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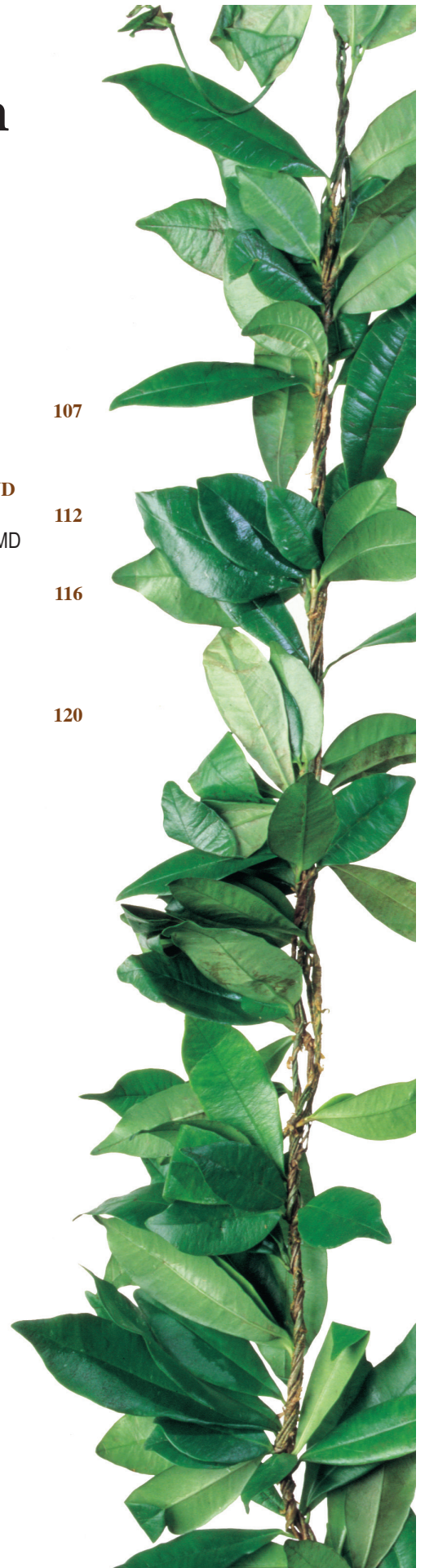
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Clinical Characteristics of Long-Term Complications of Severe Rat Lung Worm Disease in Hawai'i: A Survey of 4 Cases

Sittichai Khamsai MD; Kathleen Howe MSc; Kittisak Sawanyawisuth MD, PhD

Abstract

Rat lung worm disease (RLWD) is endemic to Hawai'i, and cases of severe RLWD with long-term sequelae have been reported in Hawai'i. However, there are limited data on clinical features of the RLWD survivors with the long-term sequelae. The authors conducted a survey to report on clinical characteristics of RLWD survivors with the long-term sequelae. Four RLWD survivors had severe RLWD with persistent, neurological symptoms for years after RLWD. In conclusion, long-term sequelae of severe RLWD exist. The most common long-term consequence among participants was severe skin pain, which may relate to damage of the nerves or spinal cord.

Keywords

Angiostrongylus cantonensis, eosinophilic meningitis, numbness, pain, rat lung worm disease

Abbreviations and Acronyms

CBD = cannabidiol
CSF = cerebrospinal fluid
ELIS = enzyme-linked immunosorbent assay
OTC = over-the-counter
PCR = polymerase chain reaction
RLWD = rat lung worm disease
TENS = transcutaneous electrical nerve stimulation
THC = tetrahydrocannabinol
TNF- α = tumor necrosis factor alpha

Introduction

Rat lung worm disease (RLWD), caused by *Angiostrongylus cantonensis*, has several forms and clinical manifestations. Presence of cerebrospinal fluid (CSF) eosinophils of 10% or more is used as suggestive criterion for RLWD.¹⁻³ There are several forms of RLWD such as encephalitis or coma, ocular angiostrongyliasis, gastrointestinal angiostrongyliasis, or radiculomyelitis.⁴⁻⁷ The most prevalent form is eosinophilic meningitis which is commonly reported from Thailand.^{1,3} RLWD can be found worldwide particularly in Asia Pacific countries. In the US, RLWD is most commonly reported in Hawai'i.^{8,9} There were 82 confirmed cases of angiostrongyliasis (severe and non-severe forms) reported in Hawai'i from 2007 to 2017.⁹⁻¹¹ Two deaths with eosinophilic meningoencephalitis have been reported in Hawai'i since 1962.¹⁰

Eosinophilic meningoencephalitis is a severe form of RLWD which can lead to coma and death. A report from Thailand found that this form occurred in less than 10% of RLWD

cases but had a mortality rate of at least an 80%.^{11,12} Several confirmed reported cases of RLWD from Hawai'i are published in literature.¹³ At least 1 case of a long-term sequela of severe RLWD in Hawai'i was reported in the literature in 2013.¹⁴ Severe RLWD or long-term sequelae of RLWD in Hawai'i may be underreported. Additionally, there are limited data on risk factors or clinical manifestations of the long-term sequelae of RLWD. This study aimed to report the clinical characteristics of long-term sequelae of RLWD in Hawai'i.

Methods

This study was conducted as a survey after the 6th International Workshop on *Angiostrongylus* and *Angiostrongyliasis*, which was organized by the University of Hawai'i at Hilo. The workshop was held on January 5-8, 2020 in Hilo, Hawai'i with survivors of RLWD attending. RLWD survivors who registered or attended for the meeting were invited to participate in the survey by personal approach during and after the conference. A self-reported questionnaire was used to evaluate the clinical course of RLWD and also the long-term sequelae from the RLWD. The questionnaire was developed for this study and was comprised of questions around demographic characteristics, diagnosis, treatment, outcomes, and long term sequelae as shown in **Table 1**. RLWD survivors were invited by purposive sampling and asked to fill out the questionnaire without personal identifiers by an online link or by printing it out and mailing to the authors. Data were tabulated and reported by using Microsoft Excel software version 11.1 (Microsoft Corp., Redmond, WA). The study protocol was waived for ethical consideration, Khon Kaen University, Thailand (HE631229).

