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Assessing Knowledge on Gestational Diabetes Mellitus and Child Health

Emma Ludowici BSc

Abstract

Gestational diabetes mellitus (GDM) is a diagnosis of glucose intolerance during pregnancy. The risk of type II diabetes mellitus (T2DM) and obesity for the child and mother increases when GDM develops. Preventing the development of GDM could help lower the prevalence of obesity and type II diabetes mellitus morbidity rates in children of affected mothers. The purpose of the study was to identify the awareness level of females ages 12 and 51 years, on the long-term risk of obesity and T2DM on their children in Australia and Samoa. This is a quantitative study involving 202 females, from across Australia and Samoa, between April 2021 and November 2021, comparing the level of knowledge between a developing and developed country. In Australia and Samoa, 15% (n=16) and 34% (n=33) of females respectively, were aware of the long-term complications of GDM on their children. These findings indicate that there is inadequate knowledge regarding the long-term consequences associated with GDM on both the risk for T2DM in women and the risk for long-term complications for their children. The greatest source of information in both countries was obtained from physicians or midwives, 52% (n=105). This supports the need for increased education on GDM, through social media, the internet, and community health professionals. By increasing awareness of GDM and implementing preventive strategies, it may be possible to reduce the prevalence of obesity and T2DM in Australia and Samoa.

Keywords

Diabetes Mellitus, Gestational diabetes, Samoa, Australia, Education

Abbreviations

DM = diabetes mellitus
GDM = gestational diabetes mellitus
T2DM = type II diabetes mellitus

Introduction

Diabetes mellitus (DM) is associated with vascular disease which has a high morbidity and mortality rate.[1] DM is a metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[1] DM is subcategorized into type I, type II, and gestational diabetes mellitus (GDM).

Type II diabetes mellitus (T2DM) is predominantly diagnosed among the older population and the overweight population. Globally the prevalence of T2DM has increased from 14.0% in 1990 to 16% in 2020. Among females TD2M went from 11.5% in 1990 to 18% in 2020, partially associated with the rise in obesity.[2]

T2DM develops from a combination of defective insulin secretion by pancreatic β-cells and the inability of insulin-sensitive tissues to respond appropriately.[3] Obesity is 1 of the major contributing factors for T2DM. Currently 53% of the adult Samoan population are classified as obese (body mass index [BMI] $>30.0 kg/m^2$).[4,5] Other studies have indicated that around 25% of children and adolescents between the ages of 2 to 17 years in Samoa are categorized as overweight increasing the risk for development of various metabolic diseases, including T2DM.[6]

Increasing frequency of T2DM and obesity has paralleled GDM development.[5] In the last 10 years, the Pacific Islands were identified as having the highest rate of T2DM, globally.[7] Studies indicated that 27% of women are currently diagnosed with T2DM.[8]

Obesity is the most significant risk factor for GDM development.[9] Obesity is an epidemiologic challenge for many medical practitioners.[9] Between 2000 and 2001 and 2016 and 2017, the proportion of women diagnosed with GDM in Australia, tripled from 5% to 15%.[10] T2DM in Samoa increased from 2% in 1978 to 20% in 2013.[4] Similarly, obesity among Samoan women increased between 1978 and 2013 from 45% to 77%.[4]

GDM, an endocrinopathy that has the ability to develop during pregnancy, is associated with the numerous hormonal changes. Hormonal changes that have been identified to increase the risk of GDM include placental production of diabetogenic hormones that involve human placental lactogen associated with the later stages of pregnancy.[11] Cortisol levels are increased and have the potential to reduce the action of insulin, leading to an insulin resistance state. During pregnancy, the body will compensate through augmenting the insulin production via the beta pancreatic cells, resulting in increased glucose levels in the blood. This compensatory increase in insulin production can lead to insulin resistance and increase the risk of developing GDM.

GDM has been associated with short-term complications during pregnancy to both the mother and the child. The increase in insulin causes the fetus' pancreas to accentuate its insulin secretion, leading to an insulin secretory defect and development of DM.[12]

Today, the rates of childhood obesity globally have increased 4-fold over a 30-year period.[13] Studies regarding the intrauterine environment and long-term complications including the increased risk of obesity, insulin resistance, neurocognitive development and cardiovascular disease have become more established over the years.[14] GDM has been identified to play a role in the child's health both in the short term and long term.

Currently, there is a deficit in the research addressing the maternal awareness of the long-term effects of GDM on the children's health. The literature does not indicate whether women are aware of the link between GDM and their child's increased risk for developing T2DM and obesity later in life.

The purpose of this study is to identify the level of awareness in women from Australia and Samoa, regarding GDM and the association between mothers being diagnosed with GDM their children's long-term risks of obesity and T2DM. It will also compare awareness of long-term complication awareness between women who have had children and those without children. Additionally, the sources of where women obtain their knowledge will also be identified to tailor future health promotion activities.

Methods

A quantitative study was conducted via an online questionnaire that was distributed through schools, universities, word of mouth and hospitals across Australia and Apia, Samoa. A hard copy of the questionnaire was available for individuals without access to a computer. The questionnaire was also translated into the Samoan language. The questionnaire consisted of 20 close-ended questions (response options of "yes", "no" or "not applicable"), demographic information which included the age of participants and questions pertaining to GDM. The questions were focused on assessing the participant's knowledge of GDM, where they obtained their information and if they would make more conscious decisions to reduce the chance of developing GDM during pregnancy. Eligible participants included females from Australia and Samoa between 12 and 51 years of age, regardless of whether they have children. Respondents who answered "yes" to being a health professional were excluded from the study based on their professional training and education.

Internal Review Board approval for this project was granted in October 2020 from Oceania University of Medicine (IRB 20-0904EL). Participants younger than 18 years of age were required to obtain parental consent. Data collection occurred between April 2021 and November 2021. Information was collected and stored securely by the principal investigator. Participant's questions were directed to the principal investigator.

Data Analysis

The data was analyzed with SPSS software version 28 (IBM Corp., Armonk, NY), using descriptive statistics. To compare the level of knowledge for both Australian and Samoan women regarding the long-term effects of gestational diabetes on their children, analysis of variance tests for continuous variables and a chi square test were used for categorical variables, with the level of significance set at $P < .05$.

Results

A total of 229 females participated in the study: 127 from Australia and 102 from Samoa. Of these, 23 participants from Australia and 4 from Samoa were excluded from the study on the basis of being health professionals or older than 51 years of age. The final number included in the analysis was 104 participants from Australia and 98 participants from Samoa.

Background Demographics

The median age range for females with children was 35-40 years. The median age ranges for females without children was 23-28 years in Australia and 18-22 years in Samoa (**Table 1**).

Awareness of GDM

Roughly 58% of Australian and Samoan participants with children were aware of the short-term complications associated with GDM (**Table 2).** There was no difference by country. By contrast Australian females who have not had children were significantly less likely than Samoans to be aware of short-term complications associated with GDM (10% and 64%, respectively $P<.001$).

