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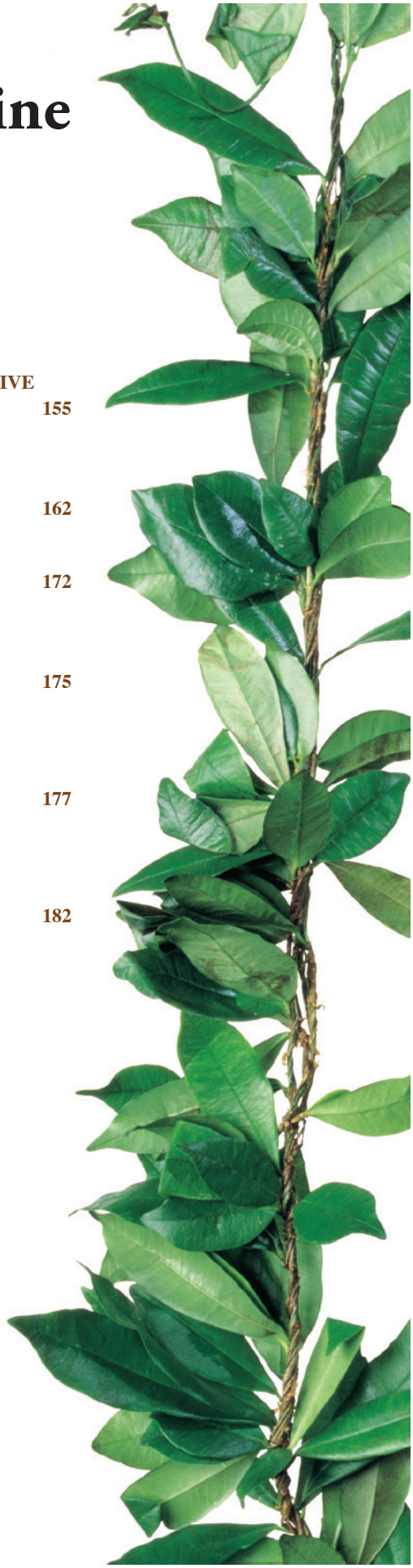

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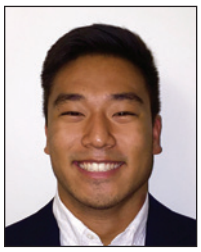
Racial Disparities in the Prevalence of Arthritis among Native Hawaiians and Pacific Islanders, Whites, and Asians

Kyle K. Obana and James Davis PhD



Kyle K. Obana

Kyle Obana is a junior Biology and Psychology double major at Amherst College in Amherst, Massachusetts. He was recently awarded the Kauffman Fellowship in Biomedical Research and will be conducting research in the Department of Orthopedic Surgery at the Columbia College of Physicians and Surgeons in the summer of 2016. He was coauthor of a publication addressing the willingness of young adults in Hawai'i to favor aggressive care following severe traumatic brain injury. Having been born and raised in Hawai'i, he aspires to attend medical school and practice medicine in Hawai'i. He volunteers in the Amherst community and plays defensive back on the Amherst College football team.

Through the Department of Native Hawaiian Health Summer Research Internship program in 2015, he was fortunate to work with James Davis PhD, Associate Professor in Biostatistics & Quantitative Health Sciences. Consistent with his interest in arthritis and Native Hawaiian health, Kyle chose to study whether there is a racial disparity among Native Hawaiians, Whites, and Asians with arthritis.

Health disparities in Native Hawaiians and Pacific Islanders (NHPI) are well established for diabetes and cardiovascular disease, but less is known about disparities in arthritis. Arthritis is a chronic disease that affects millions of Americans and is the leading cause of disability. This study examined possible disparities in the prevalence of arthritis by age, sex, and severity comparing NHPI, Whites, and Asians. The study population included 6,735 Hawai'i adult participants in the 2013 Behavioral Risk Factor Surveillance Survey. This study found that NHPI adults are more likely to have arthritis than White and Asians. This disparity can be attributed mostly to the higher prevalence of arthritis among NHPI males. Obesity may be a contributing factor, since obesity rates were significant higher in NHPI males and females. The average age at diagnosis of arthritis in NHPI was significantly lower than Whites and Asians. Among NHPI males, this was 13 years younger than Whites and 14 years younger than Asians. NHPI females were diagnosed on average 4 years younger than Whites and 6 years younger than Asians.

This study is the first to demonstrate racial disparities in the prevalence of arthritis among NHPI, Whites, and Asians. NHPI adult males have a significantly higher prevalence of arthritis than White and Asian adult males in all age groups, and arthritis in this population peaks twenty years earlier than in other groups. In order to prevent or eliminate health disparities, they must first be identified. Future research into potential causal relationships and specific types of arthritis through longitudinal studies are warranted.

Abstract

The health disparities of Native Hawaiians and Pacific Islanders (NHPI) are well established for diabetes and cardiovascular disease, but less is known about disparities in arthritis. This study examined possible disparities in the prevalence of arthritis by age, sex, and severity comparing NHPI, Whites, and Asians. The study population included adult Hawai'i participants in the 2013 Behavioral Risk Factor Surveillance Survey. NHPI males had a significantly higher prevalence of arthritis, which peaked twenty years earlier, than White and Asian males (P<.001). The prevalence of arthritis peaked at 65-79 years in males and females in all racial groups, except in NHPI males where it peaked at 45-54 years. The mean ages (years) for males with arthritis were 46.2 for NHPI, 59.1 for Whites, and 60.5 for Asians; the respective ages for females were 54.2, 60.5, and 58.8. NHPI males body mass index averaged 2.4 kg/m^2 greater than White males (P<.001), and obese NHPI males had twice the age-adjusted odds of arthritis than obese White males. Although NHPI females had a greater body mass index than White females (P=.05), the prevalence of arthritis was only slightly and not significantly higher. NHPI males and females reported high pain scores more frequently than Whites did, but the differences did not reach statistical significance. Diabetes was a comorbidity more than twice as often in NHPI and Asians of both sexes than among Whites. This study demonstrated racial disparities in the prevalence of arthritis among NHPI, Whites, and Asians.

Keywords

Native Hawaiians; Pacific Islanders, Whites; Asians; arthritis; prevalence; racial disparity; obesity

Introduction

Arthritis affects 22.7% of US adults, or 52.5 million people,[1] and is the most common cause of disability with 43.2% of those with arthritis reporting activity limitations.[2] Inherent risk factors for arthritis include advancing age,[2-4] female sex,[1,2,4] and genetic conditions.[5-10] The prevalence of arthritis has been reported to be 7.3% in those 18-44 years of age, 30.3% in the 45-64 age group, and 49.7% in those 65 years and older.[2] Twenty six percent of females and 19.1% of males have ever been told by a physician that they have arthritis.[2]

Modifiable risk factors for arthritis include obesity,[3,11-15] occupation,[16,17] and joint trauma[18,19] or infection.[20] Obesity has been associated with a higher risk of osteoarthritis.[3,11-15] Studies have demonstrated that being overweight preceded the onset of osteoarthritis in the knee[11,12] and increased the rate of its radiographic progression.[13,14] Also, weight loss has been shown

to decrease knee osteoarthritis in women.[15] Occupations with repetitive manual tasks have a higher rate of hand arthritis[16] and those with heavy lifting or frequent knee bending have a higher rate of knee and hip arthritis.[17] Joint trauma from a fracture[18] or athletics[19] has been associated with an increased risk of osteoarthritis. A variety of infectious pathogens can cause both acute and chronic arthritis.[20] Diabetes and heart disease are common comorbidities associated with arthritis.[1] Forty seven percent of adults with diabetes and 49% with heart disease are reported to have arthritis.[1]

The reasons for racial and ethnic health disparities are complex, but genetic, behavioral, environmental, cultural, and socioeconomic factors may contribute. Health disparities in Native Hawaiians have been reported in diabetes,[21-23] obesity,[23-27] ischemic[28] and hemorrhagic stroke,[29] and cardiovascular disease.[27,30] Racial and ethnic differences in the prevalence, treatment, and outcome of different forms of arthritis have been reported.[31-35] African Americans have a higher prevalence, more severe disease, and poorer outcomes due to systemic lupus erythematous than Whites.[31,35] Non-Hispanic Blacks, Hispanics, and multiracial groups have been shown to have higher arthritis-attributable activity, and work limitations and more severe joint pain than non-Hispanic Whites with arthritis.[32] However, previous studies have combined Asians and Pacific Islanders into one group.[32] Similarly, prior studies and surveys have not routinely identified Native Hawaiians and Other Pacific Islanders (NHPI) as a distinct racial or ethnic grouping. This study analyzed the prevalence of arthritis by age, sex, and severity among NHPI, Whites, and Asians in Hawai'i using 2013 Behavioral Risk Factor Surveillance System (BRFSS) data.

Methods

Study Design

The study population was adult participants residing in Hawai'i surveyed in the 2013 BRFSS who self-identified as NHPI, White, or Asian race. The study employed the dataset available nationally through the Centers for Disease Control and Prevention (CDC).[36] The study population was restricted to those who answered that they either were or were not diagnosed with arthritis in response to the question asking if a doctor had ever told them that they had some form of arthritis (eg, arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia). Eligible ages ranged from 18 to 79. The study was designed to compare the prevalence of arthritis by race, age, sex, and categories of body mass index (BMI). A secondary objective was to assess possible racial differences in the prevalence of diabetes among participants with arthritis.

Analysis Variables

Race was the preferred race selected by participants. BMI was analyzed categorically: underweight (12 to <18.5 kg/m^2), normal weight (18.5 to < 25 kg/m^2), overweight (25 to < 30 kg/m^2), and obese (>30 kg/m^2). The presence of diabetes was based on the answer to a question asking participants if a doctor had ever told them they had diabetes. Age and sex were used as reported by participants. BRFSS includes three questions on the burden of arthritis: (1) Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?; (2) Do arthritis or joint symptoms now affect whether you work, the type of work you do, or the amount of work you do?; (3) During the past 30 days, to what extent has your arthritis or joint symptoms interfered with your normal social activities, such as going shopping, to the movies, or to religious or social gatherings? Answers for social limitations were categorized as none, a little, or a lot. The questionnaire also asked participants with arthritis to rank their joint pain in the past 30 days on a scale from 0 to 10 describing 0 as no pain or aching and 10 as pain or aching as bad as it can be. For analyses, the pain scores were categorized as five or higher versus 0 to 4.

Data Analysis

Characteristics of the study participants are summarized by percentages and standard errors within race and gender categories. All analyses were performed accounting for the complex survey design by using the primary sampling units, strata, and weights provided by CDC. Differences in prevalence by race and gender were evaluated by chi-square tests. The analyses employed logistic regression to examine race differences by body mass category with adjustment for age. Models included indicator variables for combinations of race and sex using the combinations of White females or White males as the reference category. As an example, one analysis compared obese Asian and NHPI females to obese White females. A similar analysis was employed to model the prevalence of diabetes by sex and race groupings among people with arthritis. Limitations in activities due to arthritis comparing NHPI and Asians to Whites were analyzed employing separate models for females and males. Age-adjusted logistic regression models were used for the questions on activities with binary (yes/no) answers and multinomial logistic regression for the question on social activities with three outcome categories. Results of logistic regression models are reported as odds ratios with 95% confidence intervals.

All analyses were performed using SAS version 9.3 and accounted for the complex survey design.

Results

The study results are based on the responses of 6,735 participants. Table 1 summarizes the characteristics of the study population. For both females and males, NHPI had the greatest proportions in the youngest age groups. NHPI males also had the highest prevalence of obesity at 49.4%, compared to Whites (22.7%) and Asians (17.9%). NHPI female obesity was 36.7%, compared to Whites (20.2%) and Asians (12.9%).