Results

Five RLWD survivors were invited to participate the study. Four RLWD survivors agreed to participate (80%). All lived on Hawai'i Island. There were 3 men and 1 woman, and their average age was 63.5 years (range 50-78 years) as shown in **Table 1**. Three cases had exposure of RLWD by consuming salad or shrimp with an incubation period from 2 to 6 weeks. Persistent headache was a presenting symptom in one case, while the other two cases had flu-like symptoms and back/chest tightness as presenting symptoms. Overall, headache was reported in three cases (75%) at the presentation. All cases had several symptoms at the time of presentation such as skin pain (4 cases), urinary retention (Cases 1, 3, and 4), and constipation (Case 1). Two of 4 cases had positive confirmation test by PCR

Table 1. Clinical Course and Characteristics of Rat Lung Worm Disease in Survivors with Long Term Complications in Hawai'i				
Factors	Case 1	Case 2	Case 3	Case 4
Age (years)	60	66	50	78
Sex	Female	Male	Male	Male
Ethnicity	White	White	White	White
Year of diagnosis	2015	2016	2019	2015
Route of infection	Shrimp	Prawn salad on Hawai'i Island	Slugs on lettuce from garden, North Kohala, Hawai'i	Contaminated water tank
Incubation	Unknown	6 weeks	9 days	2 weeks
Presenting symptom	Persistent headache	Flu like symptom with metallic taste	Strong pressure on upper middle back and chest	Weird feeling in the eye
Accompanying symptoms	Double vision Urinary retention Hip and leg weakness Nerve pain Constipation Severe itchiness Lethargy	Severe skin pain: itchiness and pain	Fitful sleep Restless legs Tingling in the tip of right thumb Progressive headache Cough Tingling/burning in neck, toes, and hands Fever, Strained urination Sore calves, shooting pain in legs, trouble walking Hiccups Night sweats Ice cold feet Stiff neck Blurred vision Nausea Severe nerve pain Bedridden	'Creepy' feeling in the back of the head, headache, pain in the leg, urinary retention
Basis of diagnosis	CSF PCR positive (Oct 13)	Clinically with CSF eosinophils	CSF PCR positive	ELISA test
Numbers of lumbar puncture, n; numbers of CSF white blood cells (cells/mm ³), date (Parenthesis).	1. WBC 194 (Oct 9) 2. WBC 177 (Oct 15) 3. WBC 128 (Nov 20) 4. WBC 183 (Nov 30)	None	1. unknown WBC 2. unknown WBC	None
CSF eosinophils in each lumbar puncture	1. 42% 2. 59% 3. 15% 4. 2%	None	1. 0% 2. 7%	None
CSF glucose in each lumbar puncture	1. 37 2. 50 3. 50 4. 64	None	None	None
CSF protein in each lumbar puncture (normal range < 40 mg/dL)	1. 79 2. 73 3. 84 4. 52	None	None	None
Blood eosinophilia in each test	1. 6.8% of 6900 WBC 2. 11.0% of 6800 WBC 3. 14.9% of 9800 WBC	None	1. 5.7% 2. 7.4%	None
Other labs and imaging	Normal CT of brain	None	MRI brain: micro-hemorrhage in left brain	None
Treatment	IV antibiotics IV steroids Pain killers Oral steroid: 80 mg max for 6 months Gabapentin Albendazole	Unknown but treatment protocol for RLWD	IV morphine prn Fentanyl patch oxycodone oral IV steroid zolpidem	None

Table 1. Clinical Course and Characteristics of Rat Lung Worm Disease in Survivors with Long Term Complications in Hawai'i (Con't)				
Factors	Case 1	Case 2	Case 3	Case 4
Clinical course	Severe pain at buttocks, back of legs, feet (sharp pain) persistent pain 6 weeks high blood pressure with high pulse rate urinary tract infection sepsis insomnia Inflammatory arthritis	1 week of coma 5 weeks of bed ridden status	Phase 1 (month 1): walk with cane, slowly getting back to work Phase 2 (month 2-7): alternative therapy with slow improvement Phase 3 (month 8-10): able to work and walk without a walking aid	None
Current medications	Duloxetine Pregabalin Eszopiclone Magnesium d-mannose	None	Cerebrolysin (215 mg) injections Dihexa (20mg) every other day Perineural injection therapy to several peripheral nerves Mindfulness-based stress reduction	Traditional Chinese Medicine
Current status	Pain (numbness, stinging, burning, pin sensation, tingling) on 50% body, right side of head Uncontrollable sharp breaths, sometimes Constipation Poor short-term memory	Left leg neurologic pain Cranial nerve 6th palsy Sleep deprivation	Able to work and walk almost normal Pain/numbness in right leg Fatigue Mood swing Tingling and itchiness in arms, hands, and fingers	Fairly constant pain in left side of head, ear, neck, and arm.
Thoughts	Have to go through the stages of grief "Each day we are born again, What we do today is what matters most" Buddhism meditation Returning to physical activity may help: walking, yoga, Pilates Treatment with albendazole seemed to help even 3-4 years out Brain exercises: use an app called elevate Use mind, brain, body connection with mindfulness and meditation to improve pain: how we think is how we feel	Excruciating itchiness and skin pain was persistent for year and can be a symptom of RLWD	Albendazole is necessary but unavailable in the US* Increased education of providers in hospital ERs, urgent care and private practices Increased funding for research and education Improved response from agencies, esp. DOH. Alerting visitors about disease and protocols for avoiding it. We were one of the rare cases who actually knew exactly when I had contact with a semi-slug	None
Time elapsed since infection	5 years	3 years	1 year	5 years

Note. CSF: cerebrospinal fluid; ELISA: enzyme-linked immunosorbent assay; IV: intravenous; PCR: polymerase chain reaction; WBC: white blood cells; DOH: Department of Health; *patient thought but albendazole is available in the US.

method, while 1 case was diagnosed clinically, and another was diagnosed by enzyme-linked immunosorbent assay (ELISA) test. CSF eosinophils, ranging from 7%-59%, were found in 3 cases. One case presented with a small intracerebral hemorrhage.

There was no consistent treatment regimen in these 4 cases. Intravenous steroids were given in 2 cases, and albendazole was given in Case 1. Cases 2 and 3 developed coma and bed-ridden status. Case 1 had urinary tract infection after long term use of steroid. Cases 1 and 3 reported use of mindfulness treatment for their remaining symptoms. The 4 respondents shared the following thoughts on RLWD care: using mindfulness and Buddha theory may reduce remaining symptom (Case 1), RLWD may have atypical symptoms (Case 2), RLWD care/diagnosis/knowledge for physicians should be improved (Case 3), and traditional Chinese medicine may be useful for long-term sequelae (Case 4) as shown in **Table 1**.

All 4 cases reported long term health consequences from RLWD for 1 to 5 years. Body pain was the most common symptom and reported in all 4 cases (**Table 1**). Other symptoms included breathing problems (Case 1), constipation (Case 1), poor short-term memory (Case 1), cranial nerve palsy (Case 2), sleep difficulty (Case 2), fatigue (Case 3), mood disturbance (Case 3), and tingling/itchiness (Case 3). Traditional or alternative medicine was used in all cases for the treatment of long-term sequelae.

