

# Hawai‘i Journal of Health & Social Welfare

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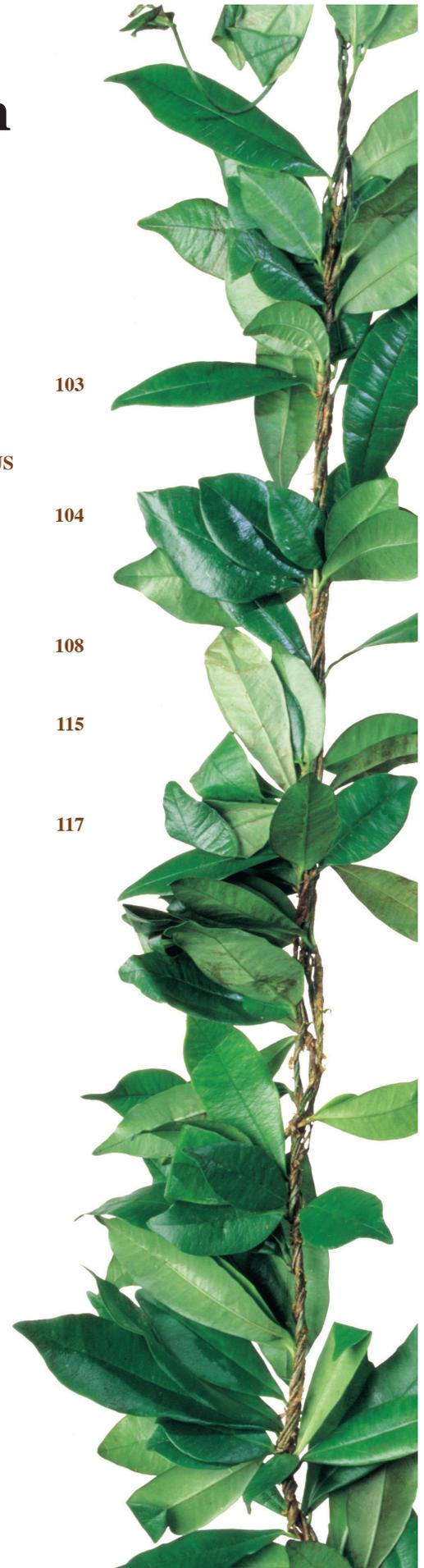
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# Hawai'i Journal of Health & Social Welfare

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**Mailing Address:** Hawai'i Journal of Health & Social Welfare  
University of Hawai'i John A. Burns School of Medicine  
Medical Education Building, 224F  
651 Ilalo Street  
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# HAWAI‘I JOURNAL WATCH

KAREN ROWAN MS

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

## HOUSE ACCESSIBILITY LINKED WITH OLDER ADULTS’ WELL-BEING

For older Korean adults, housing environment is associated with measures of health and well-being. Researchers including Seunghye Hong PhD, of the Thompson School of Social Work & Public Health, analyzed data from 2077 older adults with physical disabilities gathered from the Korean 2014 National Survey on Persons with Disabilities. Results showed that nearly a third of participants said their house lacked accessibility. House accessibility, but not house quality, was associated with lower perceived stress and lower odds of suicidal ideation. Living alone and having higher dependency on others for accomplishing activities of daily living were linked with higher odds of having depressive symptoms. Overall, the findings show that older adults’ home ownership and perceptions of their house accessibility, rather than quality of their housing environment, are important determinants of health and well-being.

- Kim M, Woo B, Kim HJ, Yi E, Hong S. Examining Housing Environments and Health Status of Older Adults with Physical Disabilities in South Korea. *J Aging Soc Policy*. 2021;1-15. doi:10.1080/08959420.2020.1851350

## MICRONESIAN WOMEN IN HAWAI‘I HAVE HIGHER ODDS OF CESAREAN DELIVERY

Micronesian women in Hawai‘i may have higher odds of delivering by Cesarean section for reasons that involve a greater level of physician discretion, compared with white women. Researchers including Catherine Pirkle, PhD, of the Office of Public Health Studies, looked at data on 620 randomly selected Cesarean deliveries at one hospital in Hawai‘i. Micronesian women had four times greater odds of delivering by Cesarean for a subjective reason, compared with white women. Reasons that may be considered subjective include a slowing down of labor or certain fetal heart rate patterns; in these cases, some providers may prefer to perform a Cesarean while others would deliver the baby vaginally. Further research is needed on physician and patient factors that affect Cesarean rates, the researchers concluded.

- Delafield R, Elia J, Chang A, Kaneshiro B, Sentell T, Pirkle CM. A cross-sectional study examining differences in indication for Cesarean delivery by race/ethnicity. *Healthcare*. 2021;9(2):159. doi:10.3390/healthcare9020159

## WHAT AUSTRALIAN ADULTS EAT FOR BREAKFAST

Dietary guidelines tend focus on specific food groups, but at meals, people select combinations of foods to eat. Researchers including Carol Boushey, PhD, MPH, RD, of the UH Cancer Center, examined nationally representative data collected from the Australian National Nutrition and Physical Activity Survey, 2011–2012. Results revealed five distinct breakfast food profiles: wholegrain cereals and milks, protein foods, mixed cereals and milks, and two profiles called breads and spreads that differed in their type of grain (wholegrain vs refined) and type of spreads (discretionary vs unsaturated fats only). Among both men and women, those with a

“wholegrain cereals and milks” profile had the lowest BMI, waist circumference, and overweight/obesity prevalence, compared to the other profiles. More research on how foods are combined into meals could inform targeted nutritional strategies aimed at improving diet quality.

- Leech RM, Boushey CJ, McNaughton SA. What do Australian adults eat for breakfast? A latent variable mixture modelling approach for understanding combinations of foods at eating occasions. *Int J Behav Nutr Phys Act*. 2021;18(1):46. doi:10.1186/s12966-021-01115-w

## REPURPOSING METFORMIN AS AN ANTI-CANCER DRUG

Metformin — the first-choice drug for treating type 2 diabetes due to its well-established efficacy, safety, and relatively low cost — may also have anti-cancer effects. However, the drug has a poor ability to move through cell membranes, and its relatively low concentrations in tumors may be part of the reason it has so far shown a lack of efficacy in cancer clinical trials. Researchers including Abhijit Date, PhD, with the Daniel K. Inouye College of Pharmacy, synthesized and characterized several lipophilic salts of metformin. They found that one of those salts, metformin docusate, was able to permeate cell membranes and showed dramatically improved anticancer activity in experiments done with cancer cell lines. Future efforts will focus on developing lipid-based formulas that contain metformin docusate.

- Saeed HK, Sutar Y, Patel P, et al. Synthesis and characterization of lipophilic salts of metformin to improve its repurposing for cancer therapy. *ACS Omega*. 2021;6(4):2626-2637. Published 2021 Jan 25. doi:10.1021/acsomega.0c04779

## IS HAWAI‘I READY TO HELP PEOPLE WITH DISABILITIES IN TIMES OF DISASTER?

The government offices in Hawai‘i and the Pacific that are responsible for ensuring that people with disabilities (PWD) are included in plans for disaster management may be ill-equipped to meet the needs of PWD when disaster strikes. Researchers including Qi Zhi, MPH, of the School of Nursing & Dental Hygiene, surveyed professionals working in local Offices of Emergency Management (OEMs) in Federal Region 9, which includes Arizona, California, Hawai‘i, Nevada, Guam, American Samoa, and the Commonwealth of Northern Mariana Islands. Results showed that 63% of OEMs had written disaster plans that addressed the needs of PWD, while 41% included detailed operating procedures that specifically stated how the needs of PWD would be addressed. Most OEMs did not include the number of PWD in their regions in their plans. About one third reported staff had been trained on identifying needs of PWD, and 26% reported training on the requirements under the Americans with Disabilities Act. The findings show that emergency planning gaps exist related to PWD.