Prevalence of Arthritis

Prevalence of arthritis varied by age, race, and sex (Figure 1). NHPI males exhibited the highest prevalence across the adult age span, significantly greater than Whites and Asians ($P<.001$). At the peak age range (45-54 years), arthritis prevalence among

Table 1. Percent (standard error) of participant characteristics by race and sex					
Sex		**Characteristic**	**White**	**NHPI**	**Asian**
Female	**Age group**				
		18-34	30.0 (2.0)	43.8 (2.8)	25.2 (1.8)
		35-44	14.8 (1.5)	18.3 (2.3)	17.3 (1.5)
		45-54	17.4 (1.5)	14.5 (1.8)	21.2 (1.6)
		55-64	19.9 (1.3)	14.1 (1.8)	18.2 (1.3)
		65-79	17.9 (1.3)	9.3 (1.4)	18.1 (1.2)
	Body Mass Index				
		Underweight	4.1 (0.9)	0.7 (0.4)	4.0 (0.7)
		Normal	50.1 (2.0)	28.1 (2.7)	56.6 (1.9)
		Overweight	25.6 (1.7)	33.6 (2.7)	26.5 (1.7)
		Obese	20.2 (1.7)	37.6 (2.7)	12.9 (1.4)
Male	**Age group**				
		18-34	32.1 (2.0)	48.7 (3.1)	28.2 (2.0)
		35-44	18.1 (1.5)	20.6 (2.6)	15.3 (1.4)
		45-54	18.9 (1.5)	13.0 (2.0)	17.7 (1.6)
		55-64	17.0 (1.3)	10.7 (1.8)	20.8 (1.5)
		65-79	13.9 (1.1)	6.9 (1.0)	18.1 (1.4)
	Body Mass Index				
		Underweight	1.1 (0.6)	0.7 (0.4)	0.9 (0.4)
		Normal	32.6 (1.8)	21.7 (2.5)	39.3 (2.0)
		Overweight	43.6 (1.9)	28.1 (2.7)	41.9 (2.0)
		Obese	22.7 (1.8)	49.4 (3.1)	17.9 (1.5)

Abbreviation: Native Hawaiian and Other Pacific Islanders (NHPI)

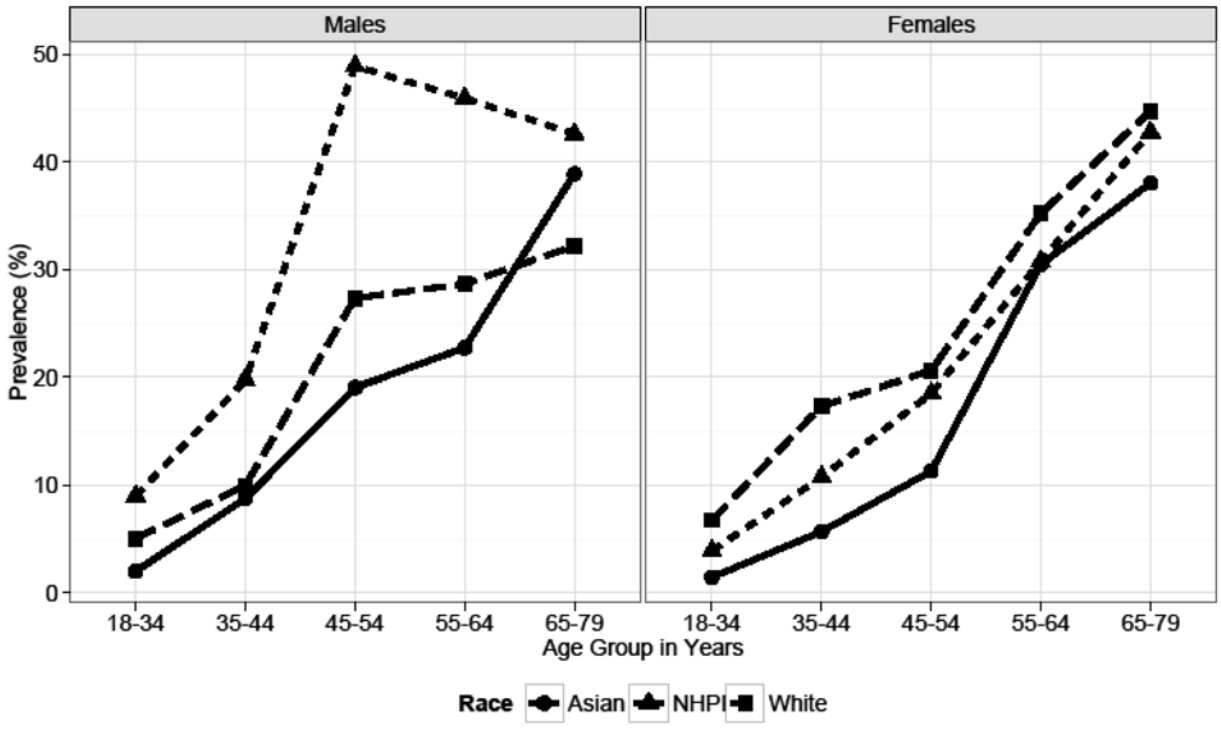


Figure 1. Prevalence of Arthritis among Asians, Native Hawaiians and Other Pacific Islanders (NHPI), and Whites by Sex

Table 2. Prevalence and age-adjusted odds ratios with 95% confidence intervals of having arthritis by sex, race, and body mass

Sex	Body Mass	Race	Prevalence (SE)	Age-adjusted Odds Ratio (95% CI)	*P*-value
Male	Obese	NHPI	34.45 (4.66)	**2.08 (1.02, 4.26)**	.045
	Obese	Asian	28.42 (4.00)	0.87 (0.45, 1.67)	.67
	Obese	White	29.75 (4.49)	1.0	
	Overweight	NHPI	11.25 (2.79)	0.95 (0.49, 1.83)	.88
	Overweight	Asian	15.58 (1.93)	0.83 (0.54, 1.27)	.39
	Overweight	White	15.54 (1.93)	1.0	
	Normal	NHPI	11.58 (3.35)	2.04 (0.97, 4.26)	.058
	Normal	Asian	13.61 (2.29)	0.96 (0.57, 1.60)	.89
	Normal	White	12.15 (1.73)	1.0	
Female	Obese	NHPI	16.75 (2.73)	0.53 (0.29, 0.95)	.03
	Obese	Asian	21.49 (4.50)	0.55 (0.27, 1.10)	.09
	Obese	White	33.85 (4.48)	1.0	
	Overweight	NHPI	16.83 (3.49)	0.94 (0.48, 1.82)	.84
	Overweight	Asian	20.70 (2.65)	0.69 (0.43, 1.10)	.11
	Overweight	White	26.70 (3.00)	1.0	
	Normal	NHPI	7.86 (2.61)	**0.40 (0.18, 0.88)**	.02
	Normal	Asian	14.31 (1.60)	**0.60 (0.40, 0.92)**	.02
	Normal	White	19.98 (2.32)	1.0	

Abbreviations: standard error (SE); confidence interval (CI); NHPI (Native Hawaiian and Other Pacific Islanders)

NHPI males was 49.4% compared to White males (22.2%) and Asian males (17.9%). The prevalence for NHPI males remained high — from 40% to 50% — at the oldest ages. Arthritis prevalence among White and Asian males increased with age, coming closer to the prevalence of NHPI males at ages 55 and older. Arthritis prevalence did not differ significantly among females but increased with age for all three races; differences were less than 15% by age groups and smallest at the oldest ages.

Arthritis and BMI

Prevalence of arthritis varied by weight status (Table 2). Obese NHPI males had twice the age-adjusted odds of having arthritis compared to obese White males (*P*=.045). The BMI of obese NHPI males was on average 2.4 kg/m^2 greater than obese White males (*P* <.001). Among females, obese White females had the highest prevalence of arthritis. The age-adjusted odds of arthritis for NHPI were about 50% lower than White females (*P*=.03). The BMI of NHPI females averaged 1.3 kg/m^2 greater than White females (*P*=.05).

Social Limitations and Joint Pain

Limitations from arthritis were not significantly different when comparing NHPI males and females to Whites (Table 3). Asian females, however, had 60% lower odds of limitations in usual activities, in the type or amount of work, and in social activities (*P*-values <.05).

Table 3. Age-adjusted odds ratios and 95% confidence intervals for limitations due to arthritis by Asians and Native Hawaiians and Other Pacific Islanders (NHPI) compared to Whites by sex

Limitations	Race	Female		Male	
		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Limited in usual activities	NHPI	0.8 (0.4, 1.3)	.324	1.0 (0.5, 2.0)	.923
	Asian	**0.4 (0.3, 0.7)**	<.001	0.8 (0.5, 1.3)	.399
	White	1.0		1.0	
Type or amount of work	NHPI	1.6 (0.9, 2.8)	.146	1.0 (0.5, 2.0)	.969
	Asian	0.7 (0.4, 1.1)	.124	0.9 (0.5, 1.5)	.611
	White	1.0	1.0	1.0	
Limited by joint symptoms	NHPI	0.8 (0.4, 1.3)	.324	1.0 (0.5, 2.0)	.923
	Asian	**0.4 (0.3, 0.7)**	<.001	0.8 (0.5, 1.3)	.399
	White	1.0		1.0	
Social activities	NHPI				
Limited a lot		1.3 (0.6, 2.7)	.534	0.8 (0.3, 2.0)	.610
Limited a little		0.8 (0.4, 1.5)	.473	1.5 (0.7, 3.2)	.368
Social activities	Asian				
Limited a lot		**0.4 (0.2, 0.9)**	.023	0.7 (0.3, 1.6)	.428
Limited a little		0.7 (0.4, 1.2)	.212	1.1 (0.5, 2.2)	.883
Social activities	White				
Limited a lot		1.0		1.0	
Limited a little		1.0		1.0	

Limitations are based on responses to survey questions on arthritis burden from the 2013 Behavioral Risk Factor Surveillance Survey
Comparison category for activity limitations is having no limitations
Abbreviation: confidence interval (CI)

Differences in joint pain among those with arthritis did not vary significantly by sex and race. However, NHPI tended to report greater than average pain scores compared to Asians and Whites (Table 4). Although not reaching statistical significance, NHPI males and females had odds ratios for above average pain 60%-70% higher than Whites.

Table 4. Age-adjusted odds ratios of high reported pain among participants with arthritis by race/ethnicity and sex

Race	Male		Female	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
NHPI	1.6 (0.8, 3.3)	.22	1.7 (1.0, 3.0)	.07
Asian	0.8 (0.5, 1.3)	.30	0.9 (0.6, 1.4)	.69
White	1.0		1.0	

High reported pain was defined as a pain score of 5 or higher on a 10-point pain scale.
Abbreviation: confidence interval (CI); NHPI (Native Hawaiian and Other Pacific Islander)

Arthritis and Diabetes

Among participants with arthritis, the age-adjusted odds of diabetes were two to three times greater among NHPI and Asians of both sexes than among Whites (Table 5, *P*-values <.05).

Table 5. Prevalence and age-adjusted odds ratios with 95% confidence intervals of having diabetes by sex and race among participants with arthritis

Sex	Race	Prevalence (SE)	Age-adjusted Odds Ratio (95% CI)	*P*-value
Male	NHPI	10.1 (1.9)	3.8 (1.7, 8.7)	.002
	Asian	10.7 (1.3)	2.9 (1.4, 5.9)	.003
	White	4.9 (0.7)	1.0	
Female	NHPI	10.3 (1.6)	2.8 (1.3, 5.8)	.008
	Asian	8.8 (1.1)	2.2 (1.2, 4.1)	.02
	White	4.6 (0.8)	1.0	

Abbreviations: standard error (SE); confidence interval (CI); Native Hawaiians and Other Pacific Islanders (NHPI)

Discussion

This study provides evidence that NHPI adults are more likely to have arthritis than Whites and Asians. This disparity may be attributed predominantly to the higher prevalence of arthritis among NHPI males. A contributing factor may be the significantly higher rate of obesity in NHPI males, a finding consistent with other studies.[22,24-27] Obesity rates were significantly higher in both NHPI males and females compared to Whites and Asians in this study, however, the difference was much greater in NHPI males. Although there may be a reciprocal relationship between obesity and arthritis, a high BMI and bone mineral density have been shown to increase the risk of osteoarthritis, the most common form of arthritis.[37,38] Obese NHPI males in this study were twice as likely to have arthritis than obese White males, but obese NHPI females were half as likely to have arthritis than obese White females. The reason for this sex disparity is unclear. Furthermore, Asians had the same odds of having arthritis in all weight categories, suggesting that BMI alone is not causative. BMI has also been shown to increase with increasing percentage of NHPI ancestry which suggests a genetic component.[23]

The average age at diagnosis of arthritis in NHPI was significantly lower than Whites and Asians. This may be attributed mostly to NHPI males whose average age at diagnosis was thirteen years younger than Whites and fourteen years younger than Asians. Compared to White and Asian females, NHPI females were four and six years younger, respectively. The prevalence of arthritis is known to increase with advancing age,[2-4] peaking in this study at 65-79 years for White and Asian males and all females, but twenty years earlier in NHPI males. Despite peaking earlier, NHPI males continued to have a higher prevalence of arthritis than Whites and Asians at older ages. The decreasing prevalence of arthritis with advancing age in NHPI males over 55 years could be due to a shorter life span related to chronic illnesses. When combined with a shorter life expectancy,[38] an earlier onset of arthritis may result in fewer quality adjusted life years. The reason for the earlier peak in the prevalence of arthritis in NHPI males is unclear. Further research into the possible causes of this age disparity is indicated.

A younger age of onset has also been reported in NHPI with ischemic[28] and hemorrhagic stroke[29] and cardiovascular mortality.[40] In these studies, NHPI also had higher rates of diabetes and hypertension which are known risk factors for stroke[41,42] and heart disease.[41-43] In the current study, NHPI and Asians had a significantly higher prevalence of diabetes than Whites, but Whites had a higher prevalence of arthritis than Asians. Likewise, NHPI had a significantly higher prevalence of arthritis than Asians but not a significantly higher prevalence of diabetes. Additional studies are needed to more thoroughly explore the association between diabetes and arthritis.

NHPI have been previously reported to experience a more severe level of disability than other ethnic groups, most commonly attributing their disabling condition to stroke, whereas Japanese and Whites most commonly cited arthritis.[44] In this study, both NHPI males and females, despite having the highest pain scores, demonstrated no significant difference in activity limitations attributed to arthritis compared to White males and females.

This study has several limitations. This was a cross-sectional study so causation cannot be established. Age adjusted analysis helped reduce prevalence bias. Self-identification with a specific racial/ethnic group does not allow the blood percentage of a particular ethnicity of the respondent to be determined. However, self-selection of a racial/ethnic group is the accepted method in determining race/ethnicity in such surveys. Our data was also based on very general race categories, particularly for Asians. Variations among ethnic groups might affect overall prevalence data. The Hawai'i Department of Health collects state-level

BRFSS data which separates Native Hawaiians from Pacific Islanders and separates Asians into specific ethnic groups, but this increases the number of groups and decreases the number in each group for analysis. Future studies with larger populations of distinct ethnic groups may reveal disparities by specific ethnicities.

