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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.

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Impact of the COVID-19 Pandemic on the Hawai‘i Nursing Workforce: A Cross-sectional Survey

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Abstract

The coronavirus disease (COVID-19) pandemic has placed extraordinary strain on health care systems. This has led to increased stress among health care workers, and nurses in particular, which has had a negative impact on their physical and psychosocial wellbeing. This is likely to negatively impact the nursing workforce at the state and national levels as the pandemic continues. The purpose of this study was to assess whether nurses licensed in Hawai‘i have considered leaving the workforce. A cross-sectional online survey was conducted among Hawai‘i nurses at all levels of licensure, with 421 responding. Of these nurses, 97 (23.0%) reported considering leaving the workforce, with safety (39.2%) and family/caregiver strain (32.0%) being the most common reasons. Reconsidering whether they should stay employed in their current roles (Odds ratio [OR] 2.05; 95% CI 1.56 - 2.69) and fear to continue providing direct patient care (OR 1.97; 95% CI 1.54 - 2.54) were associated with increased odds of having considered leaving the workforce. Based on these results, the State of Hawai‘i and local health care organizations need to adjust their nursing workforce estimates and address how to alleviate nurses' stressors and safety concerns to mitigate a potential workforce shortage. Research is needed to develop interventions to support and empower nurses in their current roles but also address future emergency preparedness.

Keywords

COVID-19; pandemic; nursing workforce; nurse

Abbreviations

ANA = American Nursing Association
APRN= Advanced Practice Registered Nurse
CI= Confidence Interval
COVID-19= Coronavirus Disease 2019
HCP= Health Care Provider
LPN= Licensed Practical Nurse
NHOPI= Native Hawaiian and Other Pacific Islanders
OR= Odds Ratio
PPE= Personal Protective Equipment
RN= Registered Nurse
SD= Standard Deviation
US=United States

Introduction

The nursing profession represents the largest segment of the health care workforce in the State of Hawai‘i.[1,2] In 2019, pre-pandemic, the Hawai‘i State Center for Nursing[1,3] predicted that the state's schools of nursing were graduating adequate numbers of pre-licensure students to meet the state's future registered nurse (RN) demands. However, future shortages were expected for licensed practical nurses (LPNs) and advanced practice registered nurses (APRNs).

Workforce predictions are based on the assumption that all employed nurses are available to work when needed. Adequate numbers of health care providers are essential in the response to an emergency. The US Department of Homeland Security guidance[4] outlines that all organizations should continuously plan and prepare for future emergencies. Hence researchers have queried members of the health care workforce about their willingness to provide patient care during different types of potential emergencies.[5-7] In these studies, about 50% of health care providers were unwilling to provide patient care during a pandemic. Factors that played into the decision to report to work during a pandemic included concerns for personal safety, concerns for the safety of others, and child- and eldercare responsibilities.[5-7]

The current coronavirus disease (COVID-19) pandemic has placed extraordinary strain on health care systems around the world. Health care providers, in particular nurses, are at an increased risk of exposure to and development of severe complications from COVID-19.[8,9] Of all health care providers hospitalized in the Spring of 2020, more than one-third were part of the nursing profession.[10] Despite elevated risk, nurses have remained in the workforce and have demonstrated a strong sense of duty and professionalism.[11,12]

As the pandemic continued, reports highlighted increased strain and exhaustion among nurses.[13] Nurses caring for COVID-19 patients, in particular, have experienced increased stress, insomnia, anxiety, depression, symptoms of post-traumatic stress disorder, as well as signs of burnout.[14-16] This physical and psychosocial stress is likely to impact the nursing workforce at the state level as well as nationally. Therefore, the purpose of this study was to assess how the COVID-19 pandemic has impacted nurses working in Hawai‘i. The authors explored nurses' perspectives on and intentions to continue in the nursing workforce and identified factors that may be associated with the nurses' consideration to leave the workforce.

Methods

Participants and Recruitment

In 2019, about 20,000 individuals held Hawai'i nursing licenses.[1] Of those, approximately 2,000 were members of the Hawai'i State Center for Nursing. During November and December of 2020, recruitment letters were sent to the Hawai'i State Center for Nursing's members via email. Additionally, recruitment flyers were posted on the Center's social media pages (Twitter and Facebook). Recruitment emails followed the Dillman's Tailored Design Method approach.[17,18] All materials distributed contained a link to the study webpage that included study information, informed consent procedures, and an assessment of eligibility. Eligibility criteria included: (1) being licensed as a nurse at any level in Hawai'i (eg, APRN, RN, LPN), (2) currently employed or actively seeking employment in Hawai'i, (3) able to read and understand English, and (4) aged 18 years or older. If eligible and consented, participants were directed to complete a 10-minute online survey. Participation was voluntary and remuneration was not offered. The study received approval from the University of Hawai'i at Mānoa Institutional Review Board as exempt (Protocol Number 2020-00862).

Measures

Demographics. The survey collected age, gender, race/ethnicity, level of education, license type, years as a nurse, level of employment, title, setting, and place of employment. Age was categorized into 4 groups: 18-30 years, 31-40 years, 41-50 years, and 61 years or older. Participants reported if they identified as Hispanic (yes/no) and, based on its distribution, race was identified as White, Asian, Native Hawaiian and Other Pacific Islander (NHOPI), and Other. Other included Black, American Indian, or Alaska Native, and those who identified as multiracial or preferred not to answer. Level of education was categorized as: (1) vocational/practical certificate, diploma, associate degree; (2) bachelor's degree; and (3) master's, doctorate in nursing practice, and/or PhD degree. Years in nursing were defined as 0-5 years, 6-10 years, 11-20 years, and 21 years or more. Title was categorized as: (1) staff nurse, (2) advanced practice (eg, nurse practitioner, nurse midwife, nurse anesthetist, clinical nurse leader), (3) nurse administrator (eg, nurse administrator, manager, executive), and (4) other (eg, faculty, researchers, consultants). Setting was categorized as: (1) community/outpatient (eg, ambulatory care, assisted living/nursing home/extended care, community/public health, correctional facility, home health), (2) hospital, and (3) other (eg, academic, research, policy/regulatory, insurance). Place of employment was determined by zip codes and categorized to O'ahu versus Other (eg, any other Hawaiian island).

Considering leaving the nursing workforce. Considerations to leave the workforce (not just changing jobs) was assessed by the following question: "Have you considered leaving the health care workforce since the start of the pandemic?" It was defined as a binary outcome variable (0=No, 1=Yes). Those who indicated "Yes" were asked to provide their reason(s) by selecting 1 or more options that included: retiring, family/caregiving strain, economic strain, unsafe work environment, do not want to be a health care provider anymore, mandated vaccine, job fatigue, and other (open response).

COVID-19 vaccine perceptions (employer policies and informed decision making). Three 5-point Likert-type questions measured COVID-19 vaccine workplace policies on intentions to vaccinate (1=strongly disagree to 5=strongly agree). The questions were "How likely is it that you will get a COVID-19 vaccine if your employer recommended (not required) it," and "How likely is it that you will get a COVID-19 vaccine if your employer required you to receive the vaccine once available." The intention to request an exemption for the COVID-19 vaccine was assessed via the dichotomous question, "If there was an option for obtaining an exemption for the COVID-19 vaccine would you obtain one" (0=No, 1=Yes). Information for informed vaccine decision making was defined using a 5-point Likert-type question, "I feel that I have the necessary information I need to make an informed decision about COVID-19 vaccination (1=strongly disagree to 5=strongly agree)."

Attitudes towards being a health care provider during the pandemic. Attitude towards being a health care provider was assessed by 3, 5-point Likert-type questions (1=strongly disagree to 5=strongly agree): "The COVID-19 pandemic has strengthened my commitment to being a healthcare provider," "The COVID-19 pandemic has made me reconsider staying employed in my current role as a healthcare provider," and "The COVID-19 pandemic has made me afraid to continue providing direct patient care as a healthcare provider."

Workload. To assess perceptions about the effect of the pandemic on workload the survey included: "Since the start of the pandemic, at your current/primary place of employment, indicate any changes in hours worked." The participants were able to select 1 of 3 choices (working less hours compared to pre-pandemic, working the same amount of hours, working more hours compared to pre-pandemic). The 'same' workload was considered as the reference group.

Statistical Analysis

Descriptive statistics were reported using frequencies and percentages for categorical variables and means and standard deviations for continuous variables. Bivariate associations between consideration to leave the workforce and each of the variables were explored using a univariable logistic regression. Then a multivariate logistic regression analysis with the bivariates was implemented with a P-value <.15. Hosmer and Lemeshow test and c-statistic were computed to address the model fit. Additionally, a multicollinearity using variance inflation factor - none

were greater than 10 was investigated. Odds ratios (ORs) and 95% confidence intervals (CIs) to measure association with intention to leave the workforce were computed. All analyses were conducted in SAS 9.4 (SAS Institute, Cary, NC) and $P \leq .05$ was considered statistically significant.

Results

Sample

Among 602 participants who opened the survey and consented, 550 met eligibility criteria. Of these, 421 participants responded to the "considering leaving the health care workforce" question. More than 70% of the participants who did not answer the "considering leaving" question completed only the first few survey questions before abandoning the survey. No significant difference was found in characteristics between participants who responded to the considering leaving question and their counterparts.

The final analytic sample included 421 nurses. The majority identified as female (87.0%); were educated at the vocational/practical certificate, diploma or associates' level (66%); and worked as a staff nurse (57.5%) in the hospital setting (56.5%) on the island of O'ahu (72.2%) (Table 1). The majority of respondents (63.4%) had 11 or more years of experience, and 34.4% of nurses were aged 51 years or older. Race was identified as 45.1% White, 27.8% Asian, 10.7% NHOPI, and 16.4% Other, and 6.2% identified their ethnicity as Hispanic. Slightly more than 80% of the respondents intended to receive the COVID-19 vaccine (Table 2).

In this sample, 23.0% indicated that they were considering leaving the nursing workforce. Reasons included: safety (39.2%), family/caregiver strain (32.0%), job fatigue (24.7%), retiring (21.6%), not wanting to be a health care provider (21.6%), and economic strain (9.3%), and 3.1% indicated they would consider leaving the workforce if employers required/mandated the COVID-19 vaccine (Figure 1).

Bivariate Analysis

In bivariate analyses, none of the demographic characteristics were statistically associated with considering leaving the workforce (Table 1). Descriptive data and bivariate analyses for COVID-19 vaccine perceptions, attitudes, and workload are presented in Table 2. Of these, the likelihood of receiving the vaccine against COVID-19 if their employer recommended/required it (OR=0.85, 95% CI=0.74-0.99), having the necessary information to make an informed vaccine decision (OR=0.79, 95% CI=0.66-0.94), having the pandemic strengthen their commitment to being a health care provider (OR=0.45, 95% CI=0.36-0.57), reconsidering staying employed in their current role (OR=2.27, 95% CI=1.83-2.82), and feeling afraid to continue providing direct patient care (OR=2.21, 95% CI=1.79-2.73) were all statistically associated with considering leaving the workforce.

