

# Hawai'i Journal of Health & Social Welfare

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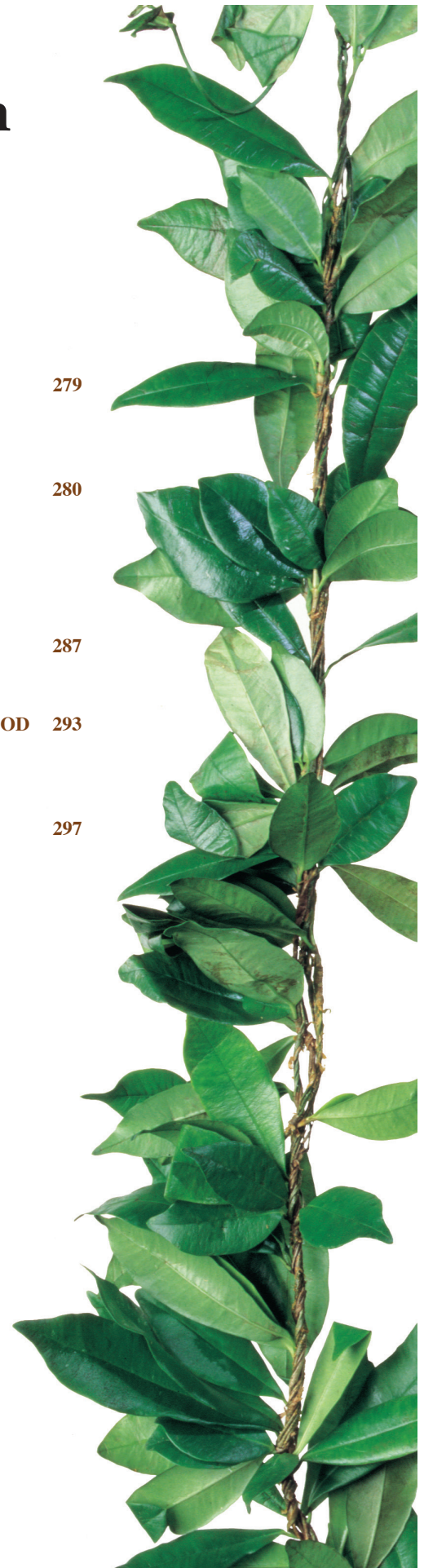
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# Hawai'i Journal of Health & Social Welfare

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

## History:

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

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

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# HAWAI'I JOURNAL WATCH

KAREN ROWAN MS

## **Highlights of recent research from the University of Hawai'i and the Hawai'i State Department of Health**

### WHERE AND WHEN RAT LUNGWORM CASES OCCUR

There were 82 reported cases of angiostrongyliasis, also called rat lungworm disease, in Hawai'i from 2007 to 2017, and most (57%) occurred between January and April, a time of cooler temperatures and heavier rainfall, a new review concludes. Researchers including David I. Johnston, of the Hawai'i State Department of Health, reviewed the case evaluation forms and medical records of cases reported to the department. Most (83%) cases occurred on the island of Hawai'i. The researchers suggested that the most effective public health prevention measures are education on how the disease is transmitted and best practices for hygiene and food storage and preparation. The paper, [Review of Cases of Angiostrongyliasis in Hawaii, 2007–2017](#), is published in *The American Journal of Tropical Medicine and Hygiene*.

### STUDENTS HIGHLY SATISFIED WITH INTERPROFESSIONAL TEAM COLLABORATION SIMULATION EXERCISE

Students of health professions must learn interprofessional communication skills, and to address this need, the Hawaii Interprofessional Team Collaboration Simulation exercise began in 2014. In the exercise, students in medicine, nursing, pharmacy, and social work collaborate to work through scenarios and receive feedback on their skills. Researchers from the Hawai'i Interprofessional Education group (HIPE) examined students' evaluations of their skills before and after this exercise. Students showed a high level of satisfaction with the exercise and increased their ratings of their competency in areas such as placing the patient/family at the center of care delivery and using effective communication techniques to enhance team function. The paper, [An Interprofessional Team Simulation Exercise About a Complex Geriatric Patient](#), is published in *Gerontology & Geriatrics Education*.

### HOW ADDICTION TREATMENT PROGRAMS' FUNDING CHANGED AFTER THE AFFORDABLE CARE ACT

The Single State Agencies (SSAs) for substance use disorder services license and oversee prevention, treatment, and recovery programs and allocate block grant funding to these programs. In a new study, researchers including Clifford S. Bersamira, PhD, of the Myron B. Thompson School of Social Work, conducted surveys of SSA directors to investigate how state funding practices changed between 2014, when key Affordable Care Act provisions went into effect, and 2017. The percentage of SSAs that provided technical assistance to programs increased in many areas, for example, assistance to collaborate with mental health providers increased by 19.3 points. However, the percentage of block grant funds allocated to prevention versus treatment changed little during the study period, and block grant funds for methadone maintenance increased less than 1 percentage point. The paper, [Changes in State Technical Assistance Priorities and Block Grant Funds for Addiction After ACA Implementation](#), is published in the *American Journal of Public Health*.

### THE CHANGING FACE OF MESOTHELIOMA

Increasing percentages of mesotheliomas — especially peritoneal mesotheliomas, which occur in the lining of the abdominal cavity — are being diagnosed in people who have not been occupationally exposed to asbestos. Researchers led by Michele Carbone, MD, PhD, of the UH Cancer Center, reviewed the epidemiology, diagnosis, and treatment of mesotheliomas. Recent research points to inflammation as well as mutations in a protein called BAP1 as having important roles in mesothelioma incidence and survival. The review concluded that misdiagnoses are a problem, and that a pathologist experienced with diagnosing mesothelioma should confirm all diagnoses. Moreover, while surgery remains controversial, greater use of genomic and immune-based biomarkers may help clinicians better ascertain whether surgery is indicated. The paper, [Mesothelioma: Scientific Clues for Prevention, Diagnosis, and Therapy](#), is published in *CA: A Cancer Journal for Clinicians*.

### PARTICIPATION IN A COMMUNITY-ACADEMIC HUI INCREASES COMMUNITY MEMBERS' TRUST IN RESEARCH

A survey of the community members and researchers who make up the Waimānalo Pono Research Hui shows that involvement in this group promotes learning and builds capacity for community research. Researchers including Jane Chung-Do, DrPh, of UH Public Health, who co-founded this hui with Ilima Ho-Lastimosa, MSW, MoA, surveyed the group. The majority of the members reported their participation in the hui increased their understanding of Native Hawaiian values. Nearly all (95%) said their involvement deepened their trust in researchers, and 85% knew how to ensure research is *pono* (righteous/moral). The researchers concluded that creating spaces for communities and researchers to build relationships can promote culturally-grounded, community-driven research. The paper, [Waimānalo Pono Research Hui: A Community–Academic Partnership to Promote Native Hawaiian Wellness through Culturally Grounded and Community-Driven Research and Programming](#), is published in the *American Journal of Community Psychology*.

### PACIFIC PEOPLES IN NEW ZEALAND: WHICH GENERATION HAS THE HEALTHIEST DIET?

Younger generations of Pacific peoples in New Zealand may be more likely to consume an unhealthy diet than older generations. Researchers including Ridvan Tupai-Firestone, PhD, of Massey University and Joseph Keawe'aimoku Kaholokula, PhD, of the John A. Burns School of Medicine, examined diet surveys of young adults, their parents, and their grandparents. The older generations ate a greater diversity of items and were more likely to have a healthy diet, compared with the young adults. Adults characterized as integrated (who reported being highly affiliated with both their Pacific heritage and mainstream culture) were more likely to have a healthy diet than those who were characterized as assimilated (who reported being highly affiliated with only mainstream culture) or marginalized (low affiliation with both cultures). The paper, [Investigating Differences in Dietary Patterns Among a Small Cross-Sectional Study of Young and Old Pacific Peoples in NZ Using Exploratory Factor Analysis: A Feasibility Study](#), is published in *BMJ Open*.

# Impact of Statewide Telestroke Network on Acute Stroke Treatment in Hawai'i

Hally M. Chaffin BA; Kazuma Nakagawa MD, FAAN, FAHA; and Matthew A. Koenig MD, FNCS

## Abstract

*Hawai'i faces unique challenges in providing access to subspecialty care, particularly on the islands outside of O'ahu. Telemedicine allows remote treatment of patients with acute ischemic stroke by a neurologist with stroke expertise. The Hawai'i Telestroke Program was implemented in 2012 to connect hospitals with limited neurology coverage to a tertiary stroke center on O'ahu with 24/7 stroke neurology coverage. By 2017, seven hospitals were included in the program. The clinical data and revascularization therapy rate for all telestroke cases between January 2012 and July 2017 were analyzed. Annual telestroke consultations increased from 11 in 2012 to 203 in 2016. Among a total of 490 telestroke consultations, 318 patients (64.9%) were diagnosed with ischemic stroke while the remaining 172 patients had other diagnoses. Revascularization therapies, including intravenous tissue plasminogen activator and mechanical thrombectomy, were provided in 190 patients (38.8%). Using the discharge modified Rankin Scale, 141 (44.3%) patients were functionally independent at the time of hospital discharge, while 162 (50.9%) were disabled or dependent, and 15 (4.7%) died while in the hospital. Of the 490 telestroke consultations, 151 patients (30.8%) were transferred to the hub hospital while 69.2% of patients were able to remain in their local hospital. In summary, development of the Hawai'i Telestroke Program resulted in an increasing number of acute telestroke consultations and revascularization therapies at seven hospitals with limited neurological subspecialty coverage. Utilization of telemedicine in acute stroke treatment is feasible and may help address existing disparities of subspecialty care in Hawai'i.*

## Keywords

*acute ischemic stroke, telemedicine, tissue plasminogen activator, inter-hospital transfer, functional outcomes, stroke mimics*

## Abbreviations and Acronyms

AIS = acute ischemic stroke

DTN = door-to-needle

IV tPA = intravenous tissue plasminogen activator

NIHSS = National Institutes of Health Stroke Scale

mRS = modified Rankin Scale

slCH = symptomatic intracranial hemorrhage

TIA = transient ischemic attack

## Introduction

The geography of an archipelago presents unique challenges in access to healthcare resources for Hawaii's 1.4 million residents. Limited access to tertiary care and a statewide physician shortage, particularly on the Hawaiian Islands outside of O'ahu, has resulted in disparities in subspecialty care.<sup>1-3</sup> While physician shortages apply across all specialties, the neurologist shortage has been reported to be especially substantial, ranging between

a 38%-100% deficit in the number of neurologists needed on the Hawaiian Islands outside of O'ahu based on population.<sup>4</sup> The demand for physicians with neurological expertise is expected to increase further with an aging population.