Discussion

This study found that these 4 patients with severe cases of RLWD faced difficulties in arriving at the diagnosis of RLWD. Factors that may have been associated with diagnosis issues in these cases include unknown risk for or exposure to RLWD and low percentage of eosinophils in Case 1; and uncommon presentation of RLWD and diagnostic errors at the emergency

department despite obvious risk factor of consuming slugs prior to developing symptoms of RLWD in Case 3. These diagnostic issues indicate a need for education about RLWD among physicians not only in endemic areas but also in other countries due to heavy traveling to endemic countries.¹⁵ Additionally, CSF eosinophils may not reach 10% in early cases. One study found 1 patient out of 9 patients diagnosed with RLWD had CSF eosinophils of 2%.¹⁶

Severe RLWD in Cases 2 and 3 may be associated with delayed diagnosis. A previous study found longer duration of headache or delayed diagnosis of RLWD for 1 day increased risk of coma or severe encephalitis form by 26%.¹² Older age is another risk factor associated with severe RLWD.¹² A study in Thailand found those with severe RLWD or RLWD with encephalitis had an average age of 51 years, compared with 33.5 years in those with meningitis or non-severe RLWD ($P = .002$).¹² The 4 cases in the current study were at high risk for developing severe RLWD as they were older than average age of patients with RLWD (33.5 years).¹² These 4 cases had symptoms of severe skin pain that is a pathognomonic sign for RLWD.⁵ Other than an indicator for RLWD, this skin pain may also indicate a migration of *Angiostrongylus cantonensis* larvae to the spinal cord.¹³ A previous autopsy of a person with severe RLWD suggested that a larva migrated to the spinal cord and caused severe skin pain such as that experienced by these 4 cases. Long term sequelae of patients with RLWD was reported in Hawai'i but there is no previous report of long term sequelae of RLWD in Thailand, an endemic area.^{11,14} One possible explanation may be due to a different vector. In Thailand, raw or uncooked freshwater snails are the main transmission mode. In Hawai'i, food or drink contaminated with slugs and shrimp are more common vectors and probably have a higher larva load.⁹

All 4 cases here continued to have long-term sequelae of RLWD with the longest duration of disease being 5 years (Cases 1 and 4). A previous report found that 57% of those who suffered from RLWD had full recovery.¹⁷ Pain and numbness may indicate permanent nerve damage from the larva migration through the spinal cord or nerve root.¹¹ There is no previous study on treatment of these long-term consequences of RLWD in literature. From the patient perspective, mindfulness and meditation may be helpful. Previous studies showed that mindfulness normalized stress biomarkers such as TNF- α (from 57.1 to 45.4 pg/mL), and meditation increased brain oxygenation in the prefrontal cortex significantly (P -value < .0001) in patients with glaucoma.^{18,19} Additionally, mindfulness may ameliorate stress, oxidative stress, inflammation, and parasympathetic nervous system activity resulting in reduction of pain from neurological system. Therefore, mindfulness and mediation may improve the damaged nerve or spinal cord that may cause severe skin pain.^{20,21}

Regarding treatment with albendazole, Case 3 thought that it was not available in the US. But, albendazole is actually available in the US and most countries. There is no clinical data on

the efficacy of albendazole for post-exposure prevention for RLWD. However, it may be effective to reduce the duration of headaches in patients with RLWD compared with placebo (8.9 vs 16.2 days; $P = .05$).²² A systematic review found that corticosteroid treatment with or without albendazole is effective.²³ For post-exposure prevention of RLWD, a study found that pyrantel pamoate given at a dose of 11 mg/kg can reduce worm burden up to 72%.²⁴ However, further clinical studies are required.

There are several limitations in this study. First, RLWD survivors who were invited to the conference were mainly from Hawai'i and were invited to the study personally resulting in small sample size. Second, the questionnaire was developed for this study and not validated prior to use. Items in the questionnaire were general, and the data on long term sequelae were qualitative. Third, clinical data from each survivor were limited as hospital chart access was not available.^{25,26} The data were self-reported, and were also subject to recall bias. Finally, no point of care test or predictive factors were studied.²⁷⁻²⁹

In conclusion, long-term sequelae of severe RLWD exist. The most common long-term consequence is severe skin pain that may relate to damage of nerves or spinal cord.

Conflict of Interest

None of the authors identify any conflicts of interest.

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A Case of a Micronesian Woman in Hawai'i with Lymphoma and the Role of Implicit Bias in Medicine Affecting Her Care

Kory M. Johnson MPH; Emma Fixsen MD; David J. Elpern MD; Douglas W. Johnson MD

Abstract

Medically indigent patients, patients of color, those with insufficient health insurance, or patients with severe diseases have a high rate of poor health care quality caused by unconscious implicit and explicit biases. Awareness of the relationship between unconscious implicit bias and negative health care outcomes is increasing in the health care community. The objective of this case study was to examine implicit biases that negatively affected the patient care of a young Micronesian woman with a severe cutaneous disease in Hawai'i. Her medical care and death may have been affected by a combination of implicit biases, including bias based on her race, type of health insurance, and underlying disease. Implicit biases and their role in health care disparities are often unintentional and not obvious. Increased awareness by health care providers may help to avoid inequities in clinical decision-making and improve outcomes.

Keywords

implicit bias, explicit bias, indigent, psoriasis, lymphoma, health care

Abbreviations

FNA = fine-needle aspiration

Introduction

Unconscious bias exists in health care and has recently been acknowledged in the literature. Health care outcomes of implicit bias include poor patient compliance and a reduction in health care efforts by providers and staff.¹ The death of a young Micronesian woman in Hawai'i led to the examination of implicit biases that negatively affect patient care. This case report and brief literature review describes the negative effects that implicit biases from health care professionals can have on patient health outcomes. Health care providers are frequently unaware of their unconscious implicit biases toward sex, ethnicity, race, gender identity, insurance status, and disease severity. The authors discuss the factors that contributed to the death of a woman who did not receive appropriate treatment for her lymphoma. Her resulting medical care and death may be the result of implicit bias based on her race, type of insurance, and disease (severe psoriasis) diagnosis.

Case Report

A 46-year-old Pacific Islander woman from Micronesia with Medicaid insurance and a history of severe disabling psoriasis and psoriatic arthritis presented to a Hawai'i dermatology clinic in March 2011 (Figures 1 and 2). Her psoriasis started during her adolescent years and was treated with numerous therapies

including topical corticosteroids, phototherapy (sunlight exposure in Micronesia), methotrexate, cyclosporine, acitretin, apremilast, etanercept, infliximab, ustekinumab, secukinumab, ixekizumab, IL-23 blocker, adalimumab, and guselkumab. The various therapies did not adequately control her psoriasis, but the patient felt that adalimumab helped the most with her psoriatic arthritis. The patient developed multiple squamous cell carcinomas (lymphoma) that complicated psoriasis treatment. She was on adalimumab for approximately 10 years; however, the therapy only controlled her psoriatic arthritis and not her psoriasis. Prior to her development of lymphoma, she switched from adalimumab to the recently approved guselkumab to address the lack of response of previous therapies to her cutaneous psoriasis.

