A Historical and Contemporary Review of the Contextualization and Social Determinants of Health of Micronesian Migrants in the United States

Davis Rehuher BA; Earl S. Hishinuma PhD; Deborah A. Goebert DrPH; and Neal A. Palafox MD, MPH

Abstract

Micronesian migrants to the US are a small but growing population with significant health disparities. Research regarding the health needs of this population is limited. The literature does not sufficiently address the circumstances and context under which migrations take place; they are influenced by historical events stretching back more than a hundred years. Within this context, the foci of this review article are to present (1) the current socioeconomic and health indicators of the Micronesian region, and (2) using a social-determinants-of-health framework, the relevant historical factors leading to the current state of the economic and health sectors in the Micronesian region. These factors include the effects of colonization, the impacts of nuclear weapons testing, rapid changes in social and cultural norms, and climate change, as well as health disparities facing Micronesians in the US. The implementations of the Compacts of Free Association allowed for unprecedented migration to the US for health care, employment, and education. Less known are the affirming attributes Micronesians provide to the US, including their high level of participation in the US military, allowing exclusive and strategic military control of the region, support for the US global policy (Micronesian countries usually vote with the US at the United Nations), and cultural influence domains (open ocean traditional voyaging), among others. Effective improvement of health care for Micronesians must include awareness of and familiarity with their experiences prior to migration. The significant impact of COVID-19 on the Micronesian population in Hawai'i highlights the disparities that exist.

Keywords

review, Micronesians, Micronesian history, social determinants of health, migration, health

Abbreviations

CNMI = Commonwealth of the Northern Mariana Islands
COFA = Compact of Free Association
FAS = Freely Associated State
SDOH = Social determinants of health
TTPI = Trust Territory of the Pacific Islands
FSM=Federated States of Micronesia
RMI = Republic of the Marshall Islands
UN = United Nations
US = United States
USAPI = United States Affiliated Pacific Islands
WHO = World Health Organization
WWII = World War II

Introduction

In the year since the pandemic began (2020), Micronesians in the US have been disproportionately affected with high rates of cases,[1] hospitalizations,[2] and mortality.[3-4] However, COVID-19 is but the latest of health issues this relatively unknown population has faced, and the health disparities it has magnified have not been contextualized in the limited available literature. This manuscript provides critical background and context for the health status of the Micronesian peoples living in their home countries and in US States and Territories through a social-determinants-of-health (SDOH) framework. Although small in numbers, people from the Micronesian region are among the fastest-growing groups in the US.[5] Few US health and social service providers understand[6] who Micronesian peoples are, Micronesian histories and cultures, and their special immigrant status and relationship to the US. Further, the lack of fair representation, coupled with economic and cultural vulnerability, have subjected minorities such as Micronesians to racist and discriminatory policies[7] and limited access to health services.[8-9] The first section of this article describes the region's geographic, demographic, and linguistic characteristics. The second section lists health disparities in the Micronesian region and among Micronesians in the US. The third section examines the health disparities of Micronesians through a historical and SDOH lens. Finally, recommendations to address and improve Micronesian health in the US are discussed. This information provides a context that supports a better understanding of the harsh impact that COVID-19 has had on the Micronesian population in Hawai'i to date.

Micronesian Region

Geography. Along with Melanesia (dark islands) and Polynesia (many islands), Micronesia (small islands) is 1 of 3 geocultural areas within the Pacific Ocean, located in the North Pacific. Figure 1 illustrates the 3 areas in relation to each other.[10] Polynesian islands such as Hawai'i, Aotearoa (New Zealand), and Tahiti in French Polynesia are well known popular tourist destinations. Most Micronesian and Melanesian islands are less known.

The region includes 3 countries and 2 territories affiliated with the US: the Federated States of Micronesia (FSM), comprised of Yap, Chuuk, Pohnpei, and Kosrae States, the Republic of the Marshall Islands (RMI), the Republic of Palau, and the US territories of Guam and the Commonwealth of the Northern

Mariana Islands (CNMI). These 5 countries and territories are collectively referred to as the US Affiliated Pacific Islands (USAPI). Figure 2 shows a map of the Micronesian region.[11] Also politically part of the USAPI, American Samoa, a US territory, is located in the South Pacific Polynesia. Nauru and Kiribati are independent Micronesian countries, further east of the Marshall Islands, not affiliated with the US and are not discussed here.