Stroke has been identified as the third-leading cause of death in Hawai'i.<sup>5</sup> Significant improvement in neurological deficits and functional outcome can be seen when acute ischemic stroke (AIS) is treated with emergency revascularization therapies such as intravenous tissue plasminogen activator (IV tPA) or mechanical thrombectomy. The treatment rate for IV tPA in Hawai'i has historically varied based on the geographic location of the patient at presentation<sup>1-3</sup> with a statewide treatment rate of 5.5% between 2010-2015.<sup>3</sup> In 2012, a Stroke Task Force was convened by the Hawai'i Department of Health to address disparities in stroke treatment across the state. A 2014 report to the Hawai'i legislature identified that 14.3% of hospitals had no access to a neurologist and 28.6% of hospitals reported door-to-needle (DTN) times for IV tPA administration to be greater than 60 minutes.<sup>1</sup> It was postulated that limited access to neurologists with stroke expertise was one of the main factors leading to low utilization of revascularization therapies and delay in administration of IV tPA.

One possible solution to address disparities in subspecialty care is the use of telemedicine. Telemedicine or more specifically "telestroke" is an increasingly viable option for hospitals with limited access to neurologists with stroke expertise.<sup>6</sup> The 2018 American Heart Association (AHA) guidelines now recommend the use of telestroke evaluation if in-person stroke expertise is not available.<sup>7</sup> Telestroke programs link "spoke" hospitals without 24-hour stroke expertise with "hub" hospitals, which are usually designated Primary or Comprehensive Stroke Centers with 24/7 neurological coverage. Two-way video-conferencing allows the neurologist at the hub hospital to immediately assess the stroke patient at the spoke hospital and make treatment recommendations such as IV tPA and/or mechanical thrombectomy if warranted. Additionally, telestroke programs allow the neurologist at the hub hospital to triage whether the AIS patient needs to be transferred to the hub hospital for a higher level of care. This allows AIS patients that do not require a higher level of care to remain at the spoke hospital, minimizing the cost of unnecessary inter-hospital transfer. Numerous studies assessing the impact of telestroke programs report improved IV tPA administration rates and DTN time quality metrics, after implementation of telestroke programs.<sup>8-10</sup>

The Hawai'i Telestroke Program was established in 2012 to provide stroke care through telemedicine for patients at hospitals throughout Hawai'i where timely access to a stroke neurologist is limited. Based out of the Queen's Medical Center Punchbowl, the program subsequently expanded to seven spoke hospitals on four islands by 2017. We hypothesized that the telestroke program would increase IV tPA treatment rates and reduce treatment delays with a safety profile that is similar to in-person stroke care.

## Methods

The project was supported by two grants from the Hawai'i Department of Health Neurotrauma Special Fund. From its inception in 2012, the Hawai'i Telestroke Program gradually expanded its spoke hospitals to include seven hospitals on four islands. These hospitals were connected to the hub hospital at The Queen's Medical Center Punchbowl via synchronous audio-video telemedicine equipment. During the study period, we used mobile wireless telemedicine carts manufactured by Interactive Care Technologies which included a remote pan-tilt-zoom camera that was accessible to the on-call neurologist using a web-based portal. For some hospitals, we used Polycom mobile telemedicine carts and Cisco Jabber software for two-way video calls.

All consecutive patients who were activated as acute stroke telemedicine consults from January 2012 to July 2017 were included in a prospectively collected clinical database that was used to report ongoing data to the grant funding agency. This study was based on a planned retrospective analysis of the first 500 patients in the telestroke clinical database with supplemental information collected by retrospective review of the electronic medical record (EMR) for missing data fields. The Queen's Institutional Review Committee approved the retrospective analysis and publication of these data with waiver of individual informed consent.

The Queen's Medical Center Punchbowl is a 505-bed hospital located on O'ahu, the largest tertiary referral center for the Pacific Basin. It was the only Joint Commission-certified Primary Stroke Center in Hawai'i until 2015 and it remains the only Hawai'i hospital with a dedicated neurocritical care unit. During the study period, the telestroke program was covered by two board-certified vascular neurologists and two board-certified neurointensivists who were also vascular neurology trained. The neuro-interventional program was covered by one board-certified neuro-interventionalist. In 2017, the Queen's Medical Center Punchbowl admitted 609 ischemic strokes and performed 37 mechanical thrombectomies.

The spoke hospitals (number of licensed beds, distance to the hub hospital) were: Moloka'i General Hospital (15 beds, 57 miles by air), Hilo Medical Center (157 beds, 218 miles by air), Wahiawa General Hospital (53 beds, 16 miles by ground), Maui

Memorial Medical Center (214 beds, 97 miles by air), North Hawai'i Community Hospital (42 beds, 178 miles by air), Kona Community Hospital (76 beds, 184 miles by air), and Queen's Medical Center West O'ahu (80 beds, 12 miles by ground).

Telestroke consults were initiated by providers at spoke hospitals for Emergency Department (ED) patients and hospital inpatients presenting with symptoms suggestive of AIS within 6 hours of the time the patient was last known to be normal. This time window was selected because, at the time of the study, mechanical thrombectomy was recommended for large vessel occlusion strokes within 6 hours of symptom onset.<sup>11</sup> These patients were treated before the recommended time window for mechanical thrombectomy was extended to 16-24 hours.<sup>12</sup>

Patients were subsequently evaluated by a hospital-employed on-call neurologist at the hub hospital using two-way synchronous audio-video telecommunications. Available imaging was also transmitted to and reviewed by the hub neurologist using an encrypted imaging file-sharing software (BEAM, OneMedNet) within the hub hospital picture archiving and communications systems (PACS). The hub neurologist also had access to patient laboratory values and vital signs through the EMR. The neurologist had direct access to the EMR at three of the spoke hospitals which are in the same health care system and indirect access to the EMR at other hospitals through Epic CareEverywhere and Hawai'i Health Information Exchange (HHIE). For non-Epic hospitals, clinical documentation was transmitted to the spoke hospital using an auto-fax functionality in Epic.

The hub neurologist made recommendations for or against IV tPA and mechanical thrombectomy based on clinical judgment. Providers also made triage recommendations to either transfer the patient to the hub hospital or manage the patient at the spoke hospital based on patient characteristics and local resources. The hub neurologists occasionally utilized telemedicine to access AIS patients at the hub hospital. For the purpose of this study, telemedicine use for the hub hospital was excluded from the final analyses.

The prospective clinical database collected information on patient demographics (age, sex, spoke hospital, self-reported ethnicity/race, etc) and stroke risk factors (hypertension, diabetes, atrial fibrillation, prior stroke, etc) from clinical documentation in the EMR. The initial National Institutes of Health Stroke Scale (NIHSS) score, symptom onset time, and telemedicine response and connection times were recorded by the hub neurologists. The NIHSS is the standard measure of functional disability for acute stroke where no disability is 0 and maximum disability is 42 based on standardized examination with high inter-rater validity.<sup>13</sup> One of the major quality metrics for acute stroke treatment, DTN time for IV tPA, was also recorded in the database and confirmed with review of EMR documentation. The DTN time is defined as the interval from patient arrival to time of initiating IV tPA, and shorter times reflect more ef-

efficient care processes. Outcomes were retrospectively assessed based on review of the EMR upon hospital discharge based on the modified Rankin Scale (mRS) score. The mRS is the most commonly used post-stroke disability scale where 0 is asymptomatic, 1 is symptoms without disability, 2 is slight disability but independent, 3 is moderate disability but able to ambulate, 4 is moderately severe disability, 5 is bedridden, and 6 is dead.<sup>14</sup> The hub hospital only started routinely collecting the 90-day mRS data in 2016 so prospectively collected 90-day mRS data was not consistently available for this study period. Symptomatic intracerebral hemorrhage (sICH) was also recorded in the database as a complication of revascularization therapies and verified based on retrospective review of relevant imaging by the principal investigator (MAK). Determination of sICH was based on the presence of new intracerebral hemorrhage within 24 hours of IV tPA administration and an increase in the NIHSS score by  $\geq 4$  points according to standard criteria.<sup>15,16</sup> The final diagnosis of AIS was determined by presence of visible stroke on subsequent MRI or CT imaging or persistent disability attributable to stroke in the opinion of the treating physician. “Stroke mimic” was defined as a final diagnosis other than stroke and no visible stroke on subsequent MRI or CT imaging.

### Statistical Analysis

The data were summarized by descriptive statistics using SPSS version 24.0 (SPSS IBM Inc., Chicago, IL). This was a descriptive study of the entire cohort without any attempt to perform pre-specified two-group comparisons.

### Results

From its inception in January 2012 to July 2017, the Hawai‘i Telestroke Program conducted a total of 500 telemedicine-based consultations for patients with suspected AIS. Among these, 10 telestroke consultations were performed to access suspected AIS patients at the hub hospital and these were excluded from the final analyses. A total of 490 telestroke consultations were conducted to access patients at the spoke hospitals and were included in the final analyses. Clinical characteristics of all included patients are shown in Table 1. Of the total cohort, 318 patients (64.9%) were ultimately diagnosed with stroke while the remaining 172 patients had other diagnoses.

Overall, 190 (38.8%) patients were treated with revascularization therapies via telestroke consultation (Table 2). Of those who were treated, 183 received IV tPA alone, 22 received IV tPA and mechanical thrombectomy, and 7 received mechanical thrombectomy only. The median time from patient arrival to telestroke consult activation was 15.5 minutes and the median telestroke activation to connection establishment (response time) was 6 minutes.

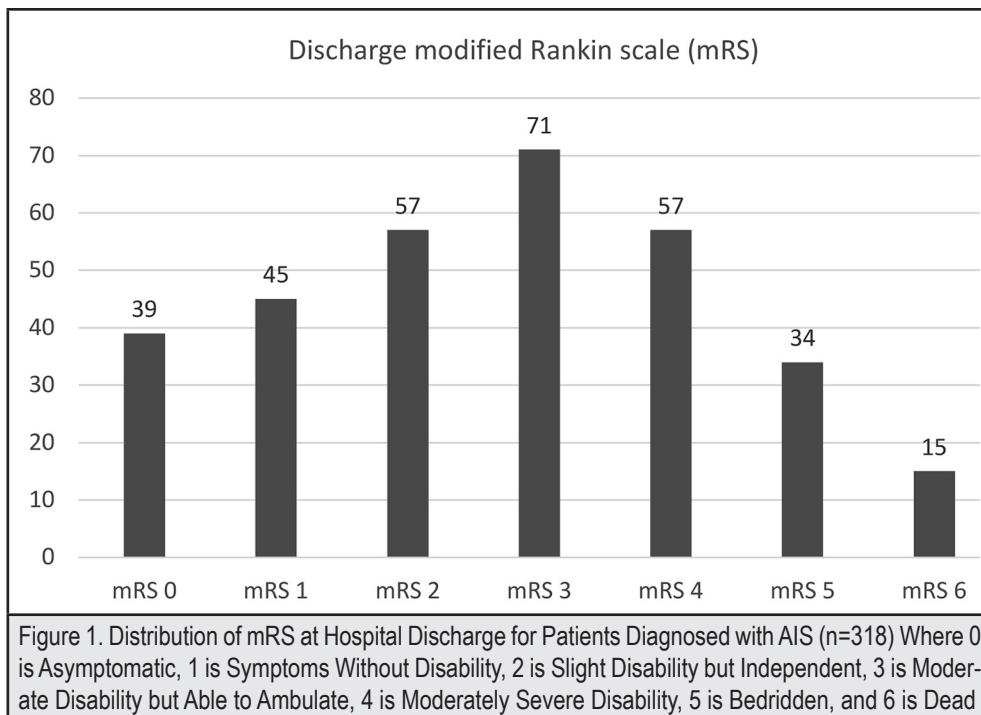
Among the 318 patients who were diagnosed with AIS, the distribution of discharge mRS is shown in Figure 1. Using discharge mRS 0-2 as the standard definition of “functional

