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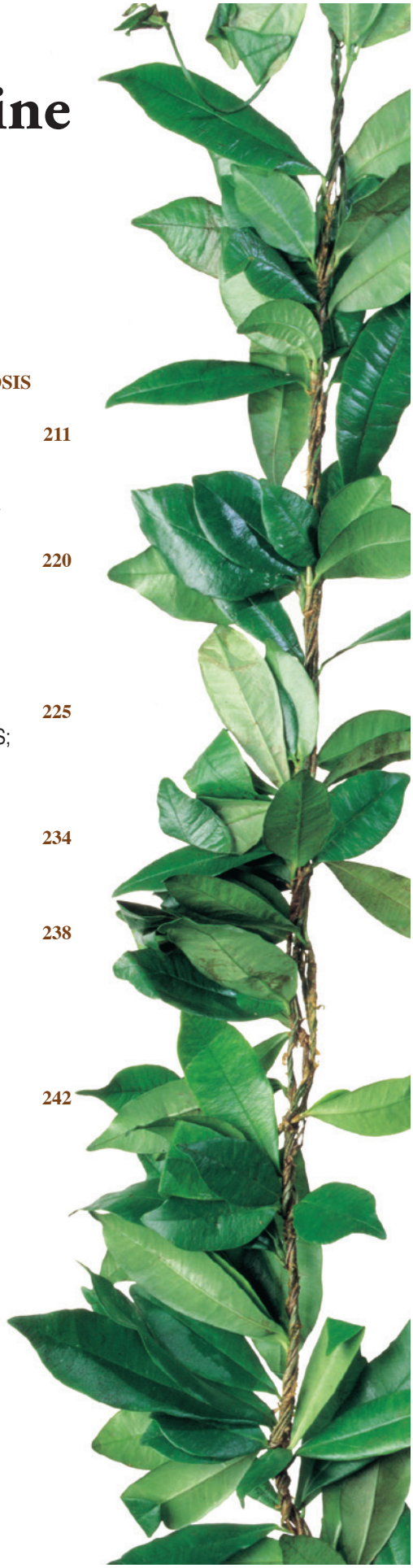

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D. Varez

Association between Alcohol Consumption and Diverticulosis and Diverticular Bleeding: A Systematic Review and Meta-analysis

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Abstract

There have been conflicting reports on the association of alcohol use and diverticular disease. We aimed to determine the odds of developing diverticular disease and diverticular bleeding in patients who consumed alcohol on a regular basis compared with those who did not. MEDLINE and PUBMED were searched up until February 2017 on observational trials, which investigated the effect of alcohol use on two outcomes of diverticular disease: diverticulosis and diverticular bleeding. Quantitative estimates (odds ratios [OR] and confidence intervals [CI]) from included studies were pooled by using a random-effects model. Heterogeneity across studies was assessed by the I^2 statistic. In 6 studies including 53,644 subjects and 6 studies including 3,404 subjects, alcohol consumption on a regular basis was not associated with either diverticulosis (OR=1.99; 95% CI 0.99-4.03, I^2=99%) or diverticular bleeding (OR=1.39; 95% CI 0.84-2.32, I^2=45%) compared to subjects who did not consume alcohol on a regular basis, respectively. Increased odds of diverticulosis or diverticular bleeding among individuals who consume alcohol on a regular basis were not observed in these meta-analyses.

Keywords

Alcohol; Diverticulosis; Diverticular bleeding; Meta-analysis

Introduction

Diverticulosis is one of the leading causes of outpatient clinic visits and inpatient admissions for gastrointestinal disorders in the United States.[1] It represents the fifth most expensive gastrointestinal disease in the United States in terms of direct and indirect costs ($2.5 billion per year) with an associated annual mortality of 2.5 per 100,000 persons.[2] Prevalence appears to be higher in the United States and Europe compared to Asia and Africa.[3] Nevertheless, the number of individuals with diverticulosis in lower prevalence areas is increasing due to westernization. Risk factors for diverticulosis apart from age and obesity remain uncertain.[4-6] While eighty percent of persons with diverticulosis remain asymptomatic throughout their lifetime, the remainder may develop severe complications such as diverticulitis, abscess formation, perforation, and fistulation.[7] Since diverticulosis can progress into serious complications, identifying the modifiable risk factors for diverticula formation is essential in order to prevent those lethal consequences. Diverticular bleeding is one of the most frequent complications accounting for 40% of lower gastrointestinal hemorrhage.[8] Identifiable risks of diverticular bleeding include age, obesity, the use of NSIADs and aspirin, and arteriosclerotic diseases.[9-12]