In January 2018, the patient visited a Hawai'i dermatology clinic for a psoriasis follow-up and an IL-23 blocker injection. The patient reported her psoriasis did not improve and complained of groin pain and fever for 3 days. New-onset erythema, tenderness, and induration of the right proximal thigh were noted. Preliminary diagnosis was abscess with an incision and drainage attempt in the clinic but was unsuccessful. Systemic psoriasis treatment was withheld, and she was sent to the emergency department where a repeat attempt was made to incise and drain the right groin mass; but, again, was unsuccessful. She was admitted for intravenous antibiotics and obtained a CT scan that showed a 5.5 cm right thigh mass concerning for necrotic lymph node versus abscess, as well as widespread lymphadenopathy. A left groin lymph node fine-needle aspiration (FNA) performed 3 days after admission showed peripheral T-cell lymphoma. She was seen once by oncology as an inpatient, discharged, and referred for outpatient lymphoma treatment.

Eight months later she returned to the dermatology clinic having stopped her psoriasis treatments. When asked about treatment for her lymphoma, she described negative interactions on her first and only visit with the outpatient oncology staff and oncologist, stating that "those people weren't nice to me" and that she didn't want to go back to see them. The authors believe she was referring to the oncologist's office staff. She stated that she planned to take "medications from home" and use alternative herbal therapies; however, it was never confirmed that she initiated treatment for her lymphoma. An attempt was made to refer her to other oncologists in the community, but they were not accepting patients with an established relationship with another oncologist and suggested that she go back and see her first oncologist.



Figure 1. Patient's Baseline Cutaneous Disease and Deforming Psoriatic Arthritis Located on Hands



Figure 2. Patient's Severe Psoriasis Affecting Both Legs

Thirteen months from her lymphoma diagnosis, she again presented to the dermatology clinic with severe psoriasis, extensive lymphadenopathy, weight loss, bilateral severe leg edema, difficulty walking, and increasing shortness of breath (**Figures 3 and 4**). The dermatology staff took the patient by wheelchair to the emergency department where she received an inadequate and unfriendly evaluation as observed by the dermatology staff. The patient was quickly sent home because her oxygen saturation was satisfactory, still never having received treatment for her lymphoma. Six days later, she re-presented to the emergency department with severe abdominal pain in septic shock with hydronephrosis from ureteral obstruction by the tumor. She died 17 days later from multi-organ failure secondary to proteus mirabilis urosepsis.

Discussion

Several factors contributed to this patient not receiving appropriate treatment for her lymphoma. Her medical care and death may have been affected by a combination of implicit biases, including bias based on her race, health insurance for low-income individuals, and underlying disease. Implicit bias may have also played a role in her inability to obtain a timely

diagnosis and oncologic treatment during both hospital admissions: in the 3-day delay before performing a FNA during her first hospitalization, and not being admitted during her second visit to the emergency department. The patient was sent home from her first hospitalization without receiving any treatment for her lymphoma and had an unsatisfactory follow-up visit at the oncology office. She was later sent home from the emergency department in a debilitated state, only to be readmitted 6 days later with septic shock and dying without treatment for her lymphoma.

Implicit biases are unconscious associations between a group attribute such as race, and a negative evaluation or stereotype.² These involuntary biases can affect the judgment of the physician and staff, as well as interpersonal interactions with patients, despite a conscious desire to treat everyone equally. Compare this to explicit biases, which are held consciously, believed to be correct in some way, and are acted upon by the biased person.² Implicit biases against certain patient populations can negatively affect communication and care between patient and provider. This has been shown to impact patient confidence in oncologic therapies. In a study looking at interactions between non-Black oncologists and Black patients, oncologists with



Figure 3. Patient's Prominent Left Axillary Lymphadenopathy



Figure 4. Patient's Prominent Right Cervical Lymphadenopathy

higher pro-White/anti-Black racial implicit bias scores (as measured by the implicit association test) had shorter patient interactions, and their communication was rated by patients and observers as less patient-centered and non-supportive.³ An increase in oncologist implicit bias was also associated with increased patient-difficulty remembering contents of the patient-provider interaction, and indirectly with lower patient confidence in recommended treatments and more perceived difficulty in completing them.³ Some providers exhibit explicit bias by not participating with Medicaid.⁴ Others participate with Medicaid but provide substandard care, which is another form of implicit bias.⁵

In the case presented here, the authors believe implicit bias against the patient's race may have played a significant role in her medical care and the lack of treatment for her lymphoma. Unfortunately, significant implicit and explicit biases against the Micronesian community exist in Hawai'i. A recent study from the University of Hawai'i found that 1 in 4 Micronesians reported experiencing bias against them at work because of their race and 1 in 10 reported discrimination from medical and social services.⁶ Another study in Hawai'i found that Micronesians had higher severity of illness at the time of hospitalization across a variety of categories (cardiac illness, infectious disease,

cancer, and endocrine disease) and tended to be hospitalized at a younger age compared to White or Japanese patients.⁷ Micronesians were also significantly more likely than the other race/ethnic groups (White, Japanese, and Native Hawaiian) to have Medicaid insurance or be self-pay.⁷

Like many Micronesian patients in these studies, the patient had Medicaid insurance. Both implicit and explicit bias as well as discrimination against patients based on insurance status can affect patient access to care. For example, many physicians may not accept patients with Medicaid insurance because of low reimbursement rates, increased paperwork requirements (prior authorizations, limitations on prescriptions, etc.), high illness burden, and psychosocial demands within this patient population.⁸ A 2013 Minnesota Health Access Survey found that reports of insurance discrimination were higher among uninsured and publicly insured adults compared to privately insured individuals.⁹ Adults reporting insurance-based discrimination were also more likely to face barriers to accessing care including lack of a usual source of care, lack of confidence in getting needed care, foregoing needed care due to cost, and provider-level barriers (ie, refusal of insurance or to accept new patients).⁹ A 2007 study of Florida Medicaid Enrollees found that 14% of respondents reported discrimination based on Medicaid insurance, while

9% reported discrimination based on race/ethnicity, and 6% reported both types of discrimination.¹⁰ Patients who reported discrimination based on either race/ethnicity or insurance status also had worse patient experiences (ie, receiving needed care, timeliness of care, and provider communication) than those who did not perceive discrimination.¹⁰

Explicit and implicit bias against individuals with severe cutaneous disease may have also played a role in this case. This includes historic discrimination against people with leprosy in the 19th and 20th centuries in Hawai‘i when people diagnosed with or suspected of having leprosy were exiled to Moloka‘i.¹¹ Patients with skin disorders like psoriasis may face discrimination.¹² A study from 2018 found that laypersons reported social avoidance of people with visible psoriasis, because of misinformation that the disease is contagious.¹² Medical students were also surveyed and reported significantly fewer stigmatizing attitudes than laypersons; however, some of them still had stigmatizing views. Knowing someone with psoriasis or having heard of the disease previously predicted fewer stigmatizing attitudes. Discrimination may also contribute to the psychiatric co-morbidities known to be associated with severe psoriasis. For example, a 2017 review and meta-analysis found that patients with psoriasis, especially among the younger age group, had a significantly higher likelihood of suicidal ideation, suicide attempts, and completed suicides than those without psoriasis.^{1,13}