Table 1. Clinical Characteristics	
N	490
Age, years, median [IQR]	68 [56, 78]
Sex, female, n (%)	228 (46.5)
Race/Ethnicity, n (%)	
White	157 (32.0)
Asian, non-Filipino	78 (15.9)
Filipino	117 (23.9)
Native Hawaiian or other Pacific Islander	128 (26.1)
Other or unknown	10 (2.0)
Hypertension, n (%)	313 (63.9)
Diabetes mellitus, n (%)	132 (26.9)
Atrial fibrillation, n (%)	105 (21.4)
Hyperlipidemia, n (%)	140 (28.6)
Coronary artery disease	62 (12.7)
Previous TIA or stroke, n (%)	144 (29.4)
Anticoagulant use, n (%)	84 (17.1)
Initial NIHSS, median [IQR], AIS patients only (n=318)	5 [2, 11]
Stroke Subtype, n (%), AIS patients only (n=318)	
Large artery atherosclerosis	86 (17.6)
Cardioembolism	149 (30.4)
Small vessel disease/lacunar stroke	55 (11.2)
Other determined etiology	8 (1.6)
Undetermined etiology	13 (2.7)
Unable to determine	7 (1.4)

AIS = acute ischemic stroke; IQR = interquartile range; NIHSS = National Institutes of Health Stroke Scale; TIA = transient ischemic attack

Table 2. Process Measures and Performance	
N	490
Any revascularization therapy, n (%)	
IV tPA	183 (37.3)
IV tPA + Mechanical Thrombectomy	22 (4.5)
Mechanical Thrombectomy only	7 (1.4)
Onset-to-Arrival, min, median [IQR]	70.0 [45.0, 123.5]
Arrival-to-Stroke Code Activation, min, median [IQR]	6.0 [0, 15.0]
Arrival-to-Telestroke Activation, min, median [IQR]	15.5 [7.0, 31.0]
Telestroke Activation-to-Connection Establishment, min, median [IQR]	6.0 [4.0, 10.0]
“Door-to-Needle” Time, min, median [IQR]	47.0 [39.0, 62.0]
Outcome of Telestroke Encounter, n (%)	
Not AIS (“stroke mimics”)	172 (35.1)
AIS, no treatment, remain at spoke hospital	115 (23.5)
AIS, treatment, remain at spoke hospital	52 (10.6)
AIS, no treatment, transfer to hub hospital	26 (5.3)
AIS, treatment, transfer to hub hospital	125 (25.5)

AIS = acute ischemic stroke; IQR = interquartile range; IV tPA = intravenous tissue plasminogen activator



independence”, 141 (44.3%) patients in this study were considered independent at the time of hospital discharge, while 162 (50.9%) were disabled or dependent (mRS 3-5), and 15 (4.7%) died while in the hospital (mRS 6). For the subset of 26 patients who were treated with mechanical thrombectomy, median mRS at discharge was 4.0 [3.0, 5.0].

Temporal trends of telestroke consult utilization show a consistent increase from 2012 to 2017 (Table 3). This increase reflects the growth of the Hawai‘i Telestroke Program in which the number of telestroke spoke hospitals grew from 1 in 2012 to 7 in 2017 as well as increased per-site utilization. The aggregate median DTN for IV tPA for the spoke hospitals is shown in Table 4. The median DTN across all spoke hospitals was less than 60 minutes during the study period, which is the current national benchmark.<sup>7</sup>

Of the 490 telestroke consultations, 151 patients (30.8%) were transferred to the hub hospital for further tertiary care while 69.2% of patients were able to remain in the spoke hospital for treatment. Among those AIS patients who were treated with IV tPA, 52 patients were able to remain at the spoke hospital while 125 patients were transferred to the hub hospital. Twenty-six patients with AIS who were not treated with IV tPA were also transferred to the hub hospital. Triage decisions were based on local capacity at the spoke hospital and need for higher level of care as well as patient and provider preferences. Two of the spoke hospitals do not have MRI, carotid imaging, and/or echocardiography available on-site. At these hospitals, even routine stroke patients who were not treated with IV tPA

required transfer to the hub hospital. In other cases, high risk patients with large strokes who would benefit from monitoring in the neurocritical care unit or may have needed decompressive craniectomy were transferred to the hub hospital.

Temporal Trends in Number of Telestroke Consults by Year	
Year	N
2012	11
2013	18
2014	29
2015	130
2016	203
2017*	99

\*last data in July 2017

Year	Minutes, median [interquartile range]
2012 (n = 4)	72.5 [56.8, 95.0]
2013 (n = 11)	60.0 [35.0, 62.0]
2014 (n = 11)	45.0 [42.0, 62.0]
2015 (n = 48)	44.0 [38.0, 58.8]
2016 (n = 69)	50.0 [40.5, 63.5]
2017* (n = 40)	43.5 [35.0, 60.0]

\*last data in July 2017

Among patients who were treated with revascularization therapies, 11/183 (6.0%) had sICH. Five of these patients were treated with mechanical thrombectomy in addition to IV tPA while 6 patients were treated with IV tPA alone. All of the patients with sICH had poor neurological outcomes at the time of hospital discharge with mRS 3 in 1 patient, mRS 4 in 2 patients, mRS 5 in 4 patients, and in-hospital death in 4 patients.

Despite the criterion for telestroke activation by the spoke hospital being an initial clinical impression of AIS, 172 patients (35.1%) were ultimately diagnosed with stroke mimics by the hub neurologist. These patients had final diagnoses of conversion disorder (n=57), transient ischemic attack (TIA) (n=33), encephalopathy (n=23), spontaneous ICH (n=20), seizure (n=19), migraine (n=9), and other causes (n=11). Of the 183 patients who were treated with IV tPA, 9 patients (4.9%) were ultimately diagnosed with a stroke mimic. Six patients were diagnosed with conversion disorder, 2 patients with seizure, and 1 patient with migraine. Of the 9 stroke mimic patients who were treated with IV tPA, none had sICH and all were eventually discharged to home.

## Discussion

National and regional physician shortages have encouraged the development of programs that allow patients in rural or otherwise underserved areas to receive similar care to those treated at tertiary academic medical centers. One of the most visible developments has been the implementation of telemedicine, which has been shown to be safe and effective for evaluation and treatment of AIS.<sup>16-18</sup>

Other regions have successfully implemented telestroke programs which have connected smaller, rural hospitals with Primary and Comprehensive Stroke Centers. A pilot program implemented in southeastern Louisiana that emphasized first responder training in addition to early telemedicine activation showed reduction in time to neurology consult and IV tPA administration rates that were higher than the national average.<sup>19</sup> Implementation within the Kaiser Permanente system in Southern California increased IV tPA administration for AIS by 4.6% and brought IV tPA administration rates at spoke hospitals in line with those at the Comprehensive Stroke Center.<sup>18</sup>

Our study demonstrated a significant increase in telestroke adoption and number of patients treated with revascularization therapies during the study period. Of the 490 telestroke consultations, 309 patients (69.2%) were able to remain in their local community hospital for treatment. Triage decisions regarding which patients required inter-hospital transfer were based on recommendations from the hub neurologist and spoke physician as well as patient preferences. These decisions were largely based on local resources available at the spoke hospital, local experience with post-IV tPA monitoring, and patient character-

istics such as anticipated stroke size, need for neurocritical care monitoring, or need for mechanical thrombectomy. Because of the island geography, the cost of inter-hospital transport between islands has been reported to be at least \$15,000 per patient and as high as \$70,000 in some locations.<sup>20,21</sup> Considering these costs, we anticipate that appropriate triage of stroke patients based on telemedicine will result in significant healthcare cost savings.

In this study, 339 telestroke cases did not require transfer to the hub hospital, 172 of whom were located on one of the neighbor islands outside of O'ahu. It is difficult to estimate the exact number of patients who may have been transferred to the hub hospital without the telestroke program. However, if the maximal potential cost savings were to be estimated with an assumption that all 172 cases would have been transferred using air ambulance services, it would be approximately \$6.2 million over the study period based on an average estimated air ambulance cost of \$36,000 per inter-island medical transfer.<sup>21</sup> If we were to make a conservative estimate of 10% preventable transfer among these neighbor island cases, it would still be \$620,000 in cost savings over the study period.

Since the implementation of the Hawai'i Telestroke Program, according to the Get With the Guidelines – Stroke database, the rate of DTN times under 60 minutes in Hawai'i has improved from 43.6% of patients in 2012 to 77.3% in 2017. Revascularization therapies for AIS patients at all Hawai'i hospitals also improved from 6% to 15.3% between 2012 and 2017. While these improvements may not be directly attributable to the Hawai'i Telestroke Program alone, these findings indicate an overall improvement in the number of patients in Hawai'i who received appropriate, timely therapy for AIS during the study period.

One of the strengths of telestroke care is that it has been found to be as safe as treatment based on in-person assessment in other studies.<sup>16,22</sup> The rate of inadvertent IV tPA administration in patients with stroke mimics and the rate of sICH in AIS patients treated with IV tPA are two safety concerns frequently discussed in reference to telestroke programs. Stroke mimics are those patients who initially present with symptoms similar to AIS but are ultimately determined to have a different diagnosis, such as seizures, conversion disorder, or TIA. Stroke mimics are estimated to make up around 15% of those presenting with AIS symptoms and present a dilemma for providers caring for these patients.<sup>23,24</sup> Ideally, stroke mimics are accurately identified prior to administration of IV tPA. However, time constraints for IV tPA administration often make the advanced imaging or other tests that could differentiate between AIS and stroke mimics difficult to employ. Prior case series have reported a low incidence of complications such as sICH when patients with stroke mimics are inadvertently treated with IV tPA.<sup>23-26</sup>

Remote neurological examination based on telemedicine requires different clinical skills compared to in-person neurological



examination which may raise the potential for a higher rate of inadvertent IV tPA treatment in stroke mimics. In the present study, 35.1% of patients who received a telestroke consult were ultimately determined to be stroke mimics. Of the patients treated with IV tPA in the present study, 11 patients (4.9%) were subsequently diagnosed with a stroke mimic. Our findings were similar to a prior large multi-center study that reported 32.6% of telestroke activations were ultimately diagnosed with a stroke mimic.<sup>27</sup> Increasing numbers of SM patients are likely being evaluated via Telestroke. We developed a model to prospectively identify ischemic SMs during Telestroke evaluation. **METHODS AND RESULTS:** We analyzed 829 consecutive patients from January 2004 to April 2013 in our internal New England-based Partners TeleStroke Network for a derivation cohort, and 332 cases for internal validation. External validation was performed on 226 cases from January 2008 to August 2012 in the Partners National TeleStroke Network. A predictive score was developed using stepwise logistic regression, and its performance was assessed using receiver-operating characteristic (ROC). Two prior studies reported stroke mimic rates of 7% and 7.8% among patients treated with IV tPA based on telestroke consultation which was similar to the stroke mimic rate among patients treated with IV tPA based on in-person examinations in their respective cohorts.<sup>28,29</sup>

Some studies have attempted to identify factors that are associated with higher likelihood that a patient's symptoms are caused by a stroke mimic.<sup>27</sup> These studies suggest that stroke mimics are more common in patients who are younger, present with a minor neurological deficit, and have lower NIHSS scores.<sup>23,24,27</sup> Evaluation and IV tPA treatment oversight by a neurologist reduces the likelihood that a stroke mimic patient will be administered IV tPA compared with emergency physicians acting without neurological consultation.<sup>30</sup> Telestroke programs that connect patients with neurologists are likely to improve appropriate IV tPA administration rates and reduce inadvertent treatment of stroke mimics.