Alcohol is the most commonly used and abused drug throughout the world.[13] In 2015, 51.8% of adults 18 years and older in Hawai'i drank at least one alcoholic beverage within the past 30 days, and 7.7% were considered heavy drinkers (defined as men having >2 drinks per day, women having >1 drink per day).[14] Alcohol has several pathologic effects on the gastrointestinal tract. It can cause mucosal injury, impair motility, and inhibit the absorption of nutrients, resulting in various gastrointestinal disorders including esophagitis, gastritis, malabsorption syndrome, and gastrointestinal tumors.[15,16] Furthermore, it is associated with reduced rectosigmoid motility that is thought to be an important pathogenic factor of diverticula formation. Some previous studies showed that consuming alcohol was related to increased odds of diverticulosis[17-20] and diverticular bleeding.[11] By contrast, these associations were not observed in some studies.[21-26] Therefore, we carried out a comprehensive meta-analysis to investigate the association between alcohol consumption and both diverticulosis and diverticular bleeding.

Materials and Methods

Search Strategy

We registered our meta-analysis in PROSPERO (registration number: CRD42016032851). Two reviewers performed a systematic search in PubMed and EMBASE from inception to February 2017 independently using the search terms that comprised alcohol and diverticulosis, as detailed in Item S1, with no restriction in language. Manual searches of reference lists from retrieved articles and review articles were also performed.

Eligibility Criteria

All published observational studies that investigated the association between alcohol intake and diverticulosis and diverticular bleeding in adult participants were included. Cases were participants with higher alcohol consumption, whereas controls were participants with lower alcohol consumption. Higher and lower alcohol consumption thresholds were defined by each study. Diverticulosis was ascertained by imaging studies including computed tomography, barium enema, or colonoscopy. We excluded reviews, letters to the editor, editorials, and conference abstracts.

Data Extraction

The following data were recorded from each study: first author, publication year, sample size, study design, participant characteristics, definition of alcohol use in cases and controls. The Newcastle–Ottawa Scale (NOS) was utilized to assess the methodological quality of included studies that is based on selection of study groups, comparability of study groups, and the ascertainment of the exposure/outcome of interest.[27] Two reviewers independently extracted the data. Differences were solved by discussion between the authors. We conducted 2 meta-analyses, one where the outcome is diverticulosis and one where the outcome is diverticular bleeding. Each meta-analysis derived from each set of manuscripts.

Statistical Analysis

Generic inverse variance based on calculating odds ratios (OR) of the association between alcohol consumption and diverticulosis and diverticular bleeding and standard errors comparing between subjects who consumed alcohol on a regular basis to those who did not was conducted using a random-effects model. We used estimates that adjusted to the highest degree of confounders if the study provided more than one multivariable adjusted estimate. The between-study heterogeneity was tested with use of both Q and I^2 statistic values. An I^2 of more than 50% indicates substantial heterogeneity.[28] We performed sensitivity analyses by eliminating one study at a time to confirm the robustness of the result. A funnel plot is a scatterplot of outcome (vertical axis) and study size (horizontal axis). Visual inspection for asymmetry of funnel plots was performed to assess publication bias.[29] Formal statistical assessment of funnel plot asymmetry was done with Egger's regression test.[30] $P < .1$ was considered statistically significant. Comprehensive Meta-Analysis 3.3 was used for data analysis.