Similarly, 49% of Australians and 53% of Samoan participants with children were aware that they were at increased risk of developing T2DM if they developed GDM ($P=.66$) (**Table 2**). Only 23% of participants without children were aware of the increased risk developing T2DM among those with GDM; however, Samoan participants (36%) were significantly more likely than Australian participants (11%) to be aware of the increased risk ($P=.001$)

Regarding awareness of the long-term effects of GDM on the health of children, Samoan women with children (49%) were significantly more likely than their Australian counterparts (22%) to be aware ($P=.01$) (**Table 2).** However, there was no significant difference in knowledge by country among participants without children.

Participants selected various sources for obtaining information regarding GDM. Among Australian women with children, doctors or midwives were the largest contributing source of information (31%) followed by internet/ social media (13%) and family or friends (12%). Among Samoan women with children 32% cited family and friends, 30% internet and social media, and 26% doctors and midwives (**Table 1**).

Attitudes to Changing

Almost all participants, 98% of Australians and 92% of Samoans and 98% of participants with children and 93% of those without children (**Table 3),** stated that they would be more conscious about decisions when pregnant if it meant it would have better outcomes long term for their child.

Table 1: Participant Demographics and Sources of Information on Gestational Diabetes Mellitus								
Age of Participants								
	With Children				**Without Children**			
	Australia n=42		**Samoa n=43**		**Australia n=52**		**Samoa n=55**	
	Number	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Age (years)								
12-17	0	0	2	2	8	8	25	26
18-22	0	0	1	1	12	12	15	15
23-28	6	6	8	8	18	17	4	4
29-34	12	12	7	7	22	21	6	6
35-40	11	11	8	8	1	1	2	2
41-46	6	6	3	3	1	1	2	2
47-51	7	7	14	14	0	0	1	1
Didn't complete high school	1	1	14	14	1	1	7	7
High school	23	22	15	15	11	17	23	23
Tertiary education[a]	16	16	10	10	30	26	13	13
Post grad/masters	12	11	11	11	17	12	5	5
Sources of Information Regarding GDM								
Doctor/midwife	32	31	25	26	19	18	29	30
Family/Friends	12	12	31	32	15	14	5	5
Internet/social media	13	13	26	30	13	13	25	26
Courses[b]	5	5	11	11	3	3	2	2

[a] Tertiary: education for people above school age, including college, university, and vocational courses.
[b] Courses: Any educationally run seminar with trained professionals in the area over a period of time.

Table 2. Awareness of Short- and Long-term Complications and Developing the Risk of T2DM from GDM

Awareness of the Short-term Complications Associated with GDM			
Women With Children			
	Yes (Number)	**Percent (%)**	**Overall *P*-value[a]**
Australia	24	59	.97
Samoa	25	58	
Total	49	58	
Women Without Children			
Australia	6	10	< .001
Samoa	34	62	
Total	40	34	
Awareness of Risk of Developing T2DM if They Develop GDM			
Women With Children			
	Yes (Number)	**Percent (%)**	***P*-value[a]**
Australia	20	49	.67
Samoa	23	53	
Total	43	51	
Women Without Children			
Australia	7	11	.001
Samoa	20	36	
Total	27	23	
Awareness of the Long-term Effects of GDM on Children			
Women With Children			
	Yes (Number)	**Percent (%)**	**Overall *P*-value[a]**
Australia	9	22	.010
Samoa	21	49	
Total	30	36	
Women Without Children			
Australia	7	11	.114
Samoa	12	23	
Total	19	16	

[a] Chi square test: with the level of significance set at P < .05

Table 3. Women Who Would Make a More Conscious Decision about Their Health During Pregnancy, Knowing That There Is an Increased Risk of Long-term Effects on Their Children

	Women With Children			**Women Without Children**			
	Yes #	**%**	**Sub-Total**	**Yes #**	**%**	**Sub-Total**	**Total**
Australia	40	98	41	62	98	63	104
Samoa	42	98	43	48	87	55	98
Total	82	98	84	110	93	118	202

Discussion

Globally, GDM is the most common complication of pregnancy.[14] This study found that majority of participants who willing to change their behavior during pregnancy if it would reduce the risk of developing GDM and reduce the risk on their child's health. Previous studies have assessed the in-utero exposure to GDM as a risk factor for macrosomia and the development of obesity and T2DM among children during their adolescence and young adulthood .[14] Studies conducted on obesity and T2DM risk in children of mothers with GDM have shown a positive association through many studies including Northwestern Diabetes in Pregnancy Study in Chicago,[15,16] Pima Indian,[17] HAPO in Hongkong[18] and Kaiser Permanente centers.[21]

A study conducted at Kawempe National Referral Hospital[16] concluded that a significant portion of pregnant women were not aware of GDM and its risk factors or complications. The authors noted that increasing age and higher education were associated with increased awareness regarding GDM. Results from this study show that participants from Samoa had greater knowledge of complications of GDM, which could be linked to increased prevalence of diabetes in Samoa.

Regarding the educational component of GDM and the increased risk of obesity and T2DM in children, there still stands a gap between education and knowledge regarding the long term impacts of GDM on their children. Almost all paticipants (98% of those with children and 93% of those without) said they would change their behavior if it helped reduce the risk of obesity and T2DM for their children.

Participants obtained information about GDM and childrens's risks through various sources. Doctors and midwives are still the dominant source. Education to individuals early in pregnancy or prior to becoming pregnant is paramount to reduce the chance of developing GDM.

Strengths and Limitations

The study was created as a quantitative study to assess the awareness of the knowledge of women on the long-term complications on their children if they develop GDM. The results of the study can help provide guidance in education and health care promotion in Australia and Samoa.

The studies limitations consisted of duration, sample size, and sample area. The study was conducted over a 3-month time period, providing a limited snapshot of time, and reduced capacity to increase sample size. The sample size was targeted to 100 individuals per country, of similar demographics. The narrow sample size does not account for a variety of socioeconomic statuses, and therefore may not have captured individuals at higher risk of GDM.

Limitations existed in the level of understanding of participants answering questions based on answers to questions contradicting another. For example, 1 answered "yes" they had developed T2DM post-partum but had previously answered that they were nulliparous. The limitation may have fallen in line with not using validated questions or conducting inter-reliability. Caution needs to be addressed when interpreting the data.

Recommendations

Awareness of GDM among women who have had children from Australia and Samoa show that a vast majority are not aware of the long-term complications for themselves or their children. Globally, obesity and diabetes are becoming more prevalent and continue to be a common risk factor for GDM development in pregnant women. Increased education through health professionals or online resources for the long-term complications of GDM is essential.

Early education prior to pregnancy is likely to have its benefits. The majority of participants with no children indicated little knowledge on the short- and long-term complications of GDM associated with themselves and their children's health.

Further research into the population's exercise, and diet habits would be beneficial. Participants in this study identified that they are likely to change their approach to health if it concerned their child. Further studies are required to see if women are likely to implement changes to help reduce the risk of GDM.