BRFSS data is based on self-reporting which introduces the possibility of reporting bias. The validity of self-reported prevalence of arthritis using BRFSS data has been shown to be sensitive and highly reliable.[45,46] Self-reported height has been found to be significantly overestimated and self-reported weight significantly underestimated, which would result in a lower calculated BMI.[47] This would suggest that the prevalence of obesity may be higher than reported. Variations in reporting by race or ethnic group could also influence BMI.

This study included only Hawai'i residents. According to the US Census 2010, 55% of NHPI, or 289,970 people, reside in Hawai'i. About one-third of NHPI in the continental US reside in California.[48] The 2010 Hawai'i Health Survey cited 291,223 NHPI living in Hawai'i.[49] The investigators chose to analyze NHPI residing in Hawai'i because Hawai'i has the largest population of NHPI and self-reporting as NHPI should be the most accurate of the states surveyed.

The different types of arthritis and the joints involved could not be distinguished using 2013 BRFSS data. Future research with more detailed patient data will be important in determining whether there are specific arthritic conditions and joint locations that are more prevalent in NHPI.

Conclusion

This study demonstrated racial disparities in the prevalence of arthritis among NHPI, Whites, and Asians. NHPI adult males have a significantly higher prevalence of arthritis than White and Asian adult males in all age groups, and arthritis in this population peaks twenty years earlier than in other groups. Obesity may be a contributing factor.

In order to prevent or eliminate health disparities, they must first be identified. This is the first study to analyze health disparities in the prevalence of arthritis among NHPI. Future research into potential causal relationships and specific types of arthritis are warranted.

Conflicts of Interest

None of the authors identify a conflict of interest.

Acknowledgments

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2015 WRITING CONTEST GRADUATE WINNER

Modifiable Determinants of Obesity in Native Hawaiian and Pacific Islander Youth

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Katherine Braden holds a Bachelor of Arts degree in Psychology with a minor in Sociology, magna cum laude, from the University of San Diego. She is a Master of Public Health student with a specialization in Social and Behavioral Health Sciences, graduating from the University of Hawai'i's Office of Public Health Studies in May 2016. She works as a Graduate Research Assistant for the Hawai'i State Department of Health's Healthy Hawai'i Initiative Evaluation Team, assisting with the evaluation of statewide physical activity and nutrition projects implemented in the community setting. Her research and professional interests include physical activity and nutrition, childhood obesity, socioeconomic determinants of health and health equity, public health evaluation, and public health workforce development. Katherine is a member of the Delta Omega National Public Health Honor Society.

Her winning manuscript, Modifiable Determinants of Obesity in Native Hawaiian and Pacific Islander Youth, *is a systematic literature review that assesses the existing body of research on modifiable determinants and correlates of obesity in Native Hawaiian and Other Pacific Islander (NHOPI) youth. Mentored by faculty advisor Claudio Nigg PhD, this research reviewed articles published between 2000 and 2015 in PubMed, with additional expert recommended articles identified through the Hawaii Initiative for Childhood Obesity Research and Education (HICORE) research database. Of an initial pool of 471 articles, 60 articles were read in full and 14 articles were selected for inclusion in the qualitative synthesis. Utilizing an ecological model as a framework to identify gaps in the literature and suggest areas for future research, findings from this review indicate that early life and contextual factors—namely, infant feeding mode, geographic location, and education—appear to play an important role in obesity in NHOPI. However, more research is needed, particularly pre-birth cohort studies evaluating the effects of prenatal and early life risk factors, studies on the sociocultural influences on obesity-related psychosocial factors and health behaviors, as well as the influence of environmental and policy-level variables.*

Abstract

In the United States, obesity continues to be a major public health concern. Obesity disproportionately affects Native Hawaiian and Other Pacific Islanders (NHOPI) who demonstrate alarming rates of obesity and its related chronic conditions. However, little is known about the causes of obesity for this group. Given the modest effects of individual-level obesity treatments, identifying the most impactful determinants that can be modified to prevent or reduce obesity in NHOPI youth is critical to the development of interventions that best meet the needs of this population. A systematic review was conducted in PubMed, with additional expert-recommended articles identified through the Hawai'i Initiative for Childhood Obesity Research and Education (HICORE) research database, to evaluate the current body of research on modifiable determinants or correlates of obesity in NHOPI youth. Of an initial pool of 471 articles, 60 articles were read in full and 14 articles were selected for inclusion in the qualitative synthesis. Utilizing an ecological framework to identify gaps in the literature and suggest areas for future research, findings from this review indicate that early life and contextual factors—namely, infant-feeding mode, geographic location, and education—appear to play an important role in obesity in NHOPI youth. However, more research is needed, particularly pre-birth cohort studies evaluating the effects of prenatal and early life risk factors, studies on the sociocultural influences on obesity-related psychosocial factors and health behaviors, as well as the influence of environmental and policy-level variables.

Keywords

obesity, determinants, correlates, Native Hawaiian, Pacific Islander, children, youth

Introduction

Obesity among children and adolescents has risen dramatically in the United States. While the prevalence of obesity in youth appears to have leveled off, prevalence remains high at 16.9%.[1] The epidemic proportions of obesity and its associated health problems have gained recognition as a major public health concern.[2,3] Obesity in youth is associated with physical and psychosocial risk factors such as high blood pressure, high cholesterol, abnormal glucose tolerance, low-self esteem, and stigmatization.[4-7] Moreover, obesity in youth tends to persist into adulthood.[8] Obesity in adulthood is a major contributor to preventable morbidity and mortality, as it increases the risk of coronary heart disease, stroke, type 2 diabetes, and different cancers.[9] It is projected that the costs attributable to overweight and obesity will account for 16-18% of total US health care expenditures by 2030.[10]

Obesity disproportionately affects racial and ethnic minorities, with a consistently higher prevalence in Hispanics and Blacks than in Caucasians.[1] While the National Health and Nutrition Health Examination Survey has not reported on Native Hawaiians and Other Pacific Islanders (NHOPI),[11] NHOPI constitute 1.2 million people and are the second fastest-growing racial/ethnic group in the United States, increasing 40% from 2000 to 2010.[12] While the NHOPI label encompasses at least 20 distinct

cultural groups, each with its own traditions and languages, these groups share commonalities due to unique island cultures and history of colonization by the US government.[13] NHOPI have the greatest representation in Hawai'i and the US-Affiliated Pacific region (USAP).[12]

Until 2000, the US Census aggregated Native Hawaiians and Pacific Islanders with Asian Americans in a single racial group (Asian American and Pacific Islander [AAPI]).[12] This masked health disparities experienced by the NHOPI population and its subgroups and led to a paucity of disaggregated data on these heterogeneous groups.[14,15] Available evidence shows that NHOPI adults display alarming rates of obesity and related diseases. Compared to Caucasians, NHOPI are 30% more likely to be obese, 30% more likely to be diagnosed with cancer, twice as likely to be diagnosed with diabetes, and three times more likely to be diagnosed with coronary heart disease.[16] The Children's Healthy Living Program estimates the overall prevalence of overweight or obesity (OWOB) in Hawai'i and the USAP to be 21% in 2 year-olds (y/o) and 39% in 8 y/o, which exceeds corresponding national averages of 15.6% for 2-5 y/o and 26% for 6-11 y/o.[1,17] Additionally, NHOPI adolescents in Hawai'i were found to have OWOB rates 10% higher than other ethnic groups.[18]

Given the rapid growth of the NHOPI population, the relative paucity of data specific to this group, the disproportionate burden of obesity and its associated diseases in adults, and high prevalence of OWOB in youth, it is imperative that evidence-based obesity interventions be developed that best meet the needs of this group. In recent years, the traditional focus on the etiology of obesity as an energy-balance equation has been expanded to consider a broader ecological context.[19] In public health, ecological models account for people's interactions with their physical and sociocultural surroundings.[20] In contrast to traditional behavior change paradigms, ecological models are set apart by their inclusion of environmental and policy variables.[21,22] Instead of a sole focus on the influence of a narrow range of psychosocial variables on behavior, these models incorporate a wide range of influences at multiple levels of one's environment.[22] These levels include the intrapersonal (biological, psychological), interpersonal (social, cultural), organizational, community, physical environment, and policy.[22] Ecological models are thought to provide comprehensive frameworks for understanding multiple, interacting determinants of health behaviors and are well suited for multifactorial behaviors.[22] While eating and physical activity are fundamental behaviors governing energy balance, they are mediated by a range of influences.[23] In light of this, researchers have called for more complex, multilevel approaches to understanding and preventing childhood obesity.[23,24]

Given the modest long-term effects of individual-level obesity treatments in adults, efforts should prioritize reducing the incidence of OWOB among youth.[19] To inform the development of a comprehensive intervention targeting different levels of influence, an evidence base of the key determinants of OWOB in NHOPI youth must be developed. The purpose of this study is to systematically assess the existing body of research on modifiable determinants or correlates (able to be changed with intervention, eg, parental determinants, diet, sleep, etc.) of OWOB in NHOPI youth, using the ecological model as a framework to identify gaps in the literature and suggest areas for future research.[25] To the best of the authors' knowledge, no review of this nature has been conducted to date.

Methods

A literature review was conducted in PubMed of original articles published between January 2000 and February 2015. Additionally, expert-recommended articles were identified through the Hawai'i Initiative for Childhood Obesity Research and Education's (HICORE) research database. Search terms were "obesity" and "Pacific Islander" or "Hawaiian." When possible, results were filtered by age category (child: birth-18 years), otherwise "child" and "adolescent" were included as additional search terms. Inclusion criteria are listed in Table 1. There was no restriction on study design due to the relative paucity of research on this topic. Only studies with modifiable determinants or correlates were considered, as results of this review are intended to guide intervention development.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Checklist and Flow Diagram were used to guide the search process.[27] The search yielded an initial pool of 471 articles, 324 from PubMed and 147 from the HICORE database. After eliminating duplicates, the remaining articles were screened by title and abstract for relevance, resulting in the removal of 406 articles that did not meet inclusion criteria. Sixty articles were read in full to determine eligibility. Of these, 46 were excluded for reasons (see Figure 1), such as not including an OWOB outcome, not analyzing the relationship between OWOB and a determinant or correlate, or not disaggregating NHOPI from AAPI data. Through this process, 14 articles were selected for inclusion in the qualitative synthesis. Two of these articles were featured in a 2011 special issue of the Hawai'i Medical Journal on obesity in youth in Hawai'i.[28,29] Additionally, two articles represent the same study.[30,31] Data were extracted from all reviewed articles (Table 2). Inter-rater reliability with a PhD-level content expert on a subset of articles (n=2) revealed 95% agreement.

Table 1. Inclusion criteria for the selection of articles on modifiable determinants or correlates of obesity in Native Hawaiian and Other Pacific Islander (NHOPI) youth

1. The article was from the U.S. or U.S. Affiliated Pacific region
2. NHOPI was the primary study population
   - If NHOPI was not the primary study population, or if Asian American and Pacific Islander (AAPI) were, only articles with a disaggregated sub-analysis of NHOPI were considered due to the tendency for AAPI data to mask disparities in its subpopulations[14,15,26]
3. The study sample's age ranged from birth–18 years
   - Articles on mothers or caregivers were considered if obesity-related knowledge, attitudes, or behaviors in infancy or childhood were identified
4. Overweight or obesity (OWOB) was a primary outcome variable
5. At least one modifiable determinant or correlate of OWOB was assessed

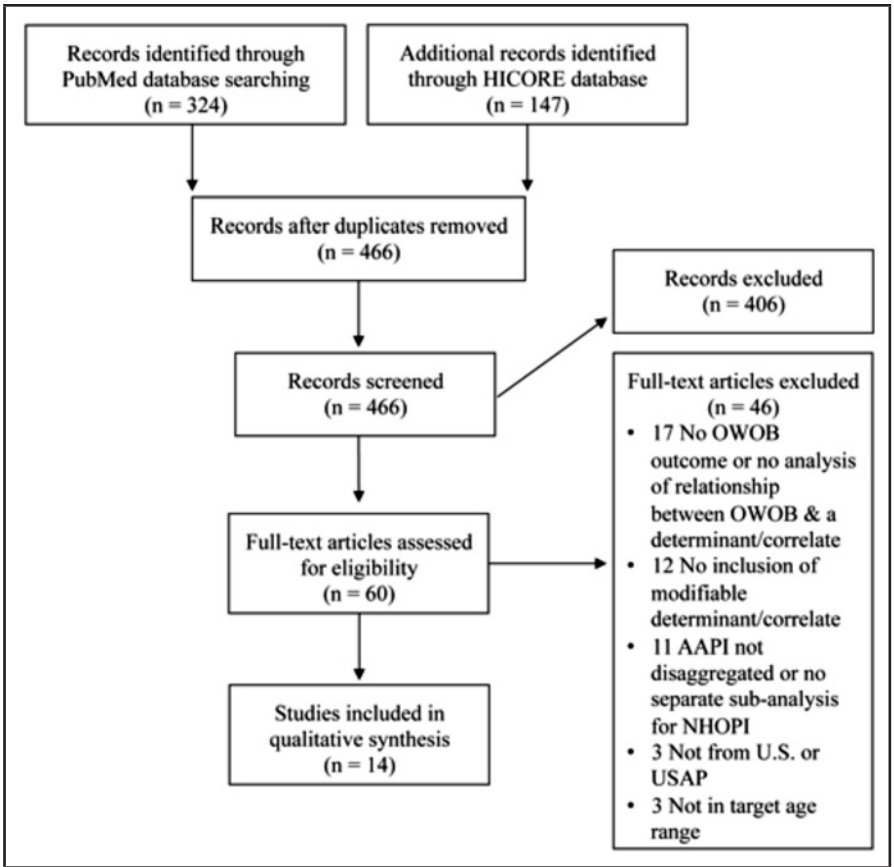

Figure 1. Flow chart of the systematic literature review process of articles on the determinants or correlates of obesity in Native Hawaiian and Other Pacific Islander (NHOPI) youth