An uncommon but significant complication after IV tPA administration is sICH. Rates of sICH in AIS patients treated with IV tPA have been shown to be no different in telestroke assessments when compared with in-person assessments.<sup>19</sup> In the present study, 6% of patients who were treated with revascularization therapies developed sICH over the course of the study period. A disproportionate number of patients with sICH were treated with the combination of IV tPA and mechanical thrombectomy rather than IV tPA alone. The sICH rate was similar to the rate reported in the original National Institute of Neurological Disorders and Stroke (NINDS) treatment trial and the package labeling for IV tPA (6.4%)<sup>31</sup> but higher than post-marketing surveillance data from the Safe Implementation of Treatment in Stroke (SITS) registries (1.6-2.2%).<sup>15,32</sup> A meta-analysis of prior observational studies of telestroke programs reported a range of sICH of 1-8% which was similar to control groups of patients treated with IV tPA in-person.<sup>8</sup>

This study has some important limitations based on the geography and healthcare systems in Hawai'i and the retrospective nature of the study design. First, due to the unique island geography of Hawai'i, the results may not be generalizable to healthcare systems in other regions. Second, longer term functional outcomes were not available for many of the patients in this study, particularly those who were not transferred to the hub hospital. Because of this limitation, the long-term safety and outcomes of telestroke treatment are not known. Third, although the study was based on a prospectively collected database, some retrospective chart review was required to obtain data regarding the final diagnosis, imaging results, and functional outcomes. Retrospective EMR review was often required for patients who were not transferred to the hub hospital. Investigators conducting these retrospective reviews were not blinded to the initial treatment decisions which could introduce outcome ascertainment bias.

The unique environment of the Hawaiian Islands presents many challenges to care for patients on islands other than O'ahu who may not have timely access to a neurologist. While stroke is a leading cause of death and disability in Hawai'i, patients living on other islands and in rural areas have historically had difficulty accessing the same quality stroke care as those patients living in urban Honolulu. The Hawai'i Telestroke Program has sought to bridge the gap for these patients through the implementation of a telemedicine program that connects hospitals with acute stroke care. The program has been shown to be safe and effective at improving rates of revascularization therapies and reducing DTN time across all hospitals where the program was implemented. In future studies it would be beneficial to assess long-term outcomes of patients treated with IV tPA and outcome trends at individual hospitals within the Hawai'i Telestroke Program.

## Conflict of Interest

None of the authors identify any conflicts of interest.

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# Examining the Use of Photovoice to Explore Disaster Risk Perception Among Native Hawaiians Living on O‘ahu: A Feasibility Study

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## Abstract

*The purpose of this feasibility study was to evaluate the use of Photovoice (PV) to explore disaster risk perception (RP) among Native Hawaiians living on O‘ahu. Six participants identified 5 primary concerns: (a) issues of infrastructure, (b) Oahu’s dependence on imports, (c) concern for family, (d) the presence of outsiders in the community during disaster warning periods, and (e) the complexity of the issue. Findings from this study suggest PV shows potential as a useful tool for evaluating risk perception and providing valuable community insight. Despite the potentially stressful nature of examining the outcomes of a disaster, speaking with members of the community in a supportive environment provided protection and encouragement. Finally, the use of community-based participatory research (CBPR) and participatory action research (PAR) methodologies facilitates a trusting relationship between the researcher and the community which may help improve disaster-planning efforts.*

## Keywords

*CBPR, disaster preparedness, Native Hawaiians, Photovoice, qualitative methods, risk perception*

## Abbreviations

*CBPR = community-based participatory research  
PAR = participatory action research  
PV = Photovoice (PV)  
RP = risk perception*

As various hazards increasingly threaten Hawai‘i, the need for disaster planning expands. The complicated dynamics potentiating catastrophic events are an interaction of natural hazards, human behavior, and sociocultural factors.<sup>1-3</sup> Effective preparedness minimizes the consequences of disasters and improves outcomes.<sup>1-3</sup> Despite efforts to communicate concerns to the public, community members’ understanding of risk and potential dangers remains largely unknown.<sup>4-6</sup> This feasibility study evaluated the use of a research method called Photovoice (PV) to determine disaster risk perception (RP) among Native Hawaiians on the island of O‘ahu, Hawai‘i. Owing to cultural and historical factors, Native Hawaiians may have unique perspectives regarding risk. Understanding how Native Hawaiians perceive the risk for disasters in their communities can assist emergency planners with developing risk communication and disaster preparedness strategies.

## Risk Perception

RP is the awareness of possible consequences or outcomes and their likely costs.<sup>7</sup> Honolulu faces a range of threats including earthquakes, hurricanes, tsunamis, landslides, flooding, and wildfires.<sup>8</sup> Determining whether communities recognize these as concerns is vital to developing effective preparedness plans.<sup>6,7</sup> RP is essential to emergency planners because of the role it plays in decision-making; people prepare when they feel threatened or stand to lose something.<sup>2,3,7,9</sup> RP is generated within communities in response to the threats the community prioritizes.<sup>9-12</sup> Because community members share concerns, people respond to threats perceived within their social systems.<sup>11-14</sup> Culture is a dominant influence on RP because it acts as the basis for understanding threats and ascribing value to outcomes.<sup>10-13</sup> Understanding a community’s unique perspective regarding risk strengthens the ability to make accurate assessments of the community’s concerns based on the shared experiences of community members.<sup>10, 12,13</sup>

## Understanding Risk

Encouraging disaster planning is challenging because knowledge alone does not motivate change.<sup>10,11,14</sup> Paton identified RP as a contributing factor for taking action.<sup>15</sup> The literature supports Paton’s model, demonstrating that people are more likely to plan for disasters when they understand potential threats.<sup>9,16</sup> Slepski identified 3 antecedents to disaster preparedness: awareness of the environment, perceived threat, and recognition of needs.<sup>16</sup> Abramson explained that culture, socioeconomic, age, and ethnicity contribute to risk perception and influence how people prepare.<sup>9</sup>

## Native Hawaiians

Native Hawaiians have a unique relationship to the land and may have extensive knowledge of the local area.<sup>17-19</sup> That knowledge may provide contextual understanding that will better prepare disaster planners working in Hawai‘i.<sup>10,11,13,20</sup> Understanding RP from the perspective of Native Hawaiians could help disaster planners determine if existing risk assessments match perceived risk.<sup>3,21,22</sup> This information could then be used to improve risk communications and preparedness efforts.<sup>3,22,23</sup>

## Photovoice

PV is a qualitative research method that uses photographs taken by participants to answer research questions and is rooted in participatory action research (PAR) and community-based participatory research (CBPR).<sup>24,25</sup> PV involves participants recording day-to-day phenomena and provides graphic authenticity of participants' lives to facilitate understanding.<sup>26-28</sup> The images that participants capture form the basis for discussions to further develop their research questions.<sup>25,26</sup>

PV involves 3 steps. First, participants learn camera use, discuss ethical issues, and develop research questions. Second, they take pictures to address the research questions. Third, the researcher works with participants to respond to concerns uncovered through the research process.<sup>26-29</sup> There are many ways to utilize PV research; investigators take into account the specifics of a project and aim to meet the needs of the participating community. For example, participants may use cameras or the cameras built into their phones. Images may be shared in person or presented online. All PV projects require participants to take pictures and share the meaning of those images in a group setting to describe the significance of their images and establish which pictures best present the concerns of the group.<sup>25-29</sup> Participants in this study used cameras provided by the researcher and shared their images at meetings held in the community.

Despite its use in an array of settings to examine a multitude of questions, PV has been used minimally to explore disaster risk perception. This study sought to explore the use of PV as a method for assessing community-based disaster risk perception in a Native Hawaiian community. The researcher was a faculty member at the University of Hawai'i when this research was conducted and formed a relationship with the community as a community nursing clinical instructor. The researcher received no funding and has no conflict of interest to disclose.

## Methods

### Research Design

This feasibility study was conducted to explore the use of PV as a method for assessing community-based disaster risk perception. Community leaders reviewed the study to affirm its appropriateness before recruitment began. The Institutional Review Board at the University of Hawai'i Human Studies Program approved the study protocol and all participants gave written informed consent. Recruitment began in May 2017. Participants met as a group for a total of 5 times over 2 weeks. At the first meeting, the researcher explained the goal of the research, the use of PV, the anticipated time commitment, and the need to share images with one another and the public. Par-

ticipants also received their cameras and instructions on how to use them from a professional photographer.<sup>25,27,29</sup> Participants then met 3 more times to review photos they took and refine their response to the research question. At the final meeting, the group clarified remaining questions, decided what they wanted to do in response to the issues they uncovered, and discussed the use of PV.

### Participants

Participants meeting criteria for this study included individuals who lived or worked in the community, identified as Native Hawaiian, were at least 18 years old, and could speak English to the extent required by the project. Minors were excluded from the project because of the potential for the topic to cause anxiety.<sup>7,9</sup> Participants were recruited using convenience sampling with the help of community leaders who screened potential participants and discussed the project at community meetings. A sample size of 6 participants was supported by the research design and previous PV projects.<sup>25,28,29</sup> Participants received a \$5 gift card at each meeting they attended and were asked to keep the cameras they used, valued at \$40.

### Setting

The research took place in a Hawaiian Homestead community elevated above the surrounding neighborhoods and accessible by a single road through the community and several parallel cross-streets. Hawaiian Homesteads are divisions of land set aside for individuals who meet the criteria of having at least 50 percent Hawaiian blood. These areas were designated by the Hawaiian Homes Commission Act of 1920 and are managed by the Department of Hawaiian Home Lands.<sup>30</sup> Due to the topography, many homes in the neighborhood are built above or below roads on steep inclines. Meetings were held in a semi-private setting at the neighborhood community center.

### Measures

Participants were asked their age, gender, how long they had lived or worked in the community, and if they had experienced a disaster event. No personally identifiable information was collected. Using images, participants were asked to answer the question, "How do you identify risks for the consequences for natural disasters in this community?" Participants were asked not to photograph identifiers such as faces, addresses, and homes. Participants returned in 2 days with 5 images each that best expressed their responses. Photos were shared with the group via projector, allowing examination of one photo at a time for analysis and discussion. At the conclusion of the study, the researcher asked a series of questions related to the use of PV to clarify participants' perceptions of accuracy, ease of use, and value of what was uncovered using PV.