- Gershon RR, Muska MA, Zhi Q, Kraus LE. Are local offices of emergency management prepared for people with disabilities? Results from the FEMA Region 9 Survey. *J Emerg Manag*. 2021;19(1):7-20. doi:10.5055/jem.0506

# Constructing a Novel ‘Uterine Sandwich’ with Simultaneous Intrauterine Balloon Tamponade and Uterine Compression Sutures to Manage Postpartum Bleeding

Jennifer W.H. Wong MD and Grace K. Wong MD

## Abstract

*The uterine sandwich is a relatively new surgical technique for managing postpartum hemorrhage, which is the leading cause of maternal mortality worldwide. The purpose of this case series is to describe a novel method of constructing the uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures. Six patients with postpartum bleeding refractory to medical management were successfully treated with this novel method and avoided hysterectomy. There were no additional complications. This novel method of constructing a uterine sandwich appears to be a simple, safe, and effective technique that could be considered in cases of persistent postpartum bleeding. More research is needed to compare the efficacy of various techniques.*

## Keywords

obstetrics, postpartum hemorrhage, uterine atony

## Abbreviations and Acronyms

CD = cesarean delivery

PPH = postpartum hemorrhage

## Introduction

Postpartum hemorrhage (PPH) is the leading cause of maternal mortality worldwide.<sup>1</sup> Multiple medical and surgical interventions have been studied and trialed to manage PPH and prevent escalation to hysterectomy as definitive management. Postpartum hysterectomy is associated with loss of fertility and high rates of major complications, including transfusion of red blood cells (84%) and other blood products (34%), fever (11%), subsequent laparotomy (4%), ureteral injury (3%), and death (2%).<sup>1</sup> According to the American College of Obstetricians and Gynecologists, a uterine sandwich surgical technique can be considered in the management of postpartum hemorrhage.<sup>2</sup> The uterine sandwich has been classically described as uterine compression sutures followed by reassessment of the patient’s bleeding, followed by placement of an intrauterine tamponade balloon as needed for continued bleeding.<sup>3,4</sup>

The uterine sandwich is a relatively new technique, and only a few small case series and prospective studies have described this technique. Yoon et al. conducted one of the most extensive studies on the uterine sandwich; all patients (n = 11) were successfully treated with uterine compression sutures, followed by intrauterine balloon tamponade for persistent bleeding.<sup>3</sup> Variations of the uterine sandwich have been described in

the literature (Table 1). Other modifications target the type of uterine compression sutures, using B-Lynch sutures,<sup>3-5</sup> Hayman sutures,<sup>3</sup> or Matsubara-Yano uterine compression sutures,<sup>6</sup> or the type of intrauterine tamponade, such as gauze.<sup>5</sup>

The most effective technique of constructing the uterine sandwich has yet to be established. The purpose of this case series is to describe a novel method of constructing a uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures for the management of postpartum bleeding.

## Methods

Institutional Review Board exemption was obtained from the Hawai‘i Pacific Health Research Institute, and patient consent was not required. Between September 2018 and August 2019, patients with bleeding refractory to conservative treatment were managed with a uterine sandwich constructed by the simultaneous placement of an intrauterine Bakri balloon (Cook Ireland Ltd, Limerick, Ireland) and modified B-Lynch sutures. In all cases, patients were initially managed conservatively with manual uterine massage, intravenous oxytocin (30 IU in 500 mL of normal saline at 300 mL/hour), intramuscular ergometrine (0.5 mg per dose to a maximum of 2 doses, unless contraindicated), intramuscular carboprost (0.5 mg for a maximum of 6 doses, unless contraindicated), and rectal misoprostol (800 mcg, once). Uterine bleeding was refractory to medical management, so a uterine sandwich was constructed.

The uterus was exteriorized from the abdomen. The hysterotomy was closed with 0-Vicryl in a running locking fashion, and a second imbricating layer was done using the same suture. A modified B-Lynch was performed with 1 chromic catgut on a 90 mm curved needle, and the sutures were left untied. The uterus was returned into the abdomen. A skilled assistant inserted the Bakri balloon into the uterine fundus via the vagina, and the Bakri was filled with normal saline until the balloon filled the uterine cavity (maximum 500 mL per the manufacturer’s instructions). The B-Lynch sutures were then cinched down and tied together. Vaginal packing was inserted to prevent expulsion of the Bakri balloon into the vagina (Figure 1). The Bakri balloon and vaginal packing were removed within 24 hours after placement. Treatment success was defined as the management of bleeding without requiring a hysterectomy. Awareness of this novel technique was disseminated throughout the hospital via resident-led Morbidity and Mortality conferences.

## Results

Six cases were identified from 6 different obstetricians. Upon admission, 4 patients were multiparous, and 2 patients were nulliparous. Five patients were of term gestational age, and 1 patient was late preterm. All patients underwent cesarean section, and each had a different underlying risk factor for PPH, including placenta previa, history of PPH, fetal macrocephaly, protracted labor, uterine inversion, grandmultiparity, and chorioamnionitis (Table 2).

Regarding the uterine sandwich, the Bakri balloon was inflated with a volume of normal saline ranging from 180 mL to 450 mL, but 1 patient's Bakri volume was not recorded. Estimated blood loss ranged from 600 mL to 5 000 mL, and the number of packed red blood cells transfused ranged from 0 to 4 units. Five patients did not require additional intervention. One patient was stabilized by the uterine sandwich with minimal bleeding that could have been managed expectantly, but she underwent a precautionary uterine artery embolism due to the hospital's lack of blood products. There were no complications (Table 2).

Table 1. Techniques for Constructing a Uterine Sandwich for Postpartum Hemorrhage Secondary to Uterine Atony			
Author and Year	Study Population	Technique	Complications
Nelson 2007	5	1. Place B-Lynch sutures 2. Reassess bleeding 3. If continued bleeding, place Bakri balloon	None
Yoong 2012	11	1. Place B-Lynch or Hayman sutures 2. Reassess bleeding 3. If continued bleeding, place Bakri balloon	None
Kaplanoglu 2013	1- septate uterus	1. Place B-Lynch sutures 2. Place intrauterine packing with gauze	None
Matsubara 2014	5	1. Place 2 longitudinal and 2 transverse compression sutures in a box-like shape in the upper and mid uterine segments 2. Place a metreurynter, like an intrauterine balloon, into the lower uterine segment. Inflate to 100 mL.	None
Diemert 2012	6	1. Place Bakri balloon 2. Reassess bleeding 3. If continued bleeding, place B-Lynch sutures	1 hysterectomy for placenta increta