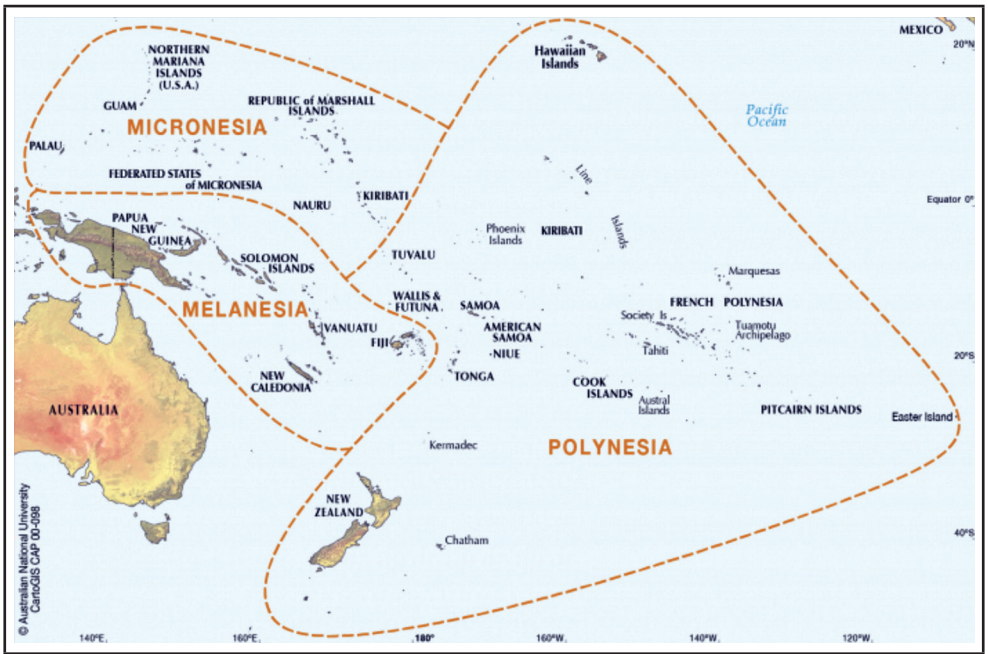

Figure 1. Regions in the Pacific: Micronesia, Melanesia, Polynesia[10]
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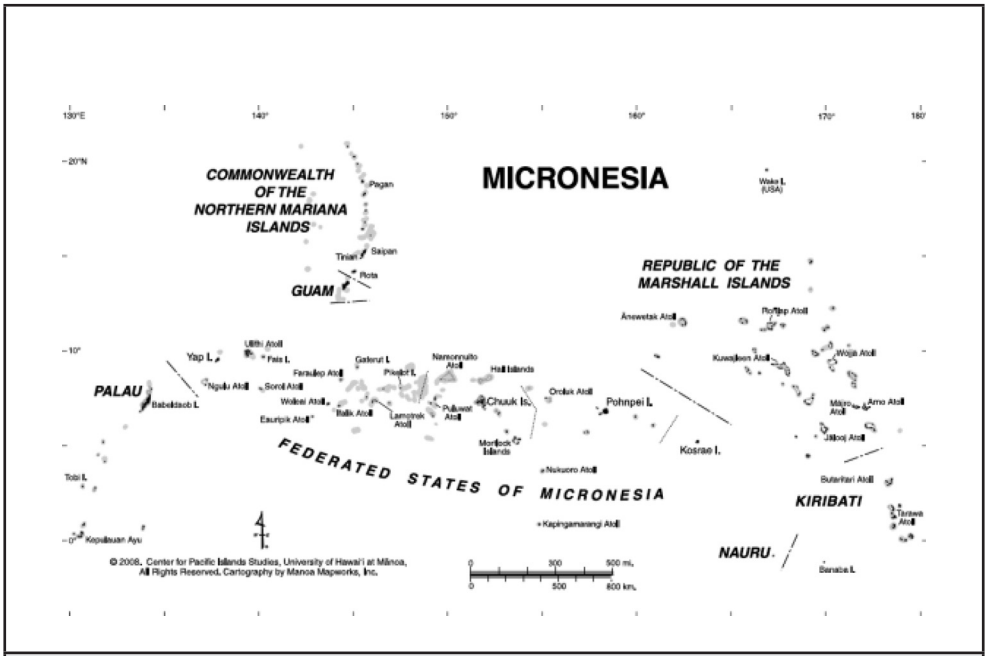

Figure 2. Countries and Territories of the Micronesia Region[11]
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US Citizenship. Individuals born in Guam and the Northern Mariana Islands are US citizens by birth. People born in FSM, the RMI and Palau are citizens of their respective countries. Through agreements called Compacts of Free Association (COFA) with the US (see below), citizens from these countries are a category of migrants who can enter and live indefinitely in the US without going through the visa process.[12]

Languages. Across the region, significant language and cultural differences exist among the island states.[13-14] There are 23 Micronesian languages, not including local dialects. These languages are mostly spoken in FSM, and most are considered Nuclear Micronesian oceanic languages.[15] Chamorro and Palauan are unrelated, non-oceanic languages, which appear to have originated in Southeast Asia. Yapese is a unique oceanic language unrelated to any other group.[15] English is used to communicate across linguistic boundaries as there is no other language mutually understood across the region. English is recognized, in addition to the traditional languages, as an official language in FSM, RMI, and Palau.[15]

Population. Table 1 presents the description of each of the territories and countries. Guam is the most populated with 159 358 in 2010,[16] followed by FSM with 102 843 (Chuuk: 48 654; Pohnpei: 36 196; Yap: 11 377; Kosrae: 6616) in 2010,[17] 53 883 for the CNMI in 2010,[18] 53 158 for the RMI in 2011,[19] and 17 661 for Palau in 2015.[20] The 2010 the FSM population declined by 4165 people from the 2000 FSM census count of 107 008. While a lower fertility rate contributed, the decline was primarily due to outmigration to Guam, Hawai'i, and the continental US.[21-22]

Demographics. There are substantial differences in the proportions of the populations that are under the age of 18 years and average household size. In FSM and the RMI, 39%[23] to 46%[19] of the populations are 18 years and under, while in the remaining regions approximately 25% of the populations are 18 years and under.[18,20,24] Average household sizes are 3.3 in the CNMI,[18] 3.4 in Palau,[20] 3.8 in Guam,[16] 6.8 in the RMI,[19] and between 4.9 to 6.9 in FSM.[17]

Health Disparities

Micronesian region. Life expectancy between FSM (69 years)[25] and the US (79)[26] differs by 10 years. Life expectancy is the same for the RMI and Palau (both 72 years),[19,27] and is higher for the CNMI (77 years)[28] and Guam (79 years).[16] The region is experiencing an epidemic of non-communicable diseases, with rates of obesity, diabetes, and hypertension among the highest in the world.[31] Table 2 presents the proportional mortality for Micronesian countries compared to the US.[32-33] Cardiovascular diseases, diabetes, and cancer rates were higher than in the US.[32-33] Cancer registry data during 2008-2013 revealed total cancer incidence-based-mortality rates for males were highest for Palauans (151.5/100000), Marshallese (142.0), and Guamanians (133.2), compared to Asian Pacific Islanders in Hawai'i (136.9). Rates were highest among females for Marshallese (120.3/100 000), Palauans (107.7) and those of Guam (72.2), compared to Hawai'i Asian Pacific Islanders (88.6).[34]