The mean "likelihood of getting a COVID-19 vaccine if employer recommended it" was 3.6 (SD=1.6) for nurses who were not considering leaving the health care workforce and 3.2 (SD=1.5) for nurses who were. Mean "likelihood of getting vaccinated if employer required it" was 3.9 (SD=1.5) for nurses who did not consider leaving the workforce but the mean for nurses who did was 3.5 (SD=1.5). Means of strengthened commitment to being a health care provider were 4.0 (SD=0.9) for nurses who did not consider leaving but 3.1 (SD=1.2) for those who did. Also, the means of "reconsidering staying employed in current role" and "fear to continue providing direct patient care" among participants who indicated considering leaving were higher than those of the counterparts. However, having the necessary information to make a vaccination decision was the opposite direction; the mean for nurses "considering leaving" was lower than nurses with "no intention to leave."

Multivariate Analysis

With all the potential bivariates included, 3 variables were significantly associated with considering leaving the nursing workforce: strengthened commitment to being a health care provider, reconsidering staying employed in current role, and feeling afraid to continue providing direct patient care. The fit statistics of this model were good: Hosmer and Lemeshow goodness-fit test was not significant (P=.47) and c-statistic was 0.856 (95% CI=0.817-0.896). More specifically, the odds for indicating "considering leaving" were decreased by a factor of 0.48 (95% CI=0.36-0.64) for 1 unit increase in strengthened commitment to being a health care provider. The odds for indicating "considering leaving" were increased by a factor of 2.05 (95% CI=1.56-2.69) and 1.97 (95% CI=1.54-2.54) for 1 unit increase in reconsidering staying employed in current role and fear to continue providing direct patient care, respectively.

Table 1. Bivariate Associations Between Demographic Characteristics and Consideration to Leave the Workforce among Hawai'i Nurses (N=421), 2020

Demographic Characteristics	Total	Consideration to leave		OR [95% CI]	*P* value
		No (n=324, 77%)	Yes (n=97, 23%)		
Age (years)					
18-30	69 (16.4%)	54 (16.7%)	15 (15.5%)	1.00	
31-40	103 (24.5%)	82 (25.3%)	21 (21.6%)	0.92 [0.44, 1.95]	.83
41-50	104 (24.7%)	81 (25.0%)	23 (23.7%)	1.02 [0.49, 2.13]	.95
51-60	86 (20.4%)	61 (18.8%)	25 (25.8%)	1.48 [0.71, 3.09]	.30
61 or older	59 (14.0%)	46 (14.2%)	13 (13.4%)	1.02 [0.44, 2.36]	.97
Gender					
Female	360 (87.0%)	279 (87.2%)	81 (86.2%)	1.00	
Male/Other*	54 (13.0%)	41 (12.8%)	13 (13.8%)	1.09 [0.56, 2.14]	.80
Hispanic					
No	395 (93.8%)	306 (94.4%)	89 (91.8%)	1.00	
Yes	26 (6.2%)	18 (5.6%)	8 (8.2%)	1.53 [0.64, 3.63]	.34
Race					
White	190 (45.1%)	142 (43.8%)	48 (49.5%)	1.00	
Asian	117 (27.8%)	94 (29.0%)	23 (23.7%)	0.72 [0.41, 1.27]	.26
NHOPI	45 (10.7%)	36 (11.1%)	9 (9.3%)	0.74 [0.33, 1.65]	.46
Other	69 (16.4%)	52 (16.0%)	17 (17.5%)	0.97 [0.51, 1.83]	.92
Education					
Certificate/Diploma/Associate	274 (66.0%)	209 (65.3%)	65 (68.4%)	1.00	
Bachelor's	112 (27.0%)	90 (28.1%)	22 (23.2%)	0.79 [0.46, 1.35]	.39
Master's/Doctorate	29 (7.0%)	21 (6.6%)	8 (8.4%)	1.23 [0.52, 2.90]	.64
License Type					
Advanced Practice	35 (8.3%)	30 (9.3%)	5 (5.2%)	1.00	
RN	386 (91.7%)	294 (90.7%)	92 (94.8%)	1.88 [0.71, 4.98]	.21
Years in Nurse (years)					
0-5	103 (24.5%)	85 (26.2%)	18 (18.6%)	1.00	
6-10	51 (12.1%)	41 (12.7%)	10 (10.3%)	1.15 [049, 2.72]	.75
11-20	105 (24.9%)	76 (23.5%)	29 (29.9%)	1.80 [0.93, 3.50]	.08
21 or more	162 (38.5%)	122 (37.7%)	40 (41.2%)	1.55 [0.83, 2.88]	.17
Job Title					
Staff nurse	242 (57.5%)	181 (55.9%)	61 (62.9%)	1.00	
Advanced practice	54 (12.8%)	42 (13.0%)	12 (12.4%)	0.85 [0.42, 1.71]	.65
Nurse administrator	87 (20.7%)	71 (21.9%)	16 (16.5%)	0.67 [0.36, 1.24]	.200
Other	38 (9.0%)	30 (9.3%)	8 (8.2%)	0.79 [0.34, 1.82]	.58
Job Setting					
Hospital	238 (56.5%)	183 (56.5%)	55 (56.7%)	1.00	
Community/outpatient	145 (34.4%)	112 (34.6%)	33 (34.0%)	0.98 [0.60, 1.60]	.94
Other	38 (9.0%)	29 (9.0%)	9 (9.3%)	1.03 [0.46, 2.31]	.94
Island of Employment					
Other Hawai'i Islands	117 (27.8%)	89 (27.5%)	28 (28.9%)	1.00	
O'ahu	304 (72.2%)	235 (72.5%)	69 (71.1%)	0.93 [0.57, 1.54]	.79

OR = Odds Ratio. CI = Confidence Interval. NH = Non-Hispanic. NHOPI = Native Hawaiian and Other Pacific Islanders. RN = Registered Nurse. Column percentage. Bivariate association was explored using a logistic regression model with each demographic variable as a predictor. *Options for gender included female, male, other (to include those who identify as transgender).

Table 2. Bivariate Associations Between Health Care Provider Related Predictors and Consideration to Leave the Workforce among Hawai'i Nurses (N=421), 2020

Health Care Provider Related Predictors	Total	Consideration to leave		OR [95% CI]	*P* value
		No (n=324, 77%)	Yes (n=97, 23%)		
Categorical	n (%)	n (%)	n (%)		
Intention to obtain COVID-19 vaccination					
No	83 (19.7%)	60 (18.5%)	23 (23.7%)	1.00	.26
Yes	338 (80.3%)	264 (81.5%)	74 (76.3%)	0.73 [0.42, 1.26]	
Workload perception compared to pre-pandemic					
Less	81 (19.3%)	61(18.9%)	20(20.6%)	1.21 [0.66, 2.21]	.54
Same	206 (49.2%)	162(50.3%)	44(45.4%)	1.00	
More	132 (31.5%)	99(30.7%)	33(34.0%)	1.23 [0.73, 2.06]	.44
Continuous	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**		
Likelihood of vaccinating if employer recommended vaccine[a]	3.5 ± 1.6	3.6 ± 1.6	3.2 ± 1.5	0.85 [0.74, 0.99]	.030
Likelihood of vaccinating if employer required vaccine[a]	3.8 ± 1.5	3.9 ± 1.5	3.5 ± 1.5	0.85 [0.74, 0.99]	.032
Had necessary information to make informed vaccine decision[a]	3.2 ± 1.3	3.3 ± 1.2	2.9 ± 1.3	0.79 [0.66, 0.94]	.009
Strengthened commitment to being a HCP[a]	3.7 ± 1.1	4.0 ± 0.9	3.1 ± 1.2	0.45 [0.36, 0.57]	<.001
Reconsider staying employed in current role[a]	2.8 ± 1.3	2.5 ± 1.3	3.8 ± 1.0	2.27 [1.83, 2.82]	<.001
Afraid to continue providing direct patient care[a]	2.4 ± 1.2	2.1 ± 1.1	3.3 ± 1.2	2.21 [1.79, 2.73]	<.001

OR = Odds Ratio. CI = Confidence Interval. HCP = Health Care Provider. a Item was scaled to indicate 1=Strongly disagree to 5=Strongly agree. Column percentage. Bivariate association was explored using a logistic model with each demographic variable as a predictor.

Table 3. Multivariable Logistic Regression for Consideration to Leave the Workforce among Hawai'i Nurses

Variable	OR [95% CI]	*P* value
Perceived vaccination recommended	0.84 [0.57, 1.24]	.39
Perceived vaccination required	1.03 [0.73, 1.46]	.86
Exemption for vaccine: Yes vs. No	1.02 [0.40, 2.60]	.96
Strengthened commitment to being a health care provider	0.48 [0.36, 0.64]	<.0001
Reconsider staying employed in current role	2.05 [1.56, 2.69]	<.0001
Afraid to continue providing direct patient care	1.97 [1.54, 2.54]	<.0001
Decisional information	0.98 [0.77, 1.24]	.85

OR = Odds Ratio. CI = Confidence Interval. Multivariable logistic regression model was used to identify factors in this table that may be associated with the nurses' consideration to leave the workforce (1=Yes, 0=No). All items except exemption for vaccine were 5-point Likert point scales (1=strongly disagree to 5=strongly agree) and treated as continuous variables. C-statistics was this model was 0.856, 95% CI = [0.817, 0.896]. Hosmer and Lemeshow goodness-of-fit test is insignificant (*P*-value=.476).

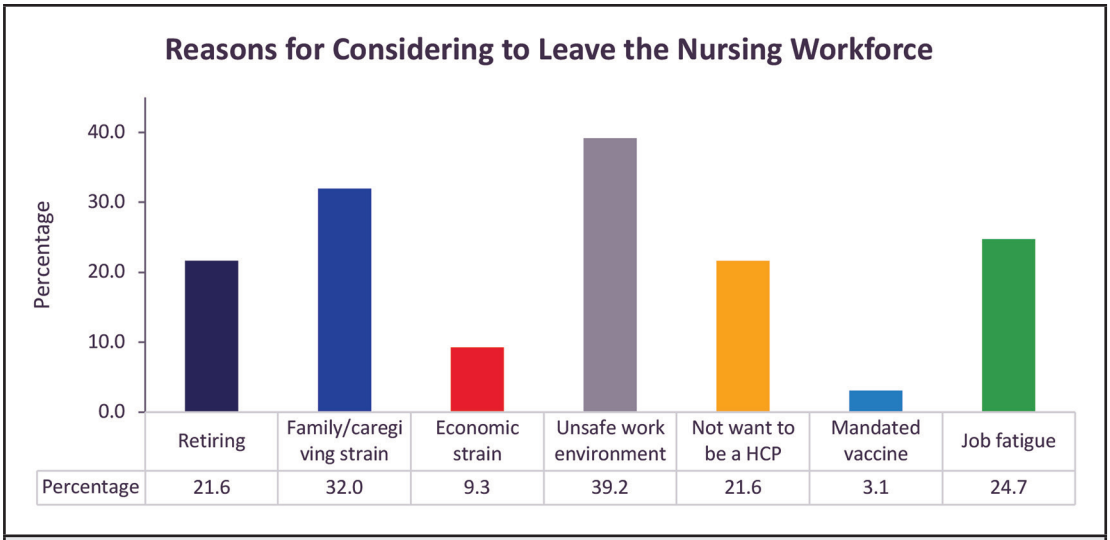

Figure 1. Distribution of Reasons for Considering Leaving the Nursing Workforce (n=97). HCP = Health Care Provider.