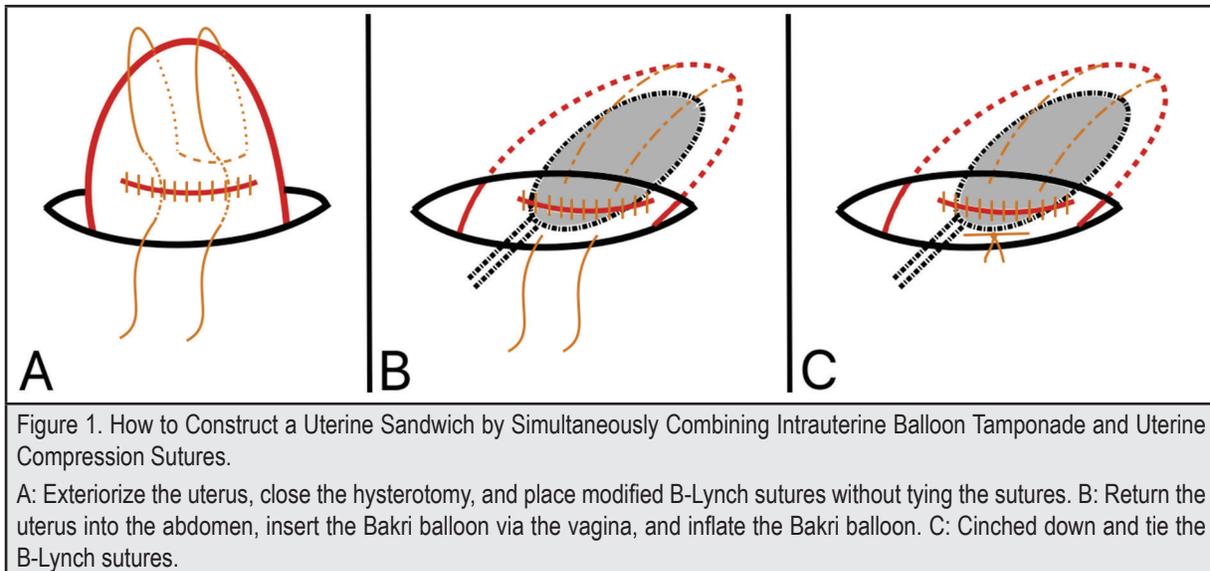


Table 2. Patient Demographics and Management of Persistent Postpartum Bleeding with Novel Uterine Sandwich Method						
Characteristics	Case No.					
	1	2	3	4	5	6
<b>Patient Demographics</b>						
Age, years	31	27	22	27	32	20
Parity upon admission	1	1	1	0	6	0
<b>Obstetrics</b>						
Gestational age, weeks	36 0/7	37 5/7	39 2/7	39 4/7	40 4/7	37 4/7
Risk factors for hemorrhage	Placenta previa	History of PPH	Fetal hydrocephalus	Protracted labor	Uterine inversion, grandmultiparity	Chorio-amnionitis
Mode of delivery	CD	CD	CD	CD	CD	CD
Neonatal birth weight, g	2 620	3 099	3 830	3 634	3 181	3 195
<b>Hemodynamic Status</b>						
Estimated blood loss, mL	5 000	1 500	2 000	600	1 000	1 500
Bakri balloon inflation volume, mL	300	350	450	Unknown	180	200
Packed red blood cells transfused, units	4	0	4	0	0	1
Additional interventions	Uterine artery embolization	None	None	None	None	None
<b>Postpartum</b>						
Complications	None	None	None	None	None	None

Abbreviations: CD, cesarean delivery; PPH, postpartum hemorrhage

## Discussion

All 6 cases of postpartum bleeding refractory to conservative management were successfully treated with the uterine sandwich and avoided hysterectomy. There were no complications. This novel method of constructing a uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures appears to be a simple, safe, and effective technique that can be considered in cases of persistent postpartum bleeding.

Intrauterine balloon tamponades are 86% effective at controlling refractory bleeding by placing direct pressure on the uterine sinuses.<sup>7</sup> Compression sutures are 60% effective at controlling refractory bleeding by physically compressing the myometrium and uterine sinuses.<sup>7</sup> The classically described uterine sandwich is created in a stepwise fashion, starting with uterine compression sutures as the primary tool for managing hemorrhage. On the other hand, this novel method uses the intrauterine balloon tamponade as its primary tool and compression sutures as an ancillary tool, taking into account their respective rates of effectiveness. Moreover, when considering the mechanism of action for each tool, the classically described method distorts the intrauterine cavity, preventing the plastic cylindrical-shaped intrauterine tamponade balloon from placing direct pressure on the uterine sinuses and decreasing its overall efficacy. This novel uterine sandwich maximizes the intrauterine balloon's efficacy by maintaining the intrauterine cavity shape for which the balloon was designed. In extreme uterine atony cases in which

individual methods are likely to fail, there is likely a synergistic effect of synchronous placement of uterine compression sutures and intrauterine balloon tamponade. More research is needed to compare the efficacy of various techniques.

The literature describes a few other techniques with seemingly subtle but clinically large differences from the method described here. For example, Diemert et al constructed 6 uterine sandwiches in a stepwise fashion, starting with the placement of a Bakri balloon and reassessment of the bleeding. Once hemostasis was deemed inadequate, B-Lynch sutures were placed.<sup>8</sup> Although the result is essentially the same as the method described here, the increased procedural time will result in increased blood loss, which could be a clinically significant amount, especially when the uterine sandwich is constructed only after failed medical management, and the blood flow to the term gravid uterus is at least 600 mL per minute.<sup>9</sup> Moreover, this method is technically very challenging to perform and requires above-average surgical skills. The suturing needle needs to incorporate a sturdy bite of thin atonic myometrium without puncturing and destroying a fully inflated tamponade balloon that is pressing firmly against the uterine sinuses to place effective B-Lynch sutures.

In a different study, 53 patients with placenta previa underwent cesarean delivery and planned uterine sandwich. This uterine sandwich was constructed by simultaneously placing 2 transverse compression sutures and a Foley balloon catheter inflated to 80 mL in the lower uterine segment. The authors concluded that this method significantly decreased blood loss.<sup>10</sup>

This simultaneous placement of uterine compression sutures and intrauterine balloon tamponade, while seemingly similar, is somewhat different from our novel method. This prophylactic lower uterine segment sandwich was designed to address PPH secondary to placenta previa, a relatively rare condition. Our novel method was intended for PPH secondary to uterine atony, the most common cause of obstetrical hemorrhage, and positioned the balloon tamponade up to the uterine fundus. The balloon tamponade was then inflated to fill the intrauterine cavity, which in this case series ranged from 180 to 450 mL, much more than an 80 mL Foley.

The most effective technique for constructing the uterine sandwich has yet to be determined. Additional research is needed given the relatively high incidence of PPH and its associated morbidities. The current literature describes small studies using variations in bleeding evaluation and stepwise construction, types of intrauterine tamponade, and types of uterine compression sutures (Table 1). In the future, randomized controlled trials are needed to determine which method is the most effective.

A strength of this novel uterine sandwich is its simplicity. It requires a limited amount of equipment, which should be available in nearly all obstetric operating rooms. This technique is easy to learn and within the skill set of an obstetrician. All 6 cases were successfully performed by different obstetricians, which increases the generalizability of this study. A limitation of this novel uterine sandwich is that proper placement of the intrauterine balloon via the vagina requires a skilled assistant. If a skilled assistant is unavailable, the intrauterine balloon can be inserted by the surgeon through the hysterotomy, using ringed forceps to place the drain through the cervix. This approach would be advantageous in managing patients whose cervixes are closed, but care must be taken to avoid needling the intrauterine balloon when suturing the hysterotomy. Notable limitations of this study include its small sample size and retrospective nature, limiting the data to chart review.

In conclusion, this novel method of constructing a uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures appears to be a simple, safe, and effective technique that can be considered in cases of persistent postpartum bleeding. This novel method has multiple advantages over the originally described stepwise approach and could be more effective than the original uterine sandwich. More research, particularly comparative and randomized controlled trials, is needed to determine the most effective method of constructing a uterine sandwich given the severe complications associated with PPH.