Results

The database search resulted in 156 articles but only 134 remained after duplicates were removed. Of these, 115 articles were eliminated after reviewing titles and abstracts. We reviewed the full text for the remaining 19 articles. Seven articles were further removed because they were duplicate publications (2 articles), had no outcome of interest (2 article), had no subject of interest (2 articles), or had no control group (1 article). The final analysis includes 6 articles [17-21,24] for diverticulosis and 6 articles [18,22,23,25,26,31] for diverticular bleeding. Table 1 and Table 2 show the main characteristics of the trials for diverticulosis and diverticular bleeding, respectively. Item S2 demonstrates the search methodology.

The Odds of Diverticulosis in Patients Consuming Alcohol

Six observational studies (5 cross-sectional studies[17-21] and 1 cohort study[24]) involving 53,644 participants were analyzed for diverticulosis. The pooled OR of diverticulosis in subjects with higher alcohol consumption was 1.99 (95% CI 0.99-4.03) compared to those with lower alcohol consumption (Figure 1). The statistical between-study heterogeneity (I^2) was 94% with $P_{heterogeneity}$ of less than 0.01. The sensitivity analysis confirmed the robustness of the findings (Item S3). The funnel plot excluded bias with non-significant Egger's test (P = 0.20) (Item S4).

The Odds of Diverticular Bleeding in Patients Consuming Alcohol

Six observational studies (3 cross-sectional studies[11,23,26] and 3 case-control studies[22,25,31]) involving 3,404 participants were analyzed for diverticular bleeding (Figure 2). The pooled OR of diverticular bleeding in subjects with higher alcohol consumption was 1.39 (95% CI 0.84-2.32) compared to those with lower alcohol consumption. The statistical between-study heterogeneity (I^2) was 45% with $P_{heterogeneity}$ of 0.001. Sensitivity analysis further confirmed the robustness of the findings (Item S5). The funnel plot excluded bias with non-significant Egger's test (P = 0.99) (Item S6).

Discussion

Alcohol has been widely used across the world and has been related to multiple gastrointestinal disorders. Several studies have reported inconsistent results regarding the association of alcohol consumption and diverticulosis and diverticular bleeding. Our meta-analyses found no association between alcohol use and diverticulosis or diverticular bleeding.

However, significantly increased risk of diverticulosis in alcohol drinkers was reported by several previous studies.[17-20] The exact mechanism is unknown, but the plausible explanation is due to increased intra-colonic pressure secondary to impaired colonic motility from alcohol.[32,33] This classical pathophysiologic concept of diverticula formation needs to be reconsidered. Painter, et al, first proposed the pathogenesis of diverticulosis in 1969 to be the relation between eating habits and geographical distribution of this disorder. [34] It was thought that a low-fiber diet created an excessive segmental contraction in the colon that further increases intraluminal pressure and facilitates mucosal herniation. Excessive contraction of the colon was due to increased water reabsorption secondary to low-residue diet, leading to smaller colonic luminal diameter and increased colonic pressure.[35] This hypothesis was further argued by a number of following studies. Peery, et al, performed a cross-sectional study involving more than 2,000 subjects showing that both constipation and a low-fiber diet were not associated with an increased risk of diverticulosis.[36] Another large population-based study from Austria also showed no association between constipation and diverticulosis.[37] Bottner, et al, proposed an alternative pathogenic hypothesis that an enteric neuropathy and myopathy may underlie the development of diverticulosis.[38] Based on this available evidence, our finding shows no increased odds of diverticulosis in alcohol drinkers and does not support the Painter hypothesis.

Additionally, there are few studies assessing alcohol consumption and the risk of diverticular bleeding. Nagata, et al, conducted a prospective study including 911 patients with diverticulosis showing increased odds of bleeding in moderate drinkers compared to non-drinkers.[11] A possible mechanism could be mucosal irritation similar to the effect of esophagitis and gastritis.[39] After summarization of all included studies, we found no association between alcohol drinkers and diverticular bleeding.

It should be noted that our negative results should be interpreted with caution because high between-study heterogeneity was observed in our meta-analysis that could be from variability in participants' characteristics, interventions, and study designs. Sensitivity analyses were performed to confirm that no single study significantly altered the summary of our findings.