Table 1. Selected Characteristics of Micronesian Countries and Territories

Country/ Territory	Citizenship	Selected Indigenous Populations	Number of Islands	Land Area (Square Miles)	Population	Under 18 Years of Age (%)	Average House-hold Size	Unemployed Rate (%)	Per Capita GDP (US$)	Life Expectancy (Years)
Guam	United States	Chamorro	1	210.0	159 358[16]	25.1[24]	3.8[16]	8.4[16]	30 500[16]	79[16]
Northern Mariana Islands	United States	Chamorro Carolinian	14	179.2	53 883[18]	25.7[18]	3.3[18]	12.8[18]	8685[29]	77[28]
Federated States of Micronesia	FSM		607	271.0	102 843[17]	43.0[23]	6.1[17]	16.2[17]	2341[17]	69[25]
Chuuk State	FSM	Chuukese Carolinian			48 654[17]	44.0[23]	6.9[17]	24.6[17]	1411[17]	n/a
Kosrae State	FSM	Kosraen			6616[17]	44.0[23]	5.7[17]	23.0[17]	2323[17]	n/a
Pohnpei State	FSM	Pohnpeian Mwoakilloa			36 196[17]	43.0[23]	5.6[17]	9.0[17]	3138[17]	n/a
Yap State	FSM	Yapese Carolinian			11 377[17]	39.0[23]	4.9[17]	6.0[17]	3532[17]	n/a
Republic of the Marshall Islands	Marshall Islands	Marshallese	1156	70.1	53 158[19]	46.0[19]	6.8[19]	34.0[19]	3168[19]	72[19]
Republic of Palau	Palau	Palauan Carolinian	340	177.0	17 661[20]	24.7[20]	3.4[30]	1.7[20]	11 424[30]	72[27]

Abbreviations: FSM = Federated States of Micronesia, GDP = Gross Domestic Product, US = United States

Table 3 lists the top 10 causes of death for the USAPI, Hawai'i, and the US.[35-36] The leading causes of death for the USAPI are heart disease, stroke, diabetes, lower respiratory infections, and chronic kidney disease.[35] In the RMI, thyroid cancer and birth defects have been attributed to radiation exposure from nuclear testing.[37] Suicide rates among Micronesian youth and young adults have been historically some of the highest in the world, particularly among males,[38-39] and suicide is currently a leading cause of death for these age groups.[40-41] Schizophrenia is prevalent in parts of Micronesia. Palau's rates of schizophrenia is amongst the highest worldwide,[42-43] and high rates have also been found in Yap[42] and Kosrae.[44] Poor health outcomes have been documented throughout the region and have been most pronounced in FSM, the RMI, and Palau.[45]

Table 2. Proportional Mortality due to Noncommunicable Diseases (%)

	Federated States of Micronesia[33] 2016	Republic of the Marshall Islands[32] 2010	Republic of Palau[32] 2010	United States[33] 2016
Cardiovascular diseases	32	40	38	30
Cancers	12	7	13	22
Chronic respiratory diseases	6	7	6	9
Diabetes	9	5	4	3
Other NCDs	16	14	13	24
Communicable, maternal, perinatal, and nutritional conditions	18	22	20	5
Injuries	7	5	6	7
NCDs estimated to account for all deaths	75	73	74	88

The US per capita health care expenditure is 45 times greater than Chuuk State, 15 times greater than the RMI, and 5 times that of Palau since 2016.[46] Figure 3 shows the health expenditures for the USAPI compared to the US territories and the US.[46]

Micronesian health in the US. The limited literature on the health status of Micronesians in the US shows that infectious diseases, diabetes, obesity, hypertension, and cardiovascular disease are areas of concern.[47-50] Hagiwara and colleagues (2016)[51] examined hospital inpatients from 2010 to 2012 and found that Micronesians with cancer, dental, endocrine, cardiac, pulmonary, and infectious diseases were significantly younger than Japanese Americans, European Americans, and Native Hawaiians who were hospitalized for those conditions. They also found similar age of onset for mental health, substance use, and skin diseases compared to Native Hawaiians. Micronesians had significantly greater severity of illness than all other racial/ethnic groups for cardiac and infectious diseases, greater severity than Native Hawaiians for substance abuse, and greater severity than Japanese Americans and European Americans for cancer and endocrine hospitalizations.[51]

Table 3. Top 10 Causes of Deaths, US Affiliated Pacific Islands, Hawai'i, and the United States, 2019

	Northern Mariana Islands[35]	Federated States of Micronesia[35]	Guam[35]	Republic of the Marshall Islands[35]	Republic of Palau[35]	Hawai'i[35]	United States[36]
Ischemic heart disease	1	1	1	1	1	1	1
Stroke	2	3	2	2	3	3	5
Diabetes	3	2	5	3	2	10	7
Lower respiratory infection	8	6	8	4	4	5	4
COPD	6	7	7	5	6	6	
Chronic kidney disease	4	4	4	6	5	7	8
Self-harm	10	9	10	7			10
Hypertensive heart disease		8		8			
Road injuries		10		9	10		3
Cirrhosis	7		9	10	8		
Cancer	5		3		7	4	2
HIV/AIDS		5					
Alzheimer's disease			6			2	6
Breast cancer					9		
Colorectal cancer	9					8	
Pancreatic cancer						9	
Influenza and pneumonia							9