Table 2. Qualitative review of research addressing determinants or correlates of obesity in Native Hawaiian and Other Pacific Islander (NHOPI) youth

Citation	Study population	Study Design	Predictors/correlates	Outcome variable measure	Results
Prenatal					
CDC, 2011	Washington 28,671 Infant-mother pairs 2,442 NHOPI & 26,229 Asian pairs	Cross-sectional	Maternal characteristics: Pre-pregnancy height & weight Initiation of prenatal care Maternal age Smoking during pregnancy	Infant characteristics: Birth weight (BW) Length of gestation	Infants born to NHOPI mothers significantly more likely than Asian counterparts to be born preterm (*P*<.001), at high BW (*P*<.001), or to have received late/no prenatal care (*P*<.001). NHOPI mothers significantly more likely than Asian mothers to be OWOB (*P*<.001) before pregnancy, to smoke during pregnancy (*P*<.001), or to be adolescents (*P*<.001).
Utz, et al, 2012	Utah 229,598 Adolescent (16 or 17y/o) - mother pairs 2,743 NHOPI, 987 Asian, & 225,868 Non-Hispanic white pairs	Retrospective	Maternal exposure to prenatal care (initiation & utilization) Potential covariates: Adolescent variables (birth weight, exact age at BMI measurement, birth year, gender) Maternal variables (educational attainment, pre-pregnancy BMI, gestational weight gain, smoking / drinking behaviors)	Overweight or obesity (OWOB) in adolescence (BMI)	Adolescents of others who received early (first trimester initiation) or adequate (defined by Kotelchuck Index) prenatal care were significantly less likely to be OWOB (data not shown). NHOPI mothers less likely to receive adequate prenatal care, largely driven by late initiation (*P*<.05). NHOPI demonstrated the largest protective effect of early prenatal care on the risk of adolescent obesity (*P*<.001). The effect remained after controlling for maternal education (*P*<.05), but became non-significant (*P*=.1) after controlling for pre-pregnancy BMI.
Infancy (birth – 2 y/o)					
Hawley, et al, 2014	American Samoa 795 Infants Ages 0-15 mo.	Longitudinal	Feeding mode at 4 mo. (+/- 2 mo.): Breastfed Formula fed Mixed-fed (breast milk, formula, or solid foods)	OWOB at 15 mo. (BMI z-score) Rapid growth (RG) (Conditional gain >.67 z-scores)	Formula-fed infants gained weight & length faster than breastfed infants (*P*<.05). Formula-fed boys were significantly more likely to be obese at 15 mo. than breastfed boys (*P*<.01). There were no significant differences in girls at 15 mo., but OWOB was greater in the mixed-fed group. There was a significant difference in RG by feeding mode among boys (27% RG in formula-fed, 17% breastfed, & 6.4% mixed fed) (*P*<.01), but not girls.
Novotny, et al, 2007	Common - wealth of the Northern Marianas Islands (CNMI) 420 children participating in WIC Ages 6 mo.-10 y/o 54 native Chamorro, 8 native Carolinian, 69 Filipino, & majority mixed ethnicity or of other ethnicities	Cross-sectional	Primary caregiver's report of past breast feeding	OWOB in childhood (BMI)	Any breastfeeding was negatively associated with BMI (after adjusting for age, sex, BW, & mother's years of education) (*P*=.043). The association of BMI w/ exclusive breastfeeding & duration of breastfeeding were not significant.

Table 2. Qualitative review of research addressing determinants or correlates of obesity in Native Hawaiian and Other Pacific Islander (NHOPI) youth (Continued)

Citation	Study population	Study Design	Predictors/correlates	Outcome variable measure	Results
Okihiro, et al, 2012	Hawai'i 389 children Ages 4-5 y/o 66% Native Hawaiian (NH), 21.6% Samoan, & 12.3% Filipino	Retrospective	Growth acceleration during first 2 years of life (consecutive time intervals: 2 days-5 mo., 6-11 mo., & 12-23 mo.) Severe RG (increase in weight-for-length z-score of ≥1.0 SD over an age interval) Moderate RG (increase in weight-for-length z-score of ≥.67 SD, but <1.0 SD over an age interval)	OWOB at pre-kindergarten (PreK) (BMI)	Severe RG from 12-23 mo. was strongly associated w/ PreK obesity (OR 4.36, 95% CI 1.85-10.27), w/ 48% of these children obese at PreK, compared to 16.7% of children w/ moderate RG & 19.3% w/out RG.
Childhood (3 – 10 y/o)					
Pobutsky, et al, 2013	Hawai'i 12,823 children Ages 4-5 y/o	Cross-sectional	School Complexes	OWOB (BMI)	28.6% of children were overweight or obese (14.4% &14.2%, respectively). Proportions of OWOB were persistently higher (32.5%+) in certain school complexes on O'ahu (Farrington, Kahuku, Waialua, & Waipahu), as well as some rural & neighbor island school complexes (Lana'i & Lahainaluna)
Stark, et al, 2011	Hawai'i 554 children Ages 2-10 y/o 42.6% NH/ part-NH, 6.9% Pacific Islander (PI), 18.8% Asian/part- Asian, 2.7% Hispanic, 18.4% Filipino, 7.6% White, & 5.8% Hispanics, Black & Other	Cross-sectional	Socio-economic status (SES) (Medicaid vs non-Medicaid) Place of residence	OWOB (BMI)	Boys had a higher incidence of OWOB (54%) than girls (46%). No association between SES & OWOB. PI had highest incidence of OWOB (40%) followed by NH/part-NH (19%) & Filipinos (19%). PI 3.6 times more likely to be OWOB. There was a significant relationship between OWOB & place of residence (*P*=.008). Children from West O'ahu, Honolulu, & Central O'ahu/North Shore areas were 2-3 times more likely to be OWOB compared to those from the Windward side.
Novotny, et al, 2013	Hawai'i 4,608 children Ages 5-8 y/o 13.6% White, 9.4% Asian, 9.9% Filipino, 7.1% NH, 15.2% NH-Asian mixed, 1.9% Samoan, 33.1% other mixed (Incl. African American, American Indian/Aleutian/Eskimos, or other PI), & 9.8% Other	Cross-sectional	Neighborhood education level A subsample (n=2,169) had Vital Records data on: Maternal education level Maternal age	OWOB (BMI z-score)	All children, except Asians, significantly more likely to be OWOB compared to Whites (*P*<.05). Excess risk varied by ethnic group (Samoan & NH had the highest; OR = 9.4, OR = 2.5, respectively). There was a significant association between ethnic group & neighborhood education level (*P*<.001), which held after adjusting for age & sex (data not shown). Older maternal age groups (*P*<.04) & higher maternal education levels (*P*=.001) were associated w/ lower BMI among children.
Brown, et al, 2011	Hawai'i 125 kindergarten (K) & third grade students K: mean age 5.6 y/o Third grade: Mean age 8.7 y/o 48.8% NH, 57.8% non-NH	Cross-sectional	Cohort (K or third grade) Sex Hawaiian ancestry Parental educational attainment Household	OWOB (BMI z-score & other adiposity measures eg, waist circumference, abdominal circumference, etc.)	BMI z-scores were significantly higher in third grade male NH children (*P*<.01). There was no significant ethnic difference in adiposity measures in kindergarteners. Among third grade girls, father's educational attainment was significantly & inversely related to adiposity measures (*P*<.1). Hawaiian ancestry & income was not significantly related to adiposity measures.

Table 2. Qualitative review of research addressing determinants or correlates of obesity in Native Hawaiian and Other Pacific Islander (NHOPI) youth (Continued)

Citation	Study population	Study Design	Predictors/correlates	Outcome variable measure	Results
Bruss, et al, 2003 & Bruss, et al, 2005	CNMI 32 primary caregivers of children (ages 6-10 y/o)	Observational	Sociocultural & familial factors	Child feeding practices Perceptions of weight normalcy	Themes: Caregivers, esp. mothers, demonstrate inner dissonance when child-feeding practices conflict w/ cultural values related to food, identify challenges posed by the community as a barrier to healthful eating habits for their children. Cultural differences among ethnic groups regarding children's weight status. Intergenerational conflict related to child feeding between mothers & grandmothers. Both mothers & fathers report intra-family conflict related to child feeding. Parents report avoiding emotional conflicts related to child feeding.
DeRenne, et al, 2008	Hawai'i 68 K- sixth grade students, enrolled in the A+ afterschool program at two schools About 75% NH	Quasi-experiment	Primary objective: assess feasibility of incorporating physical activity (PA) into an afterschool program Secondary objective: compare effectiveness of two intervention programs: - School A: model curriculum led by trained after school leaders - School B: structured activity program designed & taught by PE teacher	Anthropometric measures (stature, weight, skin fold thickness to determine BMI & estimate body fat) Health-related physical fitness, knowledge & attitudes on PA	After 12 weeks, children from both groups had a mean decrease of 1.2mm in the sum of skinfolds (P<.05) & a significant increase in mean distance covered in the 3-min walk-run test (P<.001). Students in School B had better scores on all variables & significantly lowered BMI (P<.05), did more sit-ups (P<.001), & covered longer distances on the walk-run test (P<.05) than School A.
Adolescence (12 – 18 y/o)					
Teranishi, et al, 2011	Hawai'i 874 children & adolescents Ages 10-17 y/o Over 33% multiracial, 25%White only, 20% Asian only, 20% NHOPI	Cross-sectional	Child's health status (reported excellent-to-poor by parents) Potential covariates: Demographics (parental education, federal poverty level, insurance type, primary household language, parent nativity)	OWOB (BMI)	Children reported to be in poorer overall health were 2.92 times more likely to be OWOB than those in better health (after accounting for age, race, gender, parental education). Compared to Asian children, NHOPI & multiracial children were 3.04 & 2.31 times as likely to be OWOB. Boys were 1.94 times more likely than girls to be OWOB. Children whose parents' highest level of education was <12 years were 4.40 times more likely to be OWOB than children w/ at least one parent w/ >12 years of education.
LeonGuerrero, et al, 2004	Guam 643 middle & 590 high school students 54% & 53% Chamorro, 32% & 31% Filipino, 6% & 3% Micronesian Islander, 5% Asian, 5% Other ethnicity	Cross-sectional	Demographic characteristics Drug use behaviors	OWOB (BMI)	Adolescent males more likely to be OWOB than adolescent females (P<.01). Filipino adolescents had significantly lower BMI than all other ethnic groups (P<.01). There was a significant difference in percent of OWOB in Chamorro adolescent girls (31.01%) vs Filipino adolescent girls (11.42%) (P<.0001). OWOB adolescents significantly more likely to try marijuana (P<.01). & cocaine (P<.05) than "healthy weight" counterparts. OWOB adolescent girls significantly more likely to smoke cigarettes (30%) than "healthy weight" counterparts (P<.05).

*NHOPI=Native Hawaiian or Pacific Islander; NH = Native Hawaiian; OWOB=overweight or obese; BMI = body mass index; BW = birth weight; mo. = months; y/o = years old; wks = weeks; w/ = with; & = and

Results

A summary of the results is provided in Figure 2. Identified determinants or correlates are presented from left to right, based on the order they appear in this review. Arrows are used to highlight determinants that have demonstrated significant impact on OWOB in multiple studies and those that have demonstrated significance in just one study.

Prenatal. Two studies assessed prenatal determinants or correlates of OWOB.[32,33] In both, infants born to NHOPI mothers were significantly more likely to be high birth weight than other ethnic groups (Asian and/or Non-Hispanic White).[32,33] While one study found that NHOPI infants were also more likely to be born at low birth weight than other groups,[33] the other found they were more likely to be born pre-term.[32] Both found NHOPI mothers to have significantly higher pre-pregnancy obesity prevalence and lower likelihood of receiving early prenatal care (first trimester initiation) than other ethnic groups.[32,33]

Only Utz and colleagues assessed the impact of one of these prenatal determinants (maternal exposure to prenatal care) on subsequent OWOB in youth.[33] This study revealed a large protective effect of mothers receiving early prenatal care on the risk of adolescent obesity in the NHOPI group. This effect was smaller, but still significant for Whites and there was no effect for Asians. After controlling for maternal education, this effect remained for the NHOPI group; however, it became insignificant ($P = .1$) after controlling for maternal pre-pregnancy Body Mass Index (BMI).

Infancy. Three studies assessed determinants or correlates present in infancy.[34-36] Two studied the relationship between breastfeeding and OWOB.[34,35] In a sample of children from the Commonwealth of the Northern Mariana Islands (CNMI), Novotny and colleagues found that those who had been breastfed had significantly lower BMIs than those who had not.[34] However, there were no significant associations between BMI and breastfeeding exclusivity or duration. In a sample of Samoan infants, Hawley and colleagues found that formula-fed boys were significantly more likely to be obese at 15 months than breastfed boys.[35] While no significant differences were seen in girls, OWOB prevalence was highest in the mixed-fed group. Furthermore, there was a significant difference in rapid growth (RG) by feeding mode, with formula-fed boys demonstrating greater RG than breast-fed or mixed-fed groups. However, no significant differences were seen in girls.[35]

Hawley and colleagues found that 21.8% of Samoan infants demonstrated RG over the first 12 months of life, with weight gain occurring almost exclusively during the first four months.[35] While this study did not evaluate the relationship between RG and subsequent obesity in infancy, Okihiro and colleagues found a strong association between severe RG from 12-23 months and obesity in prekindergarten in a predominantly Hawaiian and Samoan sample.[36] Of the infants who demonstrated severe RG from 12-23 months, 48% were obese by prekindergarten.