There are some limitations that should be acknowledged. First, we could not report a causal association between alcohol consumption and diverticulosis given the nature of these observational studies. Second, high between-study heterogeneity

was observed in this study, which indicates high variation in study outcomes between studies, therefore our result needs to be interpreted with caution. Third, we could not carry out a subgroup analysis according to age, sex, fiber intake, smoking, and BMI since these were not provided in the primary studies. These variables are potential confounders that could interfere with this association. Fourth, not all included effect estimates were adjusted for these potential confounders; this could affect the validity of our results. Fifth, some of the included studies did not report the definition of alcohol drinkers regarding the amount of alcohol consumption. Sixth, most of the included studies are from Asia that may limit the generalizability our findings. Finally, only 12 studies were included in the analysis of diverticulosis and diverticular bleeding.

In summary, significantly increased odds of diverticulosis and diverticular bleeding among individuals who consumed alcohol were not observed in this meta-analysis. Further randomized controlled trials are required to better clarify this association.

Table 1. Characteristics of Included Studies of the Odds of Diverticulosis

	Sakuta, et al[21]	Song, et al[17]	Crowe, et al[24]	Nagata, et al[18]	Sharara, et al[19]	Wang, et al[20]
Country	Japan	Korea	United Kingdom	Japan	Lebanon	Taiwan
Year	2007	2010	2011	2013	2013	2015
Study design	Cross-sectional	Cross-sectional	Prospective cohort study	Cross-sectional	Cross-sectional	Cross-sectional
Total number	954	848	47,033	2,164	746	1,899
Alcoholic use in case	Alcohol ≥ 30 ml per day	N/A	Alcohol ≥ 16 grams per day	Alcohol ≥ 360 gm per week	Alcohol ≥ 1 drink per day	Alcohol > 3 times per week
Alcoholic use in control	Alcohol < 30 ml per day	Non-drinker	1-7 grams per day	Non-drinker	Non-drinker	≤ 3 times per week
Mean age (years)	53.0±1.2	50.9 ± 12.3	N/A	N/A	61.1 ± 8.3	52.8 ± 10.6
Female (%)	0	38.9	75.9	37	50.5	36.7
Confounder adjustment	N/A	Age, sex, BMI, smoking, mini dietary assessment index, diabetes, and hypertension	Smoking	Age, sex, smoking, aspirin use, anticoagulants, corticosteroid, hypertension, and atherosclerotic disease	Age, sex, BMI, bowel movement frequency, exercise, aspirin, and adenoma	Age, sex, smoking, colonic polyps
Quality assessment (NOS: selection, comparability, outcome)	3,0,3	3,2,3	3,1,3	4,2,3	4,2,3	3,2,3

Abbreviations: BMI: Body mass index; HTN: Hypertension; NOS: Newcastle Ottawa scale

Table 2. Characteristics of Included Studies of the Odds of Diverticular Bleeding

	Sugihara, et al[31]	Suh, et al[26]	Jansen, et al[23]	Nagata, et al[11]	Tsuruoka, et al[25]	Yamada, et al[22]
Country	Japan	Korea	Germany	Japan	Japan	Japan
Year	2016	2012	2009	2014	2011	2008
Study design	CC	CS	CS	CS	CC	CC
Total number	221	216	140	911	163	1,753
Alcoholic use in case	Beer ≥ 350 mL per day	N/A	N/A	Alcohol ≥ 180 grams per week	N/A	Alcohol ≥ 20 grams per day
Alcoholic use in control	Beer < 350 mL per day	Non-drinker	Non-drinker	Non-drinker	Non-drinker	Non-drinker
Mean age (years)	70 (33–92)	65.9±13.7	73.4 ± 9.9	66 ± 12	69	67.2±12.8
Female (%)	35.7	43.1	60	34	31.4	27.4
Confounder adjustment	N/A	N/A	N/A	Age, sex, smoking, aspirin, NSAIDs, acetaminophen, anticoagulants, corticosteroid use, Charlson comorbidity index, gastrointestinal symptoms score	N/A	N/A
Quality assessment (NOS: selection, comparability, outcome)	4,0,2	3,0,3	4,1,3	4,2,3	3,0,3	4,2,3