Conclusions

The knowledge of GDM and its complications have increased over the past few years. However, the ability to relay the information to females of childbearing age has correlated with improvements in knowledge. Samoan women have shown greater knowledge regarding GDM and their child's risk of developing T2DM and being overweight compared to women in Australia. The study shows that there is room for improvement regarding the awareness and education of the complications linked to GDM for the child across both cultures. It is essential that accurate information is available to patients, health professionals, and the general public.

Conflict of Interest

The author does not identify any conflicts of interest.

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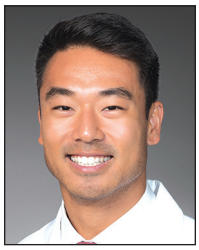
2022 Writing Contest graduate Winner

Decreasing Trend in Upper Extremity Surfing Injuries Presenting to United States Emergency Departments – A 20-Year Analysis

Kyle K. Obana MD; Morgan E. Hasegawa MD; John D. Mueller MD; Julian B. Rimm MS; Dane R.G. Lind BA; Alexander N. Berk BA; Bryan M. Saltzman MD; Robert L. Parisien MD; David P. Trofa MD; Lorrin S.K. Lee MD



Kyle K. Obana

Dr. Kyle K. Obana received his BA in Biology and Psychology, cum laude, from Amherst College and his MD from the John A. Burns School of Medicine (JABSOM) through the Territorial Savings Bank Scholarship. At JABSOM, he founded the Orthopaedic Interest Group, was president of the JABSOM Alpha Omega Alpha Medical Honor Society, and was awarded the Allen B. Richardson MD Endowed Surgery Scholarship during both his third and fourth years of medical school.

Through his extensive research efforts, he has published over 20 peer-reviewed manuscripts, including a first-author manuscript in the #1 orthopaedic journal establishing reporting standards for the use of orthobiologics, presented over 50 manuscripts at local, national, and international conferences, and was awarded the Po'okela Noi'i Research Award at graduation.

Dr. Obana is currently a first-year orthopaedic surgery resident at New York-Presbyterian/Columbia University Medical Center and plans on pursuing a fellowship in sports medicine and shoulder reconstruction. He intends on returning home to Hawai'i to give back to both the local community and the orthopaedic surgery residency.

Abstract

Surfing is a globally popular recreational sport with limited epidemiologic data. Currently, there is a paucity of literature regarding injury profiles and mechanisms of orthopaedic-related injuries. This study analyzed trends, etiologies, and diagnoses of upper extremity orthopaedic-related surfing injuries presenting to United States (US) emergency departments. The National Electronic Injury Surveillance System database was accessed to query upper extremity surfing-related injuries presenting to US emergency departments from January 1, 2002 to December 31, 2021. Data were analyzed for year, body part, mechanism of injury, diagnosis, and disposition. National estimates were calculated based on the assigned statistical sample weight of each hospital. A total of 33 323 surfing-related injuries were included. The most common upper extremity body parts involved 15 169 shoulders (45.5%), 4220 fingers (12.7%), and 3753 hands (11.3%). The most common identifiable mechanisms of injuries were 7474 board-to-body (22.4%), 4188 impact with sand (12.6%), and 2639 impact with water (7.9%). Overuse constituted 7.2% of overall upper extremity injuries but 40% of strains. Only 2.2% of injuries required hospital admission. Between 2002 and 2021, there was a decreasing annual trend in upper extremity surfing-related injuries (P=.01). The decreasing trend in emergency department visits may be due to urgent care utilization and training for surfers and lifeguards to manage these injuries on-site, as the majority were minor given the small proportion requiring hospital admission. Chronic stress on rotator cuff and peri-scapular musculature while paddling in the prone position likely contributed to the large proportion of overuse injury.

Keywords

Surfing, NEISS, emergency department, upper extremity, sports, orthopaedic, trauma, sports medicine, ocean

Abbreviations

AC = acromioclavicular
ED = emergency department
NE = national estimate
NEISS = National Electronic Injury Surveillance System

Introduction

Surfing is a physically demanding sport originating within the Native Hawaiian and Polynesian communities.[1] Recently, it has grown in global popularity, being recognized as an official high school sport in Hawai'i and making a debut appearance as an Olympic event in the Tokyo 2020 Summer Games.[2,3] Given that surfing is primarily a recreational sport, there are limited data regarding global and national participation, though current estimation supposes 30 million surfers worldwide, with most participants in the United States (US), Australia, and Brazil.[4,5] Specifically, the US states with the most surfable locations and most surfers per 1000 individuals are California, Hawai'i, and Florida.[6,7] Unlike other popular surf locations, Hawai'i is the smallest and most isolated archipelago, facilitating easy access to surfing around the entire island year-round. This, combined with the large prevalence of overhead waves and challenging breaks, makes Hawai'i a desirable location for surfers from around the globe.

Unlike non-aquatic sports such as American football, soccer, and lacrosse, aquatic sports involving the ocean entail a larger proportion of uncontrollable environmental hazards, some of

which contribute to orthopaedic-related injuries. These factors include wave size, wave morphology, underlying reef, wind patterns, and ocean floor depth.[1,5,8] The sea floor in Hawai'i is complex and contains various ridges and valleys. These promote shoaling—the compression of wave sets when the first wave speed decreases upon meeting shallow water, and refraction—the convergence of wave energy to the shallowest location.[9] Thus, many locations around Hawai'i have a high frequency of large waves at shallow breaking points and a larger proportion of overhead waves compared to other locations throughout the world.[5,10,11] Subsequently, recent studies found that surfers in Hawai'i are at greater risk of both traumatic and atraumatic injuries.[12–19] Other proposed individual risk factors include surfing in Hawai'i while visiting from one of the 48 contiguous states, surfing >6.5 hours/week, performing aerial maneuvers, and performing at a higher competition level.[4,14,19] Prior reports demonstrate 98% of surfers experience at least 1 injury during their career, with one-third experiencing an acute surfing-related injury each year necessitating medical care, missed work, or missed time surfing.[4] As most individuals surf recreationally, on-site support for acute care is often limited to lifeguards and bystanders.[20] This contrasts professional surfing events, in which athletic trainers and physicians are present.[15] Furthermore, many beaches do not have lifeguards or can be accessed outside of monitored hours.[21]

Recent studies have investigated common surfing injuries and associated etiologies, although most are from the United Kingdom (UK) or Australia. A retrospective epidemiologic study from Australia analyzed mechanisms and types of injuries, however data were limited to 1 year and did not report anatomic fracture location.[4] Recent studies analyzing surfing injuries found the shoulder constituted 7-16% of acute injuries.[4,22,23] Importantly, previous studies have found most acute surfing injuries do not require emergency department (ED) or hospital management.[8,10,24] Given the variability in wave and ocean characteristics, injury profiles and associated fracture patterns may differ between surfers in the US and the UK or Australia.