## Conflict of Interest

None of the authors identify a conflict of interest.

## Acknowledgments

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### Authors' Affiliations:

- Female Pelvic Medicine and Reconstructive Surgery, Department of Obstetrics and Gynecology, University of California San Francisco, San Francisco, CA and Division of Female Pelvic Medicine and Reconstructive Surgery, Department of Obstetrics and Gynecology, Kaiser Permanente East Bay, Oakland, CA (JWHW)  
- Department of Obstetrics, Gynecology, and Women's Health, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI (GKW)

### Correspondence to:

Jennifer W.H. Wong MD; 1319 Punahou Street Suite #824, Honolulu, HI 96826; Email: jwhwong@hawaii.edu

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# Total Joint Arthroplasty at a Tertiary Military Medical Center in Hawai'i: Does Travel Distance Influence Short Term Complications?

Gregory E. Lausé MD, MS; M. Justin Willcox MD; and Duke G. Yim MD

## Abstract

*As the health care delivery system in the United States changes, there has been an increase in the presence of specialized medical centers, translating into increased travel distance for patients. Tripler Army Medical Center in Honolulu, Hawai'i serves a unique population of local patients and those traveling from neighboring Hawaiian Islands and from across the Pacific Basin and Asia. Previous studies have examined the role of distance traveled, but no study has looked at patients routinely flying in the immediate postoperative period. The purpose of this study is to investigate if increased travel distance is associated with a higher probability of complications after a total joint arthroplasty (TJA). A retrospective review of all patients receiving TJA at a single medical institution was performed. After meeting the inclusion criteria, 126 consecutive patients were reviewed for 30-day complications. Sixty-four patients were local (from O'ahu, Hawai'i), and 13 from neighboring Hawaiian Islands, while 49 were international. There were no significant differences in complications between the groups. Length of stay was not affected by distance. A significant risk factor for short-term complications was having a higher score based on the American Society of Anesthesiologists Physical Status Classification System (ASA), ASA 3 vs ASA 1&2 (14% vs 1%,  $P = .015$ ). There were no findings in our population to support inferior outcomes in patients traveling from the outer Pacific Basin during their initial postoperative course compared to the local population. No patient sustained a short-term complication after a patient returned to their island or country of origin. The results of this study will help to guide clinical decision making and effective resource management for patients seeking TJA traveling from a significant distance.*

## Keywords

*total hip and knee arthroplasty, joint replacement, postoperative orthopaedic complications, distance traveled*

## Abbreviations and Acronyms

ASA = American Society of Anesthesiologists Physical Status Classification System

BMI = body mass index

TJA = total joint arthroplasty

US = United States

## Introduction

As the health care delivery system in the United States (US) changes, there has been increased specialization through “centers of excellence” within various regions of the US. This transition aligns with the shift in the health care model and payer system from volume to value. In recent years, payers, providers, and policymakers have placed increased emphasis on strategies to control costs and improve quality associated

with elective surgical procedures such as total joint arthroplasty (TJA). As a result, more specialized surgical centers are developing throughout the US to minimize procedural expenses and in-patient length of stays through easier coordination of related health care providers. This finding has been the trend in the civilian health care market.<sup>1</sup> Consequently, increased pressures on the US government spending, illustrated through government shutdowns and cuts to the defense budget, has resulted in similar changes within the Military Health System, including 55 hospitals and more than 370 clinics across the nation and at US bases overseas.<sup>2</sup> These facilities are also now under the control of the Defense Health Agency. As a result, the Department of Defense has programmed a 25% reduction in workforce positions aligned to medical headquarters across the enterprise and a \$202.5 million cut in health plan costs tied to that effort.<sup>3</sup> With these changes, the ability to improve quality of care while decreasing costs of standardized procedures are gaining more attention.

In recent years, the volume of patients undergoing TJA has increased due to an aging population, expansion of indications to include younger patients, and advances in technology, implant systems, and training. Therefore, this cost burden is expected to rise both in the civilian and military markets.<sup>4</sup> As more veterans and beneficiaries age, the percentage of the government health care budget required to address this need will only increase. Therefore, reducing costs and complications in TJA is at the forefront of cost reduction considerations.

Asian Americans and Pacific Islanders are one of the fastest-growing and most heterogeneous ethnic groups in the US currently accounting for 4% of the population but are expected to comprise 15.3% of the population by 2050.<sup>5</sup> Due to the geographic location of the Hawaiian island of O'ahu, many of the same socioeconomic and access to care limitations are experienced by all patients regardless of their ethnicity.<sup>6</sup> It has also been reported that race, ethnicity, specifically Pacific Islanders, and geographic region are direct factors in disparities for utilization of TJA.<sup>7-8</sup> Furthermore, the socioeconomic disparities of the populations within the Pacific Basin have been associated with a higher rate of high-risk health behaviors, including smoking, alcohol abuse, obesity, and high-fat diet.<sup>9</sup> Several of these risky behaviors, particularly smoking, lack of diabetic control, and high body mass index (BMI), have been to be directly associated with rates of periprosthetic joint infections and overall complications in TJA.<sup>10-12</sup>

When looking at short-term outcomes, peri-prosthetic joint infection remains one of the most devastating complications in TJA. Not only does it lead to significant patient morbidity, but it can also create a cost burden to society by raising costs for primary TJA.<sup>13-14</sup> Total payments for a 30-day TJA episode in the US range from a mean of \$25,568 for primary TJAs in patients with no comorbidities or complications to a mean of \$50,648 for revision TJAs in patients with major comorbidities or complications.<sup>14</sup> Hence, reducing a single potential complication or identifying potential risk factors for complications can be a significant source of cost savings.

When assessing the risk of complication, one of the newest variables in the discussion has been travel distance.<sup>1,16</sup> The impact of travel distance on orthopedic surgery outcomes is a growing area in need of investigation, as very few studies have examined the effect of distance traveled on patient outcomes. Previous studies in general surgery demonstrated an increased risk for complication with increased travel distance.<sup>17</sup> Conversely, a recent study in bariatric surgery showed no increased risk for distance traveled.<sup>18</sup> Despite multiple studies demonstrating improved outcomes in high volume TJA centers, only 1 has evaluated the effect of distance traveled within a high volume center.<sup>1</sup> Moreover, air travel is associated with an increased risk of venous thromboembolism in orthopedic surgery.<sup>19</sup> This is the first study to look at distance traveled in the Pacific and have comparison groups composed entirely of patients who underwent air travel within 30 days of surgery.

Taken together, few centers in civilian or military medicine provide total joint arthroplasties to the underserved patients from outlying Pacific Islands or international patients from an expansive referral network. The purpose of this study is to compare the short-term complications associated with TJA for patients from the island of O'ahu versus neighboring Hawaiian Islands and patients referred from the outlying Pacific Basin and Asia.