Discussion

The COVID-19 pandemic has created a significant strain on the health care system and health care workers. This study explicates and highlights a potential health care provider shortage in Hawai'i; 23% of nurses who responded indicated that they were considering leaving the nursing workforce. Further, reconsidering whether one should stay in their current role and being afraid to continue direct patient care doubled the odds of considering leaving the workforce. Whereas the nurses who reported a strengthened commitment to the profession decreased the odds of considering leaving. The outcomes of this study suggest that a significant nursing shortage could occur if stressors of the pandemic do not abate and interventions to support nurses in their current roles are not developed.

The findings in this study are similar to other recent national surveys of nurses. A survey conducted by the Washington Post/Kaiser Family Foundation (KFF)[19] highlighted that 28% of nurses expressed a desire to quit their current roles as a result of the COVID-19 pandemic. The American Nurses Association (ANA)[20] similarly has documented that many nurses report feeling exhausted or experiencing other negative emotions such as feeling overwhelmed, irritable, anxious, sad, or depressed. These negative feelings are commonly associated with burnout.[21] In this survey burnout was not directly measured, but about one-quarter of those who considered leaving the workforce cited job fatigue, while one-third mentioned additional family or caregiving strains as their reason.

Burnout has become an important issue in regard to nurse retention.[22,23] Kelly et al[22] determined that a 1 unit increase on the Maslach Burnout Inventory emotional exhaustion scale led to an 11% increase in the likelihood of staff turnover. In their study, the highest predictor of actual turnover was a nurses stated intention to leave. Shah et al[23] reported that of those who left their positions due to burnout, almost 70% did so because of stressful work environments. Ultimately, more research into the effects of the COVID-19 pandemic on nurses' burnout, work hours, work conditions, mental health, nurses' consideration to leave the workforce, and the effects of these stressors on the nurses' mental health is needed. This is an especially important topic since nearly a quarter of nurses have sought professional mental health support during the pandemic despite reported barriers of being too busy or being too afraid or embarrassed to seek care.[19] Due to the overwhelming strain shared among nurses during the pandemic, many nurses may need greater support services going forward. Health care systems need to find ways to provide these services and address barriers that prevent their uptake among nurses and other health care workers.

Of the nurses considering leaving the workforce in this study, nearly 40% reported concerns related to an unsafe work environment. Inadequate supplies of personal protective equipment (PPE), particularly early in the pandemic, have been a main source of stress for nurses nationally and nurses overwhelmingly have reported concerns associated with being exposed to COVID-19 at work, or exposing others in their households.[19] The ANA has repeatedly documented nurses reporting shortages of PPE.[20,24,25] While nurses have risen to the occasion to provide care to their patients in seemingly austere conditions,[26] preserving an adequate supply of PPE and other safety equipment is imperative to maintain the safety of the nursing workforce. Other factors that negatively influence nurses' willingness to work during a pandemic include fear for personal health, health of immediate family members, and lack of available vaccination.[27] Nurses in this study who reported fear related to providing direct patient care were nearly 2 times more likely to report considering leaving the workforce.

Nurses' readiness, willingness, and ability to participate in any disaster response effort has been described as critical to sustained public health success.[28] Interventions to support nurses are needed and safeguarding the physical and mental health of the nursing workforce should be a priority. The COVID-19 pandemic has underscored that (1) health care organizations need to be prepared with adequate emergency supplies/resources as well as a structure to support both the physical and mental health of their employees,[29] and (2) training in disaster preparedness and specialized pandemic-associated care are needed.[27,30] Locally, the University of Hawai'i at Mānoa Nancy Atmospera-Walch School of Nursing is educating nursing students to lead public health efforts via disaster and emergency response simulation training.[31] Integrating pandemic response training into routine disaster preparedness will help prepare health care systems' and providers' responses to a future pandemic.

Health care organizations can address current shortfalls by seeking ways to support their current nursing workforce's capacity to continue providing pandemic associated care as well as recover from pandemic-related stress, trauma, and burnout. Moving forward, it is imperative to bolster nurses' skills and abilities to respond in the future. Ongoing training focused on infection prevention, proper donning and removal of PPE, implementation of crisis standards, and setting up emergency medical facilities and mass vaccination clinics are needed.[29] Hospitals and other health care organizations could encourage and support nurses to join disaster relief volunteer agencies, such as the American Red Cross or Medical Reserve Corps, and provide paid time off to workers who volunteer to respond to disaster events as a means of increasing specialized experience and capacity to respond to large scale public health emergencies.

Lastly, future preparedness should include monitoring trends in workforce supply/demand. It appears that current workforce models have not accounted for the potential of nurses leaving the workforce before retirement age.[32-34] Previous reports in Europe have documented that job satisfaction accounts for about 10% of nurses considering leaving the workforce.[35] Ultimately, ongoing assessments are needed to track job satisfaction and stress among nurses in the US in response to the pandemic, in order to adjust the models used to predict the status of the nursing workforce.

Current estimates from the Hawai'i State Center for Nursing[1,3] indicate that the state will have adequate numbers of generalist RNs as the local schools of nursing were graduating adequate numbers of pre-licensure students prior to the pandemic. However, fewer specialty RNs existed. Therefore, health care organizations, in combination with schools of nursing, need to find creative solutions to allow new nurses to move into specialty areas immediately after graduation to mitigate this shortage. Potential ideas include creation of robust undergraduate nursing externships or immersive clinical experiences in specialty areas and/or creation of post-graduation nurse residency programs where newly licensed nurses are provided with additional resources, orientations, and support.[36]

These findings should be viewed in light of study limitations. As reported elsewhere, the sample population in this study differed (ie, higher proportion of those identified as White) to the general demographic make-up of Hawai'i's nurses.[1,37] Further, since participation was voluntary, findings may have been affected by a self-selection bias which could have affected the study's outcomes. Finally, data were collected in late 2020 as cases throughout the US surged[38] and approximately at the same time as the first 2 COVID-19 vaccines received national emergency use authorization and recommendations.[39,40] The surge could have exacerbated the nurses' stress/strain; however, vaccine availability could have provided reassurance to perceived safety. Hawai'i's success in keeping overall COVID-19 cases numbers lower than the continental US[38] and the unique racial and cultural composition of the local nursing workforce may also limit the generalizability of our results. However, national reports have documented similar rates of nurses' intention to leave the workforce as a result of the pandemic.[19] Future longitudinal research is needed to capture nurses' employment considerations, education and training needs, and organizational support structures needed to support nurses' mental health and safety.

Conclusion

This study explicated how the COVID-19 pandemic is affecting Hawai'i nurses' consideration of staying in the workforce. In this sample, approximately 1 in 5 nurses considered leaving the workforce in late 2020, citing an unsafe work environment, family/caregiving strain, and job fatigue as the 3 most common reasons (Figure 1). These numbers are concerning as the US and the State of Hawai'i may be facing significant nursing shortages in the future. Further research is needed to develop interventions to support and empower nurses in their current roles, promote safety, and reduce burnout.

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Disclosure/Competing Interests

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Conflict of Interest

None of the authors identify a conflict of interest.

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Hepatitis B Core Antibody Positivity Associated with Increased Risk of Liver Cancer in Patients with Chronic Hepatitis C: Analysis of a Large Patient Cohort in Hawai‘i

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Abstract

Chronic hepatitis C infection is a major cause of liver cancer in the United States. Hawai'i's incidence of liver cancer consistently ranks among the highest in the US, due in part to the high prevalence of hepatitis B in the state. To better understand the factors associated with liver cancer among patients in Hawai'i with hepatitis C virus (HCV) infection, the patient database of Kaiser Permanente's Hawai'i region was used to identify a cohort of 3198 patients with a history of chronic HCV infection, of whom 159 (5%) were diagnosed with liver cancer between the years 2004-2020. Multiple logistic regression was used to identify factors independently associated with liver cancer. Male sex (AOR 2.02, 95% CI 1.34-3.06), Asian race (AOR 1.78, 1.16 - 2.74) and hepatitis B core antibody (HBCAB) positivity (AOR 1.76, 95% CI 1.25 - 2.49) emerged as independent predictors of liver cancer among patients with chronic HCV infection. A history of diabetes (AOR 1.56, 1.07 - 2.27) and older age at the time of HCV diagnosis (AOR 1.19, 1.09-1.29) also emerged as significant associations. HBCAB-positive individuals did not differ significantly from those who were HBCAB-negative in regards to demographics or 5-year survival rate. In this cohort of patients with chronic HCV, a positive HBCAB without evidence of active hepatitis B infection was associated with 1.76 increased odds of liver cancer compared to those with negative HBCAB. This finding may have important implications for screening algorithms among individuals with hepatitis C infection.

Keywords

Liver cancer, chronic hepatitis C, hepatitis B, occult hepatitis B

Abbreviations and Acronyms

HBCAB = hepatitis B core antibody
HCV = hepatitis C virus
HBsAg = hepatitis B surface antigen
KP = Kaiser Permanente
OBI = occult hepatitis B infection
US = United States

Introduction

Liver cancer is currently the third leading cause of cancer-related death worldwide,[1] and its incidence in the United States (US) has more than tripled since 1980.[2] Despite recent treatment advances, liver cancer remains a particularly lethal malignancy with a 5-year relative survival rate in the US of 18%.[2] Deaths in the US from liver cancer increased 56% between 2003 and 2012,[3] largely due to the tide of maturing liver disease among Baby Boomers with chronic hepatitis C virus (HCV) infections.[4] It is estimated that approximately 50% of US liver cancer cases are related to underlying HCV infection; in contrast, only 15% of US cases are attributable to chronic hepatitis B infection.[3,5] In much of the world outside of the US and Europe, however — and especially in regions of Asia, the Pacific, and Africa where the penetrance of childhood immunization against hepatitis B is low — chronic hepatitis B infection is the predominant risk factor for liver cancer.[5] Although chronic hepatitis B and HCV infections rarely co-exist,[6] occult hepatitis B infection (OBI) (ie, detectable hepatitis B DNA in the blood or liver without detectable serum hepatitis B surface antigen (HBsAg)) is common in HCV-infected cohorts,[7-9] reflecting both the overlapping modes of transmission of the 2 viruses as well as the tendency of 1 virus to predominate as an active infection in any given individual. Whether OBI plays a significant role in the development of liver cancer among HCV-infected patients is a matter of active debate.

Although the prevalence of chronic HCV infection in Hawai‘i appears broadly similar to that of other states — estimated at 0.84 % in males and 0.64 % in females in recent modeling,[10] and higher among selected cohorts within the state[11,12] — Hawai‘i has an especially high incidence of liver cancer. For several decades, age-adjusted death rates for liver cancer in Hawai‘i have ranked among the highest 3 states in the country.[4,13] Hawai‘i's heavy burden of liver cancer is poorly understood, but likely reflects at least in part a high prevalence of chronic hepatitis B infection in the state, estimated at 3.6% overall[14] and particularly elevated among Asians and Pacific Islanders.[15-18] Other factors may also contribute to Hawai‘i's increased liver cancer incidence, including: historical immigration patterns to Hawai‘i from countries and regions with widely varying prevalences of hepatitis B, C, and smoking (eg, the Philippines, Polynesia, Micronesia, Japan, and Taiwan); steatohepatitis and diabetes prevalence in subsets of the population; and genetic/environmental factors.

Three prior studies have investigated the characteristics of patients with liver cancer in Hawai‘i;[16-18] however, none of these focused exclusively on patients with HCV infection who developed liver cancer. The current study explored the possible role of OBI and other potential risk factors in the development of liver cancer in patients in Hawai‘i with a history of chronic HCV infection.