Prior studies have utilized the National Electronic Injury Surveillance System (NEISS) to analyze trends in sports-related orthopaedic injuries presenting to US EDs.[25–32] Klick et al utilized the NEISS database to analyze surfing injuries and found the most common diagnoses were lacerations (40.7%), sprains/strains (14.4%), contusions (12.9%), and fractures (11.9%).[24] However, the study did not specify the body part injured, nor did it calculate national estimates (NE) to present representative patient demographics or outcomes. Given the known risk of traumatic injury, including orthopaedic fractures, and the paucity of epidemiologic studies on upper extremity surfing injuries, the purpose of this study was to analyze trends, etiologies, and diagnoses of upper extremity orthopaedic-related surfing injuries presenting to US EDs. The authors hypothesized that (1) there would be an increasing trend of upper extremity surfing injuries over time due to growing participation in the sport, and (2) these injuries would primarily involve the shoulder.

Materials and Methods

Data Collection

The Consumer Product Safety Commission's NEISS database was used to analyze sports-related injuries. The NEISS is a national public database containing ED visits from 100 hospitals with a minimum of 6 beds and 24-hour services. Each hospital is assigned a statistical sample weight to generate NE, which are reliable, representative epidemiological data for the 5000 US hospital EDs. Trained coders enter data and assign weights to each hospital, which are used to calculate NE.

The dataset was built by querying different product codes associated with activity, diagnosis, body part, disposition, sex, and age. This included surfing-related injuries (product code 1261: surfing [activity, apparel or equipment]) involving the shoulder (product code 30), elbow (product code 32), lower arm (product code 33), wrist (product code 34), upper arm (product code 80), hand (product code 82), and finger (product code 92). All available diagnoses and dispositions were included in the query. Treatment dates ranged from January 1, 2002 to December 31, 2021. Age was collected in years and all ages were included. Sex was not specified to ensure all data were included.

The dataset contained information regarding date of ED presentation, age, sex, race, body part, injury diagnosis, disposition, and a brief narrative detailing the injury written by the healthcare provider. The narratives were individually reviewed by the first author to confirm the injury took place while surfing without use of additional equipment (ie, paddles or foils) and to identify mechanism of injury including board-to-body, board-to-head, collision with another surfer, impact with reef, impact with sand, impact with water, leash-associated injury, overuse, other, or not specified. The narrative was used to differentiate between strains and sprains as they are categorized under the same code (product code 64). Narratives were also used to differentiate acromioclavicular (AC), scapular, and clavicular injuries categorized under the code for shoulder. Overuse injuries were identified as shoulder injuries associated with multiple instances of surfing.

Exclusion Criteria

The narratives were also used to identify injuries sustained during non-surfing activities, which may have been inadvertently coded as surfing-related in the NEISS. Exclusion criteria included surfboard injuries that did not take place in the ocean (eg, surfing in the snow); injuries involving a surfboard but were unrelated to surfing (eg, tripped and fell while holding surfboard); non-surfing related aquatic activities (eg, paddleboarding, foiling, wake boarding, skim boarding, tubing, water skiing, etc); and injuries that did not specify surfing within the narrative.

Statistical Analysis

Statistical analyses were performed using STATA/MP Software 13.0 (StataCorp LLC, College Station, TX). Linear regression was performed to analyze the relationship between the year and total annual incidence of surfing injuries. Statistical significance was set at $P < .05$. NEs were calculated by multiplying each raw data point with the respective statistical weight (corresponding to the hospital) and rounded to the nearest 10 place.

Results

From January 1, 2002 to December 31, 2021 there were 1462 (NE = 82330 ED-diagnosed surfing-related upper extremity injuries. After reviewing the narratives using inclusion and exclusion criteria, 542 (NE = 33320) patients with surfing-related injuries were included for analyses and 920 (NE = 49010) injuries were excluded (**Figure 1**). Of the included patients, 449 (NE = 28180; 84.6%) were male and 93 (NE = 510; 15.4%) were female. Mean age at presentation was 30.3 years (NE = 30.8 years; range = 5 to 82 years). There were 353 White patients (NE = 22210; 66.6%), 133 that did not specify race (NE = 7610; 22.8%), 36 other race (NE = 2230; 6.7%), 12 Asian patients (NE = 920; 2.8%), and 8 Black patients (NE = 360; 1.1%).

The most common upper extremity body parts injured involved 241 shoulders (NE = 15 170; 45.5%), 74 fingers (NE = 4220; 12.7%), 61 hands (NE = 3750; 11.3%), and 50 lower arms (NE = 3060; 9.2%) (**Table 1**). The most common diagnoses presenting to the ED were 131 dislocations (NE = 8970; 26.9%), 122 fractures (NE = 6840; 20.5%), 77 lacerations (NE = 5400; 16.2%), and 77 strains (NE = 4680; 14.0%) (**Table 2**). There were 124 shoulder dislocations (NE = 84300; 94.7%), 4 finger dislocations (NE = 320; 3.6%), 1 elbow dislocation (NE = 80; 0.9%), and 2 AC joint dislocations (NE = 70; 0.8%). The most common sites of fractures were 25 fingers (NE = 1380; 21.3%), 20 clavicles (NE = 1250; 19.2%), and 19 lower arms (NE = 1030; 16.0%) (**Table 3**). The most common sites of strains were 57 shoulders (NE = 3580; 76.6%), 10 wrists (NE = 590; 12.7%), and 4 hands (NE = 220; 4.7%). The most common sites of sprains were 18 shoulders (NE = 870; 35.7%), 9 AC joints (NE = 680; 27.7%), and 10 fingers (NE = 424; 17.4%).

Narratives were reviewed to identify the mechanism of injury: 189 not specified (NE = 12 450; 37.4%), 124 board-to-body (NE = 7470; 22.4%), 71 impact with sand (NE = 4190; 12.6%), 45 impact with water (NE = 2640; 7.9%), 38 overuse (NE = 2390; 7.2%), 42 other (NE = 2340; 7.0%), 14 leash-associated injuries (NE = 850; 2.6%), 14 impact with reef (NE = 710; 2.1%), 2 collisions with another surfer (NE = 160; 0.5%), and 3 board-to-head (NE = 110; 0.3%). The 3 most common mechanisms of injury for the shoulder were 95 not specified (NE = 6570, 43.3%), 40 impact with sand (NE = 2170, 14.3%), and 36 impact with water (NE = 2170, 14.3%). The 3 most common mechanisms of injury for the finger were 26 board-to-body (NE = 1610, 38.1%), 22 not specified (NE = 1250, 29.5%), and 9 leash-associated injuries (NE = 610, 14.4%). The 3 most common mechanisms of injury for the hand were 29 board-to-body (NE = 1680, 44.8%), 16 not specified (NE = 1250, 33.2%), and 9 impact with reef (NE = 420, 11.2%).