Abbreviation: CC: case-control study; CS: cross-sectional study; NSAIDs: non-steroidal anti-inflammatory drugs; NOS: Newcastle Ottawa scale

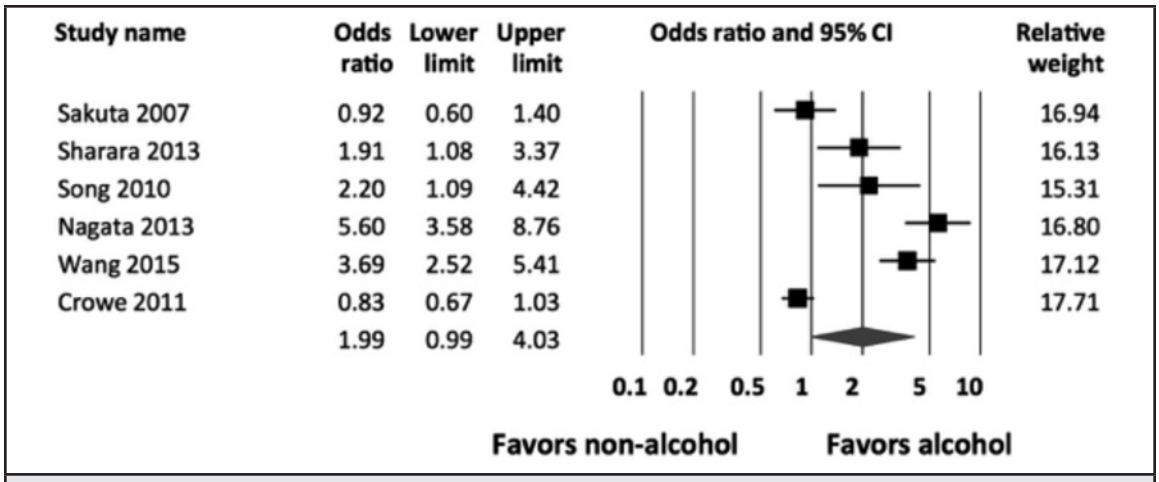


Figure 1. Forest plot of the included studies with adjusted analysis assessing odds of diverticulosis in individuals who consumed alcohol, square data markers represent ORs; horizontal lines, the 95% CIs with marker size reflecting the statistical weight of the study using random-effects meta-analysis. A diamond data marker represents the overall OR and 95% CI for the outcome of interest.

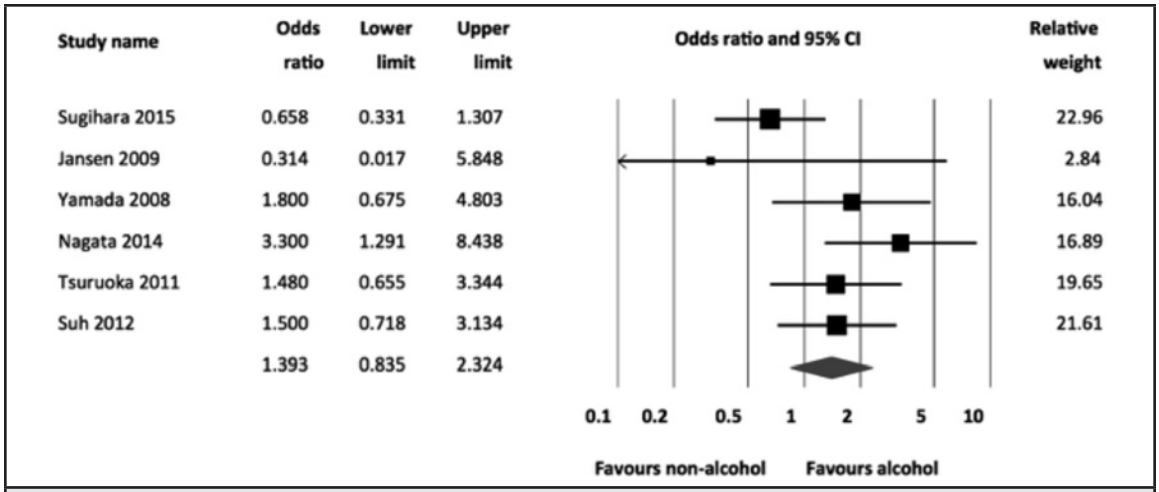


Figure 2. Forest plot of the included studies with adjusted analysis assessing odds of diverticular bleeding in individuals who consumed alcohol, square data markers represent ORs; horizontal lines, the 95% CIs with marker size reflecting the statistical weight of the study using random-effects meta-analysis. A diamond data marker represents the overall OR and 95% CI for the outcome of interest.