Methods

Kaiser Permanente (KP) currently provides medical care for approximately 250 000 individuals in Hawai‘i. Since 2004, any KP-insured patient in the state referred by their primary care physician for HCV-related care has been evaluated at a single clinic in Honolulu (KP's Viral Hepatitis Clinic). The demographic, clinical, and outcomes data for all patients seen at the clinic are maintained and updated in an electronic database, allowing for long-term, longitudinal study of a large HCV-infected population. In addition, KP's electronic medical record system — which is called Health Connect and was adopted by KP's Hawai‘i region in 2004 — enabled the inclusion of KP-insured patients with HCV infection who were not referred to the clinic.

For the current study, a retrospective analysis of patient demographics and outcomes data for all patients with chronic HCV infection evaluated at the Viral Hepatitis Clinic from January 1, 2004 to December 31, 2019 was performed. This included analysis of patients diagnosed with liver cancer during follow-up care. In addition, queries were run in Health Connect for the same 16-year period to identify additional patients who had not been referred to the clinic but had HCV infection. These queries pulled lab data (eg, results from hepatitis C antibody tests, genotypes, and viral loads), diagnostic codes, and problem lists. Lastly, a separate registry of patients with liver cancer maintained by KP's multi-disciplinary Liver Cancer Tumor Board was also used to help identify and verify the status of liver cancer patients in the HCV-infected patient cohort. These 3 sources of patient information formed a cohort of patients with HCV infection and liver cancer during this 16-year timespan. The subset of patients with liver cancer and HCV infection included both patients who were diagnosed initially with liver cancer and had chronic HCV infection discovered during their cancer evaluation, as well as patients with chronic HCV infection who developed liver cancer during follow-up care for their HCV. For patients with liver cancer, clinical data (eg, age, BMI, diabetes mellitus type 1 or 2, smoking history) at the time of cancer diagnosis were collected from the clinic's database and cross-checked in Health Connect. The remaining HCV-infected patients in the cohort who did not develop liver cancer and for whom there were sufficient evaluable data were used for comparison.

Liver cancer was defined by standard radiographic and clinical criteria, and by biopsy data when available. Cancers in the liver of non-hepatic or indeterminate origin were excluded from the analysis.

Statistical analysis was performed using SAS software version 9.4 (SAS Institute, Cary, NC). Comparisons of the demographic and clinical characteristics of patients with and without liver cancer were conducted using chi-square and t-tests as appropriate. Multiple logistic regression was used to identify factors independently associated with liver cancer. Factors that were statistically significant at alpha level .05 were retained in the final models. Interaction terms were tested, but none were statistically significant. A number of patients did not have hepatitis C genotype or hepatitis B core antibody results. For these, the missing data were treated as separate indicator variables (eg, unknown genotype vs. known) to achieve maximum sample size and statistical power. Sensitivity analyses were conducted, including complete case analysis where patients with missing data were not included in the model, to confirm that this categorization of missing data did not bias the results.

This study was granted exempt status from IRB approval by the Resource Determination Committee for the Kaiser Permanente Hawaii Region (RDO-KPH-06-18).

Results

Table 1 shows the clinical characteristics of HCV-infected patients with (n=159) and without (n=3039) liver cancer in the patient cohort. Patients with HCV infection and liver cancer were more likely to be male (odds ratio [OR] 2.18, 95% confidence interval [CI] 1.48-3.22), to be Asian (OR 2.40, 95% CI 1.65-3.51), to have diabetes (OR 2.01, 95% CI 1.41-2.87), to have a positive HBCAB (OR 1.89, 95% CI 1.37-2.62), and to have a history of smoking (OR 1.74, 95% CI 1.19-2.55) than those without liver cancer. Patients with liver cancer were, on average, approximately 5 years older at time of diagnosis of HCV than those without liver cancer ($P<.001$). Among those with known hepatitis C genotypes, Genotype 1 infection was less common and Genotype 3 infection more common among patients with liver cancer ($P<.01$). The percentage of patients treated successfully for hepatitis C (as defined by a 12-week sustained virologic response) did not differ between the 2 groups ($P=.16$), and neither the prevalence of obesity nor mean body mass index (BMI).

Table 2 presents the results of multiple logistic regression analysis and the adjusted odds ratios of clinical and demographic variables associated with liver cancer among patients with chronic HCV infection. In this analysis, male sex (adjusted odds ratio [AOR] 2.02, 95% CI 1.34-3.06), HBCAB positivity (AOR 1.76, 95% CI 1.25-2.49), and Asian race as compared to Caucasian (AOR 1.78, 95% CI 1.16-2.74) emerged as independent predictors of liver cancer. A history of diabetes (AOR 1.56, 95% CI 1.07-2.27) and older age at the time of HCV diagnosis (AOR 1.19, 95% CI 1.09-1.29) also emerged as risks for liver cancer. Neither a history of smoking nor HCV genotype emerged as independent predictors of liver cancer. Sensitivity analyses using complete cases yielded similar results (data not shown).

Table 3 compares the characteristics of patients with HCV infection and liver cancer who were HBCAB-positive (n = 79) with those of HCV-infected patients with liver cancer whose HBCAB were negative (n = 76); 4 patients in the liver cancer cohort had

unknown HBCAB status. The 2 groups did not differ significantly in regards to ethnicity, age at the time of the diagnosis of liver cancer, smoking history, sex distribution, obesity prevalence, or HCV genotype. Diabetes was less common among those with HBCAB positivity than in those who were HBCAB-negative (*P*=.02). Five-year survival did not differ between those with and without HBCAB. Of the 79 patients with liver cancer and HBCAB positivity, only 1 patient had detectable HBsAg, which was only transiently positive; this patient's hepatitis B DNA viral load was very low at 119 IU/ml (reference range, <20 HBV DNA IU/ml). The remaining 78 HBCAB-positive patients with liver cancer had persistently negative HBsAg; of these patients, 14 had serum hepatitis B DNA assays sent, and all were negative. No patient with liver cancer had tissue hepatitis B DNA assayed in liver biopsy specimens.

Table 1. Clinical Characteristics of Hepatitis C-infected Patients With and Without Liver Cancer

	No liver cancer n =3039	Liver cancer n = 159	*P*-value*	OR (95% CI)#
Age at HCV diagnosis: mean (sd)	50.7 (10.9)	55.3 (8.6)	< .001	1.22 (1.13 – 1.32)
Sex: n (%)				
Male	1934 (63.6)	126 (79.3)	<.001	2.18 (1.48 - 3.22)
Female	1105 (36.4)	33 (20.8)		
Ever Smoker: n (%)	2039 (67.1)	124 (78.0)	.004	1.74 (1.19 - 2.55)
Race: n (%)				
Native Hawaiian/Other Pacific Islander	445 (14.6)	28 (17.6)	<.001	1.25 (0.81 - 1.90)
Asian	362 (11.9)	39 (24.5)		2.40 (1.65 - 3.51)
Caucasian	1337 (44.0)	75 (47.2)		1.14 (0.83 - 1.56)
Other	240 (7.9)	9 (5.7)		0.70 (0.35 - 1.39)
Unknown	655 (21.6)	8 (5.0)		
Diabetes: n (%)	512 (16.9)	46 (28.9)	<.001	2.01 (1.41 - 2.87)
BMI >30: n (%)	626 (25.4)	32 (21.6)	.306	0.81 (0.54 - 1.21)
BMI: mean (sd)	27.0 (5.8)	26.4 (5.8)	.178	
Genotype 1: n (%)				
Yes	1185 (72.1)	82 (61.2)	.007	0.61 (0.42 - 0.88)
No	458 (27.9)	52 (38.8)		
Unknown%	1396	25		
Genotype 2: n (%)				
Yes	248 (15.1)	22 (16.4)	.682	1.10 (0.69 - 1.78)
No	1395 (84.9)	112 (83.6)		
Unknown%	1396	25		
Genotype 3: n (%)				
Yes	193 (11.8)	27 (20.2)	.005	1.90 (1.21 - 2.97)
No	1450 (88.3)	107 (79.9)		
Unknown%	1396	25		
HBCAB positive: n(%)				
Yes	851 (28.0)	79 (49.7)	<.001	1.89 (1.37 - 2.62)
No	1548 (50.9)	76 (47.8)		
Unknown	640 (21.1)	4 (2.5)		
Successfully treated for HCV: n (%)	761 (25.0)	32 (20.1)	.162	0.75 (0.51 – 1.12)

HCV=Hepatitis C virus, BMI=body mass index, HBCAB = hepatitis B core antibody. OR = odds ratio and 95% CI=95% confidence interval.
* *P*-values for age and BMI means were calculated using the t-test. P-values for all other factors were based on chi-square test.
# Odds ratio for age using a 5-year interval. Odds ratio for BMI using 1 kg/m2 interval.
% Unknown category is not included in calculation of P-values and odds ratios for genotype 1, genotype 2 and genotype 3.

Table 2. Adjusted Odds Ratios and 95% Confidence Intervals for Risk of Liver Cancer (Multiple Logistic Regression, n=3,049*)		
	AOR#	**95% CI**
Age at HCV diagnosis (per 5 years)	**1.19**	**1.09 - 1.29**
Male vs Female	**2.02**	**1.34 - 3.06**
Race (reference is Caucasian)		
Native Hawaiian/Pacific Islander	1.06	0.66 - 1.71
Asian	**1.78**	**1.16 - 2.74**
Other Race	**0.66**	**0.32 - 1.35**
Unknown Race	0.30	0.14 - 0.67
Diabetes	**1.56**	**1.07 - 2.27**
Hep B Core Testing		
Positive vs Negative	**1.76**	**1.25 - 2.49**

AOR = adjusted odds ratio, 95% CI=95% confidence interval, and HCV=Hepatitis C virus.
* Excludes 149 patients with missing age at HCV diagnosis (141 without liver cancer, 8 with liver cancer).
# Odds ratios are adjusted for all other risk factors in the table (eg, AOR for age at HCV diagnosis is adjusted for sex, race, diabetes and Hep B core testing).

Table 3. Comparison of Patient Characteristics Among 155* Hepatitis C-positive Liver Cancer Patients, Stratified by Hepatitis B Core Antibody Status			
	Hepatitis B Core Antibody Status		***P*-value#**
	Negative n =76	**Positive n = 79**	
Age at diagnosis of liver cancer: mean (sd)	60.6 (8.7)	61.3 (6.2)	.602
Gender: n (%)			
Male	61 (80.3)	62 (78.5)	.784
Female	15 (19.7)	17 (21.5)	
Ever smoker: n (%)	58 (76.3)	63 (79.8)	.606
Race: n (%)			
Native Hawaiian/Other Pacific Islander	17 (22.4)	11 (13.9)	.744
Asian	17 (22.4)	20 (25.3)	
Caucasian	34 (44.7)	40 (50.6)	
Other	4 (5.3)	4 (5.1)	
Unknown	4 (5.3)	4 (5.1)	
Diabetes: n (%)	28 (36.8)	16 (20.3)	.022
BMI>30: n (%)	15 (19.7)	17 (21.5)	.784
Genotype 1: n (%)			
Yes	40 (63.5)	42 (59.2)	.607
No	23 (36.5)	29 (40.9)	
Unknown%	13	8	
Genotype 2: n (%)			
Yes	9 (14.3)	13 (18.3)	.530
No	54 (85.7)	58 (81.7)	
Unknown%	13	8	
Genotype 3: n (%)			
Yes	13 (20.6)	14 (19.7)	.895
No	50 (79.4)	57 (80.3)	
Unknown%	13	8	
Alive 5 years after liver cancer diagnosis: n (%)	19 (25.0)	29 (36.7)	.115

BMI=body mass index. * Four HCV-infected patients with liver cancer had unknown hepatitis B core antibody status.
# *P*-value for age and BMI means are calculated using the t-test. P-values for all other factors are based on chi-square analysis.
% Unknown category is not included in calculation of P-values for genotype 1, genotype 2 and genotype 3.