## Data Management and Analysis

The group as a whole reviewed photos in an iterative process during 3 meetings. Participants used the mnemonic SHOWeD to explore each image systematically.<sup>31</sup> This technique asks participants to consider each image in terms of S (what do you See?), H (what's Happening), O (how does the image relate to Our lives), W (Why does this image concern or strengthen us), and eD (what can we Do about what we see?). This procedure was initiated by the person who took the photo and expanded on collectively. Rather than direct the conversation, the researcher interjected only as needed while the group explored ideas. Concentrated dialogue shaped the focus of each session, where participants developed ideas about images they wanted for the next meeting.

During each meeting, conversations were audio-recorded and handwritten notes were taken. A total of 159 photos were reviewed; images eliciting strong responses were logged and discussed separately in connection with the audio recordings. The researcher sought to clarify thematic concerns and explore pictures that provoked the most noteworthy reactions from the group. Images, recordings, and notes were made available to the group for their review throughout the process.<sup>25-29</sup> The researcher reviewed the recordings and notes, confirming his interpretation with the participants at each meeting. Themes were identified and validated by the group as a whole throughout the sessions.

## Results

Six participants took part in the study. Participants came from 3 age groups: 18-39, 40-59, and >59. There were 2 people in each age group. Four of the participants were women, 1 of the men was in the 18-39 age-group, and 1 man was in the >59 group. All participants had experienced some form of disaster, though participants in the 18-39 age group said they had not experienced a “serious” or “significant” event. One of the younger participants had considerable disaster preparedness training through the American Red Cross.

Participants characterized 5 themes during the group discussions: (a) infrastructure and upkeep, (b) dependence on imports, (c) concern for family, (d) outsiders in the community, and (e) complexity of disasters. The group confirmed that these topics were the most critical issues for the community.

### Infrastructure and Upkeep

The condition of homes was a constant concern. Participants worried that rubbish could become dangerous in high winds or washed into drainage culverts by heavy rains. One person stated, “I’ve seen all that stuff, you know, get washed down the road into the ditches and making things worse downstream, sometimes.” Yard debris, including tree clippings, rocks, building material, and car parts, were included in photos. Every

participant recalled how trash clogging drains and culvert grates exacerbated flooding.

Participants explained that community members are obligated to keep their homes and yards clean, safe, and in good condition, worrying that failure to keep them maintained could make things worse during a disaster. One participant wondered, “Some of these houses are so bad right now . . . the overall condition, what would happen in an earthquake, could they stand?”

Participants also identified issues they felt the local government was responsible for, such as maintenance of drainage systems. They provided images of power lines running through trees and expressed concern for electrical outages as a result of high winds or earthquakes. One participant stated, “This stuff isn’t on us, I mean, we can’t be the ones to do this work, or haul some of this stuff away, we don’t have the equipment for it.”

### Dependence on Imports

Participants were surprised upon seeing an image of Costco (Figure 1) and hearing worry-related to stores closing during a disaster: “What will we do when the stores close, or run out of stuff, this is where everything comes from, right here.” Participants listed things they needed from stores: food, household goods, fuel, medication, bottled water, and other goods. They expressed concern as they realized O’ahu’s dependence on imports: “It won’t be just us you know, it’s going to be everyone, everyone will only have what they have, they won’t be able to go get anything.”

This conversation led to questions regarding stores running out of supplies and how long the community might have to



Figure 1. Dependence on outside resources. Costco represented dependence on outside goods including food and household-goods. Used with permission.

wait for imports. One participant wondered: “*Seems like we should know how long it will take for ships to come when we think about planning?*”

### Concern for Family

Family was identified as both a strength and vulnerability. The participants saw themselves as responsible for older and younger members of the community but also recognized they might need help from family. No issue demanded as much attention as family, as the connection to family and friends was discussed at length. One participant explained, “*All I know for sure is I’m going to have to take care of my mom, that’s where I’ll be, you can find me there.*” All participants identified family as their greatest concern. Thinking about family made participants feel vulnerable but also motivated them to take action. Despite having been asked not to share photos of people, everyone shared images of children and parents, explaining the responsibility they felt for family superseded self-concern. One participant said, “*You guys know these are the people I take care of, and these are the people who will help me.*”

Acutely aware of the vulnerability of family members, participants identified frail adults and young children as primary concerns. They talked about limited evacuation options because some family members could not be moved. A participant who cared for her mother said, “*You know my mom can’t move, so I don’t know, I mean, we aren’t going to leave her.*” Participants unable to identify threats to themselves were easily able to explain family members’ risks.

### Outsiders in the Community

Participants identified 2 groups of outsiders regularly who make their way into the community: people who are homeless and those seeking higher ground during tsunami warnings. Participants worried that people who are homeless would be a liability because no one would know to look for them. The concern was not for the safety of community residents but the safety of the homeless. One participant said, “*These guys kind of hide, they lay low, some of us know where they stay, but most people don’t know, so how would anyone know if they get hurt?*” This concern was greater among the older participants who had more experience with the homeless.

Because the community is above surrounding neighborhoods (Figure 2), it is considered a refuge from tsunamis. Outsiders seeking high ground are viewed as a vulnerability for the community because they would need resources. Participants explained they had witnessed “*cars lining the street, up and down*” during tsunami warnings, congested roads and crowded public toilets. They wondered how outsiders would fit into the community during a disaster. In this community, where everyone has a role and history with one another, outsiders do not fit in well. One person asked: “*Nobody knows these people, they don’t know us, what are we going to do with them, how are they going to help?*” Despite these concerns, participants agreed they could not turn people away. Part of the community’s identity is expressed through their capacity to give and care for others, even strangers, when resources are limited. This belief was echoed by all 6 participants, articulated most clearly by older participants.



Figure 2. A view of the city. Participants agreed this photo illustrates the number of people who might be affected by a disaster and move into the community. Used with permission.

## Complexity of the Issue

Participants repeatedly identified the complexity of their concerns related to disasters. *“This issue is just so big, when you think about it, I mean, think about how much could happen, how complicated it is.”* They talked about how disasters could affect the community, wondering how earthquakes differ from hurricanes. They voiced worry for people who assume that someone else will help, and they discussed difficulty bringing up the issue in the community at large. All participants recognized the need to discuss personal responsibility within the community before an event takes place. Much of this conversation focused on avoiding embarrassing others: *“Some of these people want to do the right thing I’m sure, but they don’t have the time or the money, you know, those guys need help now.”* By the conclusion of the project, all participants recognized the interconnectedness between their fears and the need to plan for identified threats.

## Participatory Action Aspect

At the conclusion of this study, participants asked the researcher to provide a PowerPoint for future presentations in the community. Community leaders presented the findings of this project to representatives from the Department of Hawaiian Home Lands. The participants felt that using their images would communicate concerns directly to an entity with the power to make necessary changes.

## Observations Regarding Photovoice

Participants believed the results of this study were accurate and described the concerns of the community as a whole. They felt PV was easy to understand and fun to use. Finally, they felt the issues they uncovered needed to be addressed, and explained a sense of needing to prepare or take action. Though participants shared project ownership, the researcher led the project, maintained IRB guidelines, and maintained methodological fidelity. From this perspective, the researcher noticed the following 3 issues: participant input, photo variance, and topic anxiety.

### *Participant Input*

Participants can change direction of the research. For example, participants asked to include community members not approved by the IRB. While this was understandable, the researcher felt the project should be limited to the participants approved by the IRB.

Participants wanted to share their “happy space,” the things they enjoyed and worried about losing in a disaster. This deviated from the original research question, but added depth to discussion and allowed participants to discuss factors that motivated them to prepare.

### *Photo Variance*

Consistent with PV-based studies, some images were unanticipated by the researcher and participants, which led to consideration of ideas the group wanted to further explore. Participants felt some photos did not make sense or strayed from the project’s aim, and it was difficult to determine if the researcher should interject, but allowing the group to decide seemed the best approach.

A participant shared pictures of medications, bank statements, and family records, which generated conversation regarding the idea of threats from natural disasters. Participants realized threats could be more than damage-causing hazards and started discussing risks affecting needs and responsibilities: *“It’s not just something like a flood, it’s going to be having to get to family, or get medications for my mom, that’s a risk too.”*

### *Topic Anxiety*

Discussing disasters and catastrophic consequences caused worry among participants. The discussion often focused on vulnerable community members like children and the elderly. Participants named family members and explained reasons for worry: dependence on medication or anxiety that a child might lose a parent. Tense moments never lasted long; someone would refocus the group to stay motivated. Having 3 age groups facilitated confronting stressful topics, this support may also be a result of the unique community dynamic of being associated by geography, ethnicity, and local ties. In other groups, researcher intervention may be necessary.

## Discussion

PV is useful for evaluating RP and providing community insight. Participants enjoyed the method and learned from the discussions. Sharing images gave participants confidence to discuss issues using pictures as guides. Similarly, images provided understanding of other peoples’ perspectives. Iterative discussions allowed for reflection and facilitated the opportunity to build upon earlier ideas. This process helped participants explain themselves and gave them time to develop questions about one another’s photos and ideas.

Ongoing reflection and clarification among the participants may be particularly helpful in exploring disaster risk perception, as the topic is often difficult to describe or articulate. Because PV uses participant-generated images for discussion and allows for clarification and collaboration, ideas can be thoroughly articulated during multiple meetings.

Despite the stress of examining disaster outcomes, speaking with participants in a supportive environment provided encouragement. Participants reminded one another of the importance of preparatory action and affirmed community

members' responsibility. Finally, the ongoing nature of PV interviews and the depth of the discussions helped to form a relationship between the researcher and the participants who became increasingly comfortable asking questions related to preparedness and planning. The participatory action nature of PV requires the researcher strive for a solution to identified issues which reinforces the feeling of trust between the researcher and the participants.

## Limitations

This study has several limitations. In PV projects, it is difficult to determine if the participants' views and concerns accurately represent those of their community. Despite the cross-section of participants, transferability may be difficult. Also, timely completion of the project limited the number of meetings, but the group had begun to move their focus away from risks. The research question motivated participants to seek solutions, and in the final session, participants shifted the discussion to preparation and planning rather than risk identification. Despite the limited number of meetings, the group's focus changed, and it seemed the emphasis on risk gave way to preparation. Finally, the researcher worked independently, although community members provided clarification to ensure accuracy themes were identified alone. Future projects would benefit from collaboration involving at least one more researcher to code themes independently to improve validity of the findings.

## Conclusion

PV is a viable investigative instrument with the potential to reveal perspectives from diverse communities. The method allows partner communities to become co-investigators, encourages ownership of the process, and facilitates discovery of community members' priorities. Images potentially serve as the impetus for in-depth conversations leading to contextual understanding of participants' perspectives. The collaborative nature of PV and development of group dynamics may provide a safe environment for exploring a potentially distressing topic such as disasters.

Researchers utilizing PV should be prepared for the time required for the project. They have to appreciate that conversations need focused engagement with community members who may demand clarification and guidance. Researchers should also prepare to uncover information beyond the scope of the project.