The 3 most common board-to-body injuries were 52 lacerations (NE = 3540; 65.5% of all lacerations), 27 fractures (NE = 1380; 21.3% of all fractures), and 23 contusions/abrasions (NE = 1370; 37.9% of all contusions/abrasions). The 3 most common impact with sand injuries were 21 fractures (NE = 1160; 17.9%), 15 dislocations (NE = 990; 11.1%), and 10 sprains (NE = 690; 28.4%). The 3 most common impact with water injuries were 21 dislocations (NE = 1,330; 15.0%), 8 strains (NE = 520; 11.0%), and 6 fractures (NE = 390; 6.0%). The 3 most common overuse injuries were 29 strains (NE = 1870; 40.0%), 4 other (NE = 240; 20.8%), and 3 dislocations (NE = 180; 19.8%).

There were 529 patients (NE = 32 570; 97.8%) who did not require admission, 12 patients (NE = 730; 2.2%) who did require admission, 1 patient (NE = 20; 0.0%) that did not specify the disposition, and 0 fatalities. For patients not requiring admission, 521 (NE = 32 240; 96.7%) were treated and released or examined without treatment and 8 (NE = 340; 1.0%) left without being seen. For patients requiring admission, 10 (NE = 570; 1.7%) were treated and admitted and 2 (NE = 170; 0.5%) were treated and transferred to another facility.

Looking at overall annual upper extremity injury trends, simple linear regression demonstrated a decreasing trend of 47 upper extremity orthopaedic-related surfing injuries per year over the 20-year study period ($P = .01$) (coefficient = -46.6; 95% CI: [-81.7 to -11.6]) (**Figure 2**).

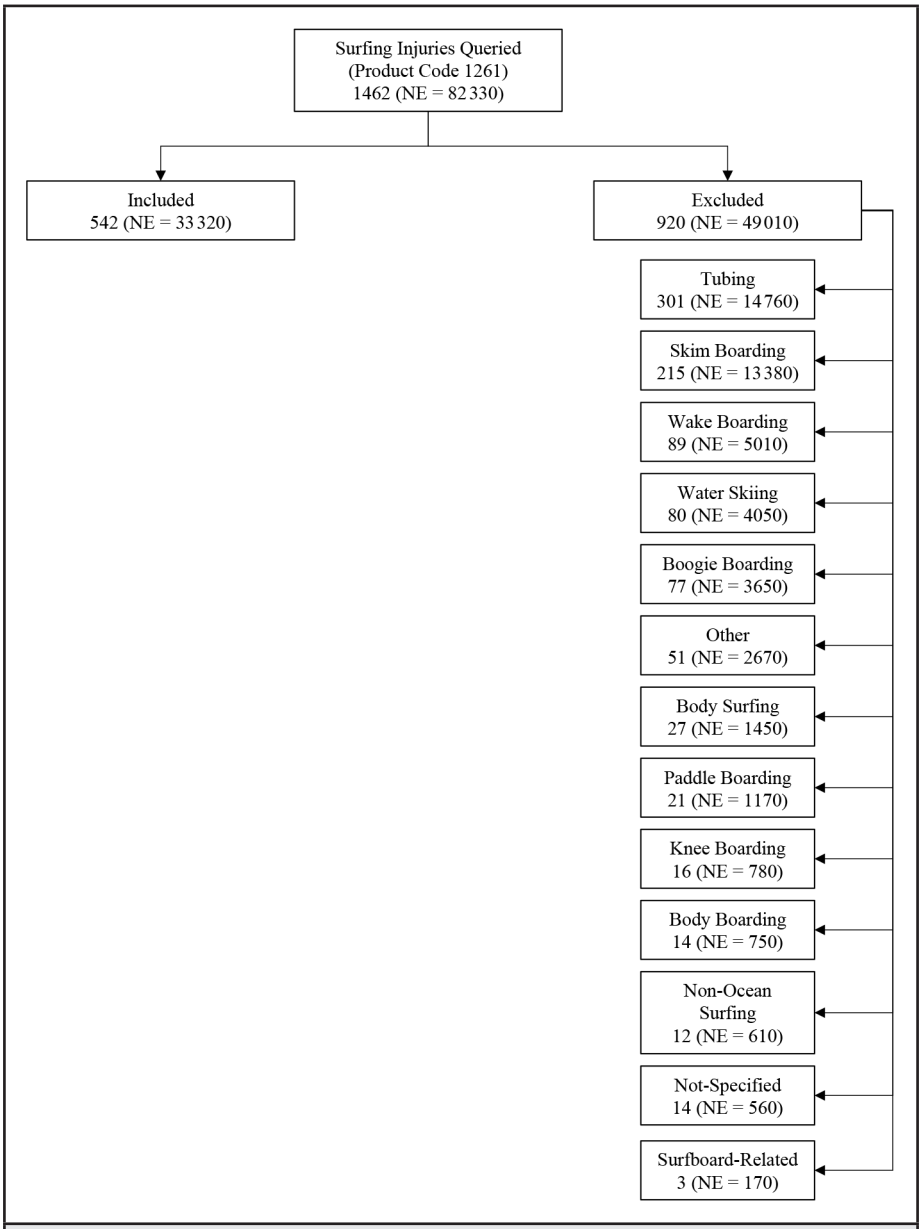


Figure 1. Flow Chart of Included and Excluded NEISS Surfing Injuries by Sport Identified Within the Narrative

NEISS = National Electronic Injury Surveillance System, NE = weighted national estimate
The total NE may not add up perfectly due to rounding after calculations.

Table 1. Distribution of Upper Extremity Surfing Injuries by Body Part, National Electronic Injury Surveillance System, 2002 to 2021

Body Part	Count	National Est[a]	Weighted %
Shoulder	241	15 170	45.5
Finger	74	4220	12.7
Hand	61	3750	11.3
Lower Arm	50	3060	9.2
Wrist	35	2110	6.3
Elbow	25	1500	4.5
Clavicle	20	1250	3.7
Upper Arm	18	960	2.9
AC Joint	11	750	2.2
Scapula	7	550	1.6
Totals	542	33 320	100.0

Abbreviations: AC= acromioclavicular

[a] Weighted national estimates and weighted percentages may not add up perfectly due to rounding.

Table 2. Distribution of Upper Extremity Surfing Injury Diagnoses, National Electronic Injury Surveillance System, 2002 to 2021

Diagnosis	Count	National Est[a]	Weighted %
Dislocation	131	8870	26.6
Fracture	122	6840	20.5
Laceration	77	5400	16.2
Strain	77	4680	14.0
Contusion or Abrasion	61	3620	10.9
Sprain	47	2440	7.3
Other	22	1140	3.4
Hematoma	4	250	0.7
Amputation	1	90	0.3
Totals	542	33 320	100.0

[a] Weighted national estimates and weighted percentages may not add up perfectly due to rounding.