Discussion

In this study of more than 3000 patients with chronic hepatitis C infection in a single health care system, of whom 5% were diagnosed with liver cancer during the years under study, HBCAB positivity was associated with a 1.76 increased odds of liver cancer compared to those with negative HBCAB. The prevalence of a positive HBCAB among patients with chronic HCV infection and liver cancer was strikingly high at 49.7%, compared to 28% in the HCV-infected population without liver cancer; in multivariate analysis, HBCAB positivity emerged as a strong independent risk for liver cancer (AOR 1.76, 1.25-2.49, *P*=.0001), increasing the risk more than either older age at hepatitis C diagnosis or diabetes.

Of the 79 patients in the current study with liver cancer and a positive HBCAB, none had a persistently positive HBsAg. The serologic profile of HBCAB positivity with negative HBsAg is an increasingly accepted surrogate for OBI,[8,19,20] a term which refers to the presence of detectable hepatitis B DNA in individuals seronegative for surface antigen. The majority of patients with OBI have undetectable hepatitis B DNA in the serum, consistent with their serum HBsAg negativity, but have detectable hepatitis B DNA in liver tissue. However, the laboratory techniques for detecting hepatitis B DNA in hepatocytes are technically complex, non-standardized, not commercially available, and necessitate a liver biopsy. Because the majority of individuals with OBI are seropositive for HBCAB, and given the risks and logistics involved in assaying hepatitis B DNA in liver tissue to definitively establish OBI, in both epidemiologic studies and in clinical practice HBCAB positivity with negative HBsAg is commonly considered a surrogate for OBI.[8,19, 20]

OBI has been found to be common in patients with a history of chronic hepatitis C who develop liver cancer.[19-24] However, the question of whether OBI significantly increases the risk for cirrhosis or liver cancer among patients with HCV infection remains an open one,[8,20] with several studies from a variety of countries suggesting that OBI in patients with HCV infection significantly increases the risk of developing liver cancer,[21-26] and others finding no such association.[19,27] Several lines of evidence from the woodchuck model of hepatitis B infection[28-31] as well as tissue-based studies of HBV genomic integration in patients with liver cancer[32-34] provide mechanistic support for the oncogenic potential of OBI in promoting this malignancy. The discrepant findings in the literature as to whether OBI increases the risk of liver cancer in patients with chronic HCV infection raises the question of whether OBI may do so only in subsets of HCV-infected patients with other contributory behavioral, environmental, or genetic risk factors. The findings of the current study clearly suggest an oncogenic role for HBCAB positivity in this population of HCV-infected patients in Hawai'i.

Because many risk factors may impact the development of liver cancer, other aspects of the current patient cohort bear examination. As illustrated in Table 1, the 159 patients with a history of HCV infection and liver cancer were disproportionately male and more likely to have a history of diabetes than patients with chronic HCV infection who did not develop liver cancer; both male sex[35,36] and diabetes[35,37] have been previously described as risks for liver cancer in patients with chronic hepatitis C infection. Smoking has been identified as a risk factor for liver cancer in several studies;[35,36] in the current cohort, a history of ever having smoked was significantly more common among patients with liver cancer, but smoking did not emerge as an independent risk factor in multivariate analysis. The mean age at diagnosis of HCV infection was higher among patients with liver cancer than in those with chronic HCV without liver cancer, which may reflect longer-term exposure to hepatitis C and greater degrees of hepatic fibrosis.

The current patient cohort was strikingly multi-racial (Table 1), reflecting Hawai'i's mixed ethnic and racial composition. In the current study, Asian race emerged as a strong risk factor for liver cancer (AOR 1.78, 95% CI 1.16-2.74), independent of smoking history, HBCAB positivity, diabetes, or hepatitis C genotype. Whether this reflects a genetic predisposition for liver cancer among Asians, or whether environmental exposures among immigrant groups, dietary aflatoxin intake, prior *Fasciola hepatica* infection, or other factors are involved is unclear.

The current study has several strengths: the data are derived primarily from a single comprehensive database maintained since 2004 by a large referral clinic serving the entirety of KP's Hawai'i membership, and were augmented by careful review of a unified electronic health record system used across the health care organization. In addition, the findings are strengthened by the ability to link any patient's hepatitis C and liver cancer status to clinical and demographic variables via a unique medical record number assigned at enrollment in the health plan.

The study also has several important limitations. A detailed evaluation of ethnicity, race, and birthplace/immigration history was not performed in all patients. In addition, grouping patients into categories such as "Asian" or "Pacific Islander" is an overly broad classification in regards to patterns of viral hepatitis; within these categories lie significant differences in regards to hepatitis B and C epidemiology and risk factors for liver cancer. For example, Micronesians in Hawai'i with liver cancer have been noted to have much higher rates of hepatitis B infection and lower rates of HCV infection as compared with non-Micronesian Pacific Islanders;[18] similarly, the prevalence of hepatitis B and C infections differ markedly in sub-regions within Asia.[39] Place of birth—not effectively captured in ethnic or racial groupings--is also of direct relevance to viral epidemiology. Immigrants to Hawai'i have patterns of hepatitis B and C infection primarily reflective of their countries of origin,[15] whereas individuals born in Hawai'i or elsewhere in the US are much more likely to have patterns of hepatitis B and C infection similar to the general US population. The current study employed

the commonly used surrogate of serum HBCAB positivity and negative HBSAG to infer OBI. Only a minority of the HBsAg-negative patients in the study had their serum hepatitis B virus DNA levels tested, and hepatitis B DNA in the liver (the gold standard for occult hepatitis B detection) was not assayed in liver biopsies. The assessment of alcohol intake, an established risk factor for liver cancer, was not reliably quantifiable in this retrospective review; differential alcohol intake by sex could account, in part, for the strength of the association of male sex with liver cancer in our study. Lastly, the study did not include estimates of the degree of liver fibrosis given wide variability in the timing of and approaches to assessing liver fibrosis/cirrhosis during the 16-year period under study.

Conclusions

Efforts to better understand the epidemiology of liver cancer at the state level are increasingly relevant in the US, given the sharp differences in liver cancer incidence between states[4,13] and the complex interplay of risk factors for liver cancer in different communities. A recent analysis of the National Cancer Institute's large Surveillance, Epidemiology, and End Results (SEER) cancer registry[38] projected a steady increase in liver cancer burden in the US through 2030. In this evolving landscape, region-specific evaluations of the risk factors associated with this lethal malignancy may prove crucial to future public health efforts.

In Hawai'i, shifting demographics and the aging of different ethnic cohorts have been suggested as important co-factors in observed patterns of liver cancer incidence.[17] The findings of the current retrospective study add to the understanding of liver cancer in Hawai'i, clarifying the associations of several clinical and demographic variables associated with liver cancer in a large cohort of patients with chronic HCV infection. In particular, the current findings underscore the potential importance of OBI, independent of Asian ethnicity, as a risk for liver cancer among patients with a history of hepatitis C infection. If the strong association between HBCAB positivity and liver cancer among HCV-infected patients observed in this patient cohort is borne out in future investigations, HBCAB serostatus may prove important in tailoring screening approaches for liver cancer among those chronically infected with hepatitis C.

Conflict of Interest

None of the authors identify any conflict of interest.

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Update on the Impact of the University of Hawai'i Family Medicine Residency Program on the Family Physician Workforce in Hawai'i

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Abstract

This study updates the previously-reported impact of the University of Hawai'i Family Medicine Residency Program (UHFMRP) on the state of Hawai'i family physician workforce. This study is a retrospective examination of all UHFMRP graduates from the program between 1996 and 2020. Graduate data regarding country or state of medical school, allopathic versus osteopathic training, current clinical practice, zip code of current clinical practice, current board certification, and current fellowship status were recorded between May and July 2020. Overall, 146 UHFMRP graduates completed the program between 1996 and 2020. Currently, 126 UHFMRP graduates have active medical licenses, with 121 graduates (96%, n=126) practicing in the United States, of whom 83 (69%, n=121) are practicing in Hawai'i. Of the 83 UHFMRP graduates practicing in Hawai'i, 67 graduates (81%, n=83) practice on O'ahu. UHFMRP graduates with active medical licenses in Hawai'i represent 23% (83 of 364) of the entire current family physician workforce in Hawai'i. The UHFMRP continues to make an impact on the Hawai'i State family physician workforce, and the retention rate of graduates in Hawai'i has remained relatively stable since 1996.

Keywords

medical education, Family Physician Workforce, Family Medicine Residency

Abbreviations

DFMCH = Department of Family Medicine and Community Health
UH JABSOM = University of Hawai'i John A. Burns School of Medicine
UHFMRP = University of Hawai'i Family Medicine Residency Program

Introduction

Primary care continues to be the area with the most significant shortage in the physician workforce across the state of Hawai'i, with a current lack of 300 full-time equivalent providers.[1] The University of Hawai'i John A. Burns School of Medicine (UH JABSOM) Department of Family Medicine and Community Health (DFMCH) has a mission to train family physicians to meet the "needs of Hawai'i and the Pacific Basin."[2] The University of Hawai'i Family Medicine Residency Program (UHFMRP) aims to "broadly train family physicians to serve the diverse population of Hawai'i and the Pacific Basin."[3] The UHFMRP was founded in 1994 and graduated its first cohort of family physicians in 1996.[3] Numerous changes have occurred within the UHFMRP in the past decade, including a change in primary hospital training site location from Wahiawa General Hospital, Wahiawā, Hawai'i, to Pali Momi Medical Center, Aiea, Hawai'i, in 2016.[4] Wahiawā is a United States (US) Health Resources & Services Administration designated medically underserved area, an area "having too few primary care providers, high infant mortality, high poverty or a high elderly population," while Aiea does not have that designation.[5] The UHFMRP continuity clinic also moved from the Mililani Shopping Center, Mililani, Hawai'i, to the Pali Momi Outpatient Center, Aiea, Hawai'i, in 2020.[6] The UHFMRP class size also increased from 6 residents per year to 7 residents per year in 2017.[7] Before these program changes, UH JABSOM DFMCH faculty published an article analyzing the impact of the UHFMRP on the family physician workforce in Hawai'i and the Pacific Basin through 2010.[8] This study attempts to update the overall impact of the UHFMRP on the state of Hawai'i family physician workforce in light of the continued primary care physician shortage.