Barriers to improving health care for people from Micronesia living in Hawai‘i have recently been explored. People from Chuuk, a Pacific Island country in Micronesia, who live in Hawai‘i reported that they do not speak negatively or confront providers about racial discrimination; in fact, they often respond to providers with what they think the provider wants to hear.¹ These barriers bring attention to the biases that negatively impact care for this community and an additional intervention may be needed to help identify and eliminate bias in health care.¹⁴

The patient’s clinical course and death presented in this case report highlight the importance of recognizing implicit bias among medical professionals. Raising awareness of these biases is the first step to addressing them. Discrimination against

individuals with severe cutaneous disease, both implicit and explicit, can have significant negative effects on patients’ well-being and health. Race, ethnicity, or insurance status biases can negatively affect access to care as well as the quality of care received. Health care professionals need to be aware of situations like this to improve the quality of care for all patients by addressing and preventing bias.

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A Model for Reaching Vulnerable and Underserved Populations During Public Health Emergencies Such as COVID-19

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Insights in Public Health is a recurring column from the public health community and is coordinated by HJH&SW Contributing Editor Mapuana Antonio DrPH from the Office of Public Health Studies in the Thompson School of Social Work & Public Health at the University of Hawai'i at Mānoa and Contributing Editor Nichole J. Fukuda MS from the Hawai'i Department of Health.

Acronyms

COVID-19 = coronavirus disease 2019
CDC = Centers for Disease Control and Prevention
HBC = Honolulu Bible Church (HBC)
HDOH = Hawai'i State Department of Health
Housing = Palolo Valley Homes, Ltd, and Palolo Homes
JABSOM = University of Hawai'i John A. Burns School of Medicine
NH = Native Hawaiian
PI = Pacific Islander
Project Vision = Project Vision Hawai'i

Community involvement during public health emergencies such the coronavirus disease 2019 (COVID-19) pandemic can be a very effective way to reach high risk vulnerable and underserved populations.¹ The US Department of Health and Human Services defines underserved and vulnerable populations as those that face health, financial, educational, and/or housing disparities. In other words, barriers that make it difficult to get health coverage and basic health care services, including, but not limited to, lack of coverage, high health care costs, inconsistent sources of care, low health literacy, lack of reliable transportation or other difficulties physically accessing provider's offices, and lack of available providers.² According to the Centers for Disease Control and Prevention (CDC), racial minorities are more likely to become hospitalized or to die from COVID-19 compared to White, Non-Hispanic persons.³ A model for reaching underserved and vulnerable populations is described here. The model describes how positive relations were established through outreach by volunteers and through collaboration between community organizations. This fostered compliance with public health recommendations to improve the health and well-being, including helping to preserve life for underserved and vulnerable populations.

In 2020, volunteers who attend Honolulu Bible Church (HBC) in Palolo, Hawai'i, began to focus their attention on the Palolo Valley Homes, Ltd, (118 units managed by the Hawai'i Public Housing Authority), and Palolo Homes (306 units owned by Mutual Housing Association of Hawai'i). Palolo Valley Homes

and Palolo Homes, collectively referred to as the Housing, have about 1500 registered residents, including, but not limited to Pacific Islanders, Native Hawaiians, and South East Asians. From the authors' observations, Pacific Islanders, appear to be one of the predominate groups living in the Housing.

In 2021, Native Hawaiians (NHs) made up 21% of the state's population and 19% of the COVID-19 cases, while Pacific Islanders (PIs), excluding NH, made up 4% of the state's population and 24% of all cases.⁵ The PI population in Hawai'i that had been diagnosed with COVID-19 had a cumulative risk that was 4 times greater than the next most impacted population (Filipinos) and 12 times that of the least impacted population (Japanese).⁵ Researchers also reported that in 2020 among the PIs, "the COVID-19 infection rate was up to 10 times that in all other groups combined and they accounted for almost 30% of cases."⁶ Thus providing outreach services to the PI population was vital as the pandemic impacted this population at a disproportionate rate.

Food drives began in April 2020 as a means to facilitate the distribution of face masks to the community to help protect them from COVID-19. It was initially observed that there was a hesitancy to wearing masks, as it was a novel practice when first introduced at the beginning of the pandemic. Bento boxes along with face masks were distributed weekly to cars driving through the parking lot of the church. Later, hand sanitizers and bags and boxes of groceries of food items were included in the distribution. Funds were initially provided by a few private donors and HBC for the weekly food distribution. The response from the community was very positive as many people were unemployed or underemployed during the spring and summer of 2020, the height of the shutdown of normal business activities due to COVID-19. Food was later supplied by the United States Department of Agriculture (USDA), the Food Bank of Hawai'i, and private donations.

Volunteers canvassed the Housing door-to-door every weekday to register residents in a database to receive the food and to

provide flyers notifying them of the food distribution schedules. During these early interactions, it was evident to the canvassers that many residents had low English literacy, and did not have the means or the capability of readily accessing internet technology.²⁴ The one time that translators were available to be used, the canvassers noted that it helped with communication. Difficulties coordinating the use of translators from other organizations and lack of funding to hire them specifically for canvassing were the main reasons for not continuing to use them. The food distribution fostered positive relationships with the residents in the Housing. It was a good mechanism to communicate COVID-19 testing and vaccination information to residents in the Housing when they became available later.

COVID-19 testing began in the Housing in May 2020 in conjunction with the University of Hawai‘i John A. Burns School of Medicine (JABSOM). Shortly thereafter, Project Vision Hawai‘i (Project Vision) took over the testing. Project Vision “provides statewide services in communities with significant access-to-care challenges related to income, lack of insurance, geographical location, or cultural conflict.”²⁷ Testing was initially offered at Palolo Park, located across the street from the Housing, with periodic assistance from uniformed personnel, such as police or military. The lead author and the Resident Services Manager of Palolo Homes observed that residents were hesitant to get tested, and attendance was low. As a way to encourage residents to get tested, the COVID-19 testing location was moved to the *Hale*. The *Hale* sits on a central site inside the Housing on Ahe Street and is run by the Honolulu Community Action program for Science, Technology, Engineering, and Mathematics (STEM) activities and computer work.

Similar to the food drive, volunteers continued in May 2020 to canvass door-to-door, on weekdays to sign people up for testing. Residents either signed up during the canvassing or they would contact the lead author to ask to be signed up for testing. The canvassers included volunteers from churches, public health nurses from the Hawai‘i State Department of Health (HDOH), and nursing students from Chaminade University.