## Methods

Following institutional review board approval, the electronic medical records were reviewed for all patients receiving TJA at Tripler Army Medical Center in Honolulu, Hawai'i from 2015 to 2017. One hundred and fifty sequential patients from a single surgeon were selected based on Current Procedure Terminology (CPT) codes for joint arthroplasty or replacement. Of these, 126 patients met the inclusion criteria, which was total joint arthroplasty, either hip or knee and completed the same preoperative evaluation instituted in 2015. Revisions were not excluded in this study to improve the generalizability of the results, and 13 revisions were included. Preoperative evaluation included medical clearance within 30 days of surgery by a primary care physician, dental clearance within 90 days, methicillin-resistant staphylococcus aureus screening, and basic laboratory evaluation with complete blood count, basic metabolic panel,

hemoglobin A1c, nutritional status and immediate preoperative evaluation by an anesthesiologist. The American Society of Anesthesiologists Physical Status Classification System (ASA) is used to categorize risk for clinical decision making based on a patient's health and medical co-morbidities. ASA 1 is a patient with no medical comorbidities and not a smoker. ASA 2 has mild systemic disease, current smoker, or well-controlled medical problems, such as hypertension or diabetes. ASA 3 is a patient with 1 or more severe systemic diseases, such as poorly controlled diabetes, hypertension, chronic obstructive pulmonary disease, or morbid obesity. ASA 4 is a patient with severe systemic disease that is a constant threat to life. ASA 5 is a moribund patient who is not expected to survive without the operation, and ASA 6 is a patient who has been declared brain-dead whose organs are being removed for donor purposes. For this analysis, we included age, gender, place of residence, preoperative laboratory results and nutrition status, ASA classification, length of hospital stay, disposition at time of discharge, and last date of follow-up either at the treating hospital or a Veteran's Administration clinic. Patient ethnicity was not reliably available and was not included in this analysis.

Details of the in-patient admission and follow up care were retrospectively reviewed by 2 resident physicians and 1 fellowship trained total joints orthopedic surgeon. For the sake of this review, we defined the following events as complications: unplanned return to the operating room or unplanned transfer to a higher level of care, acute myocardial infarction, acute stroke, deep venous thrombosis, venous thromboembolism, postoperative neurologic deficit, wound complications, periprosthetic joint infection, and death. Travel distance was calculated based on home of record in the medical chart at the time of admission. Distance was then classified into 3 categories based on the patient's residence: (1) within the hospital's island of O'ahu, (2) outside of O'ahu but part of the neighboring Hawaiian Island chain, and (3) international, which included Japan, Korea, Saipan, Thailand, Guam, Marshall Islands, and American Samoa. For context, O'ahu is 30 by 44 miles in size. Travel from a neighboring island typically involves a flight to Honolulu ranging from 108 miles east from Lihue on the island of Kaua'i to 210 miles west from Hilo on the Big Island. International locations range from 2117 miles to the Marshall Islands as the closest island chain in our referral network and 4170 miles to Korea, the farthest referral location.

## Statistical Analysis

Associations between the odds of having a complication and travel distance and patient characteristics (age, gender, BMI, ASA score) were first examined in univariate analyses. Subsequently, multivariable analyses were performed to determine the effect of travel distance on the odds of having a complication while controlling for patient characteristics. The multivariable logistic regression model included all patient characteristics listed above, as well as significant 2-way interactions. The

multivariable analysis was also performed with distance represented as a categorical variable as defined above. Independent and dependent paired t-tests were used to examine significant difference between groups and difference within pre- and postoperative data. Nonparametric testing (Mann-Whitney and Wilcoxon signed-rank tests) were used to verify the significance of each variable because of small sample sizes. The *P* value for statistical significance was set at .05.

## Results

After meeting the inclusion criteria, 126 consecutive patients were reviewed for 30-day complications. Patients had a mean age of 63.1 years ± 10.1 years. The majority of our patients were male (n=93; 74%). In total, 49 patients were international, 64 were local from O'ahu, Hawai'i, and 13 from neighboring Hawaiian Islands (Table 1). There were no significant differences in complications between the groups (Table 2). Length of stay was not significantly different between the groups (*P* > .0776).

There were 6 patients with complications among the 126 patients, representing an overall 5% who experienced a complication (Figure 1). The most frequent complication was an unplanned transfer to a higher level of care (n=4; 67%). The only significant risk factor for short-term complications was having a higher ASA score (ASA 3 vs ASA 1 & 2 [14% vs 1%, *P* = .0151]).

The 30-day outcomes in each group showed 2 significant surgical complications in our international patients (2 of 49, 4%), with 1 patient requiring return to the operating room on postoperative day 19 for an acute postoperative infection and underwent an irrigation and debridement with polyethylene exchange. The other patient had a pulmonary exacerbation due to chronic obstructive pulmonary disease that required escalation of care and during the same hospital admission went on to develop a wound dehiscence requiring a gastrocnemius flap approximately 5 weeks from his index surgery.

Among the 64 local patients, 3 (5%) had complications. One patient had a mechanical fall at home, sustaining a peri-prosthetic hip fracture on postoperative day 6, and 2 patients had medical complications during their initial admission that required escalation of care.

Among the 13 patients from neighboring islands, 1 (7%) patient sustained a minor embolic stroke on postoperative day 2 with no residual sensory or motor defects at the time of hospital discharge. There were no findings within our measured outcomes to support inferior results in those who have immediate access to care compared to patients traveling from the Pacific Basin. No patient sustained a short-term complication after a patient returned to his or her island or country of origin.

	International	O'ahu, Hawai'i	Neighboring Hawaiian Islands
Age, y	60 ± 11.3	64 ± 9.2	68 ± 4.9
Sex	37 males [M], 12 females [F]	43M, 21F	13M
TKA	28	44	10
THA	21	19	3
Revision Joint Arthroplasty	5	5	2
BMI, kg/m <sup>2</sup>	32.7	31.1	29.8
ASA 1 or 2	66%	66%	73%
ASA 3	34%	34%	27%
Complications	2 (4%)	3 (5%)	1 (8%)
Length of Stay, days	5.2 ± 7.7	5 ± 4.1	7.1 ± 3.1

Abbreviations: TKA, total knee arthroplasty; THA, total hip arthroplasty; BMI, body mass index; ASA, American Society of Anesthesiologist Physical Status Scale

Table 2. Postoperative Complications among Total Joint Arthroplasty Patients by Study Characteristics				
Complication Associations				
	N <sup>a</sup>	N <sup>b</sup>	%	P value <sup>c</sup>
<b>Patient Groups</b>	<b>126</b>	<b>6</b>	<b>5</b>	
<b>Age, y</b>				
39-59	43	1	2	.66
≥60	83	5	6	
<b>Sex</b>				
Female	33	0	0	.34
Male	93	6		
<b>BMI, kg/m<sup>2</sup></b>				
<25	15	0	0	.08
25-<30	32	4	13	
30-<35	32	0	0	
35-<40	13	0	0	
≥40	14	2	12	
<b>Veteran's Administration</b>				
Yes	68	4	6	.69
No	58	2	3	
<b>Origin</b>				
O'ahu	64	3	5	.86
International	49	2	4	
Outer Island	13	1	8	
<b>Procedure</b>				
THA	39	1	3	.48
TKA	74	4	5	
THA revision	5	1	20	
TKA revision	8	0	0	
<b>ASA</b>				
1	5	0	0	.06
2	65	1	2	
3	34	5	15	
3E	1	0	0	
<b>ASA</b>				
1/2	70	1	1	.02
3/3E	33	5	14	
<b>Laterality</b>				
Left	69	5	7	.22
Right	57	1	2	
<b>Albumin</b>				
<3.5	2	0	0	.72
3.5-3.99	10	0	0	
≥4	114	6	5	
<b>Hematocrit</b>				
20-34.9	16	1	6	.97
35-38.79	23	1	4	
38.8-50	78	4	5	

