improving access to abortion care. As comprehensive abortion training for obstetrics and gynecology residents is threatened with the overturn of Roe v Wade by the US Supreme Court in 2022, this research demonstrates the value of hands-on abortion experience in ensuring that this skill remains a core component of obstetrics and gynecology practice.

Abbreviations

ACGME= Accreditation Council for Graduate Medical Education
HIPAA= Health Insurance Portability and Accountability Act of 1996
OB-GYN= Obstetrics and Gynecology

Introduction

Despite abortion being one of the most common medical procedures among women of reproductive age, it is estimated that 89% of US counties do not have an abortion provider, and nearly 40% of reproductive-aged women live in these counties.[1-3] A 2011 study found that 97% of US obstetrician-gynecologists encountered patients seeking abortion care, yet only 14% provide that care.[4] Geographical disparities in abortion provision influence the type of abortion that patients can access. Patients who live 50 miles or more from an abortion provider are more likely to have second trimester abortions compared to patients who live within 25 miles or less from a provider.[5]

Abortion training during residency is one of the biggest predictors of future abortion provision.[6] In 1996, the Accreditation Council for Graduate Medical Education (ACGME) required that obstetrics and gynecology (OB-GYN) residency programs offer induced abortion training to residents, allowing residents to opt out for religious or moral objections.[7] Abortion training during residency has also increased due to the support of the Ryan Residency Training Program, an initiative to increase family planning training within OB-GYN residency programs, resulting in nearly 7000 OB-GYN residents participating in abortion training since its inception in 1999.[6,8] The 2022 Supreme Court decision in *Dobbs vs Jackson Women's Health Organization* has put these requirements for training in jeopardy. A 2022 analysis determined that nearly half of the US OB-GYN residency programs are located in states that were likely or certain to ban abortion in a post-*Roe* environment.[9] All of these states have since instituted an abortion ban or attempted to institute a ban.

Across medical specialties and training environments, it is evident that abortion training and education increases medical professionals' interest in providing abortion care.[8] Medical students' participation in Reproductive Health Externships through Medical Students for Choice increases their intention to provide abortion care, while pharmacists' knowledge of medication abortion was positively correlated with their willingness to dispense mifepristone when given the opportunity.[10,11] Reproductive Health Externships provide medical students an opportunity to observe reproductive health services, such as abortion care, in a clinical setting. They can be particularly beneficial for medical students attending medical school in geographical locations with abortion bans or where observation experiences can be limited. A recent study found that the majority of physicians, across specialties, at an academic medical center in Wisconsin were willing to consult on abortion care, however the strongest willingness was found among those who perceived that their professional peers were also supportive of abortion care.[12]

This study seeks to more comprehensively ascertain if there are personal characteristics or experiences that influence a resident's intent to provide abortions in their prac-

tices after completing their residency training. While training environments and exposure to abortion among trainees can increase their intention to provide care, it is also important to understand how the clinical knowledge and perspective of obstetrics and gynecology residents impact their intention to provide abortion after residency. A national survey of OB-GYN residents was completed to evaluate whether there is a correlation between knowledge about abortion and attitudes toward abortion, and whether either knowledge or attitude affect intention to provide abortions after residency. The authors hypothesized that knowledge levels differ among those with supportive and unsupportive attitudes toward abortion. It was also hypothesized that higher knowledge and supportive attitude scores positively correlate with intention to provide abortion care after residency graduation.

Methods

Study Design

Eligible survey participants were current obstetrics and gynecology residents at accredited residency programs in the US at the time of survey distribution. Between August 2019-February 2020, the resident researcher contacted via e-mail either the residency program coordinator, or, if information was not available for a coordinator, contacted the residency program director for all ACGME accredited obstetrics and gynecology programs in the US. The email requested their assistance in disseminating the anonymous survey (**Appendix 1**) to current residents. The first 100 residents who responded were offered a monetary incentive for participation. Programs who did not initially respond were contacted at least 2 more times to request their assistance with dissemination.

The primary outcome of this study was to better understand the relationship between different predictors of the intent to provide abortion care after residency training. The survey collected demographic information about participants' age, gender, religion, religiousness (self-defined through a Likert scale response to the question "how important is religion in your life?"), marital status, number of children, year in residency, type of abortion training in their residency program, and experience or planned experience with procedural abortions. It included 7 knowledge-based multiple-choice questions about abortion in the US, each scored with 1 point for correct and 0 points for incorrect (a total of 7 possible points). Participants rated the moral acceptability of 8 scenarios in which an individual might seek an abortion using a 5-point Likert scale. Finally, participants were asked if they planned to offer abortion services once they completed residency training.

Surveys were sent to every residency program in the US resulting in an estimated 5400 potential respondents. The goal was to collect 1545 completed surveys, or a 30% response rate, based on response rates from previously published studies of surgical residents.[13,14]

Data Analysis

The surveys were collected via REDCap [(Research Electronic Data Capture) Vanderbilt University, Nashville, TN], a secure, Health Insurance Portability and Accountability Act of 1996 (HIPAA) compliant data collection tool. Survey participants' characteristics were summarized using descriptive statistics. Bivariate association between intention to provide abortion services after graduation and other characteristics was tested using 2-sample t-test or Wilcoxon rank sum test for continuous variables, and Chi-squared test or Fisher's exact test for categorical variables. A multivariable logistic regression model was fitted for intention to provide abortion services after residency adjusting for age, gender, religion, religiousness, marital status, having children, year in residency, abortion training types provided, participation in abortions during residency, knowledge score, and moral acceptability score.

The University of Hawai'i IRB approved this study, protocol number 2018-00835.

Results

A total of 5400 eligible subjects were targeted for the sample however this number cannot be verified due to lack of response from some programs. A total of 547 responses were collected. Of those, 46 were excluded due to incomplete responses, resulting in final analysis of 501 responses. The demographic characteristics of respondents are presented in **Table 1**. Most respondents identified as female (86.8%), and nearly half (45.5%) were married. Ages ranged from 24 to 47 years (mean age 29) and respondents were nearly evenly distributed among the 4 years of residency.

Over half of the respondents (66.1%) had an opt-out abortion training rotation in their residency, a form of training where training is routinely integrated into the residency but residents with objections can opt out of participation, and 85.0% participated in or planned to participate in procedural abortion procedures during residency. More than half of the respondents (55.9%) reported planning to offer abortion services after graduation, while 21.8% indicated they would not offer services and 21.8% were undecided. The mean score for the 7 abortion knowledge questions was 3.6 (SD = 1.4), with a range from 0 to 7. Distribution of knowledge scores over years of residency are shown in **Figure 1**. Supportive attitude toward abortion scores ranged from 0 to 32, with the average score of 28.1 (SD = 7.8).

Bivariate analyseses revealed that residents who planned to provide abortion had higher knowledge and moral acceptability scores on average compared to those who did not intend to participate or are undecided (**Table 2**). Other factors shown to have associations with intent to provide abortion were religion, religiousness, marital status, having children, offered abortion training types, and participation in procedural abortions during residency. The majority of respondents (n = 205, 73.0%) who reported religion as not or slightly important planned to provide abortion after graduation, compared with 15.0% (n= 42, P<.001) of resi-

Table 1. Summary of Demographic Data of OB-GYN Resident Respondents, August 2019-February 2020 (n=501)

Variable	Mean ± SD or n (%)
Age (2 missing)	29.3 ± 2.5 (min=24, max=47)
Gender	
Female	435 (86.8%)
Male	61 (12.2%)
Gender diverse	3 (0.6%)
Missing	*2 (0.4%)*
Religion	
Atheist	129 (25.7%)
Non-Catholic Christian	129 (25.7%)
Catholic	92 (18.4%)
Jewish	42 (8.4%)
Muslim	10 (2.0%)
Buddhist	4 (0.8%)
Hindu	17 (3.4%)
Other	64 (12.8%)
Missing	*14 (2.8%)*
Religiousness[a]	
Not important	206 (41.1%)
Slightly important	86 (17.2%)
Neutral	55 (11.0%)
Moderately important	90 (18.0%)
Extremely important	61 (12.2%)
Missing	*3 (0.6%)*
Relationship Status	
Single	113 (22.6%)
In a relationship	93 (18.6%)
Co-habiting	65 (13.0%)
Married	228 (45.5%)
Missing	*2 (0.4%)*
Have Children (2 missing)	64 (12.8%)
Year in Residency	
First	144 (28.7%)
Second	131 (26.1%)
Third	126 (25.1%)
Fourth	96 (19.2%)
Missing	*4 (0.8%)*
Abortion Training Availability[b]	
No training available through my program	44 (8.8%)
Opt-in training available	104 (20.8%)
Opt-out training available	331 (66.1%)
Mandatory training	19 (3.8%)
Missing	*3 (0.6%)*
Participated or plan to participate in procedural abortions during residency (2 missing)	426 (85.0%)
Knowledge Score [possible range 0-7] [a]	3.6 ± 1.4 (min=0, max=7)
Attitude Score [possible range 0-32][b]	28.1 ± 7.8 (min=0, max=32)
Plan to offer abortion services after graduation	
Yes	280 (55.9%)
No	109 (21.8%)
Undecided	109 (21.8%)
Missing	*3 (0.6%)*

[a] Complete answers only; 7 missing
[b]Complete answers only; 18 missing

dents who reported religion as moderately or extremely important. Almost all (99.0%, n=276) residents who planned to provide abortion care after graduation participated or planned to participate in procedural abortions during residency, compared to 68.0% (n=149, P <.001) of providers who did not plan to provide abortion care upon graduation.

Figure 1. Distribution of Knowledge Score on Abortion by Year in Residency from OB-GYN Survey Respondents February 2019-August 2020

Multivariable logistic regression with all variables showed that participation or planning to participate in abortion training during residency had a significant and large positive effect on intention to provide abortion care after residency (adjusted odds ratio [AOR] 19.29, 95% CI 5.86-84.48), while greater religiousness was negatively associated with intention to provide abortions after residency (AOR 0.24, 95% CI 0.07-0.74). Age also produced a small positive, significant association. The full analysis is shown in **Table 3**.

Discussion

The greatest predictor of the intention to provide abortion care post-OB-GYN residency was experience or planned experience in abortion education and care during residency. This relationship was stronger than any other association in the data and underlines the critical impact of abortion training in residency shown in previous research. While other factors, such as religiousness, marital status, and age were associated with intention to provide abortions, these associations were not as strong as the association between exposure/planned exposure to abortion care during residency training. It is also important to note that the number of residents who were undecided about providing abortions after residency was equivalent to the number who did not plan to provide abortions; there is an important opportunity to increase the number of individuals committed to providing abortion care by addressing this indecision through exposure to hands-on training.