Childhood. The majority of studies assessed determinants or correlates of OWOB in childhood. Two considered the relationship between geographic location and OWOB in Hawai'i.[29,37] Pobutsky and colleagues evaluated 4-5 y/o children entering the public school system,[37] while Stark and colleagues assessed 2-10 y/o from a Health Maintenance Organization.[29] The O'ahu school complexes identified by Pobutsky, et al, as having higher proportions of OWOB corresponded with areas where Stark, et al, had reported 2-3 times greater childhood OWOB than in a referent area.[29,37] While Pobutsky and colleagues did not analyze the relationship between geographic location and

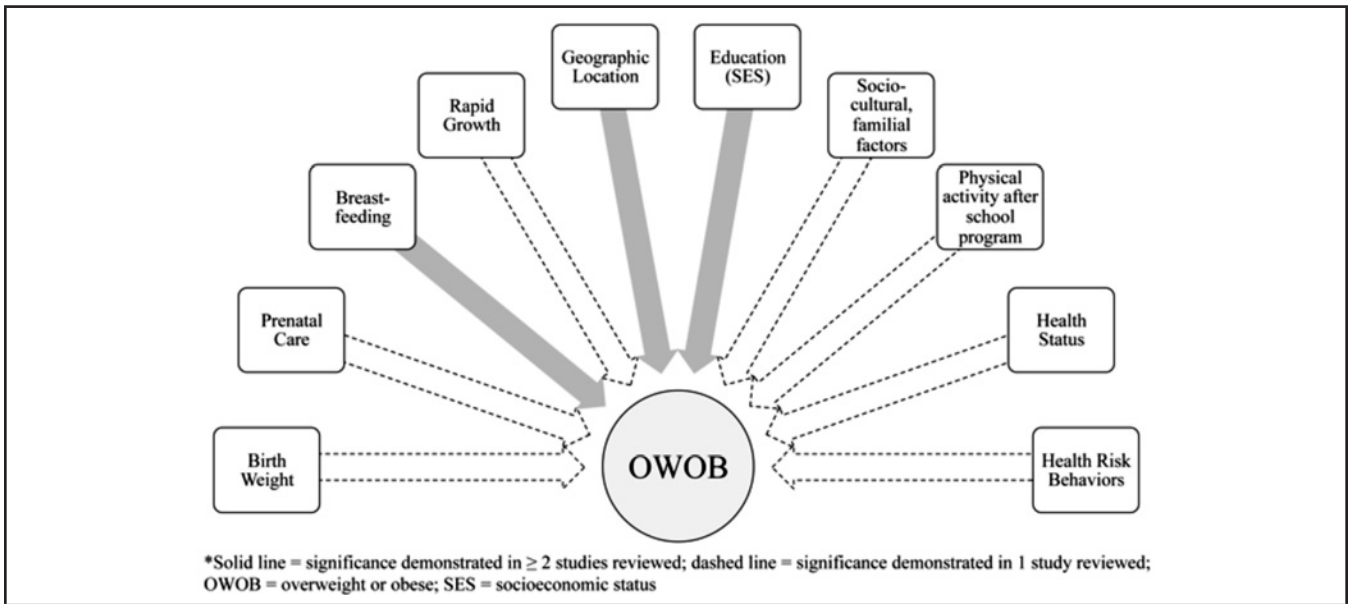

Figure 2. Modifiable determinants or correlates that have shown to impact overweight or obesity (OWOB) in Native Hawaiian and Other Pacific Islander youth

OWOB by ethnicity, they note that the school complexes with the highest proportions of OWOB were in communities with higher proportions of NHOPI and Filipinos, as well as greater socioeconomic disparities.[37]

Two studies considered the relationship between education and OWOB.[38,39] Novotny and colleagues assessed a sample of 5-8 y/o children from Kaiser Permanente,[38] while Brown and colleagues studied kindergarten and third graders from Hawai'i Island.[39] Brown and colleagues found that adiposity in third grade girls was inversely related to father's educational attainment. However, the same relationship did not exist for mothers and was not seen in boys.[39] Novotny and colleagues found a significant interaction between OWOB and neighborhood education level by ethnic group. Among Samoan, Native Hawaiian, mixed, and other children, those who lived in neighborhoods with the lowest education level (high school or less) were the most likely to be OWOB. This contrasted with children of other ethnic groups, in that those who lived in neighborhoods with the second lowest education level (some college) were the most likely to be OWOB.[38]

One study, represented by two articles, explored sociocultural and familial factors related to child-feeding practices and perceptions of weight normalcy among caregivers of 6-10 y/o in CNMI.[30,31] Caregivers identified how sociocultural values (eg, perception of food as a demonstration of love), family expectations (eg, grandparents' negative perception of thinness, grandparents undermining child-feeding practices, or parental conflicts over child-feeding), and traditional dietary beliefs and attitudes (eg, perception that being thin is unhealthy) were at odds with their knowledge of food and disease. Furthermore, caregivers identified limited awareness of disease and its relationship to diet as a stress factor when attempting to establish appropriate feeding-practices. This study also found perceptions of weight normalcy to vary between Pacific Islanders and Filipinos, in that Filipinos perceived being overweight as less acceptable than Micronesians, who associated thinness with illness.

One study evaluated the effectiveness of incorporating physical activity into an afterschool program on children's anthropometric measures and physical fitness in a predominantly Hawaiian sample.[40] The effectiveness of the two programs was compared: the first included a model curriculum led by trained after-school teachers and the second was a structured activity program designed and taught by a physical education teacher. After implementing these enhanced programs for 12 weeks, students had a significant mean decrease in the sum of skinfolds and an increase in mean distance covered in a 3-minute walk-run test. However, children in the program designed and taught by a physical education teacher experienced better outcomes for all variables, including significant differences in BMI, sit-ups, and the 3-min walk-run test, than children in the model curriculum program.

Adolescence. Two studies assessed OWOB determinants or correlates in adolescence.[28,41] Teranishi and colleagues evaluated adolescents' reported health status and demographics in relation to BMI in a sample of 10-17 y/o in Hawai'i.[28] They found that adolescents reported by their parents to be in poorer overall health were 2.92 times more likely to be OWOB than those reported to be in better health and that NHOPI children were 3.04 times as likely to be OWOB. Furthermore, children whose parents' had less education (< 12 years) were 4.40 times more likely to be OWOB compared to children of at least one parent with more education (> 12 years).

LeonGuerrero and Workman studied demographic characteristics and health risk behaviors in relation to BMI in adolescents of Chamorro, Filipino, and other ethnic backgrounds (Micronesian, Asian, or other) in Guam.[41] They found Chamorro or "other" ethnicity adolescents demonstrated significantly higher BMIs than Filipino adolescents, which was most pronounced in females. Additionally, OWOB adolescents were more likely to engage in high-risk behaviors, such as tobacco and drug use, and were significantly more likely to try marijuana and cocaine than "healthy weight" adolescents. In particular, OWOB adolescent girls were significantly more likely to smoke cigarettes than their "healthy weight" counterparts. While the dietary intake, physical activity, and sedentary behavior of this sample were deemed suboptimal, the relationship between these behaviors and OWOB was not analyzed.[41]

Discussion

The determinants identified by this review can be categorized as prenatal/early life, contextual, or behavioral factors. While all determinants demonstrated significance, there was a larger evidence-base for the impact of breastfeeding, geographic location, and education. From an ecological standpoint, the levels of influence lacking from this review include: the intrapersonal, obesity-related psychosocial variables and behaviors; the interpersonal, sociocultural environment; and, aside from the community-level factors of geographic location or neighborhood education level; the broader environmental and policy variables.

Findings from this review regarding the impact of breastfeeding are consistent with past research confirming a small but significant protective effect of breastfeeding against childhood obesity.[42,43] While rates of breastfeeding in American Samoa and CNMI meet or exceed national averages,[34,35,44] NHOPI in Hawai'i are less likely to initiate breastfeeding than other ethnic groups and, if initiated, are more likely to breastfeed for less than 8 weeks.[45] Research on other U.S. ethnic groups have revealed differences in prenatal/early life risk factors for childhood obesity,[46,47] which may partially account for the presence of ethnic disparities by preschool.[1] While some of these risk factors have been identified by this review, more research is needed to determine their impact in the NHOPI population, ideally through pre-birth prospective cohort studies.

The associations between geographic location and education with OWOB were supported by multiple studies reviewed. Though these contextual factors could reflect a number of confounding variables (eg, rural vs urban place of residence), it is possible that both observed associations are indicative of socioeconomic status (SES). Ethnic variation has been noted

in the relationship between SES and childhood obesity,[48] and a difference between NHOPI and other ethnic groups, regarding susceptibility to childhood obesity by neighborhood education level (used as a proxy for SES), was noted.[38] Future efforts should attempt to verify the SES gradients in obesity for NHOPI youth to identify which groups(s) may benefit most from intervention. While one study identified community-level influences (neighborhood education level),[38] more research on the environmental and policy-level influences on obesity in this population are needed.

The direct effects of healthy eating and physical activity on weight status are well established. However, there was a surprising lack of studies focusing on these central health behaviors in NHOPI youth. Furthermore, with the exception of one study,[30,31] the psychosocial precursors (eg, knowledge, attitudes, intention, and self-efficacy) of these behaviors and the socio-cultural influences on these precursors were largely absent from this review. Given that sociocultural environments of other US ethnic groups appear to support obesity development,[49] more research assessing the potential obesogenic influence of the sociocultural environment of NHOPI on its youth is needed. This approach will promote the development of culturally based obesity interventions, which have demonstrated success in the Native Hawaiian adult population and suggest promise for similar, youth-oriented programs.[50,51]

In light of the number of articles identified by this review, the conclusions that can be drawn at this point are preliminary. This review is limited by publication bias, in that all studies reviewed were published in peer-reviewed journals; thus, more likely to demonstrate statistically significant results. While the inclusion of articles published from 2000 to 2015 was based on the 2000 Census revision that disaggregated AAPI data, studies published prior to 2000 that may have otherwise qualified for inclusion were not examined. Furthermore, the search terms and inclusion criteria may have excluded studies addressing obesity in NHOPI youth, but lacking a deterministic approach (eg, those with an intervention based approach). Despite these limitations, these findings are instrumental, as they provide a systematic assessment of the current body of knowledge on this topic and suggest areas for future research.

Conclusion

Results from this review suggest that prenatal/early life and contextual factors play an important role in OWOB in NHOPI youth. This highlights the value of interventions addressing prenatal/early life risk factors, namely infant-feeding mode, as well as efforts to ameliorate systemic socioeconomic disparities experienced by NHOPI. It is clear that more research is needed to identify the most salient determinants of obesity in NHOPI youth, with particular focus on psychosocial precursors, health behaviors, sociocultural influences, and environmental/policy-level factors. In taking a deterministic approach to identifying the most salient modifiable causes of obesity, interventions grounded in an understanding of the multiple interacting influences of obesity can be developed to maximize the impact on obesity prevention in NHOPI youth.

Conflict of Interest

None of the authors identify a conflict of interest.

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PRACTICE UPDATE

Sudden Sensorineural Hearing Loss: Primary Care Update

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Abstract

The primary care physician's role in recognizing sudden sensorineural hearing (SSNHL) loss and delivering initial treatment is critical in the management of the syndrome. This role involves recognizing its clinical symptoms, distinguishing it from conductive hearing loss with the Weber tuning fork or the Rauch hum test, and urgent administration of high dose oral corticosteroids. Diagnosis and treatment should not be delayed for audiometric testing or referral to otolaryngology. This paper provides an update on the initial evaluation and treatment of this syndrome based on the literature and clinical guideline recommendations.

Keywords:

Sudden sensorineural hearing loss, Intratympanic steroid infiltration, Primary care, Prednisone, Dexamethasone, Glucocorticoid, Mineralocorticoid, Corticosteroid, Steroid

Abbreviations:

SSNHL = sudden sensorineural hearing loss
IT = intratympanic

Introduction

Sudden sensorineural hearing loss (SSNHL) is a syndrome that develops rapidly with hearing loss progressing within 72 hours. It is considered to be an otologic emergency requiring immediate recognition and treatment,[1,2] and can occur at any age, but most commonly affects patients 65 years and older,[3] with an annual incidence of 5-27 per 100,000 or 4,000-66,000 new cases in the United States per year.[3,4] It presents a variety of diagnostic and therapeutic challenges due to the following: idiopathic etiology in 71% of cases with viral, vascular, tumorigenic, and autoimmune as known causes;[1,5] anatomic location in the inner ear limiting access for basic science study, and clinical evaluation and intervention; presentation with common and non-specific symptoms such as a stuffy ear resulting in delayed recognition and treatment;[1,2,4] high spontaneous recovery rates up to 65%;[6] and inconsistency in using objective data to define both SSNHL[7] and treatment success.[8]

The clinical practice guideline for SSNHL recommends that clinicians may offer systemic corticosteroids as initial therapy as an option, and intratympanic (IT) steroid infiltration for salvage therapy as a recommendation, based on reviews of randomized control trials with a balance between benefit and harm.[4] In clinical practice, oral steroid therapy is the mainstay of therapy, and IT steroid infiltration being utilized by an increasing number of otolaryngologists. Some are using IT for salvage therapy as recommended,[4,9] while others are using IT as combined treatment with oral therapy,[10,11] or as singular treatment when oral therapy is contraindicated or not preferred.[12,13]

Recognizing & Diagnosing SSNHL

Clinical features of SSNHL include unilateral rapid hearing loss or hearing loss upon awakening, a normal ear examination, and associated clinical symptoms of a stuffy or full ear, tinnitus, and vertigo.[1,2] It is occasionally associated with otitis media. Evaluation of a patient includes taking a history of inciting events such as upper respiratory infection or trauma, degree of hearing loss, laterality, rapidity or chronicity, as well as associated symptoms. The sensation of a stuffy or full ear should not dissuade the examining physician that the underlying diagnosis could be SSNHL.