Table 2. Postoperative Complications among Total Joint Arthroplasty Patients by Study Characteristics (Continued)				
<b>Hemoglobin</b>				
<12	20	2	10	.41
12-15.5	96	4	4	
>15.5	10	0	0	
<b>Hemoglobin</b>				
<12	20	2	10	.24
>12	106	4	4	
<b>Protein</b>				
5-7	41	1	2	.69
>7-7.5	49	3	6	
>7.5	36	2	6	
<b>Hemoglobin A1c</b>				
<5.7	42	1	2	.63
5.7-6.4	45	3	7	
>6.4	24	1	4	

<sup>a</sup> N=number of patients within specified group; <sup>b</sup> n=observed complication(s) within the specified group; <sup>c</sup> P values calculated using Chi-squared test or Fisher's exact test. Abbreviations: BMI, body mass index; THA, total hip arthroplasty; TKA, total knee arthroplasty; ASA, American Society of Anesthesiologist Physical Status Scale

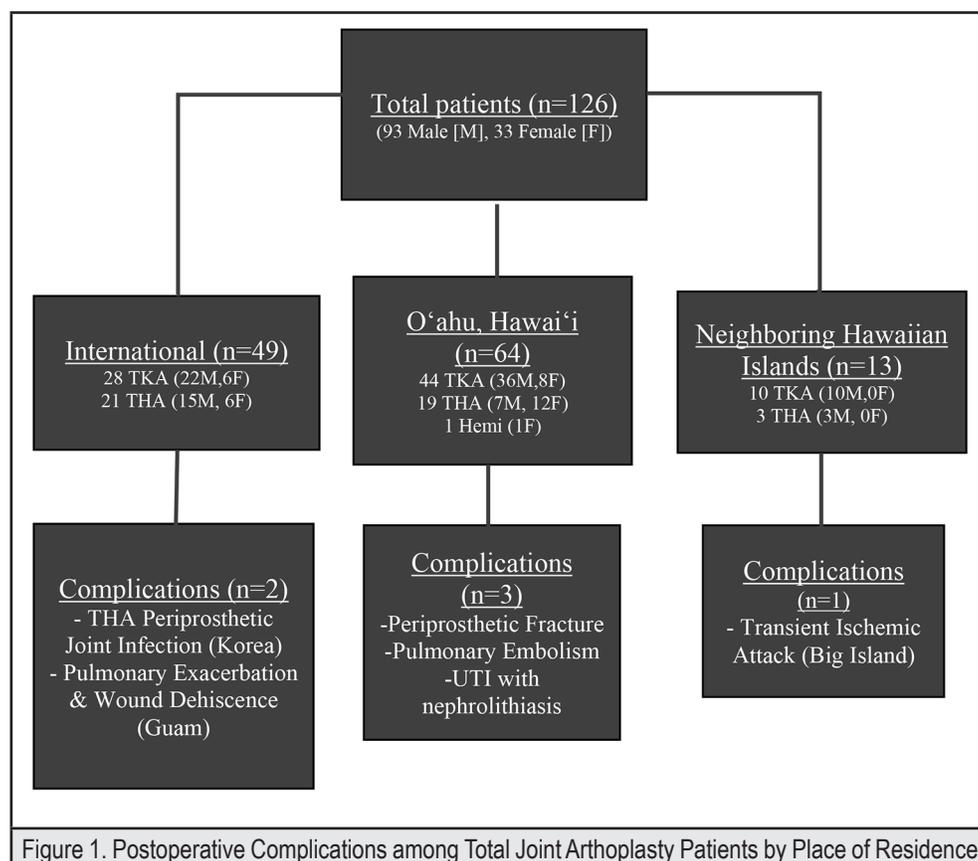


Figure 1. Postoperative Complications among Total Joint Arthroplasty Patients by Place of Residence

Abbreviations: THA, total hip arthroplasty; TKA, total knee arthroplasty; UTI, urinary tract infection

## Discussion

As health care delivery continues to evolve, there will be a shift towards value and accountability on the operating surgeon or hospital to minimize complications and adverse outcomes. Specifically, previous studies have shown an association between surgical volume at both the surgeon- and hospital-levels with complication rates and readmission rates after primary TJA.<sup>20</sup> These studies suggest that efforts to regionalize joint replacement services or concentrate surgical procedures at higher-volume institutions may reduce early readmissions and postoperative complications after primary TJA.<sup>21-22</sup> This will inevitably lead to an increase in patient travel as regional centers displace smaller institutions. However, none of these studies included significant air travel in patients undergoing TJA at these centers, which is known to increase risk of venous thromboembolism. Although our overall complication rate was 5% in this population, when we only include complications that resulted in a return to the operating room, our complication rate was 2%. This rate is lower than the overall short-term complication rate of 3.9% reported by previous series of 15,383 joint arthroplasties.<sup>23</sup> This finding is in spite of the fact that we did not exclude revisions in our series, which are known to have a higher complication rate. This lower complication rate observed may be due to our specific preoperative evaluation required before TJA, which was not universal in most large database studies or that our series was underpowered. We must also address that 2 of the 3 complications that required a return to the operating room were international. While this likely was not attributable to travel based on known complications secondary to travel demonstrated in other reports and more so due to the patients being ASA 2 and 3 with uncontrolled medical comorbidities, it is possible that with a larger sample size, we could identify new complications associated with travel.

As previously discussed, preoperative optimization of risk continues to be a major focus of research in preventing complications in TJA. Some of the most important risk factors for early complication are chronic disease states such as diabetes mellitus, obesity (BMI > 40 kg/m<sup>2</sup>), inflammatory arthritis, preoperative anemia, congestive heart failure, and renal disease.<sup>24-29</sup> One specific outlier in our series is BMI. Several large database studies indicated BMI > 40 kg/m<sup>2</sup> is an increased risk of surgical site infection, and many centers have begun to refuse TJA in these patients until they achieve a lower BMI.<sup>11</sup> Our study's average BMI was 31.6 kg/m<sup>2</sup> with a standard deviation of 7.0; 11% of our patients with BMI > 40 kg/m<sup>2</sup>. This larger percentage in our series is due to much of our patient population being flown to our center just before surgery with limited ability to refuse strictly due to BMI after otherwise obtaining medical clearance. Additionally, owing to our location, our series included a higher proportion of patients of Polynesian descent whose unique body composition has been shown to have a BMI value of up to 5 kg/m<sup>2</sup> higher than Europeans of equivalent levels of body fat.<sup>30</sup> This difference in body mass composition may explain why

we could not identify BMI as a risk factor for complications despite our population, including patients with a higher BMI than normally assessed in TJA literature.

Second, unlike previous studies that were able to identify specific patient comorbidities that were independently associated with an increased risk of infection in the 90-day postoperative period, we did not find specific preoperative risk factors for complication including distance traveled.<sup>21</sup> Our study did, however, identify that ASA classification system was independently predictive of postoperative complications. To our knowledge, ASA class has not been demonstrated in TJA to be an independent risk factor, although it has been demonstrated as a risk factor in orthopedic trauma patients.<sup>31</sup> More recently, ASA class has been used in a novel risk calculator to predict readmission following TJA.<sup>32</sup> In our population, ASA 3 was the only variable significantly associated with complication risk. Even with the relatively low patient volume of our study group (126 patients), power analysis showed the minimum number needed to detect a difference between rates of 1% and 10% was 121 patients, and we found an increased risk in ASA 3 vs ASA 1 & 2 (14% vs 1%,  $P = .0151$ ). This finding highlights the potential prognostic importance of the ASA class to identify patients at high risk of complications better.

We found no statistically significant difference in patients receiving TJA related to patient distance traveled and there was no significant difference in length of stay between the local population and those traveling internationally. Lastly, all patients were followed until a follow-up was completed in their country of origin, and no complications were observed after a patient returned to their country of origin.