Because of residents’ low English literacy and lack of readily accessible internet technology in the Housing, the volunteers would fill out the registrations with the residents and later transfer the information into Project Vision’s online database. Initially, residents were hesitant to be tested due to barriers such as “cost of testing; low health literacy; low trust in the healthcare system; availability and accessibility of testing sites; and stigma and consequences of testing positive.”²⁸ To encourage testing, free bags of rice were given to Housing residents as incentives to those who came to be tested. Using incentives as a strategy appeared to work well to encourage people to be tested based on an increase in attendance and a willingness to be registered for the testing.

When vaccinations became available in the spring of 2021, Project Vision offered vaccinations in the Housing, and were willing to vaccinate homebound individuals in their units. Initially the response was very good, since seniors were anxious to be vaccinated. This positive response continued as the age eligibility dropped to 50 years and above. However, when the eligibility for vaccinations dropped to 18 years old, there was an initial hesitancy among residents to be vaccinated. Misinformation spread throughout the community and contributed to hesitancy and skepticism about the COVID-19 vaccine.⁹ Vaccinations dropped by about 50% compared to previous months. Although individuals 12-17 years old were eligible to receive vaccinations in May 2021, it took a couple of months to get this age group vaccinated. There was an uptick in numbers when vaccinations became available to additional age groups. In addition, when vaccinations became available for individuals 5-11 years old in November 2021, the number of vaccinations in this age group contributed to the increase in vaccinations for the less than 18 years old shown in **Figure 1**.

To help counter the vaccine hesitancy, in the spring of 2021 volunteer canvassers began to confidentially survey the residents to determine how best to encourage vaccinations. The information from the surveys gathered by the canvassers included information on the number of individuals living in each household, their ages, and their vaccination status. Information on the vaccination status of occupants in each household allowed for a targeted approach to know which homes to continue to canvass to encourage eligible unvaccinated individuals. This targeted approach was useful as the age eligibility for vaccinations changed over time. Volunteers went door-to-door every weekday to pre-register residents for the vaccination clinics by helping them to fill out the forms and assigning them time slots. Volunteers would call and remind the residents of their appointments a few days prior to each clinic, and on the day of the clinic.

The survey revealed that \$25-dollar gift cards from a local supermarket would be a good incentive and were initially given to individuals being vaccinated. There was an overwhelming positive response. Initially, gift cards were paid for by private donations and by Project Vision. The participation of the lieutenant governor and a state representative serving the community, and coverage by local news outlets brought positive publicity to the vaccination clinics. As word got around about the clinics in the Housing, private individuals and local businesses provided generous donations of gift cards for pizza and supermarkets to supplement the effort. Based on feedback from the younger residents in the Housing, gift cards from a popular local restaurant chain, were also made available at the vaccination clinics. A Kaiser Foundation grant was awarded to City Church and used to help purchase additional gift cards for the vaccination clinics, in-home test kits, and, later, provide

stipends for some of the principal volunteer canvassers. Project Vision also secured large donations of personal protective equipment for the Housing from Wilson Care Group.

On alternating Saturdays in the spring of 2021, Project Vision made vaccinations and testing available in the Housing at the *Hale*. Residents were far more willing to participate when the clinics were done in a familiar setting close to home. Staff also continued to conduct home visits to vaccinate those who were homebound because of medical conditions, and to provide testing for those who were afraid to come to the testing site. The regular canvassing along with the ongoing food distribution built trusting relationships, and contributed to the willingness of recipients to be vaccinated and tested. The success of outreach was evidenced by improved attendance at the clinics and positive feedback from individuals and the Palolo Homes Resident Services Manager. Comments from individuals such as “You’re so close,” along with appreciation from home-bound residents were often vocalized.

During the vaccination clinics individuals from the HDOH Public Health nursing staff, residents from the Housing, nursing students and staff from Chaminade University, and churches helped with logistics. Other volunteers included many medical professionals who assisted with providing vaccinations and testing to the residents on site and as well as for residents who were homebound in the Housing.

As of May 19, 2022, Project Vision survey results compiled from the vaccination clinics revealed that a total of 1754 vaccinations were administered in the Housing between February 21, 2021 and April 12, 2022 to 1048 unique, unduplicated individuals. The vaccinated individuals by age group were as follows: 5-11 years 10%, 12-17 years 16%, 18-64 years 62% and 65 years and older 12%. **Figure 1** shows the trend of the percent of total

vaccinations each month given in the Housing by age group from February 12, 2021 to April 12, 2022. From February 2021 to September 2021, Project Vision administered the initial primary series. In October 2021, boosters were administered in addition to the primary series. Then in November 2021, *keiki* 5-11 years old were eligible to receive the primary series.

The vaccination clinics ended in May 2022, due to low turnout after the state dropped safe travel and indoor mask mandates in March 2022. However, masks, hand sanitizers, and in-home test kits continued to be distributed in the Housing upon request. Food distribution continues monthly by volunteers from HBC and the community, with food supplied by the Hawai‘i Food Bank and through private donations.

This model for reaching vulnerable and underserved populations proved to be highly effective and may be a useful template for future public health emergencies. The most important element of this model was regular door-to-door canvassing by volunteers to build trust with the residents, and to gather and to share information. Other successful elements included assisting residents to register for testing and vaccinations, using incentives such as food and gift cards, providing the clinics at the residential site as well as going into resident’s homes when necessary, enlisting volunteers who were familiar with the residents, and coordinating the efforts of many organizations and individuals for help with the food distribution, testing, and vaccination clinics. One element that would have been very useful for this model would have been translators for non-English speaking residents. Translators could have assisted in better communicating important public health information on testing and vaccinations. Overall, this model fostered long lasting positive community relations between the volunteers and with those who were served. This collaboration brought together individuals from all walks of life using their many gifts of service, talents, and resources

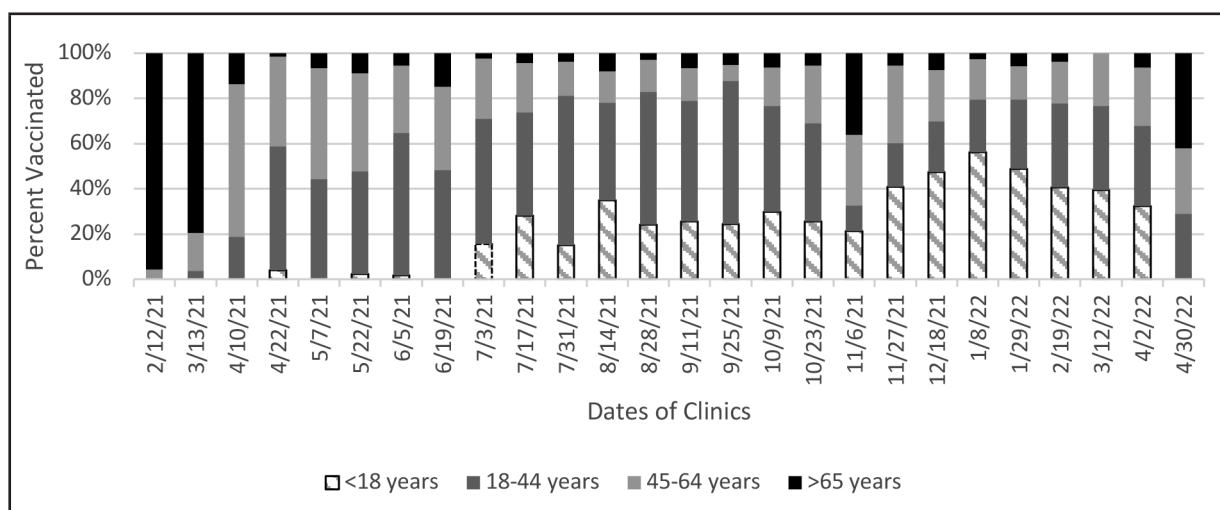


Figure 1. COVID-19 Vaccinations Given in the Housing by Age Group and Date from February 12, 2021 to April 12, 2022