## Conflict of Interest

The author does not identify a conflict of interest.

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# Overlooking Recurrent Acute Rheumatic Fever in Adulthood

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## Abstract

*Acute rheumatic fever in an adult is a rare entity. We present a 29-year-old man of mixed ancestry, including Native Hawaiian and other Pacific Islander, who presented with a 6-week history of migratory polyarthralgia and fever with a recent history of purulent lower extremity wounds and a remote history of acute rheumatic fever in childhood. The diagnosis of recurrent acute rheumatic fever was confirmed by elevated Antistreptolysin-O titers and Anti-DNase B titers. This case presentation showcases a Native Hawaiian and other Pacific Islander with acute rheumatic fever in both childhood and adulthood following pyoderma infection, with a delay in diagnosis and management for both episodes. The patient had an excellent response to naproxen without developing complications and was restarted on secondary antibiotic prophylaxis. Health care providers in the Pacific region should understand the relationship between pyoderma and acute rheumatic fever in addition to including acute rheumatic fever in the differential diagnosis of polyarthralgia in an adult.*

## Keywords

*acute rheumatic fever, migratory polyarthritis, rheumatic heart disease, pyoderma, Pacific Islander*

## Abbreviations

ARF = Acute Rheumatic Fever  
ASOT = Antistreptolysin O Titer  
CRP = C-Reactive Protein  
ESR = Erythrocyte Sedimentation Rate  
GAS = Group A Streptococcus  
RHD = Rheumatic Heart Disease

## Introduction

Acute rheumatic fever (ARF) is an autoimmune process secondary to cross-reactivity of antibodies against group A streptococcal (GAS) antigens with that of tissues throughout the body, including the heart, joints, nervous tissue, and subcutaneous tissue.<sup>1-3</sup> Untreated ARF is notorious for leading to the development of rheumatic heart disease (RHD), which is caused by autoimmune damage of cardiac tissue and can result in severe valvular damage and heart failure.<sup>3</sup> The involvement of joints in ARF includes a migratory polyarthralgia that can often be confused with other autoimmune systemic inflammatory conditions, such as rheumatoid arthritis or other collagen diseases. The recurrence of ARF is most commonly seen in children and adolescents given the increased risk of developing ARF secondary to untreated streptococcal pharyngitis.<sup>1,4</sup> However, recurrence of ARF is rarely encountered in adults in developed countries given the advent of antibiotics and secondary prophylaxis, which may lead to the condition going

misdiagnosed or undiagnosed.<sup>1</sup> Treating ARF appropriately and in a timely manner is crucial for decreasing the risk of developing or worsening RHD.<sup>2,5</sup> Herein, we describe a patient with a delayed diagnosis of recurrent ARF complicated by crippling migratory polyarthralgia.

## Case Report

A 29-year-old Native Hawaiian and other Pacific Islander man presented to the emergency department with a 6-week history of migratory polyarthralgia and fever. He had a history of recently resolved non-healing wounds of 4-months duration of the right lower extremity, obesity, and acute rheumatic fever at the age of 5. He had taken penicillin V for secondary prophylaxis for rheumatic fever from the age of 5 until the age of 18, when he decided to self-discontinue the medication. He was in a motorcycle accident 6-months prior to admission and sustained multiple lacerations to his right lower leg and used hydrogen peroxide every other day to clean the wounds due to the presence of pus. The arthralgia first developed 6-weeks prior to admission when he first sought medical attention for his right lower leg non-healing wounds and was initially treated with clindamycin. The arthralgia first developed in the left knee and progressively spread to affect the right knee followed by the ankles, hips, shoulders, and multiple joints of the hands bilaterally. He additionally reported developing a fever, fatigue, a 40 lb. weight loss over this 6-week period, and diffuse muscle pain involving the lower back, upper back, neck, and both shoulders around the same time. After the development of arthralgia, he was switched to doxycycline, but the symptoms continued to worsen. Approximately 1-month prior to admission, he had an extensive rheumatologic workup at a community hospital that was unremarkable for autoimmune rheumatologic conditions and empirically given a 2-week course of prednisone 20 mg daily. Prednisone provided partial relief of his symptoms, but upon discontinuation without tapering, the arthralgia worsened eventually to the point of paralyzing the patient, which led his family to take him to the emergency department.

On physical examination, he was in no acute distress at rest with a temperature of 37.2 C, a heart rate of 88 beats/min, a blood pressure of 124/68 mmHg, a respiratory rate of 20/min, an oxygen saturation of 97% on room air, and a body mass index (BMI) of 40.69. No pharyngeal erythema, tonsillar exudate, or cervical lymphadenopathy were found on the physical exam. A 3/6 holosystolic murmur was heard loudest at the left midclavicular line between the 5<sup>th</sup> and 6<sup>th</sup> ribs with radiation

to the axilla. There were no extra heart sounds, opening snaps, rubs, or diastolic murmurs heard on the physical exam. There were no physical exam findings suggestive of heart failure such as crackles upon auscultation of the lungs, lower leg pitting edema or elevated jugular venous pressure. Swelling, warmth, and tenderness to palpation over the right temporomandibular joint, shoulders, wrists, metacarpophalangeal joints, proximal interphalangeal joints, hips, knees, and ankles bilaterally were found on the physical exam, and these were worse in the right hand that elicited tearing upon manipulation (Figure 1). There were no apparent joint effusions in both hands. Range of motion in affected joints was limited by pain with passive motion. Multiple healing ulcerated lesions of the anterolateral surface of the right lower extremity with no exudate or surrounding erythema were noted.

Laboratory studies revealed an elevated white blood cell count of 14,800/ $\mu$ L with 73.4% neutrophils, hemoglobin of 12.3 g/dL, and platelet count of 391,000/ $\mu$ L. Additional significant laboratory values include C-reactive protein (CRP) of 146.0 mg/L, erythrocyte sedimentation rate (ESR) of >130 mm/hr, Antistreptolysin O Titer (ASOT) of 525 IU, Anti-DNase B of 1240 units/mL, and ferritin of 992 ng/mL. Extensive autoimmune workup including Human Immunodeficiency Virus, Epstein-Barr Virus, Hepatitis B, Hepatitis C, and Lyme disease were negative. Thyroid stimulating hormone, aldolase, creatinine kinase, lactic acid, lactate dehydrogenase, C3, and C4 were all within normal limits. Blood cultures on admission were negative. Synovial fluid analysis and culture showed many leukocytes but no bacteria. Electrocardiogram revealed sinus tachycardia with no PR interval prolongation. Echocardiogram revealed an ejection fraction of 55%-60%, no valvular vegetations, mild mitral regurgitation, mild mitral stenosis with mitral valve leaflets appearing rheumatic, mild aortic regurgitation, and a mean transmitral gradient of 4 mmHg.

The patient was diagnosed with a recurrent bout of rheumatic fever using the World Health Organization (WHO) criteria for the diagnosis of rheumatic fever and rheumatic heart disease.<sup>6</sup> On the day of admission, the patient was empirically treated with one dose of 20 mg of prednisone due to his previous improvement of his arthralgias on this regimen when treated at the community hospital a few weeks prior. He was then switched to 500 mg of naproxen twice a day, given his history of developing severe epistaxis with aspirin and naproxen being an acceptable alternative with outcomes comparable to aspirin.<sup>7</sup> On the second day of admission, the patient's symptoms dramatically improved, with a decrease in pain with passive movement and full range of motion in all affected extremities. Prophylactic penicillin V with instructions was initiated and prescribed to be continued until the age of 40. Upon discharge on the 4th day of admission, the patient's polyarthralgia was completely resolved and CRP returned to within normal limits.

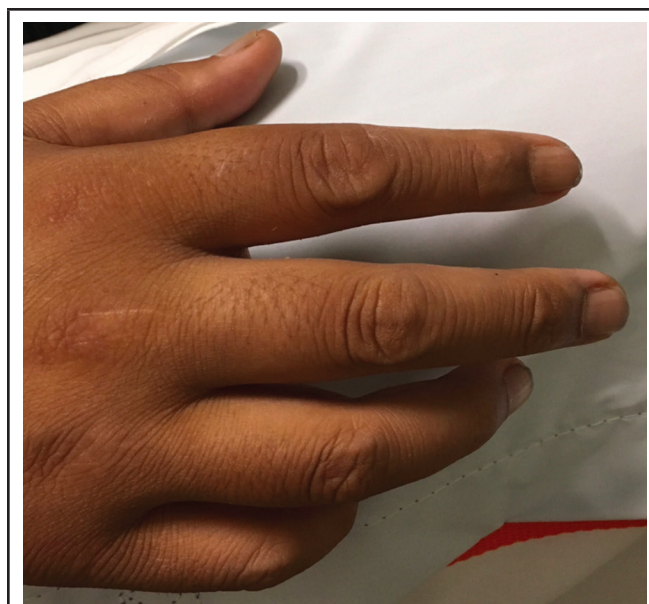


Figure 1. Picture Depicting Patient Attempting to Fully Extend Fingers of Right Hand, which were Limited by Pain.

## Discussion

ARF is an autoimmune process by which antibodies against GAS antigens cross-react with and damage native tissues throughout the body.<sup>2</sup> Autoimmune damage of the heart is the most notorious of the complications associated with ARF given the association of developing RHD in untreated patients, which may consist of irreversible valvular damage and heart failure. Since the advent of antibiotics, the incidence of RHD is low in developed countries.<sup>8,9</sup> However, clinically inapparent streptococcal infections or symptomatic patients not seeking care are common reasons for a delay in diagnosis and management of ARF in developed countries.<sup>9</sup> The patient in our report had a delayed diagnosis of recurrent ARF presumed to be secondary to lower extremity cellulitis. Because early management of ARF can decrease the risk of developing valvular damage, the early diagnosis and management of ARF is crucial.<sup>9</sup> Recurrence of ARF can result from subsequent GAS infections, in which each recurrence can cause further valvular damage and thus worsen RHD. Additionally, in one study, recurrent episodes of ARF were associated with higher mortality compared to the first episode of ARF.<sup>4,10</sup> Thus secondary prophylaxis with long term antibiotics, prompt diagnosis, and antibiotic management of underlying GAS infections is of utmost importance to prevent worsening of RHD and decrease mortality in patients with a history of ARF.<sup>4,9</sup> Although we were able to appropriately manage our patient's condition and provide almost instantaneous relief of his symptoms, this delay in diagnosis and proper management may have contributed to further irreversible valvular damage that could potentially increase his risk for developing complications in the future and require valvular surgery.<sup>11</sup>

Our patient met the WHO criteria for a recurrent episode of rheumatic fever due to his history of rheumatic fever as a child, evidence of polyarthritis (one major manifestation), fever and elevated acute phase reactants (two minor manifestations) with supporting evidence of elevated ASOT and pyoderma as a source of infection.<sup>6</sup> Unlike the Jones criteria that was previously used to diagnose rheumatic fever, the WHO criteria is a revision that further categorizes patients based on the presence or absence of RHD. The WHO criteria still holds onto the major and minor manifestations used in the Jones criteria that are key for recognizing and diagnosing ARF. Major manifestations consist of polyarthritis, carditis, subcutaneous nodules, erythema marginatum and chorea. Minor manifestations consist of fever, polyarthralgia, elevated acute phase reactants.<sup>1</sup> The WHO criteria additionally takes into account supporting evidence of a streptococcal infection in the last 45 days such as a PR prolongation on echocardiogram, elevated or rising ASOT or anti-DNase B titers, a positive throat culture or rapid antigen test for group A streptococci, or recent scarlet fever.<sup>6</sup> For the appropriate diagnosis of a recurrent episode of rheumatic fever without heart disease, either 2 major criteria or 1 major criteria and 2 minor criteria plus evidence of a preceding GAS infection is required, which is the same for diagnosing an initial bout of ARF. However, if the patient has established RHD, then less is needed for the diagnosis, as only 2 minor criteria plus a preceding GAS infection is required for diagnosis.<sup>6</sup> Although echocardiogram is not necessary for diagnosis and is viewed as a supportive test, it can be an important tool for further determining the extent and severity of RHD.<sup>1,6</sup> Thus, ARF should be in the differential diagnosis for patients who present with combinations of these clinical exam findings to allow for an appropriate and timely work-up.