The impact of real-life, hands-on training in developing OB-GYNs with commitment to providing abortion care must be understood in the context of how the landscape of abortion access is shifting after the *Dobbs* decision. It is reassuring that the data confirm the prior evidence that training significantly impacts intent to provide abortions. It is, however, troubling that access to hands-on training will likely diminish as more states ban abortion.[15-17] Little has been published to comprehensively capture the landscape of abortion training in the US since the overturn of *Roe*; however, a study that analyzed abortion training practices among residencies with Ryan Programs found that following the *Dobbs* decision, 14% of residency programs lost in-state abortion training.[18] Medical students are aware of these changes in abortion access and the threat that it provides to their training. One study showed that medical students expressed that changes in abortion access at potential training programs would likely or very likely influence their decision regarding location of considered residency program.[19] As hands-on training becomes scarce as more states ban abortion, it is critical for programs to find avenues for their students to access training through travel rotations, simulations, or increased training in miscarriage management. However, these workarounds are not equal to having integrated, routine abortion training as part of a residency program, and they fail to overcome the gaps left by abortion bans.

Hawai‘i has a long history of protecting abortion access and providing reproductive health education to medical students and residents. In anticipation of the volatile legal landscape in other states, Hawai‘i signed in a new bill in 2023 that protects local health care providers from prosecution by out of state authorities. This bill proactively protects abortion training, care, and education within the state of Hawai‘i so that training programs within the state can continue to be a resource for training future abortion

Table 2. Intention to Provide Abortion Care by Demographic Characteristics, Abortion Training, Abortion Knowledge Scores, and Moral Acceptability Scores

Variable	Mean ± SD or n (%)		*P*-value[a]
	No/Undecided on providing abortion care (n=218)	Yes, intending to provide abortion care (n=280)	
Age	29.1±2.4 min=24; max=39; median=29	29.5±2.6 min=24; max=47; median=29	.091
Knowledge Score	3.3±1.4 min=0; max=7; median=3	3.8±1.3 min=0; max=7; median=4	<.001
Moral Acceptability Score	24.7±9.2 min=0; max=32; median=29	30.8±5.2 min=0; max=32; median=32	<.001
Gender			.42
Female	192 (88.1%)	243 (86.8%)	
Male	26 (11.9%)	34 (12.1%)	
Gender diverse	0 (0.0%)	3 (1.1%)	
Religion			<.001
Atheist	30 (13.8%)	99 (35.4%)	
Non-Catholic Christian	84 (38.5%)	44 (15.7%)	
Catholic	49 (22.5%)	43 (15.4%)	
Jewish	7 (3.2%)	35 (12.5%)	
Muslim	9 (4.1%)	1 (0.4%)	
Buddhist	0 (0.0%)	4 (1.4%)	
Hindu	10 (4.6%)	7 (2.5%)	
Other	23 (10.6%)	41 (14.6%)	
Missing[b]	6 (2.8%)	6 (2.1%)	
Religiousness			<.001
Not important	57 (26.1%)	149 (53.2%)	
Slightly important	30 (13.8%)	56 (20.0%)	
Neutral	22 (10.1%)	33 (11.8%)	
Moderately important	54 (24.8%)	35 (12.5%)	
Extremely important	54 (24.8%)	7 (2.5%)	
Missing	1 (0.5%)	0 (0.0%)	
Marital Status			<.001
Single	37 (17.0%)	76 (27.1%)	
In a relationship	37 (17.0%)	56 (20.0%)	
Co-habiting	18 (8.3%)	47 (16.8%)	
Married	126 (57.8%)	101 (36.1%)	
Have Children	41 (18.8%)	22 (7.9%)	<.001
Year in Residency			.21
First	68 (31.2%)	76 (27.1%)	
Second	51 (23.4%)	79 (28.2%)	
Third	49 (22.5%)	77 (27.5%)	
Fourth	48 (22.0%)	48 (17.1%)	
Missing	2 (0.9%)	0 (0.0%)	
Abortion Training Availability			<.001
No training available through my program	30 (13.8%)	14 (5.0%)	
Opt-in training available	66 (30.3%)	38 (13.6%)	
Opt-out training available	115 (52.8%)	215 (76.8%)	
Mandatory training	6 (2.8%)	13 (4.6%)	
Missing	1 (0.5%)	0 (0.0%)	
Participated or plan to participate in procedural abortions during residency	149 (68.3%)	276 (98.6%)	<.001

[a] Two-sample t-test or Wilcoxon rank sum tests were used for continuous variables and Chi-squared or Fisher's exact test were used for categorical variables.
[b]Missing responses are not included in the statistical tests.

Table 3. Characteristics of Residents Who Plan to Offer Abortion Care Post Residency

Variable	Plan to offer abortion compared to no and undecided[a]	
	Adjusted Odds Ratio (95% C.I)	*P*-value[b]
Age	1.15 (1.03,1.31)	.019
Male (ref: Female)	1.52 (0.71,3.37)	.29
Religion (ref: Atheist)		
Non-Catholic Christian	0.46 (0.20,1.06)	.067
Catholic	0.76 (0.34,1.73)	.52
Jewish	2.67 (0.89,8.80)	.091
Other	0.52 (0.25,1.12)	.093
Religiousness (ref: Not important)		
Slightly important	0.84 (0.40,1.77)	.65
Neutral	0.91 (0.40,2.11)	.83
Moderately important	0.36 (0.16,0.78)	.011
Extremely important	0.24 (0.07,0.74)	.015
Marital (ref: Single)		
In a relationship	0.68 (0.33,1.42)	.30
Co-habiting	0.96 (0.41,2.32)	.93
Married	0.43 (0.22,0.82)	.012
Have Children	0.59 (0.25,1.37)	.22
Year in Residency (ref: First)		
Second	1.23 (0.63,2.41)	.54
Third	1.45 (0.74,2.88)	.28
Fourth	0.72 (0.33,1.56)	.40
Training (ref: Opt-out training available)		
No training available through my program	1.14 (0.42,3.20)	.80
Opt-in training available	0.59 (0.32,1.09)	.089
Mandatory training	1.92 (0.51,8.64)	.36
Participated or plan to participate in procedural abortions during residency	19.29 (5.86,84.58)	<.001
Knowledge Score	1.16 (0.97,1.40)	.115
Moral Acceptability Score	1.07 (1.03,1.12)	.001

[a]No/Undecided combined as reference category
[b]Multivariable logistic regression analysis was used.

providers. As abortion training and education declines nationally, the authors hope Hawai'i can be a resource and a partner for colleagues across the country.

This study has limitations. A true response rate cannot be calculated given the lack of the total number of email invitations received by residents. In 2020, there were ~5400 active OB-GYN residents according to the Association of American Medical Colleges which suggests this study data captured roughly 10% of all residents.[20] This 10% response rate may significantly reduce the generalizability of these findings. In addition, because our study relied on program coordinators or directors to disseminate the survey to their residents, the programs that did not respond to our email may not have disseminated the survey. It is likely that not all 5400 of the active OB-GYN residents received the survey. We do not have information on which programs did not respond and whether they did or did not disseminate the survey. Additionally, to limit question fatigue for respondents, the survey did not ask respondents to report race and ethnicity or the geographic locations of respondents or their institution. Additional information about the residency program that could have been illuminating but were not collected included presence of a complex family planning fellowship, or complex family planning fellowship trained faculty and program type (university, community, etc). These factors could have significant influence on an individual's training and intention to provide abortion care. Finally, selection bias may be informing these results, as individuals with particularly strong feelings about providing abortion care may have been most motivated to participate in the survey, thus skewing the findings.

Conclusion

Today's physician residents are graduating into a health care and legislative landscape that is increasingly stratifying access to abortion care, which subsequently restricts the abortion training available to residents. This study found that exposure to abortion care during training is the most powerful tool for ensuring ongoing commitment to provide abortion care among obstetrician-gynecologists.[8, 21] Thus it is imperative that medical education infrastruc-

ture ensures this training remains accessible for all residents. Didactic sessions about abortion will not have the same impact on future generations of providers that hands-on patient experience has repeatedly demonstrated to provide. Abortion training is critical for creating future abortion providers and thereby ensuring and sustaining access to this essential and fundamental component of reproductive health care.

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Conflict of Interest and Disclosures

Authors have no conflicts of interest to disclose.

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Appendix 1

Abortion knowledge and attitudes among OBGYN resident physicians

Aloha!

My name is Sherry Firouzbakht and I am an OBGYN resident at the University of Hawaii. I invite you to participate in my research study in which you will be asked to fill out a < 5 minute survey for a chance of receiving an Amazon gift certificate. The first 100 participants who provide an email address will receive a $10 gift card. Participation is greatly appreciated but completely optional. You can freely choose to take part or not take part in this survey. You may stop the survey at any time or skip any questions that you do not wish to answer.

The purpose of my project is to determine the attitudes that OBGYN residents have toward abortion through an anonymous survey distributed to current OBGYN resident physicians in United States residency programs. The survey will consist of demographic and multiple choice questions regarding abortions. It will also ask about cases in which women may request an abortion.

I believe there is little risk to you for participating in this research project; however, some questions may require you to evaluate your ideas about abortion and this might make some people uncomfortable. You are not obligated to answer all questions and can stop at any time.

The information from the survey will be used to understand the current knowledge and attitude surrounding abortion among the physicians who will be providing women's healthcare. It may help to guide future resident education.

Your responses are completely anonymous and no answers are linked to name or email address, as none of these will be recorded in the course of the survey. The first 100 participants will receive a $10 Amazon gift card; the email address you provide for this gift card will not be linked to your survey responses. The data from this study will not be used or distributed for future studies. Going to the first page of the survey implies your consent to participate in this study.

If you have any questions about this study, please call at 832-428-8624 or email me at sfirouzb@hawaii.edu. You may contact the principal investigator, Dr. Reni Soon, MD, MPH at rsoon@hawaii.edu. We are happy to discuss problems, concerns and questions. Please visit http://go.hawaii.edu/jRd for more information on your rights as a research participant and feel free to contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu to discuss problems, concerns and questions, obtain information, or offer input with an informed individual who is unaffiliated with the specific research protocol. Please print/save a copy of this consent form for your records.

Mahalo!