Source: Project Vision Hawai‘i Data

for the public good. Most importantly, it fostered compliance with public health recommendations to improve the health and well-being, including helping to preserve life, for vulnerable and underserved populations.

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SPOTLIGHT ON NURSING

Planetary Health and Nursing: A Call to Action

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The Spotlight on Nursing is a recurring column from the University of Hawai'i at Mānoa Nancy Atmospera-Walch School of Nursing (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 Professor for NAWSON, and HJH&SW Contributing Editor; and Joanne R. Loos PhD, Science Writer for NAWSON.

Acronyms

UHM = University of Hawai'i at Mānoa

Human activity is severely impacting the Earth's natural systems. Overuse of the planet's natural resources has resulted in irreversible environmental degradation through biodiversity loss, climate change, air pollution, and loss of natural habitats.¹ Collectively, these human-caused impacts on the environment contribute to poorer human health.¹ In Hawai'i, these trends threaten to permanently alter our way of life. Coastal erosion and beach loss due to extreme weather and rising ocean levels are threatening critical infrastructure, housing and culturally historic areas.² These conditions interact with economic and social conditions, such as poverty and access to health services, compounding existing challenges faced by traditionally underserved populations or disadvantaged groups.³ The scale of the environmental impact of human activity around the world has progressed to a point that we may no longer be able to safeguard human health and well-being.^{1,4}

In order to seek solutions to the crisis, a novel framework to guide new science, called planetary health, has emerged. Planetary health has been defined as the health of human civilization and the state of the natural systems on which it depends.¹ It is an interdisciplinary and transdisciplinary approach that aims to investigate the effects of environmental change on human health, including the study of the political, economic, and social systems that govern those effects. It differs from global health in that it has a strong emphasis on ecology and is concerned with more than just the human species.⁵ It emphasizes that humans are a part of nature, not separate from it, thus any effort to improve human conditions must not come at the expense of the environment.⁶ The emergence of planetary health comes at a time when the impact of climate change on human health has become increasingly clear. Changes in climatic conditions have resulted in direct effects on human health such as injury or death due to extreme heat, wildfires, droughts, storm surges,

and floods. Indirect health effects also occur through exposure to poorer air and water quality, food scarcity, increased risk of infectious diseases, and population displacement.⁷

Planetary Health is Aligned with Traditional Hawaiian Perspectives

One of the promising aspects of planetary health is its recognition of the need to integrate indigenous and traditional knowledge with contemporary practices to develop new strategies to live in greater harmony with natural systems.⁸ This is an area where the people of Hawai'i can offer unique perspectives to guide local and global planetary health efforts. A Native Hawaiian perspective that can inform planetary health efforts is the *ahupua'a* or *moku* system. This traditional Hawaiian method of land division, developed in the islands before European contact, segmented land into self-sustaining geographical units to manage human activities in harmony with the area's natural resources.⁹ Similarly, *malama 'āina* is a central cultural Hawaiian value that represents how caring for the land is caring for its people.¹⁰ It links human life and natural systems into a mutually dependent relationship. This value is manifested in practices such as regenerating, restoring, enriching, and rebuilding natural systems by protecting the ocean and sea life, and cultivating native plants. It is the Native Hawaiian cultural manifestation of a central tenet of planetary health, the interdependence between human health and nature. With guidance from Native Hawaiian cultural practitioners, indigenous perspectives and practices can help to inspire future planetary health strategies that foster the rejuvenation of natural systems, respect, and responsibility for stewardship of the environment and sustainable practices.

Planetary Health is Aligned with Nursing's Theoretical Perspectives

Nurses are uniquely positioned to lead the advancement of planetary health science, as they are trained in the understanding that human health and dignity are intertwined with the vitality

of the natural world. Care for the environment is deeply rooted in nursing practice. The American Nurses Association Code of Ethics compels nurses to advocate for policies and programs within healthcare that sustain and repair the natural world.¹¹ The American Association of Colleges of Nursing also lists understanding the impact of climate change on environmental and population health as a core competency of nursing education.¹² The nursing profession recognizes that social justice and environmental justice are inextricably linked as environmental degradation disproportionately impacts women, children, Indigenous or minority groups, and people in poverty.

Planetary Health: A Call to Action for Nurses in Hawai'i

Advance Planetary Health Research

Nursing scientists must partner with community members, policy makers, other health professionals, and related scientists to continue to explore the impact climate change has on the health of communities. Evidence-based interventions are needed to promote behavior change related to sustainability (in the community and within the health system), promote emergency preparedness (for natural disasters, disease outbreaks, and medical emergencies),¹³ and address health disparities associated with the impacts of climate change. For example, health is impacted by pollution, access to food and water, disease carrying vectors, and natural disasters, and those who are less resourced or have additional vulnerabilities are most at risk. However, the best practices to support at-risk individuals and communities have yet to be fully explicated.

Advocate for Planetary Health Policy and Action

Advocacy for policy change that prioritizes climate solutions is another major area where nurses can make a big difference. Climate for Health,¹⁴ a policy and action initiative led by national health leaders, provides tools and resources for health leaders to take action and advocate for climate solutions. This organization offers a guide for health care leaders to reduce the impact that health care facilities have on the environment, including reducing the amount of energy health centers consume, reducing or off-setting carbon emissions from transportation emitted from employees and patients, and implementing tips for eco-friendly transportation options.¹⁵ Nurses can also raise awareness and join other health professionals and advocacy organizations in participating in the US Call to Action On Climate, Health, and Equity: A Policy Action Agenda. This policy agenda urges government, business, and leaders in society to recognize climate change as a health emergency and prioritize action on climate health and equity.¹⁶

Lead Change for the Community and Clinical Practice

Nurses must rally people in their communities as well as their colleagues in the health professions to (1) decrease our collective environmental footprint,² (2) prepare for public health emergencies,¹³ and (3) promote sustainability in health care delivery.¹⁷ In Hawai'i, this could mean decreasing our energy consumption, choosing locally-sourced foods (85% of Hawai'i's food is imported²), reducing consumption, reusing and recycling materials utilized in nursing care, and practicing *malama 'āina*.