This study is the first to look at distance traveled and its relation to short term perioperative outcomes of TJA in the military veteran and Pacific Basin population. As additional studies demonstrate reduced complications and hospital costs when TJA is performed at higher volume centers, travel distance of patients undergoing these procedures will likewise increase. This study demonstrated no increased risk for patients traveling from neighboring islands or the Pacific Basin. Inherently in the study design, we are limited by its retrospective nature. We are also limited by the small sample size of our series that is underpowered to identify significant differences in rare complications associated with TJA. Further research will aid in the optimization and clinical decision making for patients seeking TJA within large referral networks requiring air travel prior to surgery.

## Conclusion

The results of this study may help to guide clinical decision making and effective resource management for patients seeking total joint arthroplasty at a tertiary medical center. We have not demonstrated an increased risk of complication regarding travel

distance, but we show complication risk significantly increases with ASA 3 patients, suggesting that further optimization of a patient's medical comorbidities may need to be fully addressed and corrected prior to travel. Regional "centers of excellence" appear to be a viable model in health care reorganization; however, continued attention should be paid to attenuating the individual patient risk factors, especially patient comorbidities prior to TJA, in efforts to minimize perioperative complications.

*The views herein are the private views of the authors and do not reflect the official views of the Department of the Army or the Department of Defense.*

## Conflict of Interest

None of the authors identify a conflict of interest.

### Authors' Affiliations:

- Tripler Army Medical Center, Honolulu HI (GEL, JW)
- Evans Army Community Hospital, Fort Carson, CO (DGY)

### Correspondence to:

Gregory E. Lausé MD; Department of Orthopaedic Surgery, 1 Jarrett White Rd., Honolulu, HI 96859; Email: Gregory.e.lause.mil@mail.mil

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# MEDICAL SCHOOL HOTLINE

## Thank You, Joe Anomaly – University of Hawai‘i’s Willed Body Program

Dee-Ann Carpenter MD

*In 1993, the Medical School Hotline was founded by Satoru Izutsu PhD (former vice-dean UH JABSOM), it is a monthly column from the University of Hawai‘i John A. Burns School of Medicine and is edited by Kathleen Kihmm Connolly PhD; HJH&SW Contributing Editor.*

The Willed Body Program at the University of Hawai‘i, John A. Burns School of Medicine (JABSOM) is committed to fulfilling the mission of the university in excellence in education, research, and health care. Human body donations are integral to educational, clinical, and research activities and provide an invaluable role in teaching and training medical and health-related science students and professionals in the complexities of the human body. These silent teachers provide a critical source of education: researchers benefit in discoveries to help and treat patients; the study of anatomy comes early in the medical curriculum and serves as the foundation for medical education; and physicians in residency training and those in practice often pursue special courses in anatomy to enhance their skills and learn new techniques. Each donation directly contributes to new understandings.<sup>1</sup>

While the primary focus of JABSOM’s Willed Body Program is to obtain the human cadaver for educational and scientific study, the program strives to provide a service that is compassionate and respectful. Anatomical donations are precious. Each gift is valued, honored, and appreciated. Students and staff treat each donor with the respect and dignity to all cultures and beliefs. In gratitude and appreciation, a memorial service is held annually for the silent teachers. Since the inception of the program in the late 1970s, services were made open to the public since the 1980s. Due to the COVID-19 pandemic, the Willed Body Program has temporarily stopped accepting body donations as of July 2020, as teaching programs have been reduced, however memorial services continued virtually and can be viewed online in both in Spring 2020 and 2021.<sup>2</sup>

The following speech was to honor and recognize those that have donated their bodies to the Willed Body Program memorial, delivered in 2015 by Dr. Dee-Ann Carpenter, a JABSOM MD graduate, Assistant Professor, as well as a practicing primary care physician in Honolulu.

### Introduction

I was pleasantly surprised to receive an email from a first year medical student asking me to speak at the Willed Body Program that they were having at the end of the academic year, to commemorate those wonderful people who have donated their bodies to science at JABSOM in Honolulu, Hawai‘i. I was honored to have been asked, especially after finding out that this would be the first time an alumna would be part of the program that is usually solely done by the medical students. When asked what I should speak about, the student asked if I could mention how having a willed body to work on while in medical school years ago has helped me in my practice today.

I started thinking of my own time in medical school “living” in my anatomy classroom, not necessarily only during class time. I thought of all of the hours that I put into learning anatomy, of all of the reading that was done during the dissections, of seeing the similarities and differences in other bodies in the room in comparison to mine. As an internist doing primary care, I use this knowledge daily and teach medical students and residents the importance of learning in depth so that information stays with you, even at your medical school reunion over 20 years later.

I not only thought about all of the invaluable anatomy that I had learned, but I also had to thank those families of the donors who had willed their body to science. I had to speak with respect to their family members, and omit the medical jargon, as the audience would mostly be lay people, not doctors. This, I found, not to be a simple task.

### JABSOM Willed Body Program Memorial Commemoration - April 10, 2015

Aloha kakou faculty, students, most importantly friends and family of our Willed Body donors,

Mahalo for being here.

Mahalo for asking me to speak to you today. I understand that this is the first time an alumna has been invited to be part of the Willed Body Ceremony.

And ... mahalo for allowing your own closure with your family member to be postponed because of the willingness of that person who donated their body to science and learning.

It was almost 30 years ago when I was a first year medical student just like those before you, and I was excited to be in Gross Anatomy lab. The first time I went into the lab, I had to step out and get a breath of fresh air. It also gave me time to think of WHO was in the lab. Those wonderful people who gave the ultimate gift—to will their body to help future physicians learn the best way possible, with hands on experience.

I can tell you that memories of learning from my willed body are still fresh in my mind. I've always enjoyed anatomy; it was one of my favorite subjects. I would spend HOURS in the anatomy lab, and enjoyed every minute. I continue to use what knowledge I've gained in my everyday clinic and hospital work.

Back in my day, we didn't get the name of our body until the end of the year. So, our group aptly named our man "Joe". This was a very appropriate name, as we learned, and later called him "Joe Anomaly". When you work in the anatomy lab, you learn that 90% of the time, the so and so artery veers off to the right at a 30 degree angle, but in 10% of the population, it veers off to the left. Our Joe Anomaly veered off to the left. With almost everything that we learned, our Joe did the uncommon. It was because of what I learned that is common, and what is not, that I continue to understand anatomy today. I use what I've learned about the beginnings and ends (what we call origins and insertions) of muscles and its surrounding arteries, nerves and veins, to find out what's wrong with my patient in the clinic, and can picture in that patient what happened in an injury.

Joe Anomaly also had some cool surgeries done, and when we opened his abdomen and pelvis, we found a tube where the main artery, the aorta, should have been. That was my first look at a bypass for peripheral artery disease, as the "tube" continued down into both legs.

I remember one example of another classmate's body where we found the appendix (usually found in the right lower quadrant (RLQ)) up in the right upper quadrant (RUQ) near the liver. From then on, when someone had RUQ pain, and as an internist you come up with the arm's length list of all of the possibilities that it could be, I would include appendicitis. No one would believe me, but I saw it with my own eyes. I put together the embryology that we learned, and realized that the gut hadn't rotated before entering the abdomen and therefore was in a different place.

Imagine yourself undergoing surgery. If the surgeon didn't know all of the normalities and abnormalities that could be, there could be problems in the operating room. Everyone is different. We may have all of the same STUFF inside, but it's not all put together the exact same way. I'd like to thank Joe Anomaly for teaching me this.