Diagnosis of SSNHL requires distinguishing it from conductive hearing loss. Tuning fork evaluations provide a reliable method to acutely assess the degree and type of hearing loss.[2] Air Conduction and the Weber test using the 512 Hz tuning fork can be used to help distinguish between sensorineural and conductive loss. The air conduction test involves alternating the 512 Hz tuning fork between the good and bad ears, and assessing hearing between 1-10. Ask the patient, "If the good ear is a 10, what is the bad ear?" Responses of 8 or higher generally indicate a conductive loss, and should be correlated with the clinical examination for the etiology of the acute conductive loss such as tympanic membrane rupture, hemotympanum, or otitis media. Responses of 7 and below are more likely to indicate SSNHL.

The type of loss is diagnosed with the Weber Test, that involves placing the tuning fork in the center of the patient's forehead, top of the head, bridge of the nose, or upper central incisors (with a rubber glove over the handle). In conductive hearing loss, the sound will be heard in the affected ear; in sensorineural loss the sound will be heard in the normal ear. If a tuning fork is not available, conduct the Rauch Test.[2] Have the patient hum in a low pitch. In conductive hearing loss the hum will be heard in the affected ear; in sensorineural loss the hum will be heard in the normal ear. Test this on yourself by humming and then occluding one ear, and the hum will be heard in the occluded ear with the conductive loss. The Rinne Test is used to assess the degree of conductive loss, and is not useful in assessing SSNHL.

After sensorineural hearing loss has been confirmed by tuning fork tests, an audiogram should be obtained as soon as possible, or will be obtained by the otolaryngologist. Treatment with steroids should not be delayed while waiting for an audiogram or referral.

Initial Treatment of SSNHL

High dose oral steroids are recommended and should be given as soon as possible, with best improvement during the first two weeks, but treatment should be continued up to 6 weeks, with little chance for success beyond this time.[4] When faced with the option to undergo steroid therapy for SSNHL or risk the devastating consequences of permanent severe hearing loss, the vast majority of patients and clinicians opt to proceed with treatment, balancing benefit with the potential harm of steroids. Comparable 14-day courses of prednisone or dexamethasone (7-day high dose, 7-day taper) are provided in Table 1.[4] Commonly prescribed methylprednisolone dose packs are inadequate for therapy because of lower dosing and shorter length of treatment.

Side-effects of steroid therapy should be considered and monitored while under therapy. Some complications of short-term steroid therapy include exacerbation of glaucoma, increased coagulability and intravascular thrombosis, avascular hip necrosis, and insomnia.[14] Relative contraindications to systemic steroid use include breast feeding, Cushing's syndrome, diverticulitis, peptic ulcer disease and bleeding ulcers, diabetes, heart failure, myasthenia gravis, osteoporosis, psychosis, renal disease, and ulcerative colitis.[14,15] Use of proton-pump inhibitors or H2 antagonists should be considered in selected cases to reduce gastrointestinal upset; sleep medication may be used to treat insomnia.

Comparison of prednisone and dexamethasone shows that dexamethasone has a higher biological half-life and greater anti-inflammatory properties than prednisone at drug-equivalent doses (Table 2).[4,14,16]

The increased anti-inflammatory properties of dexamethasone may provide advantages for viral and autoimmune etiologies of sudden hearing loss. However, murine cochlear models indicate that both prednisone and dexamethasone upregulate both cytokine and ion hemostasis genes, while prednisone had a greater impact on ion hemostasis.[17] Therefore, the mineralocorticoid effect of prednisone might have benefits. Other studies indicate three fold up- or down-regulation by dexamethasone of certain genes, with some possible protective effects on the inner ear.[18] Underlying genetics of the patient may also impact treatment, with SSNHL carriers of macrophage migration inhibitory factor 173-C alleles having improved responses to steroid therapy, as opposed to non-carriers.[19]

IT steroid therapy is being increasingly utilized to treat SSNHL. Studies indicate equal efficacy compared to systemic steroids.[12] In support of clinical studies showing efficacy, one novel study evaluated non-SSNHL patients undergoing cochlear implantation. Steroids were given preoperatively via IT or intravenous routes, and perilymph of the inner ear was sampled at the time of implant insertion. There was a higher level of intracochlear dexamethasone with IT infiltration versus intravenous administration.[20] As expected, lower plasma levels were also detected in the IT group, implying reduced systemic side effects. National specialty guidelines recommend IT infiltration for salvage following failure of oral therapy,[4] but an increasing number of providers are maximizing therapy with combined therapy,[10] or using IT alone when systemic steroids are contraindicated. The clinic procedure is low risk and well-tolerated by the patient. Three infiltrations are provided over a 1-3 week period, and dexamethasone 24 mg/ml is emerging as the preferred unit dose.[21]

Table 1. Equivalent Dosage Regimen for Prednisone and Dexamethasone

Prednisone	Disp: 20 mg tabs, # 30; sig: 60 mg (3 tabs) po once daily x 7 days; 40mg (2 tabs) x 3 days; 20 mg (1 tab) x 2 days; 10 mg (1/2 tab) x 2 days.
Dexamethasone	Disp: 2 mg tabs, #50; sig: 10 mg (5 tabs) po once daily x 7 days; 6 mg (3 tabs) x 3 days; 4 mg (2 tabs) x 2 days; 2 mg (1 tab) x 2 days

Table 2. Comparison of Prednisone and Dexamethasone Pharmacokinetics[14,16]

Drug - equivalent dosage	Prednisone - 5 mg	Dexamethasone - 0.75 mg
Plasma half life	1 hour	1.8-3.5 hours
Biological half life	18-36 hours	36-54 hours
Metabolism	Metabolized to liver by prednisolone (active compound)	Metabolized by liver to inactive metabolites
Glucocorticoid – Mineralocorticoid effects	Potency relative to Hydrocortisone (AI 1/MC 1): Anti-Inflammatory 4 Mineralocorticoid 0.8	Potency relative to Hydrocortisone (AI 1/MC 1): Anti-Inflammatory 30 Mineralocorticoid 0
Mechanism of action	Inhibits phospholipase A2, IL-2, histamine release	Inhibits phospholipase A2, IL-2, histamine release

Prognosis

About two-thirds of patients with SSNHL will experience full or partial recovery.[27] Recovery varies with severity at presentation, and those with mild hearing loss usually achieve full recovery. Spontaneous improvement or full recovery is rarely seen in those with severe to profound hearing loss.[4]

Conclusion

Primary care physicians can play a significant role in timely diagnosis of SSNHL and treatment with oral steroid therapy followed by urgent referral to otolaryngology for potential IT infiltration. Prompt recognition of SSNHL with the Weber tuning fork test or the Rauch hum test will lead to early diagnosis and initiation of oral steroid therapy.

Conflicts of Interest

None of the authors identify a conflict of interest.

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MEDICAL SCHOOL HOTLINE

"Leading Change"
Speech Delivered at the JABSOM Convocation, May 15, 2016
Kennedy Theater, University of Hawai'i, Honolulu, HI

Vivian Lee MD, PhD, MBA

The Medical School Hotline is a monthly column from the John A. Burns School of Medicine and is edited by Satoru Izutsu PhD; HJMPH Contributing Editor. Dr. Izutsu is the vice-dean of the University of Hawai'i John A. Burns School of Medicine (JABSOM) and has been the Medical School Hotline editor since 1993.

Dean Hedges, other distinguished guests, faculty, graduating medical students, family, and friends of the graduates, Aloha!

Congratulations class of 2016. You've done it! Thank you for allowing me to be a part of this very special day.

Unlike many of the commencement speeches I've heard, I am not here to tell you how to live your lives as doctors. I'm not here to tell you to live your lives to the fullest, to be kind to others, to look after your own health, although of course I do hope that you will do all of those things.

I don't think I need to share these words of advice for you because you already know them. After all, you were smart enough to attend medical school here in Hawai'i, in paradise.

Instead, I am here today to encourage you and to cheer you on—to do what I think you are already destined to do, which is to help us lead the transformation of health care in this country.

In 2009 Simon Sinek delivered one of the most popular TED Talks ever. It already has almost 27 million total views. For those of you Googling right now it's called, "How Great Leaders Inspire Action," and his concept is very simple.

He makes the observation that great organizations and leaders are able to inspire because they communicate their Vision using a common framework—Leaders start from the central question of why, and then move to the issue of how, and then finally discuss what.

I thought I would challenge his theory in reverse by applying his framework to this talk, and then see whether it would inspire you and your friends to watch the video of this talk 27 million times. Just kidding.

My theme today is transforming health care. I would like to make the case that all of you in this room will play critical leadership roles in this transformation. And not only will you play these roles, but that you are uniquely able to…to a far greater degree than most of us who have taught you.

The reasons for this are because you know not only why, but you know how and what to do.

Let's start with why. Actually unlike most of us in the room a generation or two ahead of you, why is not even a relevant question for most of you. You were born in the late 1980s and early nineties. Before you knew you ever wanted to be doctors, you already had heard the words "health care reform."

Hillary Clinton and her team had already started working on the prequel to the ACA before you even graduated from elementary school. You have come into the medical world knowing that we need to reform.

And here in Hawai'i, you have seen the benefits of a well-run health care system that serves one of the healthiest populations in the country. Furthermore, your system achieves that healthiness at reasonable costs.

We in Utah share some of these attributes, however we have not managed to create the same access to health care that Hawai'i has been so successful in doing. In short, you have learned from the best.

You may see the pressing need for health care reform through the lens of social justice or through economics and global competitiveness. Or you may see it simply as an essential human right to alleviate suffering and enable the pursuit of life, liberty, and happiness.

Perhaps you see it as all of the above. In any case the why of health care reform is essentially a given for you.

That makes the rest much easier. Easier, but not easy. This is where the how and the what come into play.

The how is how we think about health care reform. And again, here I believe that the core principles will resonate with your generation far better then with most of us who are struggling with this change.

There are many ways to think about this question. I offer two. The first is data. The second is diversity.

We live in an age of data. There are very few questions that my children can ask me that I can justifiably say, I don't know. Because in about 2 minutes I can find the answer to just about any question, by consulting the internet. Anything. Even my favorite recipe for bai tang gao or steamed Chinese rice cake can be found in print or you tube in English, Chinese, Vietnamese, Dutch, Spanish, you name it.

We live in a data-driven society. Decisions, including how to improve health care, can be made better now, because we have

virtually unlimited access to data. We can share data. Which means we can share wisdom. That means we can change faster and more effectively. You know this all better than anyone. After all most of you have had the internet in your back pocket since high school.

What about diversity? In his book, The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies, Scott Page shows that when challenged with very difficult problems to solve, groups of individuals who are very different, especially in their cognitive approach to problems, produce better solutions than more homogeneous groups, no matter how high their intellectual or skill level.

Probably no state in the country reflects cultural diversity like Hawai'i. You have a distinct advantage of feeling comfortable with diversity. What about interprofessional teams? Interprofessionalism is an example of a new kind of diversity in our working teams to deliver better outcomes.

We also need diversity in leadership. We need diversity in making decisions that are best for patients. We need people at the table who reflect the values and differences of the people we care for. And of course, there's tremendous value in listening to our patients' voices themselves. You all inherently understand that.

Finally, let's talk about what should be the easiest part of health care transformation and that is what do we actually do?

A big part of transformation is changing people's behaviors, whether it's patients or providers or health insurers. How successful we are depends a lot on the tools that we have and our comfort level using them. On this front, you are already ahead of the curve. I'm going to speculate that what my generation thinks of as "innovative," your generation thinks are simply "common sense" or should be.

For example, let me use some words that are expected for you and challenging for many of us:

Customer centered or patient-centered
Transparency
Technology
Social media
Empowerment
Accountability

And specifically in health care, how about:

Health and Wellness
Palliative care
Integrative care
Interprofessional care
Paying for value

How we approach health care transformation very much depends on our ability to embrace change and to leverage what really turns out to be common sense.

Let me give you an example.

Earlier this week, I had the chance to speak at a plenary session of Health Datapalooza with Yelp CEO Jeremy Stoppelman. We discussed the controversial topic of on-line reviews of doctors. In December 2012, just after the last presidential election, University of Utah Health Care became the first health care system in the country to post its patient satisfaction scores and patient reviews on-line. Using a system of five yellow stars made popular by Amazon.com, we now share with the world the actual scores of how patients rate our physicians on 10 key questions about communication, respect, shared decision making, even wait times. And we post all the patient comments online.

What's been the result? For 3 years in a row now, about half of our docs score in the top 10 percentile in patient satisfaction, and an amazing 1/4 of our doctors are in the top 1%. We've achieved these results without any financial incentives to providers. We're pleased that in the past year others have launched a similar effort, like Duke, Stanford, Cleveland Clinic, and Wake Forest.

This initiative was part of our effort to deliver what my predecessor Lorris Betz in 2008 called, an "Exceptional Patient Experience." He said, we can't be a great medical center if our patients don't think we are. We chronicled our journey in an article in the March 2016 issue of Academic Medicine.