Although ARF predominantly affects the pediatric population, young to middle-aged adults are also affected by ARF, however, at a much lower frequency.<sup>12</sup> It is rare for adults older than age 35 to have their first episode of ARF and most adults with ARF have had their first episode as a child.<sup>10,12,13</sup> However, having no history of ARF as a child does not rule out the diagnosis of ARF in an adult, as multiple cases have been reported with the first-episode of ARF occurring in adulthood.<sup>14,15</sup> One of the most recent studies conducted in 2000 that observed ARF cases in adults reported that the clinical manifestations of ARF in adults were similar to that seen with ARF in children, with migratory polyarthritis being the most common complaint.<sup>15</sup> Our patient fit this classic picture of having a migratory polyarthritis, a history of ARF in childhood and the additional history of discontinuing his antibiotic prophylaxis regimen prematurely. Therefore, despite the lower incidence of ARF in adults, ARF should still be included in the differential diagnosis, especially when accompanied by suggestive history and physical exam findings.

ARF is most commonly secondary to pharyngitis from a pathogenic strain of GAS in genetically predisposed individuals, in which Pacific Islanders, Australian aborigines, and New Zealand

Māori experience the highest incidence of ARF globally.<sup>5,16,17</sup> However, ARF secondary to pyoderma or cellulitis is an additional, less common and less known condition. In multiple studies observing ARF in aboriginal communities in the northern territories of Australia, Fiji, and New Zealand, there is a high prevalence of cases of ARF in the absence of GAS pharyngitis, but in the presence of GAS pyoderma.<sup>18-22</sup> Given that our patient was from the Pacific region and had a recent history of purulent right lower extremity lesions, his recurrent ARF was likely secondary to GAS pyoderma. Wound cultures approximately 6-weeks prior to his admission grew GAS, but wound cultures were not repeated during his hospitalization under our care due to the lack of exudate or surrounding erythema in addition to the ASOT and Anti-DNase B titers. Our patient had two separate occasions of a delay in the diagnosis and management of ARF, which were both suspected to be secondary to GAS skin infections. This may be due to the lack of understanding and the importance of recognizing the association of GAS skin infections and the development of ARF, especially in Pacific Islanders. Thus, understanding this association is of importance for health care providers practicing in Hawaii and the Pacific region. Further research is needed to elucidate this relationship, as these implications are based off of small studies and case reports given the small subject population and the relative rarity of GAS pyoderma causing ARF.<sup>18-22</sup>

Migratory polyarthritis is another component of ARF associated with autoimmune damage of the joints.<sup>1,4</sup> Particularly, febrile polyarthritis is the most common presentation of ARF in adults.<sup>4,15,16,23</sup> Although the polyarthritis that ensues with ARF is most commonly non-degenerative in nature, the symptoms can be severe to the point of immobilization.<sup>4</sup> This was seen in our patient, who presented with no spontaneous movement and unbearable pain with mild manipulation of his joints. Because ARF is an inflammatory condition, the lab values and clinical picture of polyarthritis secondary to ARF can mimic that of systemic inflammatory arthritides. Elevated ESR, CRP, and warm, erythematous, tender joints can occur with rheumatoid arthritis, psoriatic arthritis, reactive arthritis, systemic lupus erythematosus, and other systemic inflammatory conditions.<sup>4,16,24-26</sup> Important lab and clinical findings that can help differentiate ARF from other systemic inflammatory arthritides include ASOT, Anti-DNase-B antibody and most importantly the history and physical exam. In our patient, a history of rheumatic fever in childhood with discontinuation of secondary prophylaxis increased our clinical suspicion, despite the patient's clouded clinical presentation with worsening after initial attempt to treat lower leg non-healing wounds with antibiotics and only partial response to glucocorticoids. This led us to ordering ASOT and Anti-DNase B to further solidify our diagnosis and rule out other potential systemic inflammatory conditions with other laboratory testing.

In conclusion, we report a case of recurrent ARF following GAS pyoderma in a Native Hawaiian and other Pacific Islander who

presented with migratory polyarthralgias. This was his second diagnosed bout of ARF, both bouts occurring secondary to skin infections and having a delay in diagnosis with potential worsening of cardiac valvular damage. It is important to understand the association of pyoderma and ARF in Native Hawaiian and other Pacific Islanders in addition to including ARF in the differential diagnosis of polyarthralgias in adults. The appropriate and timely diagnosis and management of ARF is of significance for lowering the risk of developing RHD and its complications.

## Conflict of Interest

None of the authors identify any conflict of interest.

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# THE DANIEL K. INOUE COLLEGE OF PHARMACY SCRIPTS

## Pharmacy Students' Perspectives of Social Media Usage in Education

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### Background

When first introduced, social media was viewed as a means for personal socializing. As it evolved, the purpose of social media has grown into something much larger, particularly in recent years. It is now common for people to use social media as a source of news, primary communication, place of business, and more. As new social media platforms were introduced, each seemed to serve a niche purpose. For example, Facebook was started to connect socially with friends and family, while LinkedIn serves the purpose of connecting for the purpose of professional networking. Some of these initial purposes remain true, but, for many platforms, the purposes have become more blended. Instagram was initially intended as a venue to share photos, but it has now grown to the point where some people use it as a primary means of communication, to meet new people socially, to stay informed of news updates, and as a place of business. With all these changes and shifts in social media usage, the line between using social media for personal reasons and professional reasons has become blurred.

Most current pharmacy students belong to the Millennial generation, defined as being born between 1981-1996. However, there are also students who are categorized in Generation X (born between 1965-1980), and we will soon see more students categorized as Generation Z (born from 1997 onward).<sup>1</sup> The current generation of students is often characterized by frequent use of social media. Studies sampling pharmacy student populations have reported that 91%-93% of pharmacy students use at least 1 social media platform.<sup>2,3</sup> These estimates are from 2013, so it is likely that this percentage is even higher as social media popularity is constantly growing. Though frequent social media usage may be seen by some as a negative attribute, this generation may also be seen as resourceful in using these platforms to communicate effectively with peers. These students are also commonly described as a collaborative generation that values working in a team, using each other as resources to achieve a common goal.<sup>4</sup>

The use of social media in professional pharmacy programs is not clearly defined and can still be considered a controversial topic. Health professionals are faced with the decision of whether their social media persona should be kept private in their personal life or allowed to overlap with their professional life. One main problem that is faced is whether to have a social media account set as private or public.<sup>5</sup> Previously it was highly emphasized that professionals should have social media accounts set to private. With the shift and changes in social media however, more professionals are having public accounts that highlight both their professional and personal lives. In the professional education field, there is a large interest in learning how social media is impacting the outcomes of our students. A survey of faculty in health education programs reported that 71.3% of respondents believed social media has capacity to positively impact educational practices.<sup>6</sup>

The role of social media in a professional program is not well defined. Social media could increase students' knowledge of health care information due to the ease of communicating with others or viewing up-to-date news. Conversely, social media may be serving as a distraction from studying and thereby having a negative impact on student outcomes. Regardless of the type of effect, most pharmacy students utilize social media in their daily lives for various purposes. It is hypothesized that they are also utilizing social media to supplement their education and have the viewpoint that social media has a professional use. Previous studies have assessed and described pharmacy students' opinions on using social media, with varying results. A study from 2013 reported that 75% of first-year pharmacy students had interest in the possibility of social media being integrated in an educational manner.<sup>2</sup> Another study from 2013 reported that 74% of fourth-year pharmacy students felt the need to edit their social media accounts while applying for jobs, and 96% of fourth-year pharmacy students believed that social media accounts should always be kept private and separate from professional use.<sup>3</sup> These previous studies may not reflect the current perspectives, since social media usage

has rapidly grown causing the scope of social media to expand. Therefore, a survey was administered to gain insight into the current opinions of pharmacy students. The Daniel K. Inouye College of Pharmacy (DKICP) at the University of Hawai‘i at Hilo is the only accredited college of pharmacy in the Pacific Basin. Hawai‘i is in a unique geographical location that is physically isolated from others, therefore it is also of interest to see if there is an increased use of social media in DKICP pharmacy students.

## Methods

This survey was approved by the University of Hawai‘i Institutional Review Board. A voluntary, anonymous survey was emailed to all 318 pharmacy students enrolled in the Pharm.D. program at the DKICP in August 2018, at the start of the fall semester. The survey was administered via SurveyMonkey Inc. ([www.surveymonkey.com](http://www.surveymonkey.com); San Mateo, California) and consisted of 16 questions developed to assess opinions on various facets of using social media in professional education programs. Survey participation was not incentivized. There was no prior discussion with any pharmacy students regarding using social media in this professional program. In addition to demographic information, the survey questions were designed to assess four main areas regarding social media usage: 1) types and frequency of social media usage, 2) purposes of social media usage, 3) professionalism concerns of social media usage, and 4) educational purposes of social media usage. These four areas were selected because the author was interested in how students viewed social media in these facets. Original survey questions were developed by the author and no survey validation was completed prior.

For the area regarding types and frequency of social media usage, students were questioned about which social media platforms they are registered for, including Facebook, Instagram, Snapchat, and Twitter. These four platforms were selected for inclusion from anecdotal experience that these were the highest utilized platforms by the target demographic. Students were then asked how frequently they engaged with each registered platform. In the topic area of purposes of social media usage, students were asked whether they use social media to connect and network with classmates, other non-classmate pharmacy students, or licensed pharmacists. They were also asked if they use social media to view pharmacy-related news or for educational purposes. Regarding professionalism concerns, students were presented with various statements and asked to rank their agreement based on a 5-point Likert scale from strongly disagree to strongly agree. These statements addressed concerns regarding social media in the classroom or workplace, privacy concerns, and social media as a distraction. In the last area of educational purposes of social media usage, students were asked if they use any social media platforms for educational reasons, if

they believe it can be utilized as an effective learning tool, and if they were interested in a social media account that would be dedicated to clinical pharmacy pearls. A clinical pearl is a term used in medicine to describe a piece of information that can be applied in various patient-care scenarios to help handle clinical problems or situations. Of note, there were no open-ended response questions in this survey. After all data was gathered, descriptive analysis techniques were used to analyze results. Results were assessed collectively without subgroup analysis.