Abbreviations: COPD = Chronic obstructive pulmonary disease, US = United States

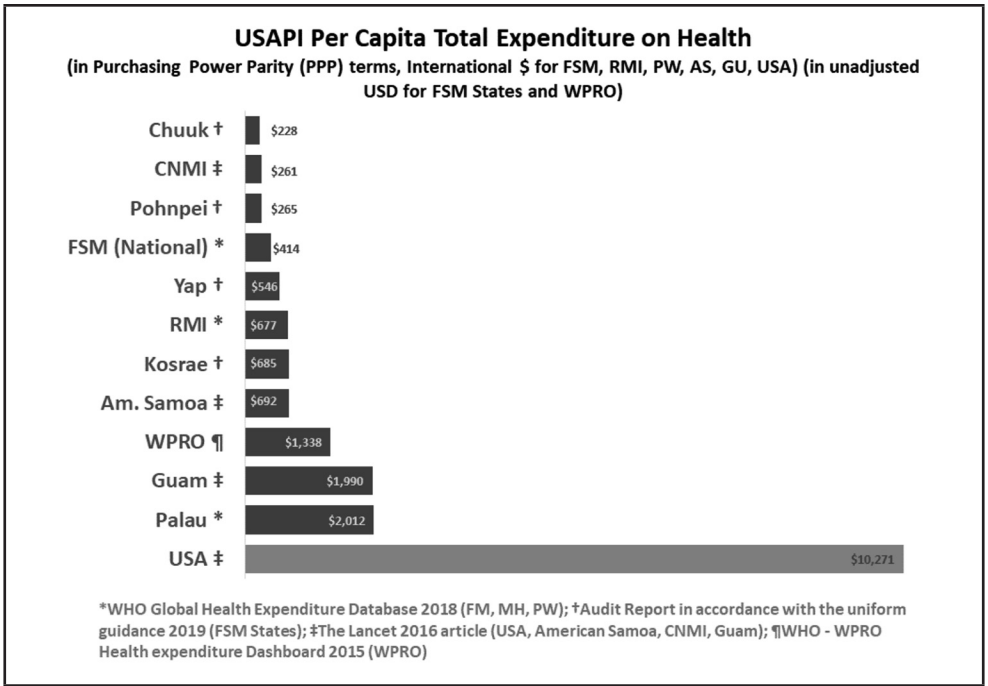

Figure 3. United States Affiliated Pacific Islands Per Capita Health Expenditures[46]

Abbreviations: AS = American Samoa, CNMI = Commonwealth of the Northern Mariana Islands, FSM = Federated States of Micronesia, GU = Guam, PPP = Purchasing Power Parity, PW = Palau, RMI = Republic of the Marshall Islands, USD = US Dollar, WHO = World Health Organization, WPRO = Western Pacific Regional Office Pacific Cancer Programs.

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Coronavirus Disease 2019 (COVID-19) disparities. During the COVID-19 epidemic to date (July 12, 2021), there were no positive cases in FSM or Palau, while RMI had 4 cases from foreign arrivals, with no deaths and no community transmission. The CNMI had 160 cases, 2 deaths, and no community transmitted cases, while Guam had 7636 cases with 136 total deaths and a daily average of 5 new cases.[52]

In contrast, Micronesians in the US have suffered alarmingly and disproportionately from COVID-19. The non-Native Hawaiian Pacific Islander community, including Chuukese and Marshallese, composes 4% of Hawai‘i’s population. However, between March 2020 and January 2021, they accounted for 24% of all cases, highest among all groups.[1] Disaggregated data for non-Native Hawaiian Pacific Islanders showed that in Hawai‘i between March 2020 and January 2021, Samoans (29%), Chuukese (24%), and Marshallese (22%) had the greatest number of cases. Over the same period, Micronesians (any, 52%), Samoans (25%), and Marshallese (23%) accounted for all deaths among non-Native Hawaiian Pacific Islanders.[1] Similarly, other states where Micronesian communities have settled and call home also demonstrated disparate health burdens among Micronesian residents. In Arkansas as of July 2020, Marshallese accounted for about 19% of all cases in 2 counties, despite representing only about 2% of the total population. Marshallese in the same 2 counties were 71 times more likely to test positive, 96 times more likely to be hospitalized, and 65 times more likely to die compared to European Americans,[2] accounting for 38% of reported deaths.[3-4]

Social Determinants of Health

The World Health Organization’s (WHO’s) SDOH model (Figure 4) posits that the circumstances in which individuals are born, grow, live, work, and age largely determine their overall health status.[53] The SDOH framework aims to improve health equity by showing how health outcomes are influenced by socioeconomic positions, in turn, shaped by social, economic, and political factors.[54] The framework consists of 3 main elements:

1. Socioeconomic and political context
2. Socioeconomic position
3. Intermediary determinants

The following sections utilize the WHO framework to examine social determinants of health: (1) in the Micronesian region, and (2) among Micronesians in the US.

Social determinants of health in the Micronesian region.

1. Socioeconomic and political context. The Micronesian region has been colonized by numerous countries for the last 500 years, beginning with Spain from 1521 to 1898, Germany from 1899 to 1914, Japan from 1914 to 1944, and the US from 1944, to independence in 1986 for FSM and the RMI , and in 1994 for Palau.[55] Early contact with Westerners introduced infectious

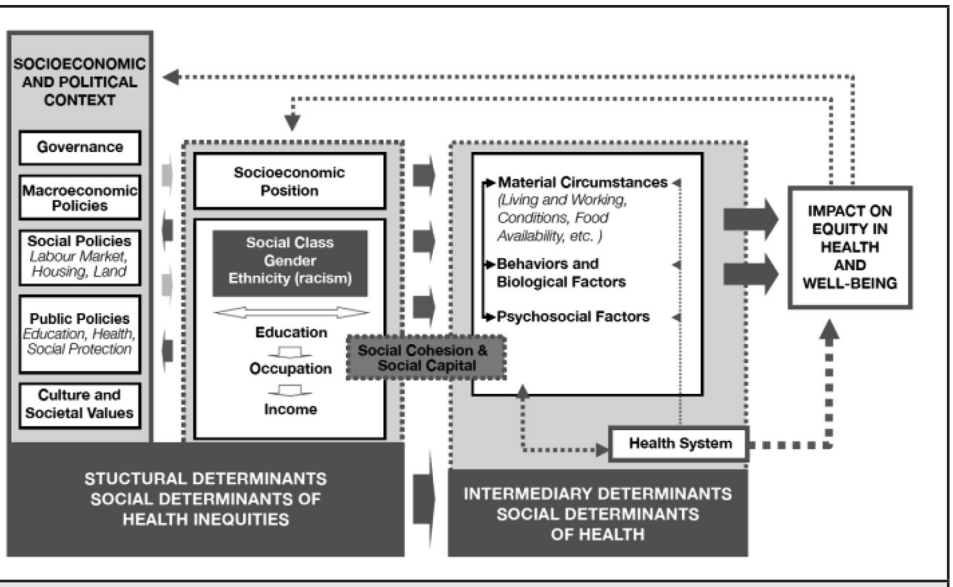

Figure 4. World Health Organization Social Determinants of Health Framework[53]