Age	_____
Gender	◯ Female ◯ Male ◯ Gender diverse
Religion	◯ Atheist ◯ Non-Catholic Christian ◯ Catholic ◯ Jewish ◯ Muslim ◯ Buddhist ◯ Hindu ◯ Other
If you chose Other, please specify.	_____

How important is religion in your life?	◯ Not important ◯ Slightly important ◯ Neutral ◯ Moderately important ◯ Extremely important
Marital status	◯ Single ◯ In a relationship ◯ Co-habiting ◯ Married
Do you have children?	◯ Yes ◯ No
Year in residency	◯ First ◯ Second ◯ Third ◯ Fourth
Type of abortion training in your residency program	◯ No training available through my program ◯ Opt-in training available ◯ Opt-out training available ◯ Mandatory training
Have you participated in surgical abortions in residency or plan to participate during residency (this includes some degree of hands-on participation)?	◯ Yes ◯ No
What proportion of pregnancies in the US are unintended?	◯ 10% ◯ 25% ◯ 45% ◯ 60%
What proportion of US women will have an abortion by the age of 45?	◯ 5% ◯ 15% ◯ 25% ◯ 35% ◯ 45%
What percentage of US OBGYNs perform abortions?	◯ 5% ◯ 15% ◯ 30% ◯ 50% ◯ 75%
What proportion of women who have an abortion already have children?	◯ 5% ◯ 20% ◯ 40% ◯ 60%
What percentage of abortions are performed in the second trimester?	◯ 2-5% ◯ 9-13% ◯ 15-20% ◯ 22-26%

What is the average mortality rate of abortion compared to a term delivery?	○ 1/100,000 for abortion VS 9/100,000 for term delivery ○ 9/100,000 for abortion VS 9/100,000 for term delivery ○ 9/100,000 for abortion VS 1/100,000 for term delivery ○ 1/100,000 for abortion VS 1/100,000 for term delivery
What is the complication rate for a first trimester abortion? (this includes requiring hospital care, blood transfusion, additional surgery)	○ 0.2-0.5% ○ 0.8-1% ○ 2-4% ○ 5-8%

For each case, indicate if you believe that abortion is MORALLY ACCEPTABLE.

	strongly disagree	slightly disagree	neutral	slightly agree	strongly agree
She is financially unable to support a child.	○	○	○	○	○
Her career and/or education would be disrupted.	○	○	○	○	○
Her family is complete and she does not want more children.	○	○	○	○	○
The pregnancy is a result of rape.	○	○	○	○	○
The pregnancy is a threat to her physical health.	○	○	○	○	○
The pregnancy is a threat to her mental health.	○	○	○	○	○
The fetus has anomalies/malformations that are INCOMPATIBLE with life (e.g anencephaly, renal agenesis, limb-body wall copmlex, etc)	○	○	○	○	○
The fetus has anomalies/malformations that are COMPATIBLE with life (e.g Trisomy 21, Dandy-Walker, etc)	○	○	○	○	○

Do you plan to offer abortion services once you graduate from residency?	○ Yes ○ No ○ Undecided

Please leave any comments, questions, concerns.

Yamanaka AB, Pham T. Assessing underlying health risks for severe COVID-19 infection among sexual and gender minority populations in Hawai'i. *Hawaii J Health Soc Welf*. 2025;84(9):180-194. doi:10.62547/TTAU2791

Assessing underlying health risks for severe COVID-19 infection among sexual and gender minority populations in Hawai'i

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Abstract

The psychosocial impact of COVID-19 on sexual and gender minority (SGM) populations has been widely studied, but risk for severe infection remains less clear, especially in Hawai'i. National studies are not generalizable to Hawai'i's unique racial demographics. This Hawai'i cross-sectional study examined associations between SGM status stratified by race and underlying health conditions and SGM status in Hawai'i, stratified by race, that may increase risk for severe COVID-19. Data from the 2015-2019 Behavioral Risk Factor Surveillance System (BRFSS) of non-institutionalized adults aged 18 years and older in Hawai'i was analyzed using descriptive and regression methods. Sexual and/or gender minority adults accounted for 5.2% and 0.6% of the population, respectively. Compared to Native Hawaiian heterosexual adults, Native Hawaiian sexual minority adults had higher age-adjusted odds of asthma (current – AOR 1.8, CI: 1.33, 2.44 and ever – AOR 1.59, CI: 1.21, 2.09), cancer (AOR 2.07, CI: 1.25, 3.42), and diabetes (AOR 1.58, CI: 1.11, 2.26). Compared to White cisgender adults, Native Hawaiian transgender adults had significantly higher odds of asthma – current (AOR 4.13, CI: 1.44, 11.92), asthma – ever (AOR 4.02, CI: 1.68, 9.66), cancer (AOR 6.67, CI: 1.98, 22.5), diabetes (AOR 4.59, CI: 1.67, 12.62), obesity (AOR 3.76, CI: 1.64, 8.59), a stroke (AOR 3.19, CI: 1.12, 9.06) and cigarette smoking (AOR 3.38, CI: 1.43, 8.02). These chronic health conditions increase vulnerability to severe COVID-19 outcomes. Findings highlight the need for increased chronic disease prevention and management in Hawai'i's SGM communities. Further research is necessary to understand COVID-19's long-term impact and informing equitable public health strategies.

ABBREVIATIONS AND ACRONYMS

BRFSS = Behavioral Risk Factor Surveillance System
CDC = Centers for Disease Control and Prevention
COPD = chronic obstructive pulmonary disease
COVID-19 = coronavirus disease 2019
SGM = sexual and gender minority
SOGI = sexual orientation and gender identity

INTRODUCTION

The psychosocial impact of coronavirus disease 2019 (COVID-19) on sexual and gender minority (SGM) populations has been widely studied.[1-4] However, the health risk for severe COVID-19 disease is less clear, especially in Hawai'i. In the US, SGM communities make up at least 5.6% of the total general population,[5] and they include, but are not limited to, sexual minorities such as lesbian, gay, bisexual, and queer (LGBQ) individuals, as well as gender minorities such as transgender and gender non-binary persons.[6]

Chronic diseases—such as diabetes, chronic obstructive pulmonary disease (COPD), cardiovascular diseases (CVD), hypertension, and cancer—can contribute to increased risk for severe COVID-19 symptoms,[7,8] which include dry cough, fever, severe headache, and tiredness.[9] Furthermore, pneumonia and acute respiratory distress, as major complications that result from COVID-19, can activate inflammatory immune responses in respiratory disease progression.[10] Severe COVID-19 cases may result in organ damage and acute respiratory distress syndrome that can lead to long-term impaired lung function, arrhythmia, and even death.[9] About 70% of patients receiving intensive hospital care for COVID-19 have comorbidities.[11]

Although data on COVID-related infection, complications, and death rates for SGM people are limited, data on chronic diseases is available.[12] For example, sexual minority adults in the US have a higher prevalence of underlying conditions that are associated with severe COVID-19-related disease and death, including cancer (9.2%), kidney disease (4.7%), asthma (13.8%), COPD (10.3%), heart disease (8.0%), hypertension (35.7%), stroke (4.7%), obesity (34.1%), diabetes (12.5%), and cigarette smoking (22.1%), compared to heterosexual adults.[13,14] In 2017, the Hawai'i Department of Health reported that 38% of sexual minority adults had 2 or more chronic conditions and were significantly more likely to smoke cigarettes and consume alcohol compared to their heterosexual counterparts.[15]

The demographic composition of SGM people in Hawai'i represents a uniquely diverse population. In 2020, SGM adults composed 5.9% of the state population and were comprised of the following race proportions: 7.8% White, 7.1% Native Hawaiian, 6.5% Chinese, 3.1% Filipino, and 2.9% Japanese.[16] This is important because sexual orientation and gender health disparities can be amplified by structural inequities related to race and ethnicity.[17,18] In the US in 2020, a higher incidence of COVID-19 infections occurred among racial minority groups compared to non-Hispanic White adults.[19] In Hawai'i, Pacific Islander populations accounted for 22% of COVID-19 cases, while Pacific Islander and Native Hawaiian communities combined experienced the highest incidence (2501 per 100000 persons), compared to all other race groups. Among Asian communities, the highest COVID-19 incidence rates occurred among Filipino (1247 per 100000 persons) and Vietnamese (1200 per 100000 persons) populations, compared to other Asian

groups.[20] Given this context, the objective of this study is to investigate the prevalence of chronic health conditions that have been associated with severe COVID-19 disease among SGM adults in Hawai'i, stratified by race.

METHODS

Study Design

The Behavioral Risk Factor Surveillance System (BRFSS)[21] is an annual cross-sectional, telephone health survey that collects state-level data from non-institutionalized US adult residents regarding their demographics, health-related risk behaviors, chronic health conditions, and preventive service utilization. De-identified Hawai'i BRFSS data from 2015-2019 were analyzed to explore risk of pre-conditions for COVID-19 before onset of the COVID-19 pandemic. Hawai'i residents who did not respond to the sexual orientation and gender identity questions or missing sex and age were excluded. The Hawai'i Department of Health reviewed and approved this study. Institutional Review Board approval is not required to use BRFSS data.

Demographic information such as age, race, sexual orientation, gender identity, and sex assigned at birth were used to describe the study population. Racial groupings included Native Hawaiian, Pacific Islander (excluding Native Hawaiians), Asian, White, and "Unspecified" racial category, which was a combination of race groups with small representation in the study population (Black, American Indian/Alaskan Native, and race groups not listed). For sexual orientation, lesbian, gay, bisexual, questioning respondents were categorized as sexual minority persons versus heterosexual persons. Individuals who responded to the sexual orientation question with "something else" were defined as "questioning" in this study. The queer orientation was not an answer option. Gender identities were categorized as transgender persons versus cisgender persons. Prior to 2018, BRFSS surveyors determined participant sex (male or female) based on cues and household enumeration selection. In 2018, the sex question was changed to "sex assigned at birth".

Self-reported chronic health conditions included asthma (ever and current), cancer, heart disease, stroke, diabetes, kidney disease, obesity, and high blood pressure. Weight status was determined from the calculated body mass index (BMI) based on 2 BRFSS questions about weight and height. Current smoking status was determined by if the respondent had smoked at least 100 cigarettes in a lifetime and now smokes cigarettes every day or some days. Chronic health conditions were categorized into yes, no, and don't know or refused to answer.

Statistical Analysis

Combining multiple years of data was important for SGM analyses, in which unreliable estimates were suppressed due to sample sizes fewer than 50, based on Centers for Disease Control and Prevention (CDC) suppression guidelines.[22] Demographic statistics were calculated for subgroups defined by sex assigned at birth, age, race/ethnicity, sexual orientation, and gender identity. Unadjusted and adjusted logistic regression models analyzed each chronic health condition among SGM groups (yes and no), stratified by race categories. The regression models were adjusted for age groups to determine odds ratio (AOR) with 95% confidence intervals (CI). Comparison groups included heterosexual White adults and cisgender White adults. Additional models within each race group were analyzed. Statistical significance was obtained at $P<.05$. All analyses accounted for the BRFSS complex survey design using SAS 9.4 statistical software (SAS Institute, Cary, NC).

RESULTS

Sexual and Gender Minorities Combined

In Hawai'i, adults who identified as sexual minorities and/or gender minorities accounted for 5.2% and 0.6% of the population, respectively (**Table 1**). Female as sex assigned at birth represented 53.1% and 53.2% of sexual minority and transgender peoples, respectively. A large representation of the younger age groups (18 – 34 years old) was reported across all SGM groups. A low proportion of heart disease, COPD, kidney disease, and experiencing a stroke was found across all SGM groups.

Tables 2 and 3 present unadjusted and adjusted OR (95% CI) of chronic health conditions within each race group among sexual minority and gender minority adults, respectively.

Sexual Minorities

Among sexual minority adults, 31.7% were Asian and 27.1% were White, while Asian (44.5%), and Native Hawaiian (28.9%) individuals made up the largest race groups for transgender adults. A little more than half of the sexual minority adults live with obesity (57.4%), and 27.0% reported having hypertension.