With this initiative, we have transformed ourselves into the most patient-centered organization I know. We've found ourselves on a virtuous cycle. Web traffic is up. Referrals are higher than ever. Quality—top in class for last 6 years. Costs among the lowest in the country. Medical malpractice is down. And best of all, we all feel really proud of how much patients love us.

This last year we started doing the same with our residents and fellows, who are much more accepting and matter-of-fact than some of our seasoned clinicians. Like you, they grew up with Yelp, TripAdvisor, and even think being reviewed as a customer by an Uber driver seems reasonable.

What we've done is simply the Yelp-ification of health care. And it's helped to bring us and health care into the 21st century. Up next, we are working on advancing quality and patient reported outcomes, tackling the costs of care, and innovating around access to care.

For us, patients are the Why; data, transparency, engagement, and diversity are the How; and continual improvement is the What of Health Care Transformation. What are yours?

This ceremony bookends your journey in medical school. At the white coat ceremony at the University of Utah, I talk about how over the next four years, our faculty will be transforming our students, from recent pre-meds to internship-ready physicians. In fact, what I know is that today, when you walk out these doors, with your new medical degrees in hand, you will be the ones who will transform us.

Lead on…Mahalo!

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Initial Systematic Reviews of the Deaths of Clients in the State of Hawai'i Developmental Disabilities System

Jeffrey Okamoto MD, FAAP

Insights in Public Health is a monthly solicited column from the public health community and is coordinated by HJMPH Contributing Editors Tetine L. Sentell PhD from the Office of Public Health Studies at the University of Hawai'i at Manoa and Donald Hayes MD, MPH from the Hawai'i Department of Health in collaboration with HJMPH Associate Editors Ranjani R. Starr MPH and Lance K. Ching PhD, MPH from the Hawai'i Department of Health.

Introduction

Historically, persons with intellectual and developmental disabilities (I/DD) were institutionalized across the United States. The passage of policy enabling reimbursement for care in the community setting led to de-institutionalization, with the goal of increasing longevity and improving quality of life outcomes for this sub-population. Nevertheless, de-institutionalization, in and of itself, has proven to be insufficient for ensuring the wellbeing of persons with I/DD. Many examples of sub-optimal care resulting in premature death and disability in this population led to a formal investigation, and subsequently resulted in a change in policies to support ongoing monitoring of the quality of care received by those with I/DD. One aspect of quality monitoring is mortality reviews. This article provides historical context and some basic information about the mortality review process for those with I/DD in the State of Hawai'i. It also highlights the importance of multiple disciplines working together to identify system-level changes needed to support those with I/DD. Clinicians and those who care for those with I/DD should be aware of these reviews and promote optimal health for those with I/DD.

Defining Developmental Disabilities

In 1978, the United States federal government defined developmental disabilities in the Developmental Disabilities Act (Public Law 95-602). Although each state interprets an intellectual and developmental disability (I/DD) slightly differently, the State of Hawai'i follows the federal definition closely. Hawai'i Revised Statute 333F relates that to be a developmental disability a condition must:

(1) Be attributable to a mental or physical impairment or combination of mental and physical impairments;
(2) Have manifested before the person attains age twenty-two;
(3) Be likely to continue indefinitely;
(4) Result in substantial functional limitations in three or more of the following areas of major life activity; self-care, receptive and expressive language, learning, mobility, self-direction, capacity for independent living and economic sufficiency; and
(5) Reflect the person's need for a combination and sequence of special, interdisciplinary, or generic care, treatment, or other services, which are of lifelong or extended duration and are individually planned and coordinated.

People who have developmental disabilities are a heterogeneous group. Most states, recognize autism spectrum disorders, cerebral palsy, and intellectual disabilities as developmental disabilities. Intellectual disabilities affect 12 per 1000 children, and autism approximately 6.6 per 1000 children.[1] Although mental health conditions such as schizophrenia are considered "mental impairments," they are not classified as developmental disabilities.

People with I/DD have problems in cognitive functioning which can affect their learning and problem solving skills. Depending on the severity, activities of daily living may be affected. Profoundly affected people with an I/DD are not able to readily dress or feed themselves, while those mildly affected may have elementary school level math and reading skills. Because of their functional limitations, people with I/DD are at risk for abuse by others. Also, because of cognitive and communication issues, they may receive suboptimal health care as they may not be able to vocalize their symptoms. The population may be at risk for having lower rates of health screenings and receiving other necessary treatments because of the challenges associated with ensuring that they understand why and what the various procedures will entail.

History of Institutionalization of People with I/DD

Given the challenges that people with I/DD pose to their families, and due to their difficulties with functioning independently in society, people with I/DD were often placed in institutions. In Hawai'i, for example, people with I/DD were placed at the Waimano Training School and Hospital. Many states eventually closed their institutions because of poor conditions, abuse, and complaints from the community and disability advocates. One study conducted on those living at Pennhurst Center in Pennsyl-

vania showed less mortality after transition to the community.[2] A multi-country review (which included the United States) done by researchers in the United Kingdom looked at multiple factors in the comparison of institutionalization versus community living. This research revealed decreased mortality to be only one indicator of positive health outcomes, with multiple other indicators being important to the quality of life of those with I/DD including community presence and participation, social networks and friendships, family contact, self-determination/choice, adaptive behavior, challenging behavior, psychotropic medication use, and user and family views and satisfaction.[3]

The end of institutionalization of people with I/DD in Hawai'i occurred in conjunction with an important policy change: the Medicaid Waiver. The Medicaid Waiver for people with developmental disabilities is a critical mechanism for providing supports for people with I/DD in Hawai'i, as in many other US states. It waives the need for a person to be in a hospital or other institution to receive Medicaid reimbursement for care. The Waiver promotes home and community services for people with I/DD and emphasizes self-determination and training for work and home functioning. Some of the services provided include employment supports, personalized assistance, professional support for families taking care of loved ones with I/DD, crisis services, and adult day treatment programs (providing activities during the day for people with I/DD who are not employed). Once the Waiver was in place, Hawai'i was able to end the institutionalization of people with I/DD, and the Waimano Training School and Hospital closed its doors in June 1999.

Death Reviews for People with I/DD with Medicaid Waivers

In conjunction with ending institutionalization, there arose a need to monitor the impact of the transition on the lives of people with I/DD. While many studies had suggested positive benefits to the community resulting from de-institutionalization, several studies in California showed an increased rate of death thought to be secondary to the "less intensive medical care and supervision available in the community" after a major deinstitutionalization between 1993 and 1996.[4]

A US federal Government Accountability Office (GAO) investigation was conducted in 2008 in response to highly-publicized untimely deaths in the post-institutionalization era, of several individuals with developmental disabilities, indicating cause for concern. One example in the report is provided below.

> "[A] 63-year-old man with visual impairment, arthritis, and significant cognitive disabilities was living in a group home that provided supportive care in the community and also offered recreational activities. According to his legal guardians, they were notified in 2004 that he had suffered a fatal heart attack. In part because he did not have a history of heart problems, his guardians requested an autopsy. The autopsy report identified quality-of-care concerns: the individual choked to death on what appeared to be part of a sandwich, even though he was supposed to be fed pureed food. A subsequent investigation of the death and conditions in the group home found that the home was understaffed and that staff did not consistently prepare meals to meet the special needs of residents."[5]

After citing several such examples, the report highlighted reasons why the federal Centers for Medicare and Medicaid Services (CMS) should encourage states with Home and Community Medicaid Waivers to conduct mortality reviews for people with I/DD.[5]

Safeguards suggested include the review of and follow-up action to critical incidents — events that harm or have the potential to harm waiver beneficiaries. GAO recommendations included: that states include death as a critical incident and conduct mortality reviews; that CMS should distribute information to states about basic and additional components for mortality reviews; and state Medicaid agencies report all deaths among people with developmental disabilities receiving Waiver services to the state office of protection and advocacy.

The report further outlined what it considered to be six basic and four additional components for mortality reviews. The basic components were:

(1) Screen individual deaths with standard information to determine if further review or investigation is needed
(2) Review unexpected deaths at a minimum
(3) Routinely include medical professionals in mortality reviews
(4) Document mortality review process, findings or recommendations
(5) Use mortality information to address quality of care
(6) Aggregate mortality data over time to identify trends

Four additional components were:

(7) Use state-level interdisciplinary mortality review committees
(8) Involve external stakeholders
(9) Take statewide actions based on mortality information to improve care
(10) Publicly report mortality information

Learning from Other Death Review Models

In response to the GAO's recommendations, and through its Waiver activities, the Hawai'i State Department of Health (DOH) Developmental Disabilities Division (DDD) began investigating the possibility of implementing a mortality review process for individuals with I/DD in 2008.

A feasibility analysis, including a review of existing death review systems in the state, was conducted. It surveyed many other systems caring for people with health or disability issues that already review deaths both in the State of Hawai'i and elsewhere. For example, hospitals routinely review cases of people who die in their facilities. Hospitals and medical training programs often have "Morbidity and Mortality" presentations (M&Ms) or similar meetings so practitioners can learn from previous mistakes. The Centers for Disease Control and Prevention (CDC) publishes the Morbidity and Mortality Weekly Report that reports surveillance data on deaths due to a variety of conditions. The National Center for Child Death Review has a standardized data collection system for states to use.[6,7] In addition, there have already been efforts to coordinate different

mortality reviews that range the life span, from infancy to the elderly.[8] These findings were incorporated into the planning process for the new death review planned for individuals with I/DD.

Legislation for Mortality Reviews

Mortality reviews for individuals with I/DD began in Hawai'i in 2009. These reviews were conducted under the direction of DDD that is permitted by Hawai'i State statute 333F to "develop, lead, administer, coordinate, monitor, evaluate, and set direction for a comprehensive system of supports and services for persons with developmental disabilities or intellectual disabilities within the limits of state or federal resources allocated or available."

The death reviews typically collected data on demographic information, including age, gender, place of residence (neighbor island, and type of home); as well as other information, including diagnoses and conditions; location of death; last time seen for medical treatment; any changes to care including medications; records from the case manager including Individualized Support Plan for person; notes of agencies providing support; records from the home (if not family home); and clinic and hospital records.

The process also revealed that obtaining information from emergency rooms, clinics, hospitals, agencies, paid providers of supports, and residential homes could sometimes be problematic. These issues were related to guardian approval for record release, particularly if the individual being reviewed did not have a guardian. DDD learned that it can be impossible (if there is no guardian) or difficult (if there is a guardian who is hard to reach) to obtain consent to release information. Therefore, planning was begun towards the passage of new legislation granting the State of Hawai'i the right to conduct such reviews without the need for consent.

A statute signed June 26, 2012 by then Hawai'i Governor Abercrombie (Act 162 – Relating to Mortality Review of Deaths of Persons with Developmental or Intellectual Disabilities) eliminated the need for consent to obtain records for mortality reviews in people with I/DD. The pertinent excerpt from the Act is provided here for reference:

> Upon written request of the director (of the Department of Health), all providers of medical care or other related services and state and county agencies shall disclose to the department and to those individuals appointed by the director to participate in the mortality review of the death of a person with developmental or intellectual disabilities, adult death review information regarding the circumstances of the death of a person with developmental or intellectual disabilities to allow the department to conduct multidisciplinary and multiagency mortality review of deaths of persons with developmental or intellectual disabilities.

The law required multidisciplinary, multiagency reviews to be conducted, enabling the committee to be comprised of representatives from a variety of practice settings. In addition, other aspects of the law require that the use of information and records from the mortality review be kept confidential; and that reviewers are granted immunity from liability.

Besides Hawai'i, other states have mortality reviews for individuals with I/DD. Those with policies readily available, published as of April 2016, include the District of Columbia,[9-11] Connecticut,[12] Massachusetts,[13] and Washington State.[14]

Hawai'i I/DD Mortality Review Committee Composition

The Hawai'i I/DD Mortality Review Committee currently includes Department of Health DDD staff including the Branch chief and nurse from the Outcomes and Compliance branch, Medical Director and Nurse from the Clinical and Eligibility Determination Staff, and case management representation. An important member currently is the medical director of the Medicaid programs (QUEST) who represents the Department of Human Services, which is the agency that is the Medicaid coordinator for the State of Hawai'i. Future representatives will potentially include those from the Developmental Disabilities Council, Protection and Advocacy agency for people with disabilities (the Hawai'i Disabilities Rights Center), and advocates for, and people with, an I/DD. These outside voices will bring community, legal and advocacy perspectives, which are essential to improving the systems of care for people with I/DD.

I/DD Population Mortality Tracking

Mortality data collected on all individuals served by DDD that died revealed that the average age of death for people with I/DD is much lower than the average US or Hawai'i life expectancies (Table 1). Additionally, the average age of death recorded by Hawai'i I/DD systems is on the lower end of the range reported by State I/DD systems nationally. A paper looking at select states showed adults with intellectual disability tend to have a lower life expectancy at birth ranging from 58.7-62.0 years.[15]

In reviewing causes of death in Hawai'i, cardiac complications and cancer were common causes of death for both the general state population and those with I/DD (Table 2). However, compared to the general population, deaths attributable to pneumonia and septic shock ranked higher among those with I/DD. These differences are not surprising, given that aspiration pneumonia is a risk for those with cerebral palsy and related conditions, as these conditions cause poor oropharyngeal movement and coordination of chewing and swallowing (dysphagia). One hypothesis to explain the higher rank received by septic shock is that since many people with I/DD are non-communicative or have difficulties in communication, they may not get required emergency medical treatment in a timely manner. Also, people who are non-ambulatory and bedridden are at higher risk for decubitus ulcers that may lead to sepsis and death.