Methods

The UHFMRP has maintained a Microsoft Excel database with all program graduates since 1996. This database includes graduate names, residency completion dates, medical schools, and medical degree types (eg, MD versus DO). Each graduate's name was queried on the American Board of Family Medicine's database, [9] the certifying body for all board-certified family medicine physicians in the US; the US Centers for Medicare and Medicaid Services National Provider Identifier's database, [10] a database of all physicians that accept Medicare and Medicaid patients in the United States; the State of Hawai'i's Professional and Vocational Licensing Division's database, [11] a database listing all currently licensed physicians in Hawai'i; Doximity, [12] a physician online networking platform; and Google.[13] Data regarding each graduate's current medical license status (eg, active versus expired), zip code of practice, current board certification, and current fellowship certification status were recorded between May and July 2020. Board fellowship certifications not monitored by the American Board of Family Medicine were not tracked in this study (eg, sleep medicine and pain medicine). Overall, 20 UHFMRP graduates in fellowship programs, academic work, governmental work, deceased, or retired were excluded from active medical license data analysis. UHFMRP graduate data was also compared against the Hawai'i Physician Workforce Report, and each included UHFMRP graduate was equated to a single full-time equivalent of direct care to patients.[1] Collected data were preprocessed using Microsoft Excel, version 16.16.25 (Microsoft Corporation, Redmond, WA).

Results

Between 1996 and 2020, 146 UHFMRP graduates completed the residency program. The majority (90%, n=132) of UHFMRP graduates were from allopathic medical schools, and 75 (51%) were graduates from UH JABSOM (Table 1). Overall, 126 (86%) UHFMRP graduates are currently board-certified in family medicine, with 13 (9%) being also board certified in geriatrics and 4 (3%) also being board certified in sports medicine. There are 126 UHFMRP graduates with active medical licenses, with 121 (96%) practicing in the US. Of those practicing in the US, 83 (69%) are practicing in Hawai‘i (Table 2).

Table 1. Academic Characteristics of UHFMRP Graduates, 1996-2020

Medical Degree Type (n = 146)	**n (%)**
MD	132 (90%)
DO	14 (10%)
Medical School Location (n = 146)	**n (%)**
UH JABSOM	75 (51%)
Other United States	54 (37%)
International	17 (12%)
Current Family Medicine Board Certification (n = 146)	**n (%)**
Additional Geriatric Board Certification[a]	13 (9%)
Additional Sports Medicine Board Certification	4 (3%)
Total Board Certified	**126 (86%)**

[a] One graduate is also board certified in hospice & palliative care.
UHFMRP = University of Hawai‘i Family Medicine Residency Program

Table 2. Clinical Practice Locations of UHFMRP Graduates, 1996-2020[a]

Current Clinical Practice	**n (%)**
United States	121 (96%)[c]
Hawai‘i	83 (69%)[c]
Hawai‘i Island	10 (12%)[c]
Kaua‘i	4 (5%)[c]
Maui	2 (2%)[c]
O‘ahu	67 (81%)[c]
Non-Hawai‘i United States	38 (31%)[c]
Non-United States	**5 (4%)**[c]
Total Board Certified	**126 (86%)**[b]

UHFMRP = University of Hawai‘i Family Medicine Residency Program
[a] Excludes 20 UHFMRP graduates that are in fellowship programs, academic medicine, governmental work, deceased, changed specialty, or who have retired.
[b] Total of clinically active UHFMRP graduates divided by all UHFMRP graduates, 146.
[c] The percentage (%) is compared to the total number per category.

Discussion

This study aimed to update the impact of the UHFMRP on the state of Hawai‘i family physician workforce. Data revealed that the UHFMRP has continued to improve the family physician workforce in Hawai‘i. Roughly two-thirds (69%, n=83) of UHFMRP graduates practicing in the US currently have active clinical licenses and are based in Hawai‘i, representing 23% (83 of 364) of the entire family physician workforce in Hawai‘i.[1] The 2012 report on the impact of the UHFMRP on the family physician workforce in Hawai‘i found that 73% (n=86) of UHFMRP graduates were based in Hawai‘i.[8] While the previous study did not specify whether the graduates were in clinical practice or not, the retention rate of UHFMRP graduates in Hawai‘i since the program’s inception remains relatively stable, around 70 percent. This trend is likely due to how the UHFMRP curriculum has residents rotate in various community-based settings,[7] such as Department of Veterans Affairs rotations on neighbor islands, and the high percentage of graduates who attended UH JABSOM for medical school. Of the 146 UHFMRP graduates, the vast majority are allopathic trained (90%, n=132) and graduates of UH JABSOM (51%, n=75), which was expected as UH JABSOM is both an allopathic medical school and the sponsoring institution of the UHFMRP.[2] Of note, the current DFMCH faculty is entirely allopathic trained and not certified in osteopathic manipulative treatment, likely resulting in fewer osteopathic graduates wishing to train at the program.[2]

Among the 50 states, Hawai‘i has a relatively low retention rate of physicians (40.6%, 36th out of 50 states) who completed only residency training in Hawai‘i.[14] In comparison, Hawai‘i has the highest retention rate in the US (86.6%, 1st of 50 states) for physicians who completed both in-state medical school and residency.[14] The authors, therefore, expected that most UHFMRP graduates would remain to practice in Hawai‘i after completing residency training, especially since more than half completed medical school at UH JABSOM. Although the UHFMRP class size has increased since 2012, from 6 to 7 residents per year in 2021, this data suggests that only by improving the pipeline of UH JABSOM students entering UHFMRP for residency training will the retention rate of graduates improve. An area of future study includes surveying UHFMRP graduates who completed medical school at UH JABSOM and determining what factors influence their seeking clinical practice outside of Hawai‘i in hopes that the retention rate can be increased further.

UHFMRP graduates primarily work in Honolulu, O‘ahu; however, UHFMRP graduates also work in rural communities such as Lāhainā and Kula on Maui island; Wai‘anae and Hale‘iwa on O‘ahu island; and Līhu‘e and Kapa‘a on Kaua‘i island. Most UHFMRP graduates also practice primary care family medicine, rather than subspecializing in geriatric or sports medicine, which directly impacts the current shortage of primary care physicians in Hawai‘i. O‘ahu continues to have the most

substantial primary care physician shortage in Hawai‘i by 192 providers.[1] Therefore, UHFMRP graduates provide critically needed primary care to areas of the state that need it most.[1]

In the decade since the 2012 study on UHFMRP graduates was performed, the overall economic incentives for medical students to enter primary care, such as the Health Resources & Service Administration's National Health Service Corps scholarship and Loan Repayment Programs and the Hawai‘i State Loan Repayment Program, have not substantially changed. The Association of American Medical Colleges reports that over 70% of medical school students graduated with debt in 2020, with a median debt of $200,000.[15] Physicians in proceduralist specialties continue to earn more than those in primary care, making primary care, such as family medicine, a less attractive career choice.[15]

Although this study focused on the impact of UHFMRP graduates on the family physician workforce in Hawai‘i, UHFMRP graduates also play an essential role in academic medicine in Hawai‘i. For example, UHFMRP graduates serve as faculty physicians at medical school and residency programs throughout Hawai‘i, including UH JABSOM, AT Still University School of Osteopathic Medicine, Tripler Army Medical Center Family Medicine Residency Program, and Hawai‘i Island Family Medicine Residency Program. In addition, UHFMRP graduates also serve as volunteer faculty for non-Hawai‘i-based medical, physician assistant, and nurse practitioner programs, as well as Hawaii-based nurse practitioner programs. These academic endeavors are critical to the health care workforce in Hawai‘i but were excluded from this study.

Limitations

Whether the UHFMRP graduates practice hospital-based inpatient family medicine versus outpatient-based family medicine or both was not differentiated for this study. Individual graduates were not contacted to verify information based on the methodology of this study. UHFMRP graduates who are faculty in residency training programs were not counted as clinically active, though the authors are aware they oversee residents and medical students practicing clinical medicine. These academic physicians have medical licenses and actively practice medicine; however, they do not necessarily have independent patient panels and, therefore, may not be equivalent to full-time clinical practice.

Conclusion

Since its inception in 1994, UHFMRP has continued to impact the family physician workforce in Hawai‘i. Currently, 23% of the entire family physician workforce in Hawai‘i are graduates of UHFMRP.[1] Residency program graduates also remain in Hawai‘i after graduation at a relatively stable rate compared to the prior study on the program's impact on the family physician workforce; nevertheless, determining how this rate can be improved upon remains an area of needed research.[8] UHFMRP is currently developing a community health curriculum in hopes that facilitating relationships between residents and community health centers will improve retention particularly in underserved areas of Hawai‘i. UH JABSOM, through the Area Health Education Center, is also working with the Hawai‘i Physician Shortage Crisis Task Force to improve Medicare and Medicaid reimbursements for physicians to offset the high cost of living in the state.[16] UHFMRP graduates also contribute to the physician and health care training pipeline, which are essential for health care workforce development. Examples of UHFMRP graduate impacts on the training pipeline include clinical faculty appointments at UH JABSOM and AT Still Osteopathic School of Medicine, clinical preceptors for nurse practitioner students, and directors of UH JABSOM programs such as the Native Hawaiian Center of Excellence and Office of Medical Education. Thus, UHFMRP continues to impact the family physician workforce in Hawai‘i positively, but there remains room to improve the overall retention of graduates in the state. Additional opportunities for educational loan forgiveness, financial incentives for rural employment, salaries comparable to the continental US, and opportunities to practice full-spectrum family medicine, including obstetrics, are systematic opportunities to improve family physician retention in Hawai‘i.

Conflict of Interest

We certify that we have no financial affiliation/interest (eg, employment, stock holdings, consultantships, honoraria) in the subject matter, materials, or products mentioned in this manuscript. We have no conflict of interest to report, nor any interests represented with any products discussed or implied.

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Forming the Future: How Hawai'i Health Employers Envision the Roles of Population Health Nursing

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

The COVID-19 pandemic has highlighted how societal inequities have contributed to greater health disparities. Populations that routinely experience limited access to health care services, poorer economic and living conditions, and elevated incidence of chronic and infectious diseases, also suffered from higher rates of COVID-19 infection, hospitalization, and death.[1,2] In Hawai'i, the greatest burden of the coronavirus disease 2019 (COVID-19) has fallen upon Native Hawaiians, Filipinos, and Pacific Islanders.[3,4] The inequitable impact that COVID-19 has had on disadvantaged groups is the latest example of disparities in care and variability of health outcomes experienced in the state of Hawai'i and nation. This underscores the urgency to devise new approaches to health care delivery that incorporate the full range of factors influencing a person's health, beyond the provision of traditional health services.

Before the pandemic, the US health care system was undergoing a gradual transformation, spurred by rising costs, poorer health outcomes as compared to other developed countries, and inequitable distribution of resources. Momentum has shifted towards an approach to health care delivery that is centered on the health of the whole population, placing greater emphasis on quality of care, and addressing social factors that influence health outcomes. This has created new opportunities for health care systems, public health agencies, and community-based organizations to partner in novel ways to improve health outcomes.[5]

The intersection of medical care and public health is giving rise to the growing field of *population health*. Population health is defined most commonly as "the health outcomes of a group of individuals, including the distribution of such outcomes within the group."[6] Central to population health is addressing the many factors that affect a patient's health and wellbeing, collectively described as the social determinants of health (SDOH), or the conditions in places where people live, work, and play that affect a wide range of health risks and outcomes.[7]

Nurses are poised to serve as leaders in the transition to a population-focused health care system. As key promoters of stronger interconnections between health and social care in the community, nurses can bridge health care services with community resources.[8–10] Professional nursing organizations and accrediting bodies have also emphasized the importance of identifying population health nursing competencies and strengthening population health skills in nursing curriculum to prepare generalist and specialist nurses for future roles in leading population health interventions.[11] Competencies for population-based nursing developed by the Quad Council Coalition of Public Health Nursing Organizations[12] are organized into 8 skill areas, including analysis and assessment, policy development and program planning, communication, cultural competency, community dimension of practice, public health science, financial planning and management, and leadership and system thinking. The American Organization for Nursing Leadership (AONL) has also published a set of competencies for nurse executives leading population health initiatives, which are organized into 5 major domains: communication and relationship building, knowledge of the health care environment, leadership, professionalism, and business skills.[13]

Population health roles for nurses working in health care agencies across the nation are rapidly evolving. In Hawai'i, registered nurses have been key partners in developing novel population health approaches to health care.[14] To further explore nursing involvement in population health efforts in Hawai'i, faculty members at the University of Hawai'i at Mānoa (UHM) Nancy Atmospera-Walch School of Nursing (NAWSON), conducted an employer needs assessment. The information collected is used to inform curriculum revisions to the NAWSON's Masters of Science Advanced Population Health Nursing (MS APHN) program. Three faculty members convened a series of discussions with community partners who hire NAWSON graduates. Meetings were held in-person or virtually between May-June

2021. Representatives from 8 employers participated, including large health care systems (3), community health centers (3), a health insurance plan (1), and the Public Health Nursing Branch of the Hawai'i State Department of Health. Discussion centered around 2 questions: (1) What are the current and future roles for population health nurses in Hawai'i? and (2) What particular skills do population health nurses need?