After adjusting for age, Native Hawaiian sexual minority individuals were more likely to self-report asthma – current (AOR 1.80, CI: 1.33, 2.44), asthma – ever (AOR 1.59, CI: 1.21, 2.09), cancer (AOR 2.07, CI: 1.25, 3.42), diabetes (AOR 1.58, CI: 1.11, 2.26) compared to Native Hawaiian heterosexual individuals. Among Pacific Islanders, no statistical difference was found among any chronic health outcome. The likelihood of having COPD was higher among Asian (AOR 2.73, CI: 1.46, 5.10) and unspecified race (AOR 2.61, CI: 1.22, 5.60) sexual minority persons compared to their heterosexual counterparts (**Table 2**). Assessing the gender identity groups within each race found only a statistical association with cancer (AOR 6.67, CI: 1.98, 22.5) among Native Hawaiian adults (**Table 3**).

After adjusting for age, compared to White heterosexual adults, Native Hawaiian sexual minority adults were statistically more likely to have asthma – current (AOR 3.91, CI: 2.87, 5.34), asthma – ever (AOR 3.34, CI: 2.53, 4.41), COPD (AOR 2.19, CI: 1.4, 3.43), diabetes (AOR 5.47, CI: 3.8, 7.85), hypertension (AOR 2.13, CI: 1.53, 2.97) kidney disease (AOR 2.48, CI: 1.38, 4.45), obesity (AOR 3.8, CI: 2.9, 4.97), current smoker (AOR 2.23, CI: 1.63, 3.06), and experienced a stroke

Table 1. Sociodemographic Characteristics and Chronic Health Conditions by Sexual Minority (Lesbian, Gay, Bisexual, and Questioning) versus Heterosexual Adults and Gender Minority (Transgender) versus Cisgender Adults in Hawai'i, Behavioral Risk Factor Surveillance System 2015-2019.

Characteristics	Sexual Minority		Heterosexual		Transgender		Cisgender	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	1828	5.2	33544	94.8	202	0.6	35608	99.4
ASSIGNED SEX AT BIRTH								
Female	948	53.1	17605	49.6	101	53.2	18731	50.0
Male	880	46.9	15939	50.4	101	46.8	16877	50.0
AGE GROUP, YEARS								
18-24	251	23.5	2002	10.5	24	22.3	2236	11.0
25-34	310	25.3	3685	17.5	29	20.1	3986	17.8
35-44	243	15.0	4266	16.6	26	14.3	4518	16.4
45-54	259	11.2	5041	15.3	28	11.5	5316	15.0
55-64	332	11.7	7165	16.9	40	15.0	7538	16.7
65-74	296	7.6	7221	13.6	37	9.4	7575	13.3
75+	137	5.8	4164	9.6	18	7.4	4439	9.7
RACE OR ETHNICITY								
Native Hawaiian	428	22.6	6487	18.4	53	28.9	6907	18.3
Pacific Islander	93	7.2	1089	3.9	13	5.3	1189	4.0
Asian	447	31.7	12048	44.6	83	44.5	12673	44.3
White	648	27.1	11217	25.4	39	14.2	11897	25.4
Unspecified	195	11.3	2494	7.8	12	7.2	2704	7.9
CHRONIC HEALTH CONDITION								
Asthma, Current	283	16.3	3160	9.6	23	20.1	3453	9.9
Asthma, Ever	407	23.6	5341	16.8	37	29.4	5759	17.0
Cancer	264	9.1	4866	9.9	33	13.7	5152	9.8
Heart Disease	69	2.5	1267	3.0	7	1.8	1352	3.0
COPD[a]	134	5.9	1710	4.1	13	4.6	1851	4.2
Diabetes	217	9.4	3992	10.6	26	9.7	4245	10.6
Hypertension	471	27.0	9211	32.2	61	29.5	9746	32.1
Kidney Disease	78	3.9	1296	3.2	9	2.1	1378	3.2
Obesity	990	57.4	18823	58.9	120	60.9	19864	58.6
Smoking, Current	333	20.6	3938	12.8	34	16.7	4259	13.1
Stroke	87	3.4	1188	2.9	11	3.8	1292	2.9

[a]COPD: Chronic Obstructive Pulmonary Disease

(AOR 3.26, CI: 1.92, 5.53) (Table 4). The unspecified race category was 2.19 (CI: 1.01, 4.75) times as likely to experience a stroke compared to White heterosexual adults. Diabetes was statistically higher in all race groups compared to White heterosexual counterparts.

Gender Minorities

Among those who identify as transgender, high proportions reported having obesity (60.9%), hypertension (29.5%), asthma – ever (29.4%), and asthma – current (20.1%) (Table 1). Compared to White cisgender adults, Native Hawaiian transgender adults were more likely to report having asthma – current (AOR 4.13, CI: 1.44, 11.92), asthma – ever (AOR 4.02, CI: 1.68, 9.66), diabetes (AOR 4.59, CI: 1.67, 12.62), obesity (AOR 3.76, CI: 1.64, 8.59), smoking (AOR 3.38, CI: 1.43, 8.02), and a stroke (AOR 3.19, CI: 1.12, 9.06), after adjusting for age (Table 5). No statistically significant difference in the estimates of any chronic health conditions was observed among transgender individuals who identified as Pacific Islander, Asian, White, or in the unspecified race categories.

Table 2. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Sexual Minority Adults within each Race Group in Hawai'i, Behavioral Risk Factor Surveillance System 2015-2019.

	Reference	**Native Hawaiian Heterosexual**		**Pacific Islander Heterosexual**		**Asian Heterosexual**		**Unspecified Heterosexual**		**White Heterosexual**	
		Native Hawaiian		Pacific Islander		Asian		Unspecified		White	
Outcome	Sexual Minority	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Asthma Current	Unadjusted	1.86 (1.38, 2.51)	<.001	1.44 (0.71, 2.92)	.31	1.99 (1.37, 2.87)	<.001	1.35 (0.74, 2.46)	.33	1.69 (1.16, 2.46)	.006
	Adjusted	1.80 (1.33, 2.44)	<.001	1.42 (0.7, 2.87)	.33	1.90 (1.31, 2.77)	<.001	1.29 (0.71, 2.35)	.40	1.62 (1.12, 2.36)	.011
Asthma Ever	Unadjusted	1.72 (1.31, 2.26)	<.001	0.86 (0.44, 1.66)	.65	1.55 (1.14, 2.1)	.005	1.18 (0.7, 1.99)	.53	1.51 (1.11, 2.05)	.008
	Adjusted	1.59 (1.21, 2.09)	<.001	0.81 (0.42, 1.6)	.55	1.41 (1.03, 1.92)	.032	1.05 (0.62, 1.78)	.85	1.38 (1.02, 1.88)	.039
Cancer	Unadjusted	1.29 (0.82, 2.02)	.27	0.21 (0.04, 1.04)	.057	0.95 (0.6, 1.52)	.84	0.76 (0.37, 1.54)	.44	0.8 (0.62, 1.03)	.084
	Adjusted	2.07 (1.25, 3.42)	.005	0.24 (0.05, 1.3)	.098	1.31 (0.78, 2.19)	.31	1.25 (0.58, 2.69)	.57	1.14 (0.87, 1.5)	.34
Heart Disease	Unadjusted	0.81 (0.43, 1.5)	.49	0.63 (0.08, 4.71)	.65	0.96 (0.43, 2.17)	.92	0.84 (0.35, 2.04)	.70	0.67 (0.41, 1.08)	.099
	Adjusted	1.32 (0.69, 2.54)	.40	0.78 (0.13, 4.74)	.79	1.35 (0.57, 3.2)	.50	1.48 (0.6, 3.6)	.39	0.95 (0.59, 1.54)	.84
COPD[a]	Unadjusted	1.09 (0.7, 1.68)	.72	0.76 (0.27, 2.15)	.60	2.17 (1.16, 4.05)	.015	1.87 (0.88, 3.94)	.102	1.14 (0.75, 1.73)	.55
	Adjusted	1.42 (0.91, 2.22)	.12	0.85 (0.29, 2.44)	.76	2.73 (1.46, 5.1)	.002	2.61 (1.22, 5.6)	.014	1.45 (0.95, 2.22)	.086
Diabetes	Unadjusted	1.03 (0.72, 1.46)	.88	0.64 (0.29, 1.42)	.27	0.86 (0.6, 1.23)	.41	1.00 (0.5, 2.01)	.99	0.84 (0.55, 1.29)	.44
	Adjusted	1.58 (1.11, 2.26)	.012	0.82 (0.39, 1.74)	.60	1.22 (0.83, 1.8)	.32	1.71 (0.81, 3.64)	.16	1.14 (0.73, 1.77)	.56
Hypertension	Unadjusted	0.74 (0.55, 1.01)	.056	0.67 (0.3, 1.5)	.33	0.84 (0.63, 1.13)	.25	0.82 (0.45, 1.5)	.52	0.91 (0.7, 1.18)	.47
	Adjusted	1.02 (0.73, 1.42)	.91	0.85 (0.33, 2.18)	.73	1.17 (0.86, 1.6)	.32	1.23 (0.61, 2.47)	.56	1.2 (0.9, 1.59)	.22
Kidney Disease	Unadjusted	1.06 (0.6, 1.89)	.83	0.66 (0.14, 3.14)	.60	1.96 (1.12, 3.43)	.018	0.57 (0.12, 2.63)	.47	1.00 (0.57, 1.75)	.99
	Adjusted	1.45 (0.81, 2.61)	.21	0.76 (0.15, 3.81)	.74	2.54 (1.41, 4.58)	.002	0.81 (0.17, 3.87)	.79	1.29 (0.74, 2.28)	.37

Outcome	Reference	**Native Hawaiian Heterosexual**		**Pacific Islander Heterosexual**		**Asian Heterosexual**		**Unspecified Heterosexual**		**White Heterosexual**	
	Sexual Minority	Native Hawaiian OR (95% CI)	*P*-value	Pacific Islander OR (95% CI)	*P*-value	Asian OR (95% CI)	*P*-value	Unspecified OR (95% CI)	*P*-value	White OR (95% CI)	*P*-value
Obesity	Unadjusted	1.1 (0.84, 1.44)	.49	1.09 (0.59, 1.99)	.79	1.17 (0.85, 1.62)	.35	1.34 (0.81, 2.24)	.26	0.94 (0.7, 1.27)	.68
	Adjusted	1.2 (0.92, 1.57)	.18	1.16 (0.64, 2.12)	.63	1.3 (0.93, 1.81)	.12	1.51 (0.9, 2.53)	.12	0.99 (0.73, 1.34)	.94
Smoking	Unadjusted	1.39 (1.02, 1.89)	.036	1.69 (0.85, 3.36)	.13	1.9 (1.35, 2.68)	<.001	1.26 (0.72, 2.18)	.42	1.86 (1.36, 2.53)	<.001
	Adjusted	1.35 (0.99, 1.84)	.056	1.72 (0.87, 3.39)	.12	1.86 (1.32, 2.61)	<.001	1.23 (0.7, 2.17)	.48	1.77 (1.3, 2.42)	<.001
Stroke	Unadjusted	1.1 (0.66, 1.83)	.70	0.31 (0.08, 1.26)	.10	1.37 (0.71, 2.65)	.35	0.92 (0.42, 2.03)	.83	1.4 (0.81, 2.43)	.23
	Adjusted	1.7 (1, 2.9)	.052	0.36 (0.09, 1.5)	.16	1.86 (0.97, 3.58)	.06	1.49 (0.66, 3.37)	.34	1.98 (1.15, 3.42)	.014

[a]COPD: Chronic Obstructive Pulmonary Disease

Table 3. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Gender Identity Minority (Transgender) Adults compared to Cisgender Adults within each Race Group in Hawai'i, Behavioral Risk Factor Surveillance System 2015-2019.