The top-ranked causes of death in Hawai'i for those with I/DD are similar to that reported by other States. Connecticut's review in 2012 indicated "that in both Connecticut and Massachusetts, the leading causes of death for persons with intellectual disabilities for the years 2002, 2003 and 2004 were heart disease, respiratory disease (including aspiration pneumonia), cancer and sepsis".[13] Massachusetts' review revealed that the rank order of causes of death among its I/DD population in 2012

and 2013 was: (1) heart disease, (2) cancer, (3) Alzheimer's disease. Aspiration pneumonia was the fourth leading cause in 2013 and fifth leading cause in 2012. Septicemia was the fourth leading cause in 2012 and tied for fourth in 2013.[14] The Massachusetts report stated that, "certain leading causes [in the Massachusetts I/DD population] differed from the general population, with higher mortality rates from influenza and pneumonia, aspiration pneumonia, and septicemia in the population." Another national study focused on causes of death in 2009 in adults with intellectual disability receiving state services in select states suggested a lower risk of death from cancer and an increased risk of death from kidney disease, septicemia, Alzheimer's disease, influenza and pneumonia, and aspiration pneumonia. Risk of death was similar to the general population for unintentional injuries and heart disease.[15]

Methodology and Select Examples of I/DD Mortality Reviews in Hawai'i

For each review conducted in 2013 and 2014, the I/DD Mortality Review Committee collected primary care provider and subspecialist records, emergency room and hospital records, care home and provider agency notes, and case management records. Records were collected dating back at least one year from the time of death, unless the review revealed the need for additional historical information. Death certificates and autopsy reports were reviewed if available.

Each death was reviewed in depth by an interdisciplinary team. A report was generated and information in the report was inputted into a database, enabling yearly analysis of aggregate data. In 2013, 42 deaths were recorded compared with 31 in 2014.

Table 1. Life Expectancy and Average Age of Death for the United States, Hawai'i, Persons with I/DD, and Persons with I/DD in Hawai'i

Data Source	Average Age of Death/Life Expectancy in Years
US Life Expectancy, 2013[16]	78.8 years
Hawai'i Life Expectancy, 2010[17]	81.3 years
Average Age at Death in State I/DD[18] Systems	50.4–58.7 years
Hawai'i Individuals reviewed by the DOH DDD in FY2013 Hawai'i Individuals reviewed by the DOH DDD in FY2014	52.9 52.0

Table 2. Cause of Death, in Order of Rank in the Hawai'i Resident Population, and Persons included in the I/DD Mortality Review

Cause of Death	DDD FY 2013 and 2014	Hawai'i Residents 2011-2013[19]
Cardiac complication	1	1
Pneumonitis	2	5
Septic Shock	3	11
Cancer	4	2

Select cases highlighting systems changes that were sought and accomplished as an outcome of the review process are provided in Table 3. The identifying information has been modified to preserve confidentiality.

Table 3. Example of System Improvements Suggested by In-Depth Reviews

Summary of Review	Discussion and Actions Regarding System Improvements
Example 1 - A 32 year old man with intellectual disability and cerebral palsy could not eat well by mouth safely, and tube feeding was necessary. A Nasojejunal (NJ) tube was placed and was working well. One day this came out and he was taken to the ER to replace it. Later that night, some retching and breathing problems were noted by the staff caring for the person. The person died the next day. NJ tube was found to be in the right mainstem bronchus, rather than in the stomach.	A letter was written to the ER regarding the death and findings of the review team. The ER wrote back regarding the situation – they changed the tube placement process in the ER to prevent reoccurrence of the erroneous tube placement into the lung of any subsequent patient.
Example 2 - A 50 year old man with Down Syndrome and profound intellectual disability during a hospitalization was suspected to have cancer. A procedure may have verified if he had cancer.	The review committee reviewed hospital notes and was spurred to write a letter because of a statement in the records "As the patient is mentally retarded, he was unable to follow commands and therefore the procedure was canceled by _____ (doctor)" The review committee received a reply from the hospital who agreed with the committee's decision upon review of the facts in the case.
Example 3 - During a review, it was found that staff was not logging blood glucose measurements for a person with intellectual disability that required insulin for diabetes mellitus.	The review committee discussed how the system would ensure that these are documented by appropriate staff caring for the person with I/DD as these measurements are important in determining the right insulin dosages.
Example 4 - A 55 year old woman with a developmental disability died of colon cancer. The woman's primary care physician did routine physical exams and hemoccult screening. The primary care physician made a referral five years before the demise of the woman to a gastroenterologist to do a colonoscopy. The gastroenterologist wondered who was going to sign the consent for the colonoscopy. No additional follow-up was noted in the patient's chart.	When questioned by the mortality review committee, the Division case manager related that the client usually signs for his procedures and other papers. There was no guardian. Since consent was never signed, no colonoscopy was done. Five years later, this person died of colon cancer. The review committee is currently deciding how to educate case managers and other staff regarding consent and medical procedures to avoid adverse outcomes resulting from a failure to diagnose conditions earlier in the disease process.

Summary

People with I/DD are often vulnerable because of poor or absent skills in communication. They may have problems telling those around them that they do not feel well and have a problem that requires medical care. They are at a higher risk for chronic medical conditions such as dysphagia, aspiration pneumonia, and decubitus ulcers and require special supports to thrive in home and community settings.

Conducting mortality reviews for people with I/DD enables systematic identification of challenges in effective medical care for the sub-population, leading to recommendations that have the potential to result in improved length and quality of life for this vulnerable population. The DOH will continue to enhance existing efforts by engaging more key stakeholders in the state to improve the robustness of the review completed and recommendations developed. More information on DOH DDD may be found on the Division's webpage: https://www.health.hawaii.gov/ddd/.

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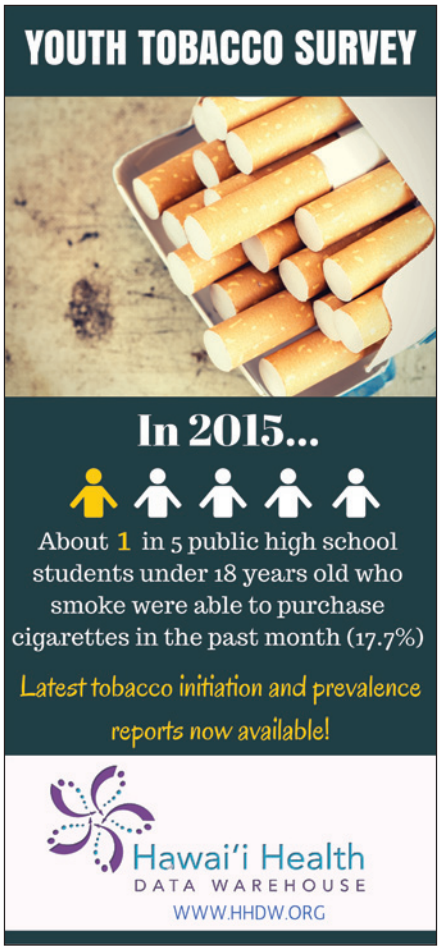

THE WEATHERVANE

RUSSELL T. STODD MD; CONTRIBUTING EDITOR

EXTREME MEASURES MAY BE NECESSARY.

The Centers for Disease Prevention and Control (CDC) is urging state and local agencies to prepare for the potential transmission of the Zika virus in the United States. The virus exploded across Latin America and the Caribbean moving quickly from Brazil and has already spread to Mexico, US Territories, including Puerto Rico, the Virgin Islands and American Samoa. The virus often produces no symptoms and many can unknowingly pass the disease to others. This week the first Zika sexual transmission male to male was recorded, further confusing the disease picture. The prime danger is to pregnant women, or to those who wish to become pregnant, since the male partner might have no knowledge of a possible infection. Tom Frieden, director of CDC stated, "We must work at all levels of government and all levels of society to reduce the threat to pregnant women. Nothing about Zika is going to be easy." The White House and CDC officials called on Congress to approve the administration request for $1.9 billion in supplemental funding to respond to Zika. Because there is no vaccine and no known therapy, the best way to protect pregnant women is killing the Aedes mosquito vector that is notoriously difficult to control. Will DDT be brought back?

IN TODAY'S ELECTRONIC WORLD, SOMEONE IS ALWAYS LISTENING.

In Fairfax County, Virginia, a man scheduled for colonoscopy wanted to record the doctor's instructions for post-op care. He did so, but when he played the recording while riding home, he was shocked. He had inadvertently (?) left the recorder on during the procedure for a complete coverage of the exam. As soon as he was asleep the surgical team mocked and insulted him. The anesthesiologist said, "After five minutes with you I wanted to punch you in the mouth and man you up a little bit." Later when an assistant noted a rash on the patient's arm, the anesthesiologist warned her to be careful she might get syphilis. A subsequent malpractice complaint went to trial where one of the jurors said there was not much to decide because it was all on tape. The gastroenterologist was dismissed from the case. Attorneys for the plaintiff asked for $1.75 million but settled for $500,000, with punitive portion set at $200,000. The anesthesiology group apologized to the patient and the doctor lost her job.

IS YOUR DOCTOR A GOOD GUY/GAL?

Consumer Reports latest edition is aimed at informing readers how to recognize a good doctor and a bad one. It is worthwhile reading save for the desire to sensationalize the story with examples of egregious medical behavior. The point is that thousands of doctors across the United States are on medical probation for various reasons: drug abuse, sexual misconduct, careless and deadly mistakes. Consumer Reports and the Informed Patient Institute analyzed the websites of boards in all 50 states to see how complete the information was and how easy they were to use. They graded on a scale of 1 to 100. California was rated tops with a grade of 84 while Hawai'i was at 22, third from the bottom with only Indiana and Mississippi lower. The report includes a report on malpractice payouts since 1990 in the United States at a total $85,064,857,850 with over 50% accrued by only 2% of total physicians. This is no surprise to underwriters for MPL insurance and board members. The really difficult part is getting licensing boards to act on the information. Often when they do so, lawyers step in and the process gets sidetracked.

WHO WOULD HAVE THOUGHT IT — TUBERCULOSIS FROM A PACHYDERM?

Recently 7 people were diagnosed with tuberculosis after exposure to elephants at a zoo. The Centers for Disease Control and Prevention (CDC) called for better screening of elephant TB. While tuberculosis cases rose last year in the United States for the first time in 23 years, the Agriculture Department, charged with regulating animals for exhibition, announced that it would stop regulating TB in elephants altogether. Tuberculosis kills more people annually than HIV and AIDS, so for the Agriculture people to renege on this duty, is simply incredible. Congress charged the USDA with this task, and it is time for action lest we see an even sharper rise in this dread disease.

IT'S EASY TO BE SAD WHEN VISION'S GOING BAD.

An instructive glaucoma study published by the Laboratory of Performance and Visual Function at the University of California in San Diego included 204 eyes in 102 patients evaluated for 4 years. All had chronic glaucoma. Each patient took Geriatric Depression Scale (GDS) questionnaires and had visual field tests on standard automated perimetry (SAP). An integrated binocular visual field was estimated from the monocular SAP tests and rates of change in mean sensitivity (MS). Findings demonstrated a significant correlation between change in the GDS scores during follow-up and changes in binocularity SAP sensitivity. With this group of glaucoma patients, faster visual field progression (loss)was associated with the occurrence of depressive symptoms. It appears that, like so many other physical conditions, depression leads the way downhill.

WOULD GYNECOLOGISTS STILL BE MORCELLATING WITHOUT THE WSJ STORY?

Johnson and Johnson through its affiliate Ethicon is settling a series of legal claims and lawsuits brought about with the use of the morcellator for hysterectomy. The individual settlement sums vary case by case ranging from $100,000 to roughly one million. The Food and Drug Administration (FDA) began looking into the risks of surgery with the device after a 40-year-old anesthesiologist mother of six developed disseminated sarcoma following hysterectomy with a morcellator. She went public in the Wall St. Journal and the stuff hit the fan. Reviewing the numbers back to first approval in 1995, the FDA found that women having surgery for uterine fibroids have a one in 350 chance of harboring a sarcoma. Power morcellators cut up benign growths so doctors can remove the tissue through tiny incisions. Well and good except that morcellators can spray cancerous tissue throughout the pelvis and abdominal cavity. Ethicon stopped morcellator sales in April 2014 and took them off the market in July 2014. One plaintiff attorney said, "You certainly don't always see a company step up and take responsibility this early on."

ADDENDA

- ENIAC, the first electronic computer was constructed in 1946. It was 100 feet long, and 10 feet high, built of 17,480 vacuum tubes housed in an engineering building at the University of Pennsylvania.
- "If you put the federal government in charge of the Sahara Desert, in 5 years there would be a shortage of sand." *M. Friedman*
- Unibrow is a turnoff for 35% of Americans.
- P.T. Barnum staged the first international beauty contest in 1854. It was closed down due to public protest.
- Christ died for our sins. Dare we make his martyrdom meaningless by not committing them?
- Sex when you are married is like going to the 7-eleven. There is not much variety, but at three in the morning, it's always there.

ALOHA AND KEEP THE FAITH rts

(Editorial comment is strictly that of the writer.)

General Recommendations on Data Presentation and Statistical Reporting (Biostatistical Guideline for HJM&PH)
[Adapted from Annals of Internal Medicine & American Journal of Public Health]

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

Percentages: Report percentages to one decimal place (eg, 26.7%) when sample size is >=200. For smaller samples (<200), do not use decimal places (eg, 26%, 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 (β), 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 β for unstandardized regression parameter estimates, and "B" or β 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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