Solar & Irwin, 2010.

diseases, including measles, Hansen's disease, and syphilis, significantly reducing the populations. By the end of the 19th century, the total population had declined by 30%-40% (Kosrae 90%, Pohnpei & Palau >50%, Marshall Islands 30%).[56]

Among the Micronesian Islands, Guam and the Northern Mariana Islands have the longest history of Western contact, resulting in the greatest losses of Indigenous language and culture.[57] Colonialism's effects on the Micronesian Islands include dependency on the US, Western life-style and diet, loss of culture, and policies that promote the colonizers' interests at the expense of the Micronesian peoples,[13,58] and greater health disparities.[45] Diets switched from healthy local foods to imported foods initially provided by the US government, such as white rice, refined foods, and fatty meats, contributing to subsequent increases in chronic diseases,[59] Vitamin A deficiency,[59] and obesity.[60] Furthermore, the Micronesia region experienced a significant rise in suicide rates in the 1960s, doubling every decade through the 1980s, rooted in substance use, changes in family structure, and cultural loss.[14]

The Micronesian Islands suffered from major battles between the US and Japan to control the region, which Japan occupied prior to and during WWII.[61-62] Beginning in 1944, the US military campaign began its invasion in the Marshall Islands, heading westward to Guam, the CNMI, Palau, and beyond.[61-62] Though not invaded, islands in central Micronesia were isolated, blockaded from outside resources, and bombarded from air and sea.[58,61-62] As the war progressed and Japanese support and supplies dwindled, starvation beset both the Japanese and Micronesians.[61-62] As conditions worsened, Micronesians were subjected to physical harm, hard labor, and hunger.[62] Towards the end of WWII, islanders suffered from fear, displacement, deprivation, and starvation, and were subjected to executions.[62]

After WWII, the US military began testing nuclear weapons in the RMI. In total, 67 thermonuclear devices were detonated between 1946 and 1958 with a combined power of 7200 Hiroshima bombs.[63] In 1954, Castle Bravo high-yield nuclear test was carried out on Bikini Atoll. The explosion was more than 21 times larger than expected, and dropped radioactive ash more than 7000 square miles with children of nearby islands unknowingly playing in the "snow."[64] The US government did not inform residents of the Northern Marshall Islands that the winds had shifted such that these locations may experience nuclear fallout.

Afterwards, Project 4.1 was a medical research project conducted by the US to examine the effects of radioactive fallout on residents of the Marshall Islands.[65] Project 4.1 remains controversial because the individuals were neither informed nor consented, they were called savages, and the nature of the research left questions regarding whether the nuclear exposure was intentional. The Marshallese people are still experiencing health problems, displacement from ancestral lands, loss of cultural practices, and loss of food resources due to radioactive contamination of land and ocean.[63] A United Nations (UN) Human Rights Council report determined that environmental contamination was almost irreversible.[66] Today, a massive concrete dome constructed in 1980 on Runit Island to temporarily store nuclear waste[67] is beginning to crack.[64,68] The most toxic, radioactive material in the world, plutonium,[67] is at risk of leaking from the structure, which lies at sea level.[64,68] The Marshallese government has neither the funding nor the

expertise to address the problem, leaving the dome vulnerable to rising sea levels and other natural disasters.[64]

Bikini Islanders, whose islands were devastated from the Castle Bravo test, had to be relocated to the uninhabited Kili Island in the Marshall Islands. Recently, they purchased 283 acres of land near Hilo on Hawai'i Island for $4.8 million.[69] The land is currently vacant, and the Bikinians are hoping to develop the land to sell at market rates or as a place to relocate in the face of challenges from climate change.[69] Many of the people from the Atoll of Enewetak, the other major site of above-ground US nuclear testing, moved to Ocean View, on Hawai'i Island. As there is no running water to the homes in Oceanview, standing water tanks are filled several times a week with water that is picked up from a central water spigot located a mile or more from the homes. Electricity is supplied by small gas generators shared between homes. There are no sewage lines, therefore outhouses and outside structures serve restroom needs.

Although some of the land in Enewetak Atoll remains uninhabitable, some Atoll of Enewetak residents desire to someday move back home.[70] It has been argued that given the extent of nuclear testing in the Marshall Islands, most areas downwind of the Marshall Islands likely received considerable fallout, including in what is now FSM, Guam, and the CNMI.[71] Measurable fallout from the nuclear testing led to the recommendation that Guam residents exposed to nuclear testing be eligible for compensation under the Radiation Exposure Compensation Act (RECA) of 1990.[72]

At the end of WWII, the Micronesian Islands (Palau, Yap, the Northern Mariana Islands, Chuuk, Pohnpei, Kosrae, and the Marshall Islands) became the Trust Territory of the Pacific Islands (referred to as "TTPI") of the UN. The US took over administration of the TTPI, assuming responsibility for the economic welfare and growth of the Micronesian islands under UN oversight.[73] The TTPI period in Micronesia lasted from the end of WWII to the late 1970s.[74] The years from 1945 to the early 1960s were called the "benign neglect" era,[75-76] and a series of reports in the 1960s criticized the US for failing to meet its UN obligations to help the people of the Micronesian Islands foster development.[77-79] Subsequently, the US significantly increased funding in a non-strategic manner implementing Western-style institutions of education, health, and infrastructure, as well as American-style food consumption,[55,58,74] paradoxically resulting in a traditional subsistence economy allowing aid-dependence.[58,74-75,80-81]