	Reference	**Native Hawaiian Cisgender**		**Pacific Islander Cisgender**		**Asian Cisgender**		**Unspecified Cisgender**		**White Cisgender**	
		Native Hawaiian		**Pacific Islander**		**Asian**		**Unspecified**		**White**	
Outcome	Gender Minority (Transgender)	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Asthma Current	Unadjusted	1.81 (0.63, 5.18)	.27	1.7 (0.21, 13.52)	.62	1.15 (0.49, 2.68)	.75	1.36 (0.21, 8.72)	.74	3.51 (0.74, 16.73)	.13
	Adjusted	1.87 (0.65, 5.39)	.24	1.58 (0.21, 12.05)	.65	1.11 (0.48, 2.6)	.80	1.41 (0.22, 9.11)	.72	3.25 (0.74, 14.37)	.12
Asthma Ever	Unadjusted	1.88 (0.78, 4.53)	.16	2.37 (0.51, 11.05)	.27	1.3 (0.66, 2.58)	.45	1.13 (0.23, 5.63)	.88	2.02 (0.45, 9.04)	.36
	Adjusted	1.88 (0.79, 4.52)	.16	2.09 (0.49, 8.81)	.32	1.24 (0.62, 2.48)	.55	1.10 (0.21, 5.83)	.92	1.78 (0.45, 7.03)	.41
Cancer	Unadjusted	4.65 (1.77, 12.21)	.002	--		1.56 (0.73, 3.34)	.25	0.56 (0.07, 4.32)	.58	0.63 (0.26, 1.56)	.32
	Adjusted	6.67 (1.98, 22.5)	.002	--		1.81 (0.8, 4.12)	.16	0.99 (0.17, 5.83)	.99	0.70 (0.28, 1.76)	.45
Heart Disease	Unadjusted	0.32 (0.07, 1.38)	.13	--		0.48 (0.12, 2)	.31	1.33 (0.16, 11.23)	.79	1.73 (0.31, 9.59)	.53
	Adjusted	0.34 (0.08, 1.52)	.16	--		0.54 (0.13, 2.26)	.39	2.72 (0.32, 23.01)	.36	2.01 (0.33, 12.38)	.45
COPD[a]	Unadjusted	0.94 (0.36, 2.49)	.91	--		2.34 (0.83, 6.61)	.11	0.55 (0.07, 4.6)	.58	--	
	Adjusted	1.00 (0.38, 2.63)	.99	--		2.53 (0.87, 7.37)	.09	0.82 (0.11, 6.34)	.85	--	
Diabetes	Unadjusted	1.12 (0.43, 2.9)	.82	0.18 (0.02, 1.39)	.100	0.72 (0.34, 1.54)	.40	1.52 (0.18, 12.83)	.70	1.13 (0.23, 5.51)	.88
	Adjusted	1.31 (0.48, 3.6)	.60	0.25 (0.03, 2.02)	.194	0.77 (0.36, 1.66)	.50	2.99 (0.41, 21.8)	.28	1.32 (0.27, 6.4)	.73
Hypertension	Unadjusted	0.54 (0.24, 1.23)	.14	0.57 (0.13, 2.52)	.45	0.91 (0.5, 1.68)	.77	2.09 (0.41, 10.71)	.38	1.08 (0.44, 2.65)	.86
	Adjusted	0.55 (0.27, 1.13)	.10	0.94 (0.22, 4.05)	.94	1.08 (0.53, 2.2)	.84	3.43 (0.6, 19.77)	.17	1.35 (0.55, 3.32)	.52
Kidney Disease	Unadjusted	0.54 (0.13, 2.17)	.38	--		0.65 (0.15, 2.91)	.58	--		1.48 (0.41, 5.43)	.55
	Adjusted	0.57 (0.15, 2.18)	.41	--		0.71 (0.16, 3.09)	.64	--		1.67 (0.45, 6.17)	.44

Outcome	Reference	Native Hawaiian Cisgender		Pacific Islander Cisgender		Asian Cisgender		Unspecified Cisgender		White Cisgender	
	Gender Minority (Transgender)	Native Hawaiian		Pacific Islander		Asian		Unspecified		White	
		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Obesity	Unadjusted	1.17 (0.51, 2.68)	.71	0.37 (0.1, 1.35)	.132	1.72 (0.9, 3.28)	.098	1.36 (0.19, 9.82)	.76	1.37 (0.54, 3.53)	.51
	Adjusted	1.17 (0.51, 2.68)	.70	0.44 (0.13, 1.47)	.181	1.81 (0.96, 3.39)	.066	1.40 (0.19, 10.34)	.74	1.60 (0.63, 4.11)	.33
Smoking	Unadjusted	2.14 (0.9, 5.14)	.09	1.57 (0.43, 5.77)	.50	0.89 (0.39, 2.01)	.77	0.67 (0.12, 3.85)	.66	0.51 (0.17, 1.54)	.23
	Adjusted	2.12 (0.89, 5.01)	.09	1.60 (0.46, 5.54)	.46	0.89 (0.39, 2.02)	.78	0.56 (0.1, 3.29)	.52	0.55 (0.18, 1.63)	.28
Stroke	Unadjusted	1.44 (0.52, 4.01)	.49	--		1.23 (0.31, 4.84)	.77	--		2.66 (0.58, 12.31)	.21
	Adjusted	1.63 (0.57, 4.64)	.36	--		1.35 (0.33, 5.49)	.67	--		3.14 (0.64, 15.38)	.16

[a]COPD: Chronic Obstructive Pulmonary Disease

Table 4. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Sexual Minority Adults compared to Heterosexual Adults within each Race Group in Hawaii, Behavioral Risk Factor Surveillance System, 2015 – 2019.

	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Sexual Minority	Native Hawaiian		Pacific Islander		Asian		Unspecified		White	
Outcome		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Asthma Current	Unadjusted	4.16 (3.07, 5.63)	<.001	1.70 (0.89, 3.26)	.111	2.27 (1.56, 3.3)	<.001	2.29 (1.29, 4.08)	.005	1.97 (1.17, 3.32)	.011
	Adjusted	3.91 (2.87, 5.34)	<.001	1.6 (0.83, 3.09)	.163	2.16 (1.48, 3.17)	<.001	2.15 (1.21, 3.83)	.009	1.85 (1.09, 3.14)	.023
Asthma Ever	Unadjusted	3.89 (2.95, 5.13)	<.001	1.03 (0.55, 1.92)	.93	1.91 (1.4, 2.61)	<.001	1.85 (1.11, 3.06)	.017	1.52 (0.95, 2.43)	.083
	Adjusted	3.34 (2.53, 4.41)	<.001	0.85 (0.45, 1.62)	.63	1.71 (1.24, 2.34)	<.001	1.56 (0.93, 2.59)	.090	1.30 (0.80, 2.11)	.30
Cancer	Unadjusted	0.42 (0.27, 0.66)	<.001	0.04 (0.01, 0.17)	<.001	0.3 (0.19, 0.47)	<.001	0.26 (0.13, 0.52)	<.001	0.60 (0.40, 0.90)	.014
	Adjusted	0.95 (0.58, 1.55)	.83	0.09 (0.02, 0.44)	.003	0.37 (0.22, 0.62)	<.001	0.6 (0.29, 1.24)	.166	1.21 (0.81, 1.81)	.36
Heart Disease	Unadjusted	0.69 (0.37, 1.27)	.23	0.74 (0.1, 5.38)	.77	0.75 (0.33, 1.7)	.50	0.55 (0.24, 1.26)	.155	0.71 (0.32, 1.55)	.39
	Adjusted	1.78 (0.93, 3.4)	.081	2.54 (0.43, 15.05)	.30	1.06 (0.45, 2.51)	.90	1.48 (0.63, 3.43)	.37	1.49 (0.69, 3.22)	.32
COPD[a]	Unadjusted	1.26 (0.81, 1.94)	.30	0.61 (0.23, 1.58)	.31	1.27 (0.68, 2.36)	.45	1.87 (0.92, 3.8)	.085	0.85 (0.45, 1.61)	.62
	Adjusted	2.19 (1.4, 3.43)	<.001	1.19 (0.45, 3.15)	.73	1.59 (0.86, 2.97)	.14	3.41 (1.65, 7.04)	<.001	1.35 (0.71, 2.56)	.36
Diabetes	Unadjusted	2.33 (1.64, 3.32)	<.001	1.64 (0.75, 3.58)	.21	1.99 (1.38, 2.87)	<.001	1.58 (0.81, 3.08)	.180	1.19 (0.67, 2.15)	.55
	Adjusted	5.47 (3.8, 7.85)	<.001	5.15 (2.5, 10.64)	<.001	2.99 (2.01, 4.45)	<.001	3.87 (1.88, 8)	<.001	2.31 (1.27, 4.20)	<.001
Hypertension	Unadjusted	0.98 (0.73, 1.33)	.91	0.61 (0.28, 1.35)	.23	1.3 (0.97, 1.74)	.08	0.88 (0.49, 1.6)	.68	0.72 (0.48, 1.09)	.12
	Adjusted	2.13 (1.53, 2.97)	<.001	1.65 (0.66, 4.17)	.29	1.95 (1.43, 2.68)	<.001	1.93 (0.98, 3.81)	.056	1.26 (0.83, 1.93)	.28
Kidney Disease	Unadjusted	1.34 (0.76, 2.36)	.32	0.67 (0.15, 3.09)	.61	2.00 (1.14, 3.5)	.016	0.53 (0.12, 2.34)	.398	0.54 (0.17, 1.69)	.29
	Adjusted	2.48 (1.38, 4.45)	<.001	1.44 (0.3, 6.95)	.65	2.59 (1.43, 4.69)	<.001	1.00 (0.22, 4.54)	.99	0.89 (0.28, 2.79)	.84

Outcome	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Sexual Minority	**Native Hawaiian**		**Pacific Islander**		**Asian**		**Unspecified**		**White**	
		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Obesity	Unadjusted	3.32 (2.53, 4.35)	<.001	4.67 (2.59, 8.42)	<.001	1.07 (0.77, 1.49)	.67	2.35 (1.43, 3.86)	<.001	1.09 (0.66, 1.78)	.74
	Adjusted	3.8 (2.9, 4.97)	<.001	5.51 (3.07, 9.88)	<.001	1.23 (0.88, 1.71)	.23	2.66 (1.6, 4.4)	<.001	1.21 (0.72, 2.01)	.47
Smoking, Current	Unadjusted	2.49 (1.83, 3.39)	<.001	3.28 (1.69, 6.34)	<.001	1.5 (1.06, 2.12)	.022	1.57 (0.92, 2.68)	.097	2.52 (1.58, 4.00)	<.001
	Adjusted	2.23 (1.63, 3.06)	<.001	2.91 (1.51, 5.59)	<.001	1.49 (1.05, 2.11)	.026	1.4 (0.81, 2.43)	.235	2.34 (1.48, 3.72)	<.001
Stroke	Unadjusted	1.41 (0.85, 2.32)	.179	0.27 (0.07, 1.04)	.057	1.35 (0.7, 2.6)	.38	0.93 (0.44, 1.95)	.84	0.90 (0.42, 1.92)	.79
	Adjusted	3.26 (1.92, 5.53)	<.001	0.73 (0.18, 2.9)	.65	1.81 (0.94, 3.49)	.075	2.19 (1.01, 4.75)	.046	1.77 (0.85, 3.67)	.13

[a]COPD: Chronic Obstructive Pulmonary Disease

Table 5. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Gender Minority (Transgender) Adults Compared to White Cisgender Adults, by Race in Hawaii, Behavioral Risk Factor Surveillance System, 2015 – 2019.