## Results

A total of 145 pharmacy students completed the survey, with a response rate of 46%, and an even distribution among first-year through fourth-year students. Most students (86%) were of the millennial generation, with an average age of 27 years. Table 1 describes the full demographic characteristics of the pharmacy student respondents.

Only four students (3%) reported not using any social media platforms, two of which are categorized as belonging to the Generation X, representing 25% of respondents in that generation. The most popular social media platform was Instagram, with 77% of students reportedly using Instagram at least once daily, followed closely by Facebook with 75% of students using the platform at least once daily (Figure 1). As anticipated, 88% of respondents agreed or strongly agreed that their usage of social media was helpful in connecting to other pharmacy students. The most common reason for using social media was to connect with classmates (88%) and with upperclassmen (79%). Other reasons for using social media included to view pharmacy-related news and education, as well as networking with practicing pharmacists and students from other colleges (Figure 2).

Baseline Characteristic	No. (%)
<b>School Year</b>	
P1 (First-Year)	38 (26%)
P2 (Second-Year)	30 (21%)
P3 (Third-Year)	40 (28%)
P4 (fourth-Year)	37 (26%)
<b>Age in Years, Average (Range)</b>	27 (20-51)
Generation X: Born 1965-1980	8 (6%)
Millennials: Born 1981-1996	125 (86%)
Generation Z: Born 1996 Onward	12 (8%)
<b>Female Gender</b>	97 (67%)
<b>Hawai‘i State Resident</b>	76 (52%)

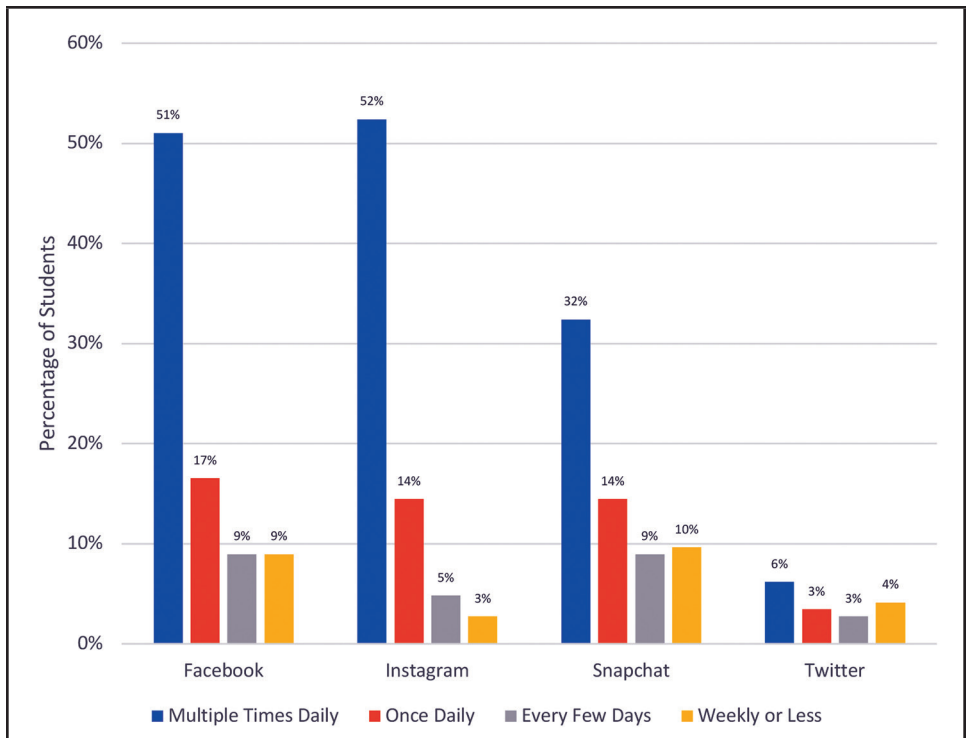


Figure 1: Frequency of Social Media Usage by Type Among DKICP Pharmacy Students

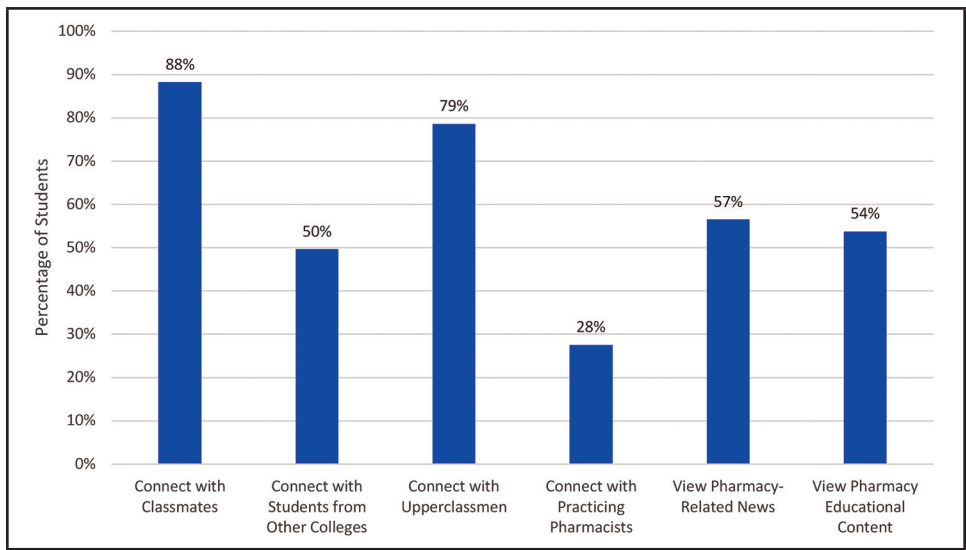


Figure 2. Purposes of Social Media Usage Reported by DKICP Pharmacy Students

The slight majority of respondents (54%) believed that social media distracted them from studying or completing assignments, and 32% of students agreed or strongly agreed that they often read and/or post to social media while in the classroom or while at work. About a quarter of respondents (26%) believed it inappropriate to discuss social media in professional settings, with 13% of respondents believing that social media should only be used for non-professional activities. While only 24% of respondents disguise their social media accounts, 69% believe that social media accounts should be set to private. A slight majority of respondents (54%) reported using social media for educational purposes. A larger number expressed interest in using social media to supplement education, with 69% believing it can be an effective educational tool and 68% reporting being interested in following an account for clinical pharmacy information. Table 2 lists the full results for the areas of professionalism concerns and educational purposes of social media.

## Discussion

The results of this survey demonstrate that current pharmacy students are frequently using social media for a variety of purposes during their professional education. Social media is becoming a standard venue for professional networking. From this survey, 50% of student respondents have used social media to connect with pharmacy students from other colleges. The DKICP is the only college of pharmacy within the Pacific Basin, which may explain why about half of students have used technology to network with students in the US mainland. A study from 2016 reported that 58% of pharmacy students use social media to communicate with classmates, which is a significantly smaller amount than the 88% of respondents from the current study.<sup>7</sup> Although there is only a difference of 3 years' time, there has been a large increase in social media use which may explain why the current findings are significantly higher.<sup>8</sup>

Though there are benefits of using social media, the findings of this study demonstrate that students both acknowledge and are aware of the costs of social media use as well, particularly that it can be a distraction from productive work. An article from 2017 reported that 44.9% of pharmacy students have admitted to using social media while in class or at work.<sup>9</sup> In the current survey it was found that 32% of pharmacy students reported using social media while in class or at work. However, the 2017 article also reported 49.2% of pharmacy students being distracted from work by social media, close to the findings from the current study of 54% of respondents.<sup>9</sup>

Though the purpose of using social media is not entirely connected to education, there are many purposes that relate to the development of a student pharmacist. For example, about half of pharmacy student respondents are already using social media as a supplemental educational tool by using it for pharmacy-related educational purposes. This can be done through a variety of ways, including following professional organizations, companies, or educators who may have social media accounts dedicated to education. Though this was only done by half of the respondents, a larger group (69%) believed social media could be effective for education purposes, and 68% of students expressed interest in engaging with a social media account for clinical pharmacy education. In 2011, a survey of pharmacy preceptors reported that 46% of preceptors were interested in using social media to complete continuing education requirements.<sup>10</sup> Though this interest level is smaller than the current findings, this can be attributed to the change in time and the different opinions of preceptors compared to students. A similar study of medical residents reported that 77% of have used social media for educational purposes, and 85.7% of medical residents believed social media had potential as a medical education tool.<sup>11</sup> This demonstrates that the current generation of healthcare students believe that social media can be used to

Statements	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Social media is helpful to connect with other pharmacy students	3 (2%)	3 (2%)	12 (8%)	77 (53%)	50 (35%)
2. Social media does not distract me from completing assignments or studying	20 (14%)	58 (40%)	29 (20%)	29 (20%)	9 (6%)
3. I often read and/or post to social media sites while attending class or work	36 (25%)	43 (30%)	19 (13%)	39 (27%)	8 (6%)
4. I often disguise my social media accounts by not using my full name	28 (19%)	52 (36%)	30 (21%)	26 (18%)	9 (6%)
5. Social media accounts should always be set to private	5 (3%)	13 (9%)	27 (19%)	51 (35%)	49 (34%)
6. Discussing social media in the professional setting is inappropriate	10 (7%)	39 (27%)	59 (41%)	28 (19%)	9 (6%)
7. Social media should only be used for non-professional activities	26 (18%)	60 (41%)	40 (28%)	11 (8%)	8 (6%)
8. Social media can be an effective tool for education	2 (1%)	7 (5%)	36 (25%)	70 (48%)	30 (21%)
9. I am interested in a social media account that disseminates clinical pearls	5 (3%)	10 (7%)	31 (21%)	59 (41%)	40 (28%)



supplement the pharmacy school curriculum education. There are many open-access accounts on a variety of social media platforms that can supplement students' knowledge.

The findings from this study bring current perspectives on the ever-changing role of technology and social media in a professional education program. Educators may consider leveraging social media to improve learning outcomes in professional education programs, either in a supplementary manner or as an integrated tool in a curriculum. With the findings that pharmacy students are interested in using social media in an educational manner, future studies should be conducted to assess whether social media usage has an impact on students' performance in the educational system or in clinical practice.

### Conclusion

Current pharmacy students frequently use social media platforms for purposes of networking and education, in addition to personal reasons. With such frequent use, students acknowledge that social media can be a distraction from work or studying, but also has helpful purposes while in pharmacy school. Most learners believe that social media can be leveraged for educational purposes during pharmacy school.

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Revised July 3, 2019

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Descriptive tables:** In tables that simply describe characteristics of 2 or more groups (eg, Table 1 of a clinical trial), report averages with standard deviations, not standard errors, when data are normally distributed. Report median (minimum, maximum) or median (25th, 75th percentile [interquartile range, or IQR]) when data are not normally distributed.

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

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

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

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