Findings

Overarching themes from these discussions included (1) Roles for population health nurses, (2) Skills and knowledge needed by population health nurses, and (3) Future opportunities and challenges.

Roles for Population Health Nurses

Roles for population health nurses identified were numerous and varied across employers. The most common roles, described further below, include: complex care, care coordinator, quality improvement, health program manager, health educator, consultant, and outreach/emergency response. The settings in which population health nurses worked were diverse, and include community centers, home health, telehealth, ambulatory care or chronic disease clinics, outreach efforts to older adult or homeless populations, and special emergency response settings, such as Points of Distribution (POD).[15]

Complex care: Nurses provide 1:1 patient care in clinic/home settings, medication reconciliation, care plans, transition care (hospital to home), and chronic disease management, specifically among populations with diabetes, hypertension, congestive heart failure, and chronic obstructive pulmonary disease. Nurses are members of interprofessional teams involving medicine, nursing, pharmacy, social work, and dietetics, with the aim of preventing emergency department visits and admissions.

Care coordinator/Case manager: Nurses navigate patient barriers to care related to SDOH, such as finding resources to assist with food, housing, and transportation, and managing care plans to provide referrals for social, behavioral, or other needed services.

Quality improvement/Data analytics: Nurses monitor patient/population statistics, generate reports using data analysis software to identify gaps in care or improve care access, and perform utilization management. Nurses use data to guide complex care team interventions at the individual patient and population level. Data were also used to track quality measures and/or apply for grants.

Health program manager: Nurses contribute to all phases of health program management, including needs assessments, program design and development, implementation, and evaluation.

Health educator: Nurses provide health education to clinic staff, individual patients, and at-risk populations, such as those with chronic diseases, or persons undergoing palliative or end-of-life care. Nurses also organize community events such as health fairs, vaccination sites, and other outreach efforts.

Consultant to government agencies: Nurses working for the public health nursing branch consult with state agencies to provide information regarding public health issues affecting their populations.

Outreach and emergency response: As during the COVID-19 pandemic, nurses are assigned various emergency response roles, including contact tracers, vaccine administrators, hotline/education experts, and infectious disease screeners/test administrators. Nurses also conduct outreach to provide education to remote populations and deliver supplies to quarantined patients, such as food, sanitary items, and personal protective equipment (PPE).

Skills and Knowledge Needed by Population Health Nurses

Nurses require a broad set of skills and knowledge to take on the roles identified and lead population health interventions. Nurses are expected to possess in-depth knowledge of pharmacology, pathophysiology, epidemiology, and evidence-based practice. Commonly mentioned skills needed by population health nurses identified included assessment/analytics, program management and policy development skills, communication and cultural competency, community engagement, and management/fiscal planning skills.

Assessment and analytics: Nurses must be able to use data to assess and address SDOH and health care barriers. One employer summarized these skills as being able to understand how data is generated, and determine what data is "saying."

Program management and policy development skills: Nurses must be able to develop, manage and evaluate population health programs, implement and lead quality improvement, and contribute to developing and implementing agency policies (eg, standard operating procedures).

Communication and cultural competency: Nurses are expected to have strong communication skills utilizing all types of methods mediums. Nurses must also understand how an individual's background and preferences influence access to resources and their ability to maintain self-care. This was described as cultural awareness, cultural safety, holistic care, and contextual care, all of which reflect the importance of understanding how one's culture is influenced by many factors, including age/generation, race/ethnicity, religious/spiritual beliefs, and other circumstances (eg, homelessness, addiction, sexual preference, etc).

Public health and community engagement: Nurses were frequently described as relationship builders who were expected to keep abreast of health/social services available in the community as well as initiate and maintain relationships with health care providers.

Management and financial planning: Nurses are expected to be involved in multiple leadership activities and to develop innovative methods for meeting the needs of the populations served. Leadership efforts carried out by nurses included applying for grants, budgeting, and program evaluation.

Future Opportunities & Challenges

Employers identified innovation as one of the major opportunities for population health nurses. Hawaii's health systems are seeking to develop new, cutting-edge approaches to address SDOH impacting patient populations. Some innovations identified included transition care centers, interventions that target "rising-risk" patients to address health problems before the need for a hospital visit, and shifting traditional nursing care from acute care into community-based settings. As population health includes activities that occur outside of regular health services delivery, nurses have an opportunity to innovate new programs/interventions to address the SDOH. Further, employers are eager to hire population health nurses to oversee health promotion programs and translate data in ways that help providers understand how SDOH impact health care outcomes.

Future challenges were also identified. For example, while care is becoming more complex, necessitating the need for advanced nursing degrees, the level of education attained by nurses currently working in population health roles varies. Most nurses in these roles in Hawai‘i possess an associate or bachelor's degree. Few nurses have obtained advanced degrees in population health nursing. Contributing to this challenge, institutions would need to expand roles, job descriptions, and requirements to allow nurses to work to the full capacity of their education, which would then justify pay differentials for nurses with advanced degrees. Another major challenge cited by employer institutions was the difficulty in hiring and retaining qualified nurses. This was especially true for community health centers. Finally, employers noted that most clinical support staff and medical personnel are not familiar with population health, so there is a need to upskill the entire workforce to better implement population health interventions.

Discussion

In Hawai‘i, roles and skills for population health nurses are evolving to meet the changing needs of health care agencies that are experiencing novel challenges associated with both the pandemic and growing health disparities existing among underserved groups in Hawai‘i. The roles of population health nurses described by employers in Hawai‘i are for a professional nurse with advanced skills who can expertly address both clinical needs and larger SDOH across the health care facility and the greater community setting.

Moving forward, nurses with advanced skills and knowledge can contribute greatly to leading population health interventions in Hawai‘i and play pivotal roles in bridging and strengthening connections between health care providers, insurers, governmental public health entities, and the community. By doing so, nurses can build and evaluate programs that address the health priorities of their community, the health care agency, and also help to achieve national and state-based health goals. For example, nurses can collaborate with community partners to enhance prenatal care services, asthma service, and organize community efforts to expand houseless hygiene centers. Population health nurses can cement partnerships between health care systems and public health agencies to conduct comprehensive community assessments resulting in the establishment of collaborative programs to reduce chronic diseases, coordinate services, and share and review outcomes and metrics.

COVID-19 has amplified the critical importance of sharing data which may lead to data-driven population health interventions involving public and private agencies working in unison. Lessons learned from the statewide emergency response to the COVID-19 pandemic can be applied to future infectious disease outbreaks as well as chronic disease prevention efforts. For example, nurses can help to facilitate the reporting of disease and immunization records between health care systems and local public health departments. Nurses can then contribute to the development of vaccine dashboards to give real-time information on vaccine uptake and target outreach interventions for at-risk communities or groups.

UHM NAWSON Advanced Population Health Nursing Program

To meet these future challenges, the UHM NAWSON MS APHN prepares graduates to engage with patients in diverse contexts and develop advanced nursing knowledge to transform health care services for individuals, families, and communities. The program focuses on population-level health, wellness, SDOH, health promotion, and disease prevention, and its curriculum has been built to strengthen competencies in population-based nursing. Faculty members are reviewing the APHN program curriculum to meet the current and future needs of key stakeholders and employers in Hawai‘i as identified in the discussions with community partners.

Summary

Major population health challenges lay ahead, including widening health inequities, impacts of climate change on human health, increasing incidences of natural and man-made disasters, and

future infectious diseases outbreaks.[5] In this complex environment, nurses with advanced population health competencies are needed to provide expertise and organizational leadership. To continue to evolve to meet these challenges, robust training and educational experiences must be provided for nurses to assume future leadership roles in population health as envisioned by Hawai‘i health employers.

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Tribulations and Triumphs of the COVID-19 Pandemic on Cancer Care in Hawai'i

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The Cancer Center Connection is a standing column from the University of Hawai'i Cancer Center and is edited by HJH&SW Contributing Editor Shane Y. Morita MD, PhD, FACS.

Introduction

On January 30, 2020, the World Health Organization (WHO) declared COVID-19 as a worldwide public health emergency of international concern. Since then, globally, nearly 500 million people have been afflicted while more than 6 million have died.[1] Nationally, approximately 80 million patients have contracted the virus while nearly 1 million have lost their lives.[1] Locally, almost a quarter of a million cases and more than 1000 deaths have been reported.[1]While these statistics are profound, they do not entirely depict the repercussions of the pandemic on cancer care. Over the last 2 years, multitudes of individuals and institutions have been gravely affected: patients, caregivers, providers, health systems, and non-profit organizations. As a surgical oncologist, it has been challenging to manage cancer patients with colleagues but rewarding to witness the collective partnerships amongst stakeholders under these circumstances.

Like other states, efforts to mitigate the spread of infection in Hawai'i included social distancing, wearing facial coverings, closing parks, and instituting quarantine protocols for travelers.[2] Initiatives in cancer prevention and early detection were temporarily halted due to the need to reprioritize resources. The Centers for Disease Control and Prevention (CDC) issued guidelines to limit viral transmission and increase healthcare workforce allocation.[3] Unfortunately, in some instances actions such as postponing procedures contributed to disease progression and poorer outcome. Holcombe and colleagues found that in 2020 screening for breast cancer and colorectal cancer in Hawai'i was reduced in rural areas and among Native Hawaiians.[4] A recent meta-analysis by Johnson and co-investigators revealed that delaying surgical intervention for 12 weeks led to decreased survival in breast, lung, and colon cancer patients.[5] In my opinion, although, much of the concern of cancer patients has been focused on the physical detriment, the emotional toll and financial hardship should not be minimized. The social and economic impacts have been worse for minority populations.[6]

For cancer patients, the constant risk of acquiring an infection in an immunocompromised state or developing metastatic disease due to an inability to obtain treatment has led to a high frequency of depression and anxiety during the pandemic; one review elucidated a prevalence rate of more than 50%.[7] Other associated problems such as insomnia, cognitive dysfunction, and fatigue impair quality of life. Studies have also shown that delays in the therapeutic regimen cause higher distress.[8] However, as the pandemic wanes, it is hopeful that these uncertainties and issues will diminish.