Outcome	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Gender Minority (Transgender)	**Native Hawaiian**	*P*-value	**Pacific Islander**	*P*-value	**Asian**	*P*-value	**Unspecified**	*P*-value	**White**	*P*-value
		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Asthma Current	Unadjusted	4.12 (1.44, 11.83)	.009	1.99 (0.25, 15.62)	.51	1.32 (0.57, 3.09)	.52	2.30 (0.36, 14.63)	.38	3.51 (0.74, 16.73)	.115
	Adjusted	4.13 (1.44, 11.92)	.009	1.76 (0.23, 13.27)	.58	1.27 (0.54, 2.98)	.58	2.32 (0.36, 14.96)	.38	3.25 (0.74, 14.37)	.120
Asthma Ever	Unadjusted	4.32 (1.79, 10.44)	<.001	2.70 (0.59, 12.44)	.20	1.59 (0.80, 3.15)	.18	1.75 (0.35, 8.71)	.49	2.02 (0.45, 9.04)	.36
	Adjusted	4.02 (1.68, 9.66)	<.001	2.08 (0.50, 8.65)	.31	1.49 (0.74, 2.99)	.26	1.60 (0.30, 8.46)	.58	1.78 (0.45, 7.03)	.41
Cancer	Unadjusted	1.54 (0.59, 4.04)	.38	--		0.49 (0.23, 1.05)	.068	0.20 (0.03, 1.50)	.116	0.63 (0.26, 1.56)	.32
	Adjusted	3.10 (0.92, 10.42)	.068	--		0.51 (0.23, 1.17)	.111	0.48 (0.08, 2.79)	.42	0.70 (0.28, 1.76)	.45
Heart Disease	Unadjusted	0.28 (0.06, 1.20)	.086	--		0.41 (0.10, 1.68)	.21	0.85 (0.10, 7.04)	.88	1.73 (0.31, 9.59)	.53
	Adjusted	0.47 (0.10, 2.10)	.32	--		0.44 (0.10, 1.86)	.27	2.71 (0.33, 22.56)	.36	2.01 (0.33, 12.38)	.45
COPD[a]	Unadjusted	1.09 (0.41, 2.86)	.87	--		1.41 (0.50, 3.96)	.51	0.58 (0.07, 4.75)	.61	--	
	Adjusted	1.54 (0.59, 4.02)	.38	--		1.5 (0.52, 4.36)	.46	1.11 (0.15, 8.56)	.91	--	
Diabetes	Unadjusted	2.56 (0.99, 6.65)	.053	0.45 (0.06, 3.50)	.45	1.71 (0.80, 3.64)	.17	2.41 (0.29, 20.19)	.42	1.13 (0.23, 5.51)	.88
	Adjusted	4.59 (1.67, 12.62)	<.001	1.54 (0.19, 12.28)	.68	1.90 (0.88, 4.10)	.10	6.89 (0.95, 49.67)	.056	1.32 (0.27, 6.40)	.73
Hypertension	Unadjusted	0.71 (0.31, 1.62)	.41	0.51 (0.12, 2.24)	.37	1.43 (0.78, 2.64)	.25	2.22 (0.44, 11.29)	.34	1.08 (0.44, 2.65)	.86
	Adjusted	1.16 (0.57, 2.35)	.69	1.81 (0.43, 7.68)	.42	1.81 (0.88, 3.69)	.106	5.34 (0.93, 30.62)	.060	1.35 (0.55, 3.32)	.52
Kidney Disease	Unadjusted	0.68 (0.17, 2.76)	.59	--		0.69 (0.15, 3.05)	.62	--		1.48 (0.41, 5.43)	.55
	Adjusted	0.97 (0.25, 3.75)	.97	--		0.73 (0.17, 3.21)	.68	--		1.67 (0.45, 6.17)	.44

Outcome	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Gender Minority (Transgender)	**Native Hawaiian**	*P*-value	**Pacific Islander**	*P*-value	**Asian**	*P*-value	**Unspecified**	*P*-value	**White**	*P*-value
		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Obesity	Unadjusted	3.58 (1.57, 8.18)	.003	1.65 (0.46, 5.94)	.45	1.58 (0.83, 3.01)	.166	2.44 (0.34, 17.61)	.38	1.37 (0.54, 3.53)	.51
	Adjusted	3.76 (1.64, 8.59)	.002	2.13 (0.64, 7.09)	.22	1.7 (0.91, 3.20)	.098	2.56 (0.35, 18.76)	.36	1.60 (0.63, 4.11)	.33
Smoking	Unadjusted	3.73 (1.56, 8.93)	.003	3.02 (0.83, 10.97)	.093	0.68 (0.3, 1.54)	.36	0.83 (0.15, 4.70)	.83	0.51 (0.17, 1.54)	.23
	Adjusted	3.38 (1.43, 8.02)	.006	2.66 (0.78, 9.11)	.120	0.70 (0.31, 1.59)	.39	0.63 (0.11, 3.63)	.60	0.55 (0.18, 1.63)	.28
Stroke	Unadjusted	1.87 (0.67, 5.19)	.23	--		1.21 (0.31, 4.78)	.79	--		2.66 (0.58, 12.31)	.21
	Adjusted	3.19 (1.12, 9.06)	.029	--		1.30 (0.32, 5.27)	.72	--		3.14 (0.64, 15.38)	.159

[a]COPD: Chronic Obstructive Pulmonary Disease

DISCUSSION

The findings of this study provide evidence that many chronic health conditions have an association with sexual minority persons in Hawai'i compared to White heterosexual counterparts, except for heart disease. Notable differences among gender minority persons were observed in Native Hawaiian adults compared to White cisgender counterparts. Thesefindings align with a 2021 CDC report that found a higher prevalence of several underlying health conditions associated with severe COVID-19 among sexual minority populations compared to non-sexual minority populations in the US.[14]

Although a study by the CDC reported the increased understanding of the impact of COVID-19 on SGM people across the US, the limited race groups used in the study were not generalizable to the unique racial demography of Hawai'i[14] In 2020, COVID-19 disparities in the US as a whole primarily affected African American, Native American, and LatinX communities,[23] whereas Pacific Islander and Native Hawaiian communities were the most affected communities in Hawai'i that same year.[19] Minority individuals, particularly SGM people, experience stigmatization and discrimination,[24] which may prevent optimal health care and access to care, and reduce overall well-being. This study illustrates that the disparities are especially pronounced for Native Hawaiian sexual minority people, for multiple underlying health conditions compared to Native Hawaiian and White heterosexuals. Among Native Hawaiian transgender people, associations with asthma, diabetes, obesity, smoking, and stroke (compared to White heterosexuals) were reported.

A true understanding of the health issues of SGM people in Hawai'i is currently limited by the lack of published research, both locally and nationally. SGM data are often not collected in electronic health records within institutional systems, including COVID-19 surveillance.[19,24] Such exclusion in reporting of data has resulted in limited information for SGM communities.[25] This hinders health care services and may mask public health significance for vulnerable communities like SGM persons who need special care and services.[25,26] The Hawai'i BRFSS has collected data through the Sexual Orientation and Gender Identity (SOGI) module since 2014.[27] Including this module in state-level data collection and reporting is one important way to track behavioral and chronic diseases among SGM adults that could lead to sustainable preventive measures and care. Notably, Hawai'i also collects data on sexual orientation and gender identity among high school and middle school students via the Youth Risk Behavior Survey.[28]

To reduce race and SGM disparities for health conditions in Hawai'i, culturally appropriate prevention, surveillance, and management are needed. Digital health interventions tailored for SGM individuals hold the potential for cost-effectiveness and may reduce barriers to health care access, especially in using social media-delivered interventions focused on improving mental and physical health outcomes.[29] Future interventions can benefit from enhancing protective and resilience factors (adult and peer support, and adaptive coping strategies) and reducing known risk factors to improve SGM health.[29] Given the disparate impact on Native Hawaiian SGM communities, culturally congruent research and resources (eg, *No Ka Māhūi: Kanaka LGBTQIA+ & Māhū Toolkit* from Papa Ola Lōkahi[30]) will play an important role in improving health outcomes.

This study adds to the limited reporting of health outcomes by sexual orientation and gender identity with race by having a large representation of Native Hawaiian adults. The study also brings attention to the large disparities between SGM and race needed to ensure health equity for all, especially for populations in the Pacific region.

There are several limitations to this study. BRFSS is a cross-sectional survey based on self-reported information, and respondents may have felt uncomfortable answering honestly about sexual orientation, gender identity, and/or personal health information. Generally, the SOGI module has a low refusal rate, but this differs by age, sex, education, and language.[31] Individuals who responded to the sexual orientation question as "something else" were categorized as "questioning", but it is unclear if the respondent did not understand the question. Hawai'i residents who did not respond to the SOGI questions and responses missing sex and age were excluded from the current study. This may have resulted in undercounting of SGM people in this analysis. Also, underlying health conditions reported by the CDC as COVID-19 risk factors were not assessed for clinical determination. The study reports on data prior to the COVID-19 pandemic, and the prevalence of these conditions may have changed. Lastly, the decision to utilize AOR as the primary measure of association rather than reporting prevalence estimates could be a limitation. While AOR offers valuable insights into the strength and direction of relationships between measures, the AOR reported may overestimate the association compared to prevalence estimates.

CONCLUSION

Chronic health conditions that may pose an increased risk for severe COVID-19 illness are disproportionately prevalent among SGM populations in Hawai'i. These disparities are evident among certain racial groups, especially Native Hawaiian SGM people. The lack of surveillance data, especially on COVID-19, among SGM patients in health care systems restricts public health efforts for this population. Further research is needed to assess COVID-19-related illness among SGM and racial minority populations, especially Native Hawaiian communities in Hawai'i. Policy and program efforts to protect vulnerable communities in culturally congruent ways are needed to support optimal health and well-being for all.