In 1978, the Northern Mariana Islands became a Commonwealth of the US, and are hence now referred to as the CNMI. The remaining island groups—Yap, Chuuk, Kosrae, and Pohnpei (FSM), the RMI, and the Republic of Palau—became the Freely Associated States (FAS) and entered into separate treaties with the US known as the Compacts of Free Association (COFA; 1986 FSM and Marshall Islands, 1994 Palau). Under the COFA agreements, the FAS conduct their own domestic and international affairs while the US provides government services and assistance in building economic, education, and health infrastructures, and has exclusive military rights to the area, including the right of strategic denial of access by other nations for military purposes.[63] Citizens of these countries can enter, work, and live in the US indefinitely without a visa.[12] Unfortunately, the respective COFA agreements have failed to live up to their bi-lateral expectations (e.g., economic development,[82] long-term goals,[83] health and education,[84] independence[85]). In the US, federal Medicaid and other federal social services, initially included under COFA, were arbitrarily disallowed for Micronesian migrants in 1996.[37] Federal Medicaid was only recently restored after nearly 25 years.[86]

After WWII, the US recognized the strategic importance of the region, resolving to prevent other nations from using it to threaten US interests.[87] In the early 1960s, the Kennedy Administration commissioned a secret study, the Solomon Report, evaluating the prospects of independence for the Micronesian islands. The report was very critical of the US administration of the islands until then, but it re-emphasized the strategic value of the region and the need to ensure stronger ties with the US.[78] In the 1970s, during COFA negotiations, security provisions were included to grant the US Government military control for extended periods of time in perpetuity regardless of the state of the COFA agreements.[13] US strategic interests are now being challenged by China,[88,89] whose soft power efforts in the Pacific threatens US-COFA relations and weakens US influence and military presence.[90] In response, the US has increased diplomatic ties[91] and expanded military personnel and exercises in its Pacific areas.[92-93]

More recently, climate-change effects, such as global warming, sea-level rise, king tides, and more variable weather systems have had serious adverse impacts on land availability,[94] food security,[95] and health risks,[96] necessitating migration to the US.[97] The low-lying atolls of the Marshall Islands and in FSM are among the most vulnerable in the Micronesian region.[95,97] Based on current greenhouse-gas emissions, sea-level rise and floods caused by waves will result in annual flooding of most low-lying atoll islands by the mid-21st century, rendering the islands uninhabitable (e.g., infrastructure, freshwater).[98]

Across political, business, national, international, military, and cultural domains, the US has benefited from its relationship with the Micronesian countries and peoples. The region's location has helped protect US security interests since WWII.[87-89,99] The Ronald Reagan Missile Defense Test Site in the RMI, a critical facility for testing the US missile defense system, is used for space surveillance and identification of satellites, space debris, and missiles.[100] Young Micronesians have been recruited into the US military at high rates,[12,101] have served in the US military at per-capita rates higher than those of most US states,[102] and have died from military service at high rates.[101,103-104] In

2009, Palau agreed to take in 17 Uighars (Chinese Muslims, considered to be terrorists by China) from the US Guantanamo Bay detention camp in Cuba,[105] despite potential reprisals from China.[106] In 2019, the US planned to install 2 radar systems in Palau to monitor threats from North Korea and China.[88,107] At the UN, FSM, the Marshall Islands, and Palau have full voting rights as member countries and almost always vote with the US, supporting US interests.[108] Micronesian migrants pay state and federal taxes,[6] but for about 25 years between 1996 and 2020, did not qualify for federal benefits.[109] Micronesians are actively recruited to work in various industries across the US that involve relatively low-paying occupations.[110] Culturally, Micronesian master navigators have revived interest and pride in traditional open-ocean voyaging practices in Hawai'i, Polynesia,[111] and Guam.[112]

Globally, the FAS nations have taken on large causes that belie their small stature. FSM issued an ambitious challenge to achieve full transparency in tuna fishing by 2023 by electronically monitoring longline fishing vessels within its exclusive economic zone,[113] which would ensure sustainability, reduce illegal fishing by foreign vessels, and add to economic growth.[114] The Marshall Islands has been actively calling for nuclear disarmament for years,[115] played a key leading role in ensuring the passage of the UN Paris Agreement on climate change, and was the first country to submit binding targets committed to reducing emissions.[116] Palau was the first country in the world to have a nuclear-free constitution,[117] establish a shark sanctuary,[118] designate a marine sanctuary banning fishing and oil drilling in 80% of its waters to allow marine life to recover,[119] and require visitors to sign a pledge upon arrival to not harm the environment during their stay.[120] Taro leaf blight disease-resistant taro from Palau were crossbred and helped taro growers in Hawai'i,[121] American Samoa,[122] and Samoa[123] recover from severe losses caused by the disease.

2. Socioeconomic position. Poverty remains an urgent concern and is intertwined with education. In the CNMI, 51% of residents live below the US federal poverty line and more than 1800 families make less than $5000 a year.[124] In the RMI, 1 in 3 people live below the RMI national basic-needs poverty line in Majuro and Ebeye.[125] In FSM, the majority of the population lives below the FSM national poverty line, with a per capita income of $3550 and an unemployment rate of 16.2%.[126] FSM ranks 36th out of 40 countries in the Asia-Pacific Region for economic freedom. Its overall score of 50.4 is below regional and world averages.[126] The latest data for Palau indicate that 24.9% of people live below the Palau national poverty line.[127] Employment opportunities are primarily in government (30%) and tourism-related services (50%).[128] In the region, the unemployment rate varies widely from a low of 1.7% in Palau[30] to a high of 34.0% in the Marshall Islands.[19] Likewise, the gross domestic product ranges from a low of $1411 in Chuuk State[17] to a high of $30 500 in Guam.[16]