Table 3. Distribution of Upper Extremity Surfing Fractures, National Electronic Injury Surveillance System, 2002 to 2021

Fracture Location	Count	National Est[a]	Weighted %
Finger	25	1380	21.3
Clavicle	20	1250	19.2
Lower Arm	19	1030	16.0
Wrist	13	680	10.5
Hand	11	630	9.8
Scapula	7	550	8.5
Shoulder	12	540	8.4
Elbow	8	390	6.0
Upper Arm	2	20	0.3
Totals	117	6470	100.0

[a] Weighted national estimates and weighted percentages may not add up perfectly due to rounding.

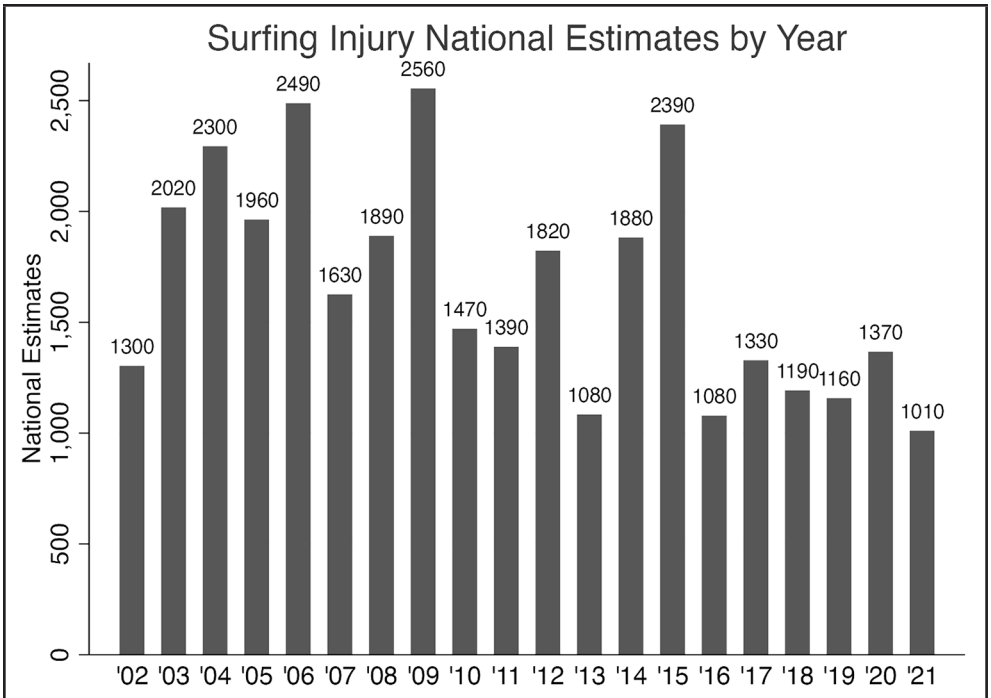


Figure 2. Upper Extremity Surfing Injury National Estimates by Year From 2002 to 2021

Discussion

The current study found a significant decline of 47 upper extremity orthopaedic-related surfing injuries presenting to US EDs for every 1-year increase from 2002 to 2021. Most (96.7%) upper extremity surfing injuries presenting to the ED were presumed to be not life-threatening as they were treated without further admission, similar to the 95.7% reported in prior studies.[24] High-energy trauma, fractures and internal injury to craniofacial structures, and neurological injury have been associated with hospital admission, although epidemiological studies on severity of surfing injuries necessitating hospitalization are limited.[15,33–36] Importantly, surfing injuries warranting hospital admission constitute a small minority of overall injuries and the downtrend of ED presentations may be attributed to increased access to care for lower-acuity upper extremity injuries outside of the hospital setting.[24] This access may include the burgeoning presence of urgent care clinics and improved lifeguard training to manage common and minor injuries (eg, strains, sprains), obviating the need for an ED visit. Importantly, previous studies highlight the higher prevalence of surfing-related injuries in rural areas of Hawai‘i.[14,19] These findings emphasize the importance of accessible urgent care clinics in rural areas where there is a high prevalence of surfing-related injuries and limited hospital access.[14] As surfing continues to gain popularity worldwide, this will increase the number of individuals who may be on-site and can aid when other surfers are injured. It has been estimated that greater than 80% of surfers have assisted with 1 or more surf rescues and 23% assisted with more than 5.[37] Likewise, the implementation of surfing training and education programs on surf rescue has demonstrated promise, as surfers with enhanced training have performed more water rescues.[23,37] Additionally, recent advancement in surfboard designs and technology have aimed to improve gross motor coordination and surfboard mechanics, which may also contribute to the down-trending upper extremity injuries seen at US EDs over the study period.[38–40] The increased use of “soft top” surfboards, which have the board’s deck covered in a softer foam material, lessen the board-to-body impact.

The most common identifiable mechanism of injury was the surfboard impacting the upper extremity (board-to-body), which is consistent with prior studies.[5,8,23] In this study, board-to-body impact most commonly resulted in lacerations, fractures, and contusions/abrasions. Lacerations presenting as the most common surfing injury supports prior literature, which can be attributed to contact with the board or sharp reef.[5,23] Board-to-body impact was the most common mechanism of injury for the hand (44.8%) and finger (38.1%), which were the second and third most injured body parts, respectively. Interestingly, previous literature attributed 83.8% of surfing-related finger injuries to the leash.[41,42] In the current study, leash-associated injuries constituted only 14.4% of finger injuries and 2.6% of overall injuries.

The shoulder is also under significant stress from chronic use. Overuse injuries constituted 7.2% of overall upper extremity injuries in this study but were the highest proportion associ-

ated with strains (40% of upper extremity strains). Overhead paddling in the prone position induces chronic strain on rotator cuff and peri-scapular musculature. Paddling constitutes 54% of the surfer's time in the water and is the most common cause of chronic injury.[43–45] Furthermore, surfers push down with both hands to "duck dive" under an oncoming wave or "pop up" on the board to get to standing position, putting additional strain on the shoulder. Previous studies have reported the shoulder being the second most common location for chronic injuries in surfers, with 76% experiencing unilateral or bilateral complaints and 63% experiencing impingement symptoms.[45,46] Interestingly, recreational surfers are more likely to have chronic injuries than competitive surfers, which may reflect the necessary conditioning required for surfing.[45] A prior study found 42-55% of surfers presenting to orthopaedic clinics have rotator cuff tears and 35-40% to have labral tears.[43,47] With year-long access to surf in Hawai'i, total hours spent surfing may be greater than in other geographic regions, predisposing to chronic upper extremity injury. Thus, providers should be cognizant that there may be a larger proportion of chronic upper extremity injuries secondary to surfing presenting to EDs in Hawai'i compared to that of the continental US.