I learned respect, care of people as people, working together (in a group with my peers), how to understand anatomy and the ways things are put together as well as how they work, with Joe Anomaly.

Everyone will have their own stories, but I'd like to think that I had the best body ever to work on. And, I thank his family (to this day) for allowing me to learn from him.

Mahalo to all of you, and for taking the time to be here with us to commemorate the wonderful gift your family member has offered us. Because of you, we will all be the best physicians that we can be to help care for you.

Aloha.

For more information on the JABSOM Willed Body Program, please contact the University of Hawai'i, Department of Anatomy, Biochemistry and Physiology, Willed Body Program: phone 808-692-1445; email [wbdonor@hawaii.edu](mailto:wbdonor@hawaii.edu).

Author's Affiliation:  
John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI

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## Methamphetamine Use during COVID-19 in Hawai'i

Miki Kiyokawa MD; Micaiah Cape; and Jon Streltzer MD

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### Methamphetamine Use in Hawai'i: Background

Methamphetamine was synthesized in the early 20th century and was used initially for medical purposes in the 1930s for various conditions including narcolepsy, attention deficit disorder, obesity, and fatigue. In 1970, methamphetamine became a Schedule II substance under the United States (US) Drug Enforcement Administration, which reduced its use nationwide. It resurfaced in Hawai'i and areas of Southern California in 1980s. For at least 3 decades, Hawai'i has been struggling with high rates of methamphetamine use and abuse.<sup>1</sup> According to Quest Diagnostic Incorporated, in 2010, Hawai'i had 410% more positive workplace drug tests for methamphetamine compared to the national average.<sup>2</sup>

Aside from alcohol, methamphetamine is Hawai'i's most prevalent drug of misuse among adults.<sup>3</sup> Hawai'i also has one of the highest rates of methamphetamine-related convictions. In 2015, methamphetamine played a role in nearly 94% of drug convictions in federal court.<sup>4</sup> Close to half of those admitted to Hawai'i's treatment facilities stated that methamphetamine was their drug of choice, compared to alcohol (20%-30%) and marijuana (approximately 17%) for the years 2010 – 2016.<sup>3</sup> In the US only 10% of people with substance use disorder (SUD) who require treatment are treated.<sup>5</sup>

Much of the US struggles with high rates of opioid abuse, which have gathered more attention than methamphetamine abuse. In comparison to the mainland, Hawai'i's opioid use has been less problematic. According to estimates for 2015-2018 from the Substance Abuse and Mental Health Services Administration (SAMHSA), an estimated 4000 people in Hawai'i, or 0.3% of the state population, used heroin during the past year.<sup>6</sup> In the US in 2018, there were 46802 overdose deaths attributed to opioids out of 67367 total overdose deaths (approximately 70%), while in Hawai'i there were 59 overdose deaths due to opioids out of the total 213 overdose deaths (approximately 28%).<sup>7</sup>

The challenges of methamphetamine abuse are distinct from those of opioids. Unlike heroin, a short-acting opioid which may require frequent administration (sometimes 4 or 5 times per day), methamphetamine is a powerful stimulant with long acting effects (10-20 hours).<sup>8</sup> Due to its stimulant property, users may suffer from vascular complications including high blood pressure, heart ischemia, and cerebral vascular accidents. Methamphetamine is a public safety concern because people who are intoxicated on methamphetamine often have impaired judgement, putting them at very high risk for traumatic accidents. The use of methamphetamine may lead to serious medical conditions, which include damage to the heart, as well as permanent neurologic and psychological impairment. Therefore, methamphetamine use is a serious public health problem, placing an immense burden on Hawai'i's limited healthcare resources including utilization of emergency rooms, acute hospital beds, and mental health and substance use treatment facilities.<sup>9</sup> A recent report from the Centers for Disease Control and Prevention stated that overdose deaths in the US involving psychostimulants, including methamphetamine, increased by 34.8% during the COVID-19 pandemic.<sup>10</sup>

### Methamphetamine Use in Hawai'i in COVID-19

In 2020, the COVID-19 pandemic changed the world. It led many to suffer physically, emotionally, socially, and financially. The US continues to have the greatest number of COVID-19 cases and COVID-19 related deaths in the world.<sup>11</sup> The economic crisis resulting from COVID-19 has been devastating as well, where business closures and partial re-openings cost the US trillions of dollars, according to a recent study conducted by the University of Southern California.<sup>12</sup> For Hawai'i, the decrease in visitors due to the pandemic devastated the \$18 billion tourism industry, a foundation of the state's economy.<sup>13</sup> The financial crisis from the pandemic has affected many individuals, even those who have maintained their employment. Almost 40% of survey participants in the US reported in a Kaiser Family

Foundation survey that the pandemic has negatively impacted their mental health.<sup>14</sup> In another recent survey by the Addiction Policy Forum, 20% of 1079 people with SUD reported an increase in substance use during COVID-19.<sup>15</sup>

According to Hawai'i High Intensity Drug Trafficking Area (HIDTA), the average price of heroin in the state has been estimated to be \$120 - \$160 per gram, while methamphetamine costs \$40 per gram.<sup>16</sup> Some people with opioid use disorder may purchase up to 1 gram or more per day depending on the purity of the substance and the severity of their addiction. Some individuals may require several doses of heroin a day to prevent withdrawal. Maintaining the habit of drug use can be very expensive and stressful, especially for those who are addicted.

The authors' respective clinical practices in Oahu are at located a tertiary care hospital where a diversity of people suffering from SUD are seen. Although there are no clear statistics, we have recently seen several patients with SUD who are using less heroin and more methamphetamine in the midst of the COVID-19 pandemic. Since it was more difficult to obtain heroin, some reported that although methamphetamine was not the drug of choice, it was "better than nothing." Some claimed that they were using methamphetamine to relieve their pain. However, unlike opioids, methamphetamine has no significant analgesic efficacy. In fact, heroin and methamphetamine work differently. Heroin is a central nervous system depressant that can cause drowsiness, bradycardia and at times respiratory depression,<sup>17</sup> while methamphetamine is a stimulant that can cause increased wakefulness, tachycardia and hypertension.<sup>18</sup> Both, however, have a common pathway of increasing dopamine, which is a major transmitter in the reward circuitry involving various parts of the brain, including the nucleus accumbens.<sup>19</sup>

## Conclusions

Hawai'i has battled methamphetamine for a long time. Unfortunately, with the recent pandemic, there may be a rise in the use of methamphetamine, accompanied by its complications. Unlike opioid use disorder (OUD) where medication assisted treatment (MAT) is available, methamphetamine use disorder is notoriously difficult to treat. There is a need to emphasize prevention and early intervention.<sup>9</sup> In collaboration with various agencies and professionals, including social workers, law enforcement officials, school teachers, and state workers, educating every level of society, including children, about the dangers of methamphetamine use is warranted. Consulting Hawai'i Coordinated Access Resource Entry System (HI CARES), a statewide referral program for early intervention and treatment for people with SUD, may be a simple initial step.<sup>20</sup> For health care professionals, screening for substance use on their patients is a must. Ultimately, treating underlying OUD with MAT may prevent these patients from using methamphetamine,

for methamphetamine was "better than nothing," during the time heroin was being sought. Health care and public health professionals in Hawai'i should be sensitive to a potential rise in methamphetamine use associated with the pandemic.

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### Authors' Affiliations:

- Department of Psychiatry and Department of Medicine, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI (MK)
- Department of Psychiatry, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI (MC, JS)

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