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Institutional Review Board Statement

The Hawai‘i Department of Health reviewed and approved this study and data usage protocols. Public de-identified data from a national survey was used for secondary analysis and did not require Institutional Review.

Declaration of Interest

The authors declare no conflicts of interest.

Author Contribution

ABY: contributed to the conceptualization, formal analysis, methodology, writing of the draft, review, and editing; TP: contributed to the conceptualization and writing of the draft, review, and editing. All authors read and approved the final manuscript.

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Effects of Tummo Meditation and Niguma Yoga on Brain Activity

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Abstract

Hatha yoga, Qigong, Tai Chi, all ancient practices of the mind, continue to be studied and recognized for their mental and spiritual benefits. However, Tummo meditation and Niguma yoga, ancient practices with origins in the 8th and 11th centuries from the Himalayan Vajrayana tradition, remain obscure and have yet to be disseminated and studied. Previously only practiced by Vajrayana monks during a 3-year retreat, practitioners of Tummo and Niguma often report increased mindfulness and emotional calm following the exercises. In an effort to explore these once secret practices, the Manakai O Mālama Integrative Healthcare Group investigated changes in brain activity prior to and following Tummo combined with Niguma in a seasoned Vajrayana practitioner. Using quantitative electroencephalogram imaging and spectral analysis, an increase in alpha band power and intra-connectivity was observed immediately post-practice, suggesting increased activation of the default mode network (DMN), a brain network directly involved in internalized cognition, self-reflection, emotional regulation, and creativity. These findings not only offer a scientific basis for further research, but also provide neurological evidence for the mental and cognitive benefits of Tummo meditation and Niguma yoga. With continued study, it is possible to validate ancient practices of Tummo and Niguma as effective health interventions. Moreover, this study furthers research showing how yoga and meditation techniques may be of benefit for behavioral health. In particular, cultural healing components of yoga and meditation may be more easily deployed in minority populations like Native Hawaiians, who are disproportionately at risk for mental health issues in Hawai'i.

Abbreviations & Acronyms

DMN = default mode network
EEG = electroencephalogram
FFT = fast fourier transform
Hz = hertz
PLI = phase lag index
PSD = power spectrum density

Introduction

Ancient meditation and yoga practices have long been reported to impart benefits to mental and physiological health. Recent studies demonstrate quantifiably beneficial effects of meditation and yoga, including significant changes in brain power, connectivity, and structure in the hippocampus, amygdala, prefrontal cortex, and cingulate cortex, which are associated with enhancements in mood, mindset, and cognition.[1,2] Yoga meditators were also shown to have greater gray matter volume, slower decline of gray matter with age, and fewer cognitive failures in comparison to matched controls, suggesting that yoga meditation promotes neuroplasticity and may be neuroprotective against age-related decline.[3,4] As Native Hawaiians suffering from mental health disorders have been shown to prefer cultural ways of healing, yoga and meditation offer a unique therapeutic advantage to the population.

Tummo meditation and Niguma yoga, the latter once a closely-guarded practice, were only recently made available to the public in 2022. Tummo involves repetitively holding the breath during isometric contraction of abdominal muscles, resulting in increased sympathetic nervous system tone, thermogenesis, and altered brain states.[5-7] Niguma is a set of 25 Tibetan yoga exercises, comprising a broad range of difficulty, however given its only recent public practice, no scientific studies have been conducted on Niguma to date. When Tummo and Niguma are performed concurrently, Niguma magnifies the benefits of Tummo's isometric muscle engagement through rhythmic reinforcement while stabilizing the body during Niguma movements. Post-practice, practitioners report increased stress resilience, focus, and a dynamic mental state that perpetuates a deeper perspective of reality. Measurement of the activation of brain networks involved in these described experiences may provide more insight into the origins of reported phenomena.

Previous studies on meditation and yoga have focused on brain regions that form a network which is active during internalized modes of cognition, self-reflection, emotional regulation, and creativity, known as the default mode network (DMN).[8] The DMN has not yet been investigated in Tummo combined with Niguma. Resting-state brainwave activity present during awake eyes-closed and relaxed states as measured via an electroencephalogram (EEG) is an accepted proxy for DMN activation, with overlapping hubs of generation within the medial prefrontal cortex and inferior parietal cortices.[9] This rhythm is alpha activity, a cortical oscillatory rhythm with a frequency between 8-13 Hz, which varies between people, but is a stable physiological trait within an individual.[10] Higher amounts of resting state alpha activity are associated with greater DMN intra-network activation.[9,11] Importantly, DMN intra-connectivity is lower between frontal and posterior regions, and activation is less stable in people with mental health disorders.[12,13]

Standard EEG spectral analysis and connectivity measures, coherence and phase lag index (PLI), may be used to track EEG changes over time and indicate network activation and connectivity.[14-16] These measures compare variance of an EEG signal between 2 locations over time and reflect network connectivity, with PLI being more immune to effects of volume conduction. Both measures are scaled from 0-1, with a measurement of 0 reflecting no connectivity and 1 reflecting perfect connectivity. Increases in alpha power were reported following Kundalini yoga, Qigong, Transcendental and Tummo meditation; however, no studies examined DMN-specific alpha intra-connectivity.[5-7,17] Alpha connectivity and amplitude indicate the strength of communication between brain regions for this band, with alpha hypoconnectivity linked to functional brain dysconnectivity in Alzheimer's disease and mild cognitive impairment,[18] alpha connectivity decreasing following sleep deprivation,[19] and alpha amplitude decreasing following traumatic brain injuries.[20] These measures have been previously reported to increase in meditation studies, however none report on the combination of Tummo and Niguma.[21, 22] The present case study investigates the effect of Tummo and Niguma on resting state cortical function within DMN hubs as measured via awake eyes-closed and relaxed state EEG in a seasoned practitioner of this meditation and yoga practice.

Methods

The subject was a 32-year-old Vajrayana teacher trained in Tummo and Niguma with more than 15 years' experience of this meditation and yoga practice. The subject presented with no neurological or psychiatric disorders, brain injury, or addictions. The subject was recruited through Manakai O Mālama Integrative Healthcare Group and consented to 2 ten-minute EEGs recorded before and after a Tummo and Niguma session in a quiet room with the practitioner's personal cushion mat. The subject was in an awake, eyes-closed and relaxed state during EEG recordings. The session lasted approximately 35 minutes.

To measure changes in alpha activity, representative of DMN activation, a Deymed Truscan EEG amplifier was used with a 19-lead EEG cap using a standard 10-20 EEG setup, recorded at <10k Ohm impedance. Preprocessing of EEG was performed with the python module Autoreject 0.4.2,[23] and only post-processed artifact-free EEG epochs were utilized in analysis.

A fast fourier transform (FFT) routine was run for spectral analysis from which EEG frequency band power percentage was calculated for 4 main types of brainwaves: delta, theta, alpha, and beta. Connectivity measures were performed to review DMN intra-connectivity pre- and post-session in the bilateral parietal lobules, corresponding to P3 and P4 electrode locations, and the medial prefrontal cortex, corresponding to the Fz electrode location. Coherence and PLI were calculated for P3-Fz and P4-Fz electrode pairs.[24] A power spectrum density (PSD) figure was generated with regions of interest plotted. PSD calculated regions of interest were frontal (F3, F4, Fz), central (C3, C4, Cz) and posterior (Pz, P3, P4, O1, O2). These measures were repeated for pre-and post-session EEGs.

Results

Following the Tummo and Niguma session, the subject reported a change in emotional state to one with cognitive clarity, calmness, and a state without emotions of "grasping, desire, or jealousy." Pre- and post-session FFT data are shown in **Table 1**. All anterior to posterior alpha connectivity measures, which are generally lower in persons with mental health disorders, markedly increased following the practice session. Alpha band percent power increased by a proportionally large margin, (31.6% to 56.4%), following the session. As alpha band activity increased proportionally more than other band activity, the percent power of delta, theta, and beta bands decreased. For Coherence and PLI measures, all alpha connectivity measures increased relative to pre-session, the most in the right hemisphere (ie, P4-Fz).

Pre- and post-FFT power spectrum density (PSD) plots are displayed in **Figure 1** with pre-session PSD presented in pink and post-session PSD presented in blue. Theta (4-8Hz) and alpha (8-13Hz) wide-band activity increased in frontal, central, and posterior regions. The increase in alpha band activity was higher than that observed for theta band activity. As reported in observations of the peak of alpha activity following meditation,[17] the subject's alpha peak frequency was slower following the Tummo and Niguma session, decreasing from approximately 10.8Hz to 9.5Hz. Meanwhile, peak theta frequency increased from approximately 6.2Hz to 6.5Hz. Minimal changes were noted in beta band (13-30Hz) PSD amplitude.

Discussion

Tummo meditation and Niguma yoga are ancient practices that have potential for improving the quality of life for any who practice. This case study explored the impact of combined Tummo and Niguma on brain activity. Following Tummo and Niguma, a 24.8% increase in alpha band power and up to 0.13 increase in alpha connectivity measures were observed. Decreases were observed in percent band power for delta, theta, and beta activity, corresponding to the large increase in alpha percent power reported. Higher amounts of alpha activity are associated with greater DMN intra-network activation, a network active in intrinsic awareness, emotional control, and creative processes. As the DMN is abnormally activated and connected in mental health disorders,[12,13] the observed increase in alpha intra-connectivity and activation suggests beneficial changes in brain activity following combined Tummo and Niguma practice. Previous studies of Tummo reported similar increases in alpha band activity and coherence in seasoned practitioners, up to 36% increase in alpha amplitude during meditation with significant increases in alpha coherences[5-7]; however there are no reports of Niguma yoga utilizing EEG measures. Notably, the present study did not directly analyze DMN activity via fMRI or a measure of

Table 1. Pre- and Post-Session Fast Fourier Transformed (FFT) Frequency Band Percentage, Alpha Coherence, and Alpha Phase Lag Index in a Participant Practicing Tummo Meditation and Niguma Yoga

	Frequency Band Percentage (%)				Alpha Coherence		Alpha Phase Lag Index	
	Delta	Theta	Alpha	Beta	P3-Fz	P4-Fz	P3-Fz	P4-Fz
Pre-Session	27.1	29.8	31.6	11.5	0.63	0.65	0.24	0.23
Post-Session	14.2	21.7	56.4	7.6	0.67	0.70	0.32	0.36

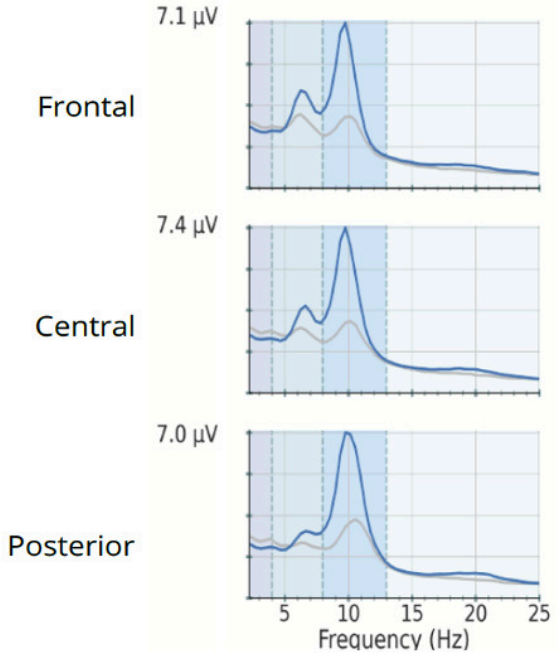

Figure 1. Pre-Session (pink) and Post-Session (blue) Fast Fourier Transformed (FFT) Power Spectrum Density Plotted by Band Frequency and Power in a Participant Practicing Tummo Meditation and Niguma Yoga

functional connectivity, however previous studies have highlighted increases in DMN functional connectivity in meditation.[8]

Limitations in this report include analysis on a single subject and lack of a comparison group, in-depth statistical analysis, or follow-up EEGs to quantify the durability of the effects of Tummo and Niguma practice. Additional research with more practitioners, a novice group, and more extensive neuroimaging to further characterize the significance of observed neurological differences is necessary to understand the impact of Tummo and Niguma on brain function.