The most common locations of fractures were the finger, clavicle, and lower arm. Importantly, this is the first study to report the incidence of clavicle fractures in surfers presenting to EDs. Although the available data in this study could not delineate location (eg, proximal, middle, or distal one-third) or characteristics of the clavicle fractures (eg, z-deformity, vertical displacement, distraction, shortening), these injuries require time off from surfing, with or without surgery, given the increased risk of subsequent nonunion and potential for reduced shoulder strength and endurance. For surfers requiring clavicle surgery, estimates of return to surfing may be extrapolated from other studies indicating a return-to-sport time of 65-83 days for athletes competing in high-impact sports.[48–50]

There are multiple limitations to this study, largely stemming from utilization of a national database. First, classification of mechanisms was limited to information in the narrative. A large proportion of mechanisms were not specified (37.4%), which may have influenced the overall findings had more details been provided. However, outcomes of the current study reflect that of prior literature and additional information may have contributed positively to the distribution of mechanisms. These data were included to provide better representations of the overall trends in ED visits. Second, the data were unable to delineate whether lifeguards, surfers, or other personnel were present to assist at the time of injury. Thus, the authors are unable to determine the effectiveness of on-site management of injuries and the proportion necessitating ED visits. Lastly, the true incidence of national surfing injuries is unknown given the stratification of the NEISS across 100 different hospitals. However, it is not feasible to determine the true epidemiologic data on surfing injuries in the US given it is predominantly a recreational sport. Thus, this is the most reliable sample available regarding surfers and surfing injuries.

Going forward, Hawai'i-specific data are needed to investigate state-level trends in surfing injuries presenting to EDs. Importantly, these studies could stratify data based on hospital location (eg, island and county-specific) and analyze trends based on presence of nearby urgent care centers. Urgent care-specific data may also demonstrate if there is a corresponding increase in surfing injuries. Lastly, studies quantitatively and qualitatively evaluating rotator cuff tears in surfers, as well as outcomes following treatments, are needed to guide both physician and patient expectations.

The current study found a statistically significant decreasing trend in annual upper extremity surfing injuries presenting to US EDs. This may be due to increased urgent care utilization, implementation of surfer and lifeguard training, and improvements in surfboard technology to improve board control and decrease the force of board-to-body impact. Overuse injuries constituted the greatest proportion of strains in the study, highlighting the chronic stress on rotator cuff muscles in recreational surfers.

Conflict of Interest

None of the authors identify a conflict of interest.

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Collaborative Regional Workforce Development for Hawai‘i and the Pacific: 85+ Years of Social Work Education

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Social Work in Action is a solicited column from the social work community in Hawai‘i. It is edited by HJHSW Contributing Editor Sophia Lau PhD, of the Thompson School of Social Work & Public Health at the University of Hawai‘i at Mānoa.

Abbreviations

BSW = Bachelor of Social Work
CEPD = Continuing and Professional Education
DSW = Department of Social Work
MSW = Master of Social Work
UH Mānoa = University of Hawai‘i at Mānoa

The purpose of land grant institutions of higher education is "to engage with communities to solve problems and improve the quality of life for its citizenry."[1] The Thompson School of Social Work & Public Health's Department of Social Work (DSW) has been engaged in that mission for over 85 years, serving local, regional, and global communities to solve increasingly complex social problems and their intersection with social determinants of health. Similar to the purpose of land grant institutions, the roots of social work are in serving a community's most marginalized and vulnerable members. The Thompson School has prepared social workers to go into health-related fields, such as trauma work at hospitals, hospice care, health education and prevention efforts. However, social work is much broader than biological health alone, serving as the nation's top provider of substance use treatments, providing family support and clinical therapy, addressing poverty and other systemic issues, while also writing and advocating for policies, and standing on the front lines of community advocacy. Social workers are everywhere there are people in need, and schools of social work train graduates at the bachelor, master and doctorate levels to be prepared for a wide variety of possible job roles.

The social work labor force throughout the Pacific is currently facing a shortage, with the need for more social workers projected to grow substantially.[2] For example, rural areas of Hawai‘i are considered "medically underserved," including a lack of social workers. In addition, US-affiliated entities throughout the Pacific are plagued by chronic and severe shortages in the health professions. There is a particular shortage of substance use and mental health providers in these regions where the social work professional need is projected to grow over 20% in the next 10 years.[2] The University of Hawai‘i (UH) at Mānoa Thompson School DSW trains a culturally-grounded workforce in their home communities through innovative outreach in online based distance education and traditional campus-based modalities, and by engaging community partners across the region to identify and address workforce needs. The DSW is deeply invested in collaborations to improve the health and well-being of Hawai‘i, the Pacific region and beyond and produces research that has local, national, and global reach.

Innovative Programs

UH Mānoa's commitment to social work education has resulted in significant contributions to the well-being of the state of Hawai‘i, the Pacific region and the social service workforce. In 1936 the School of Social Work focused exclusively on social work education, in 2016 the school merged with Public Health and the Center on Aging, and in 2021 changed the name to the Thompson School of Social Work & Public Health.

From 1988 until 2007 the DSW addressed regional labor force concerns by launching a "traveling option" of the Master of Social Work (MSW) program and in 2007 the traveling program was converted to an online program that graduates 30-40 students a year. Additionally, in 2010 the DSW launched a partnership with the University of Guam to facilitate the matriculation of their accredited Bachelor of Social Work (BSW) students to the DSW online MSW program. Due in part to the expansion of the distance program, the MSW program is now the largest graduate program at UH Mānoa with over 200 MSW students per year.

Since its inception in 1976, the BSW program has worked to ensure a smooth transition for those who attend community colleges to find a home in social work at Mānoa, while filling critical workforce needs in the region. In furtherance of their goals to address labor force shortages at the BSW level, an innovative online, asynchronous BSW program was launched in 2018. The program is the first at UH Mānoa to offer the asynchronous 5-week class option which is of high value to students who may be unable to access traditional UH Mānoa based, in-person courses. This option has now graduated over

100 BSWs across the Hawaiian islands, leading to an important increase in the number of social workers trained to serve workforce needs in case management, education, family coaching, and other support positions.

More recently, the DSW has developed its Continuing Education and Professional Development (CEPD) program to continue the advancement of the profession and the development of the workforce in the region. Through delivery in person and in virtual spaces, with a number of contracts with state and private agencies, the DSW is delivering high quality workforce development. In many cases, CEPD fulfills training needs to assist the workforce in maintaining their licensure and in attaining professional certifications. CEPD also responds to emerging workforce needs, such as promoting training during the COVID-19 pandemic to support a social service and health infrastructure that was shifting to adapt to the constraints and threats of the pandemic. Thus, the DSW not only contributes to producing new workers, but in sustaining and training professionals for increasingly higher levels of practice.

The DSW continues its commitment to grow its student body to ensure strong representation of all communities. Research has consistently shown that minoritized communities are underrepresented among health, behavioral health, and social service trainees.[3] However, the DSW has one of the most diverse faculty and student bodies at UH Mānoa, reflecting the people and cultures of the state of Hawai'i, the Pacific region and beyond. Since its initial accreditation over 85+ years ago, the school has trained 5000+ students, the majority of whom stay and work in the state of Hawai'i and the region. Thus, not only does the DSW produce consistent numbers of professionals, but the DSW contributes to the advancement of some of the most marginalized members of communities. The department's work engaging high school students, early college students and those already working in the social service field is rooted in identifying pathways to further professionalization of the field of social work for all peoples in the region.