In the Micronesian region, as education attainment increases, the proportion of those living in poverty declines, indicating a clear link between the poorest households and the lack of educational achievement. Furthermore, female-headed households, especially those with children, are over-represented in impoverished categories.[129] Poverty has drastically affected the children of the Marshall Islands with 33% of those under age 5 exhibiting signs of developmental delays.[125] While primary education is mandatory until eighth grade, most children over 14 years do not continue school.[125] Children between ages 6 and 16 are mandated to attend formal school, yet in FSM, 35.8% of all household heads achieve only an elementary level of education. An additional 12% of the poorest had no education, compared to 7% of household heads overall.[129] While Palau also has compulsory education from ages 6-16, they have greater resources and 92% of adults are literate.[128] Additionally, more Palauan women than men have reached higher education and earned a college degree since 2000, with 81.5% of women over age 25 completing some college compared to 75% of men.[130]

3. Intermediary determinants. Ebeye Island on Kwajalein Atoll in the RMI is one of the most densely populated communities in the world, with more than 80 100 people/square mile.[131] The population suffers from the social and health consequences associated with overcrowding.[132] In addition to the relocation and evacuation of people to Ebeye from Bikini and Rongelap due to nuclear arms testing, many Marshallese are drawn to Ebeye to work on the adjacent Kwajalein Island at the Ronald Reagan US Army Military Base.[133]

Obesity, which is fueled by types of food available and lifestyle factors, has become a significant problem in the USAPI region. In Pohnpei State, FSM, which has one of the highest obesity rates in the world,[134] increasing physical activity (walking) may decrease body mass index (BMI) among obese persons[135] and is a viable intervention to lowering obesity in the region. Food insecurity across the region is becoming more pronounced, with increasing dependence on imported foods and movement away from healthier traditional diets driven by the effects of climate change[80,94] and lifestyle changes.[136] Stress stemming from the breakdown of traditional extended family structures and intergenerational relationships have contributed to high suicide rates among youth and young adults.[137] The Micronesian region is experiencing a shortage of qualified health professionals. WHO (2018)[138] data showed that the number of physicians per 1000 people were low: 0.19/1000 in FSM in 2009, 0.46/1000 in the Marshall Islands in 2012, and 1.19/1000 in Palau in 2014. In comparison, it was 2.57/1000 in the US in 2014 and 3.5/1000 in Australia in 2015.

Social determinants of health among Micronesians in the US.

1. Socioeconomic and political context. The aforementioned events partially contribute to the long-standing and more-recent outmigration of Micronesians to the US. The long-standing

reasons have been health-related and socioeconomic in nature, including for health-service opportunities and the persistent nuclear-health related problems,[49,139] education, employment, and family (e.g., being related to an employed person).[140] Micronesians are actively recruited to work in various industries, such as health care facilities for older adults, Disney World,[140-141] chicken-processing farms in Arkansas,[142] pork-processing plants in Iowa,[143] and in agricultural industries, such as pineapple harvesting[144] and seed production[145] in Hawai'i. The more recent reasons for migration have been attributed to climate change[97] and the uncertainty of the COFA status with agreements scheduled to end within the next 4 years, unless renegotiated.[146-147] The COFA countries are actively seeking more sustainable methods and models to develop and thrive. Out-migration to the US will likely increase beyond current levels.[84]

A health policy change, which removed Micronesians in Hawai'i from receiving Med-QUEST services, has been shown to negatively impact the health of Micronesian residents. Med-QUEST is a Hawai'i State Department of Human Services program providing health coverage to eligible low-income adults and children. In 2015, Hawai'i ended Med-QUEST health insurance coverage for Micronesian adults who were not pregnant, aged, or blind. Under the Affordable Care Act, these individuals were required to purchase health insurance through the Hawai'i Health Exchange.[148-149] Two studies reported on the adverse impact. Halliday et al. (2019)[150] found substantial decreases in Med-QUEST-funded inpatient (by 42%) and emergency room (by 69%) utilization for Micronesians after Med-QUEST health insurance coverage ended. These decreases were not offset overall by increases in privately funded coverage for inpatient and emergency room utilization. Molina et al. (2020)[151] found the Micronesian mortality rate in Hawai'i was 43% higher compared to European Americans. It was not until 2021 that Med-QUEST health coverage was restored in Hawai'i for Micronesians residing in the state.[86]

2. Socioeconomic position. There is a high rate of intimate partner violence in some Micronesian communities that is exacerbated by socio-economic challenges that may inhibit seeking help as well as cultural expectations that are barriers to disclosure and action.[152] Numerous studies have shown Micronesians have faced racism in Hawai'i[153-154] including in health care settings,[155-158] housing,[159-160] in schools,[161-162] and in their communities.[163] Micronesians have low rates of graduating from high school and enrolling in higher education.[49,164-165] Overall, Micronesians have limited incomes with high levels of poverty.[140,142,164]

3. Intermediary determinants. Micronesians in the US have experienced food insecurity in Hawai'i[166] and Arkansas,[167] and quality-of-housing and housing insecurity.[161,168] There have been high rates of substance use[169] and suicides[170] among Micronesians in Hawai'i. Unemployment has been shown to be high among Micronesians,[140,142,164] while access to health care is limited.[12,149,165,171]

Addressing and Advancing Micronesian Health in the US

Collectively, these historical and current social determinants of health in the FAS and Hawai'i can explain the untoward outcomes of COVID-19 on the Micronesian population in Hawai'i. Addressing the health determinants and challenges outlined involves reframing the emphasis to strengths-based approaches and leveraging cultural assets. It is helpful to be aware of the historical trauma and health disparities experienced in the region and motivations to move to the US. Micronesians are already well aware of their histories, traumas, subsequent health disparities, stigma, and racism attached to being a Micronesian.[155,157] These factors contribute to Micronesians' hesitancy to disclose relevant information to providers[157] and participate in research.[155] Using strengths-based approaches may lower hesitancy, improve communication, and increase participation in interventions. Examples of strengths include family support,[157,161,172] culture and cultural practices,[157,161,173] faith,[161,173] and self-advocacy for Micronesian health.[171,174] There are opportunities for action.