Cancer patients with economic limitations have demonstrated a decreased survival. There are multiple reasons for this disparity but lack of access to specialized care and other barriers may be essential variables. Because of the pandemic, facilities such as the Hope Lodge necessitated closure. This structure managed by the American Cancer Society, is truly a "home away from home." It was established in 2016 and provides a complementary place for neighbor island patients and caregivers to stay while undergoing treatment on Oahu. The reduction of the financial burden allows them to focus their energy on fighting the cancer in lieu of unnecessary worry.

While much has been said about patients, in my encounters, caregivers also suffered from the uncertainty of their loved ones. The lack of control in determining timing of treatment was a source of constant turmoil. The loss of job security was a cause of emotional crisis in a recent study of cancer patients.[9] Other challenges including restrictions on visitation were also major stressors but were partially alleviated by innovative efforts. Telemedicine served as a conduit for an interactive approach to maintaining visits while reducing viral exposure and enabled participation by all relevant parties when feasible.

Providers needed to pivot during the pandemic. Many were tasked with explaining to patients why their services had to be rescheduled. Numerous physician, nursing, and administrative

leaders partnered to devise algorithms and implement guidelines in determining the optimal timing of surgeries. Other modifications of modalities were enacted; chemotherapeutic regimens were truncated and in person encounters were limited. However, reduction of in-person visits did not uniformly create a desirable environment when making end of life decisions. Cases of death occurring without family being available at the bedside was not optimal since there was lack of intimate closure. An undesired result of the pandemic was physician burnout, including those in the oncology field.[10] In fact, a national survey of oncologists reported by the American Society of Clinical Oncology found that loss of personal interaction with cancer patients led to feelings of burnout.[11]

Health systems were hampered with overcrowding and staffing issues but still managed to find a way to navigate the landscape of cancer patients, given their immunocompromised status. The launching of extensive vaccine clinics off-site helped mitigate critical hospitalizations, especially for those who required chemotherapy and immunotherapy. However, clinical trial participation at cancer institutes and medical centers was attenuated. Fortunately, enrollment is increasing as the pandemic abates.

Non-profit organizations were not spared from the pitfalls of the pandemic. In fact, during the summer of 2020 the American Cancer Society announced the elimination of more than 1000 jobs and reduction in executive salaries.[12] During 2020, charitable commitment and fundraising efficiency had declined. It is imperative that philanthropists continue to support the mission of saving lives and celebrating lives so that programs and resources can be sustained to assist cancer patients.

Conclusion

In essence, although the pandemic illustrated the plight of cancer care in Hawai‘i it also highlighted how collaboration was the key to overcoming obstacles. Alliances were forged throughout the community to benefit cancer patients and their caregivers. As normalcy ensues, the coronavirus crisis has shed light on the vulnerability of cancer patients and their need for specialty care. It is hopeful that those diagnosed during the pandemic persevere without any major physical, mental, social, or financial turmoil.

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Hawai'i Journal of Health & Social Welfare (HJH&SW)

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c. Establish and oversee a peer review process that ensures the accuracy and validity of the articles.
d. Ensure that all articles adhere to the guidelines set forth in journal's Instructions to Authors page, especially the instructions for manuscript preparation and the statistical guidelines.
e. Obtain a signed Copyright Transfer Agreement for each article from all authors.
f. Comply with all federal, state, and local laws, rules, and regulations that may be applicable in connection with the publication, including ensuring that no protected health information appears in any article.
g. Work with the editorial staff to create and adhere to a timeline for the publication of the supplement.
h. Communicate any issues or desired changes to the HJH&SW staff in a timely manner.

4. Upon commissioning a supplement, the sponsor will be asked to establish a timeline for the issue which the sponsor and the HJH&SW editor(s) will sign. The following activities will be agreed upon with journal publication to take place no later than 24 months after signing. Extensions past the 24 months will be subject to additional fees based on journal publication rates at that time:

- Final date to submit a list of all articles, with working titles and authors
- Final date for submitting Word documents for copy editing
- Final date for submitting Word documents for layout
- Final date to request changes to page proofs (Please note that changes to page proofs will be made only to fix any errors that were introduced during layout. Other editing changes will incur an additional fee of $50 per page.)

5. The cost of publication of a HJH&SW supplement is $5,000 for an 8-article edition with an introduction from the sponsor or guest editor. Additional articles can be purchased for $500 each with a maximum of 12 articles per supplement. This cost covers one round of copy editing (up to 8 hours), layout, online publication with an accompanying press release, provision of electronic files, and indexing in PubMed Central, SCOPUS, and Embase. The layout editor will email an invoice for 50% of the supplement to the designated editor for payment upon signature of the contract. The remaining will be due at the time of publication. Checks may be made out to UCERA.

6. The sponsor may decide to include advertisements in the supplement in order to defray costs. Please consult with the HJH&SW advertising representative Michael Roth at 808-595-4124 or email rothcomm@gmail.com for assistance.

7. Supplement issues are posted on the HJH&SW website (http://www.hawaiijournalhealth.org) as a full-text PDF (both of the whole supplement as well as each article). An announcement of its availability will be made via a press release and through the HJH&SW email distribution list. Full-text versions of the articles will also be available on PubMed Central.

8. It is the responsibility of the sponsor to manage all editorial, marketing, sales, and distribution functions. If you need assistance, please contact the journal production editor. We may be able to help for an additional fee.

9. The editorial board reserves the right of final review and approval of all supplement contents. The HJH&SW will maintain the copyright of all journal contents.

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Sample Workflow and Timeline for a Supplement

1. The sponsor contacts the HJH&SW editors (hjhsw@hawaii.edu) to discuss the supplement topic, estimated timeline, length and cost. HJH&SW staff will review the journal requirements for articles and share our review process with the sponsor. **Time frame: 2 weeks**

2. The sponsor will complete the draft contract and pay a non-refundable deposit of $2500 or half the contract value. **Time frame: 3 days**

3. The sponsor will solicit articles for the supplement. **Time frame: 3-6 months**

Articles must comply with:

- Instructions for Manuscript Preparation and Submission of Research Articles
- Instructions for Manuscript Preparation and Submission of Columns
- HJH&SW Statistical Guidelines
- HJH&SW Style Guide for Native Hawaiian Words and Phrases
AMA Manual of Style A free summary can be found here.

4. The sponsor will oversee the article selection, peer review, and editing process. We recommend that time be allowed for at least two rounds of reviews for each article. **Time frame: 3-6 months**

- Ensure that each article includes Institutional Review Board (IRB) review and approval, and a statement disclosing any conflicts of interest.
- Obtain a Copyright Transfer Agreement signed by all authors for each article.

5. *Optional*: During this time, the sponsor can solicit advertisements for the supplement to help defray costs for publication and/or printing. To initiate this process, the sponsor will work the HJH&SW advertising representative Michael Roth at 808-595-4124 or roth-comm@gmail.com.

6. The sponsor or their designee will conduct a final review of each article to ensure adherence to HJH&SW guidelines and AMA style. **Time frame: 2 weeks**

7. For each article, the sponsor will submit the final Word document and Copyright Transfer Agreement to the HJH&SW journal production editor. The journal production editor will send the articles to the copy editor for final journal style review. Copyediting will be 8 hours per edition plus 1 hour per article for additional articles purchased. Any additional hours will be billed at $100 per hour. **Time frame: 2 weeks**

8. The sponsor will submit the final articles to the layout editor for formatting. **Time frame: 1 month**
Acting in the role of guest editor, the sponsor will include a column introducing the supplement.
IMPORTANT: All articles submitted for layout should be in their finalized form. Page proofs will be returned to the sponsor for their review and approval, but changes will only be made to fix any errors that were introduced during the layout process. Any editing or changes to the text or figures after the initial copy layout will incur a fee of $50 per page.

9. The sponsor will review the electronic copy from the layout editor and submit any final corrections. **Time frame: 5 working days**

10. The layout editor will make the final corrections and provide a finished electronic copy of the supplement to the sponsoring editors to allow time for printing.

11. The managing editor will work with the sponsor to draft a press release. Sponsors should contact the managing editor at least 30 days prior to the date of publication to plan and script the press release. Sponsors are encouraged to submit 1-2 photos to accompany the press release. Note that obtaining signed photo releases is the responsibility of the sponsor.

12. The supplement will be published online along with the press release. An electronic copy will be sent to our subscribers and circulation lists, and the edition will be forwarded to the National Library of Medicine for indexing and made available for no cost access to the public.

Revised 2/6/20

Hawai‘i Journal of Health & Social Welfare (HJH&SW)

Style Guide for the Use of Native Hawaiian Words and Diacritical Markings

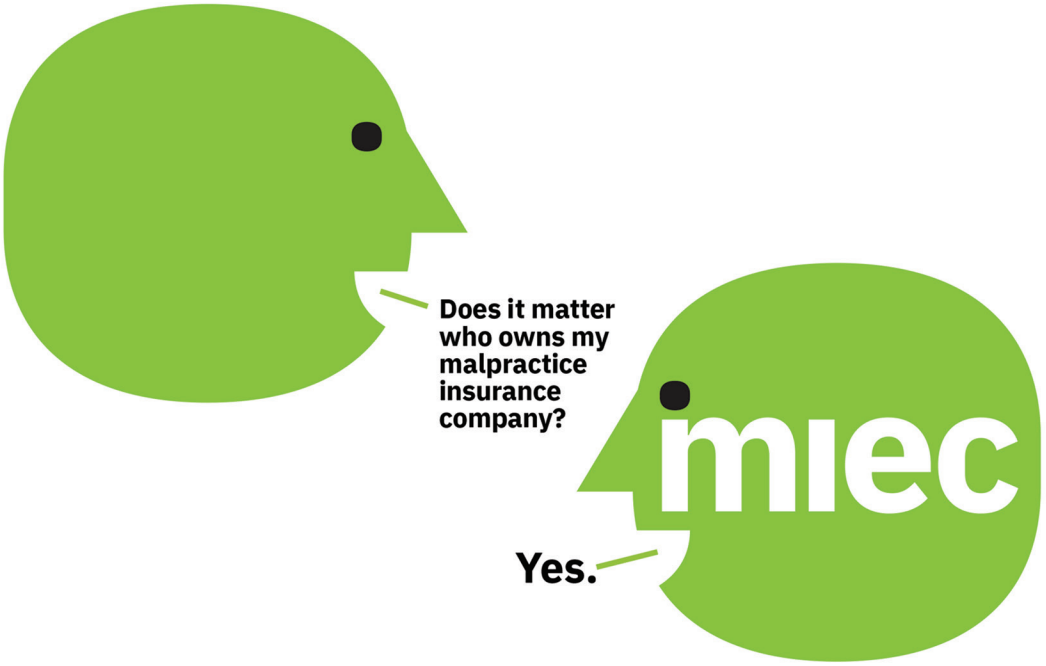
The HJH&SW encourages authors to use the appropriate diacritical markings (the ‘okina and the kahakō) for all Hawaiian words. We recommend verifying words with the Hawaiian Language Dictionary (http://www.wehewehe.org/) or with the University of Hawai‘i Hawaiian Language Online (http://www.hawaii.edu/site/info/diacritics.php).

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.

Examples of Hawaiian words that may appear in the HJH&SW:

‘āina	***Mānoa***
ali‘i	***Māori***
Hawai‘i	***Moloka‘i***
kūpuna	***O‘ahu***
Kaua‘i	***‘ohana***
Lāna‘i	***Wai‘anae***



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