Innovations in Research

While the results of the DSW's educational programs may be the most visible activities for addressing workforce shortages and health, mental health, and social service innovations, the DSW has contributed significant research that advances the profession as well. For over 80 years, social work faculty have produced ground-breaking research that has addressed a variety of local, national, and international social issues. Initially, social work faculty focused on local research sorely needed in the community, including topics such as juvenile justice, housing, social work with Pacific Islanders, and the social conditions of different racial/ethnic groups across the state. The 1960s saw the faculty focus on civil rights, diversity, and advocacy-related research, while the 1970s focused on research and reform related to the Hawaiian Renaissance, and the integration of Hawaiian knowledge into social work practice. Later cohorts of faculty have produced some of the most innovative research on human sexuality, on the importance of evidence-based practice in social interventions, international social welfare interventions and social service delivery; social work with Hawaiians; and the then emerging field of gerontology.

Currently, the social work faculty examine a wide variety of topics that serve the local community, but also contribute to social change and knowledge creation at the national and international levels. The faculty study topics in: interprofessional education; technology in practice and education; addiction/behavioral health policies; Indigenous health and social work practice; child welfare; social and adjustment issues of Pacific Islander youths; social welfare policy; health care access and service utilization; mental health literacy; international social work; productive aging; immigrant and refugee rights; and prejudice, stereotypes, and hate crimes, among others. The faculty's research informs local policies and programs, and has contributed to national debates before influential bodies such as the US Supreme Court and the US Commission on Civil Rights.

More specific to current workforce needs, the DSW has produced a number of research studies that examine social work workforce issues in the state of Hawai'i, including pathways to licensure attainment among social work graduates in the state,[4] licensure attainment among MSW students from campus-based or distance options in Hawai'i,[5] empowering the workforce through resilience training,[6] and examinations of ongoing monitoring and definitional issues for the social work profession in the state,[2] among others. Thus, the research produced by faculty of the DSW directly impacts the understanding of workforce needs in the state and region, that in turn informs the DSW's educational endeavors to develop a highly trained workforce.

Innovations Through Collaborations

With field internship partners at over 150 sites in Hawai'i, Guam, and beyond, social work is deeply rooted in communities and associated organizations. Field instructors, frequently UH Mānoa alumni, provide supervision to, and assist students in internship settings where students become contributors to our workforce. In fact, current estimates suggest that while DSW students do require an educational environment in their field sites rather than being treated as employees, they still contribute over $1 000 000 in services each year across the Pacific while they are students. While a significant number of field sites are in the City and County of Honolulu, almost half are on neighboring islands, with a significant number in Guam, and international opportunities for field settings are also located in Korea, Japan, and the Philippines.

In addition to field sites, the DSW has a strong history of partnering across disciplines and with community and state organizations to develop and launch programs. These innova-

tive collaborations emphasize the DSWs commitment to interdisciplinary work to grow the knowledge base of social work connected research and service delivery. Selected examples of such collaborations are:

- Hawai‘i Interprofessional Team Collaboration Simulation (HIPTCS)
- Hawai‘i Interprofessional Education (HIPE) program
- Hawai‘i Child Welfare Education Collaboration (HCWEC): with the Department of Human Services, Child Welfare Services
- Hawai‘i Substance Use Professional Development (SUPD); with the Alcohol and Drug Abuse Division of the Department of Health
- Native Hawaiian Interdisciplinary Health: BSW and the Native Hawaiian Center of Excellence at the John A. Burns School of Medicine (JABSOM)
- Ke A‘o Mau, interdisciplinary program with Public Health, supported by external community partner
- Micronesians Advancing in Health Professions, collaboration with JABSOM
- Hā Kūpuna, the National Resource Center for Native Hawaiian Elders

These collaborations offer specific innovations in training the workforce, translating new knowledge to existing professionals, and advancing the research impacts on the workforce throughout the region. These contracts and collaborations are the heart of a land grant school’s mission to serve the local community.

Conclusion

The vision of the Thompson School’s namesake to create connected Pacific communities drives the DSW to continue work in the community as part of its genealogy, its mission as a land grant institution, and its expression of social work values. The DSW has consistently prioritized listening to communities as they define the parameters of how to enhance their health and well-being, while prioritizing the preservation and integration of generations of traditional knowledge into social work education as a part of high quality service delivery in the Pacific. As the DSW further develops relationships with Pacific partners, we know that at the intersection of academic expertise and community-based practice is the deeply rooted wisdom that solutions to today’s problems are available through maintaining connection to traditional cultural solutions.

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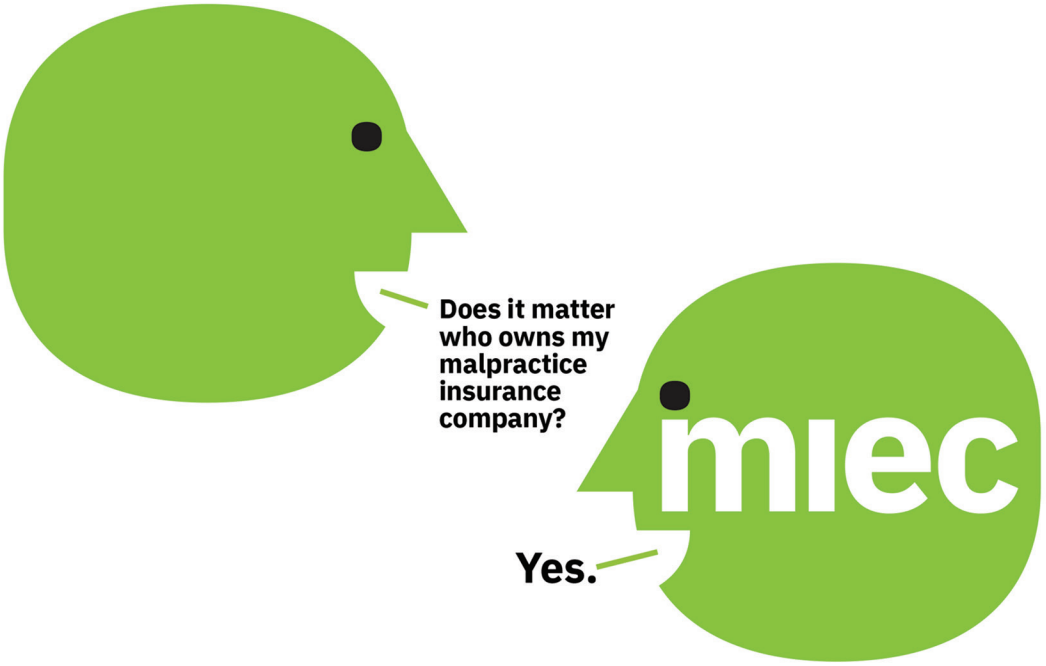

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