Trauma-informed care. Given the potential impacts of historical and current trauma on the health and well-being of Indigenous peoples,[175-184] including Native Hawaiians and Pacific Islanders,[57,137,185-192] it is essential that those working in health care, social work, and public health understand and provide best practices.[193-196] Programs that have sought to heal the community and restore culture have shown promise among Indigenous Pacific Islanders.[163,197] Such programs increase resilience and provide hope for the progression from generational trauma to indigenization.[198]

Cultural humility. Cultural humility is a lifelong and ongoing process that requires health professionals to meaningfully engage with patients, communities, colleagues, and themselves through the lens of humility, centered on continual self-improvement rather than achieving mastery or competence of another culture.[199] The life-long process of cultural humility includes the elements of being self-reflective and self-critical, learning from patients, and building partnerships.[200] Among Marshallese in Arkansas, cultural humility on the part of non-Marshallese was identified as 1 of 7 key components to addressing health disparities in the community.[172]

Cultural responsiveness. Incorporating cultural engagement, practices, and perspectives in interventions has been shown to be effective among Native Hawaiian and Pacific Islander populations, including Chuukese, in improving health outcomes.[201-203] Additionally, Inada et al.[157] advocated for providing whole-family instead of individual therapy, learning more about and connecting to Chuukese culture, expressing compassion and empathy, helping navigate services, and building relationships. Among Marshallese in Arkansas, McElfish and colleagues[172] identified the following lessons: intensive involvement from Marshallese across the community and research process; impor-

tance of interprofessional teams, the church, and consideration of sex; significance of family, talking story, and qualitative methods; and importance of cultural humility. Interventions should also account for differences among Micronesian groups regarding the following factors: language,[48,204] health-literacy knowledge,[204] degree of racism experienced,[155] locus of control,[155] religious background,[48,155,173] and location (i.e., in the home or community instead of the provider's office).[48,173]

Community health workers. Employ community health workers to work with and advocate for Micronesians in navigating the intricacies of various government, health care, and service organizations. Community health workers have successfully worked with Micronesians in a variety of health and public efforts in Hawai'i and Arkansas over the past 2 decades.[205-206] In addition, hiring Micronesian community health workers ensures effective communication and partnerships between patients and health care providers.[207]

Data disaggregation. It has been more than 20 years since the earliest calls for disaggregation of data for Asian Americans, Native Hawaiians, and Pacific Islanders was issued.[208] Unfortunately, data aggregation—a form of data inequity and social determinant of health[209]—continues to conceal health disparities between these groups.[201] Similarly, data should be disaggregated among Native Hawaiians and the specific Pacific Islander groups.[201] An often-cited challenge to disaggregation is having sample sizes too small for analysis; however, there are effective solutions to this problem, including oversampling.[201]

Evaluation and research. Further data disaggregation and research are needed to identify additional health disparities, risk-protective factors, causal models, evidence-based intervention strategies, and effective policies. Differences in the leading causes of deaths in the Micronesian region[35] and in the US[36] (Table 3) highlight the need to target specific diseases affecting Micronesians. While limited, the literature shows promise in research engagement and outcomes. A recent study[173] identified best practices for community-engaged research with Pacific Islander communities, including Micronesians: engaging community leaders, including Pacific Islander research staff and faith-based leaders; identifying facilitators and barriers to research; honoring cultural practices, including oral traditions and sharing meals; and honoring collectivist cultural structure, including group engagement and family engagement. Culturally meaningful interventions for Native Hawaiians and Pacific Islanders have shown significant improvements in weight loss[202] and reduced hypertension through a Native Hawaiian-based (hula) intervention[203] among Chuukese participants. The peoples of Micronesia have many strengths and things to offer to the state of Hawai'i, the US and the world. Their ongoing engagement with the US and presence in Hawai'i contribute to the enrichment of Hawai'i and the US. Identifying culturally appropriate political, social, and economic strategies required to compensate for the harm done to this population will be a first step towards strengthening resistance to the effects of COVID-19, reducing the marked health disparities, and achieving social justice for this group.

Conclusion

More than a century of colonization, steep population decline, trauma from war and nuclear weapons testing, and rapid social and cultural changes have left the Micronesian countries with western based economies that rely on foreign aid, and citizens challenged with serious health conditions. This has rendered the Micronesian population more vulnerable to the ravages of COVID-19 in Hawai'i and the US. Micronesians migrated to the US in greater numbers since the implementation of the COFA agreements, and this trend will most likely continue as long as economic, education, and health care conditions do not improve in their home islands.

In the US, Micronesians are faced with structural barriers and discrimination, which increase inequities that contribute to Micronesians facing distressingly high cases, hospitalizations, and deaths from COVID-19, complicated by disproportionate health disparities such as higher rates of diabetes, obesity, and heart disease. Understanding the context of Micronesian migration, health challenges, and strategies to advance Micronesian health can better prepare health providers, social services, and government agencies to meet the needs of this growing population.

Conflict of Interest

None of the authors have any conflicts of interest to declare.

Disclosure Statement

Authors Davis Rehuher, Earl S. Hishinuma, and Deborah A. Goebert were supported in part by funding from the National Institute on Minority Health and Health Disparities of the National Institutes of Health under award number U54MD007601.

Authors' Affiliations:
- Department of Psychiatry, John A. Burns School of Medicine, University of Hawai'i at Mānoa, Honolulu, HI (DR, ESH, DAG)
- Department of Family Medicine and Community Health, John A. Burns School of Medicine, University of Hawai'i at Mānoa, Honolulu, HI (NAP)

Correspondence to:
Davis Rehuher BA; Department of Psychiatry, John A. Burns School of Medicine, University of Hawai'i at Mānoa, Honolulu, HI; Email: rehuherd@dop.hawaii.edu

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