Regardless, the demonstration of changes in brain activity is an important step in furthering the understanding of Tummo meditation and Niguma yoga's impact on mental health.

Native Hawaiians are at higher risk for mental health issues and show lower rates of seeking mental health care due to colonization risk-factors and cultural stigmatization.[25] Validating and incorporating ancient mind practices into health care may help bridge cultural barriers as Native Hawaiians and other marginalized groups may value tradition and spirituality over Western medical beliefs. Additionally, Tummo and Niguma are noninvasive, non-pharmacological, and low-cost to implement. Therefore, they hold potential in offering additional mental healthcare modalities for these groups.

Disclosure

None of the authors identify any conflict of interest.

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The PhD in Nursing: Defining the Degree and Shaping the Next Generation of Nurse Scientists in Hawai‘i

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The Spotlight on Nursing is a recurring column from the University of Hawai‘i at Mānoa School of Nursing and Dental Hygiene (SONDH). It is edited by Holly B. Fontenot, PhD, APRN, WHNP-BC, FAAN, FNAP; Associate Dean for Research, Professor, and Frances A. Matsuda Chair in Women's Health for SONDH, and HJH&SW Contributing Editor; and Joanne R. Loos, PhD, Science Writer for SONDH.

Introduction

Nursing is a complex discipline, defined by the American Nurses Association as "[integrating] the art and science of caring and focuses on the protection, promotion, and optimization of health and human functioning; prevention of illness and injury; facilitation of healing; and alleviation of suffering through compassionate presence. Nursing is the diagnosis and treatment of human responses and advocacy in the care of individuals, families, groups, communities, and populations in recognition of the connection of all humanity."[1] While nursing is typically only conceptualized within the roles of the bedside nurse and the advanced practice nurse practitioner, the nursing profession is much more expansive, including roles encompassing community and public health, school health, hospital administration, policy work, education, and research.

The Doctor of Philosophy (PhD) is the highest degree offered within nursing, building a workforce of scientists and scholars to advance nursing knowledge through research and scholarship.[2] PhD-prepared nurses not only advance nursing-specific research, but as the definition above indicates, expand across all areas and levels of health, wellness, prevention, and advocacy to build evidence and promote innovative solutions to many health related topics affecting our communities. PhD-prepared nurses are important within the research setting and also within education as faculty for our future nursing workforce and within health care institutions as administrators and leaders.[3] Hawai‘i faces a significant state-wide faculty shortage and a lack of research tailored to the state's unique communities and populations. For instance, in Hawai‘i less than 3% of nurses hold PhDs[4] highlighting a critical need for more PhD-prepared nurses within our state.[5]

The demand for PhD-prepared nurses persists, especially with the faculty shortage, which is poised to grow in the coming years with much of existing faculty nearing retirement age.[5] Fortunately, there is a new opportunity for nurses to attain their PhDs locally.

The University of Hawai‘i at Mānoa School of Nursing and Dental Hygiene has relaunched its PhD in Nursing program with a new, exciting curriculum and opportunities for students to delve into how nursing research can intersect with Native Hawaiian culture to address key needs within communities.[6] The program starts in 2026. The curriculum focuses on conducting community-based research, implementing research using a multitude of methodologies and approaches, and understanding how best to address key health issues and problems with scientific rigor. It was developed with success in mind, supporting the growth and development of independent researchers and scholars upon graduation, with a focus on meeting needs in Hawai‘i and the Pacific Basin. As the only PhD in nursing program at an Indigenous-serving institution, this program has the potential to be the cornerstone for centering the needs of Indigenous communities here and across the world.

History and Evolution of the PhD in Nursing

The PhD in Nursing degree has been in existence in the US since the mid-20th century, with growth in the number of programs in the 1980s, when the National Institutes of Health established the National Institute of Nursing Research (NINR).[7] Since then, PhD in Nursing programs have often aligned their program learning objectives with NINR priority areas,[8] supporting a concerted national effort to advance nursing and health care science to transform clinical practice and improve health outcomes. As of 2023, there were 148 PhD in Nursing programs across the United States.[9] However, there remains a relative lack of racial diversity among PhD students,[10] particularly among American Indian/Alaska Native and Native Hawaiian/Pacific Islander students.[11] This disparity persists, despite 38 of these programs being at Minority-Serving Institutions, of which 22 are at Asian American and Native American, Pacific Islander-Serving Institutions.[12] Ensuring accessibility and appropriate support for PhD learners from underrepresented backgrounds is key to diversifying the nursing workforce through racially concordant education and research (through diverse faculty and researcher representation),[13, 14] which may help reduce many of the health disparities that exist today. The new PhD in Nursing program will build in these structures and support to maximize success for students.

PhD vs. DNP

A common question within the nursing discipline is how the PhD and the Doctor of Nursing Practice (DNP) degrees differ, and the relative benefits to both. The PhD in Nursing

is akin to other PhD degrees in rigor and status, with clear preparation to be a scientist developing new scientific knowledge within its respective field. Around 2004, the DNP degree was created by the American Association of Colleges of Nursing to elevate advanced practice nursing to a doctoral level,[15] similar to the pathways seen within pharmacy (PharmD), physical therapy (DPT), public health (DrPH), medicine (MD), and dentistry (DDS/DMD).[16] These clinical doctoral degrees are focused on the advancement of clinical practice expertise and on the application and translation of evidence into practice (also referred to as evidence-based practice).[17] Evidence-based practice typically relies on evidence developed by PhD-prepared scientists, ensuring evidence is used to improve outcomes within clinical practice.[3]

While some DNP graduates conduct research studies similar to what is often expected from PhD-prepared scientists, it is not the expectation within the degree structure. PhD-prepared nurses typically focus on research and academia, while DNP-prepared nurses focus on incorporating science in organizational, clinical, and policy settings. Further, DNP education programs are often integrated within advanced practice nursing training, such as family nurse practitioner, psychiatric mental health nurse practitioner, and adult/gerontological nurse practitioner education,[18] all of which are offered at the University of Hawai‘i at Mānoa School of Nursing and Dental Hygiene.[19] Given the different focus for the DNP and PhD programs, it is not uncommon for individuals to strive to have both degrees, or a PhD with a Masters of Science in Advanced Population Health Nursing or Nursing Education and Leadership, lending to unique skill sets and knowledge to address today's biggest issues.

PhD-Prepared Nurses in Hawai‘i

PhD-prepared nurses are working in numerous settings and environments within Hawai‘i, with opportunities for expansion within the state. PhD-prepared nurses fill roles as faculty in nursing education programs, from community colleges to public and private universities. PhD-prepared nurses serve as researchers and clinicians within hospital systems and health care organizations. They are leading centers and organizations promoting public policy and advocacy. PhD-prepared nurses are supporting philanthropic organizations and funding institutions at the state and national levels. Lastly, a PhD in Nursing is not only for nurses. Those with other health care backgrounds may benefit from developing research competency from a nursing perspective (the largest health care profession), which focuses on understanding health from a local to planetary perspective using prevention, wellness, and advocacy as key drivers of health. Although PhD-prepared nurses can serve a plethora of roles, the percentage of nurses who have PhDs is limited, an issue the new PhD in Nursing program will address.

Conclusion

PhD-prepared nurses can help fulfill critical roles in academia, providing not only nursing research, but also educating future local nurses. While the nursing workforce in Hawai‘i has grown since 2021, the proportion of resident nurses is decreasing.[4] For instance, as of 2023, 44% of RNs working in in Hawai‘i were out-of-state residents, while in 2013 only 33% were from out-of-state.[4] These out-of-state nurses could be providing telehealth services or working as travel nurses. Educating future local nurses has become even more crucial. The Hawai‘i State Center for Nursing states that efforts to mitigate challenges related to shortages in workforce as well as nursing education capacity "are necessary to ensure that local schools of nursing can continue to educate local students who will eventually provide care to the local community."[4] Ensuring opportunity to increase the number of PhD-prepared nurses in Hawai‘i is a key driver to addressing workforce shortages and supporting health and health care across the state.

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Guidelines for Publication of Hawai'i Journal of Health & Social Welfare Supplements

The Hawai'i Journal of Health & Social Welfare (HJH&SW) partners with organizations, university divisions, and other research units to produce topic-specific issues of the journal known as supplements. Supplements must have educational value, be useful to HJH&SW readers, and contain data not previously published elsewhere. Each supplement must have a sponsor(s) who will work with the HJH&SW staff to coordinate all steps of the process. Please contact the editors at hjhsw@hawaii.edu for more information if you would like to pursue creating a supplement.

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3. Supplements must have a sponsor who will act as the guest editor of the supplement. The sponsor will be responsible for every step of the publication process including development of the theme/concept, peer review, editing, preliminary copy editing (ie, proof reading and first round of copy editing), and marketing of the publication. HJH&SW staff will only be involved in layout, final copy editing and reviewing final proofs. It is important that the sponsor is aware of all steps to publication. The sponsor will:

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Hawai‘i Journal of Health & Social Welfare
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The HJH&SW encourages authors to use the appropriate diacritical markings (the ‘okina and the kahakō) for all Hawaiian words. We recommend verifying words with the Hawaiian Language Dictionary (http://www.wehewehe.org/) or with the University of Hawai‘i Hawaiian Language Online (http://www.hawaii.edu/site/info/diacritics.php).

Authors should also note that Hawaiian refers to people of Native Hawaiian descent. People who live in Hawai‘i are referred to as Hawai‘i residents.

Hawaiian words that are not proper nouns (such as keiki and kūpuna) should be written in italics throughout the manuscript, and a definition should be provided in parentheses the first time the word is used in the manuscript.

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‘āina	**Kaua‘i**	**O‘ahu**
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