Preparing for public health emergencies is an essential element of planetary health and a national priority. One of the national goals for Healthy People 2030 is to improve emergency preparedness and response by building community resilience.¹³ During emergencies, critical infrastructure like health care facilities can be damaged or destroyed, or the need for services can overwhelm capacity. Nurses must ensure that they and the communities they serve are prepared for emergencies by encouraging all households to develop family emergency plans and maintain basic supplies and medical necessities. Assisting patients during routine community-based care to create emergency action plans as part of standard health planning will help bolster overall community resilience and contribute to the protection of vulnerable groups in Hawai'i. This is especially important for populations with limited access to resources as well as households with vulnerable persons, such as *keiki* (children) and *kūpuna* (older adults). For example, Native Hawaiians, Pacific Islanders, and Filipinos in Hawai'i experienced poorer health and economic outcomes as a result of the COVID-19 pandemic.^{18–20}

Nurses must join their colleagues in our state's hospitals, clinics, and community health centers to be better prepared for public health emergencies, as well as identify and share concerns with public health leaders regarding harmful environmental exposures.²¹ Nurses might lead these efforts by providing ongoing interdisciplinary education and developing relevant emergency response competencies, such as disaster triage, proper use of personal protective equipment, emergency communication protocols and equipment, and knowledge of how to work within large-scale emergency response systems.

Nurses represent the largest segment of the health care workforce, and it is imperative for Hawai'i nurses to use their voice to enact organizational change that promotes sustainability and considers the core tenants of planetary health. Many Hawai'i nurses have joined more than 50 000 others nationwide to take part in the Nurses Climate Challenge, yet more nurses are needed. Launched by the Alliance for Nurses for Healthy Environments, this organization provides ready-to-use materials

that nurses may use to educate their colleagues and foster the larger health care community's commitment to climate solutions.¹⁶ Health care facilities are some of the biggest producers of waste and emissions,²² and an estimated 85% of hospital waste is non-hazardous and potentially could be reused and/or recycled. Across the nation, nurses have formed hospital "green teams" to address this problem, and these nurses can inspire similar solutions in Hawai'i.²³

Planetary Health and Nursing Education

Planetary health approaches are being integrated into the nursing curriculum at the University of Hawai'i at Mānoa (UHM). Faculty have developed innovative learning experiences that emphasize the link between human health and the natural environment, bolstering emergency preparedness and response skills, and integrating indigenous knowledge and values of conservation. For example, as part of new nursing student orientation, undergraduate students spend time cultivating *kalo* (taro) on campus. This is significant to Hawaiian culture, as *kalo* is a staple of the traditional Native Hawaiian diet. These activities centered on *malama 'aina* are embedded into their curriculum, allowing nursing students to reflect on how their connection to nature can shape personal and community health. The connection to Indigenous ways of thinking about land and resources is also emphasized in community/public health nursing courses. Students complete community assessments about their *ahupua'a*, which helps students identify community needs, strengths, resources, and vulnerabilities based on knowledge of local history and values. These experiences encourage students to gain a newfound perspective and engender respect for indigenous knowledge and its place in informing their nursing practice and perspectives. Ideally, this will inspire students to contribute to future local planetary health strategies.

UHM nursing students also receive robust training and education on emergency preparedness and response to natural disasters and disease outbreaks. Students participate in interprofessional simulations that include scenarios involving disaster triage and public health response measures to control communicable diseases during emergencies. These experiences prepare nursing students to learn to work collaboratively with interprofessional teams to address public health during crises.²⁴ Students in the Masters of Science Advanced Population Health Nursing program have a dedicated course on disaster nursing to prepare them to serve as leaders in disaster health management. UHM nursing students also receive training on how to engage in advocacy at the community and state level. For example, students develop infographics to raise awareness regarding the health impacts of climate change in Hawai'i communities. Faculty also help students learn to access the Hawai'i state legislature website. Students learn how to retrieve information such as legislators' contact information and locate the drafts of bills pertaining to health and social issues. Navigating the legislative process prepares UHM nursing students with knowledge of the tools necessary to engage planetary health issues at the systems level.

The impacts of climate change are evident and are already affecting human health. Nurses in Hawai'i have multiple ways to lead planetary health science and help to grow the planetary health movement in a way that reflects unique Hawaiian values. It is time for Hawai'i nurses to bring together teams that will work to address the crisis and take the lead to improve planetary health locally and globally.

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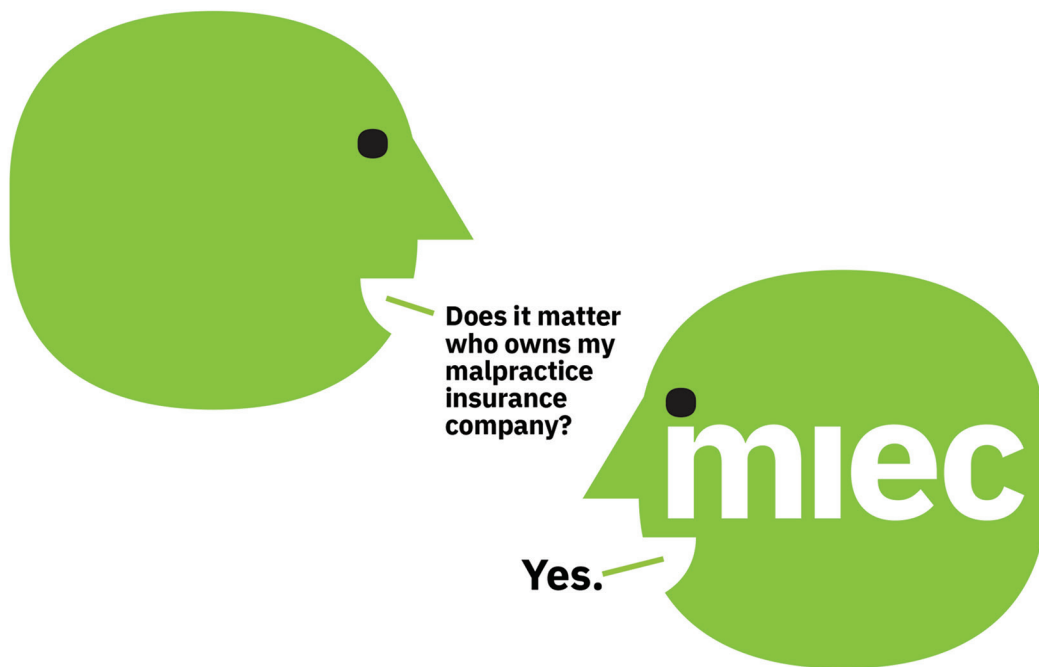
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