MEDLINE

1 diverticulosis.mp. or exp Diverticulum/

2 diverticular.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

3 colon diverticulum.mp. or exp Diverticulum, Colon/

4 exp Colon/

5 (colon or colonic).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

6 4 or 5

7 1 or 2

8 6 and 7

9 3 or 8

10 Ethanol.mp. or exp Ethanol/

11 exp Alcohols/

12 Alcohol*.mp.

13 grain alcohol.mp.

14 ethyl alcohol.mp.

15 alcoholic beverages.mp.

16 beer.mp.

17 wine.mp.

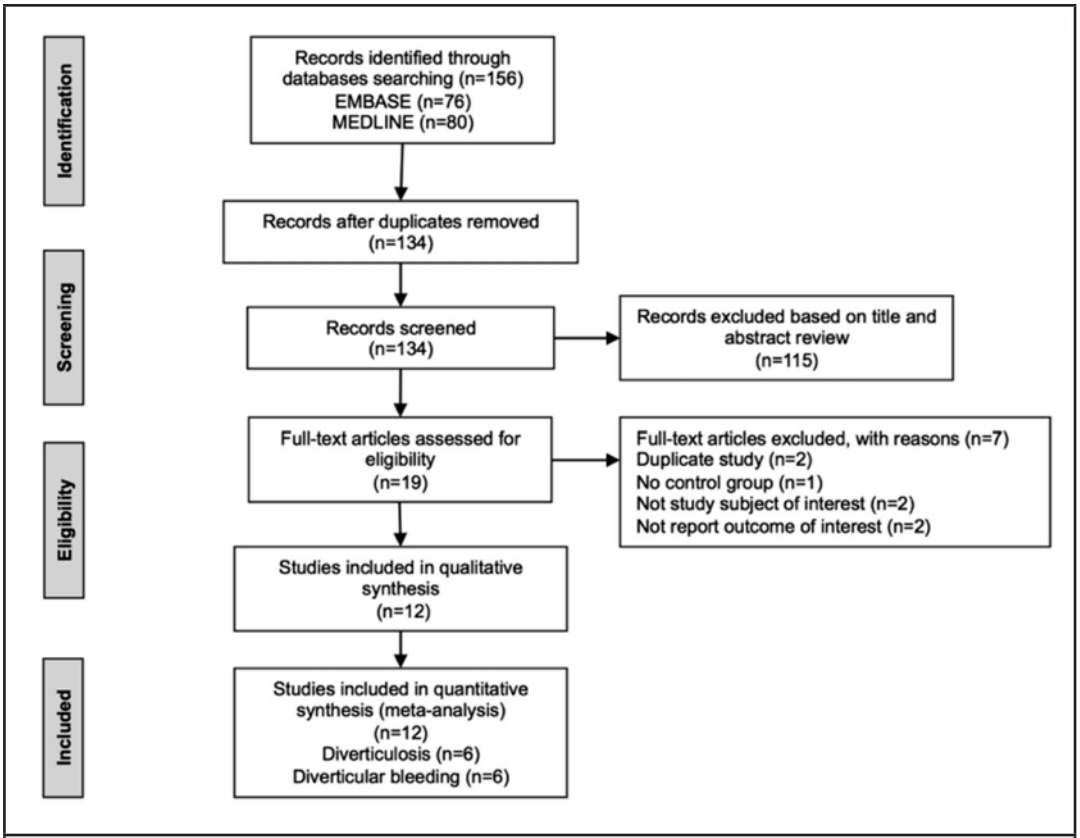
18 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17

19 9 and 18

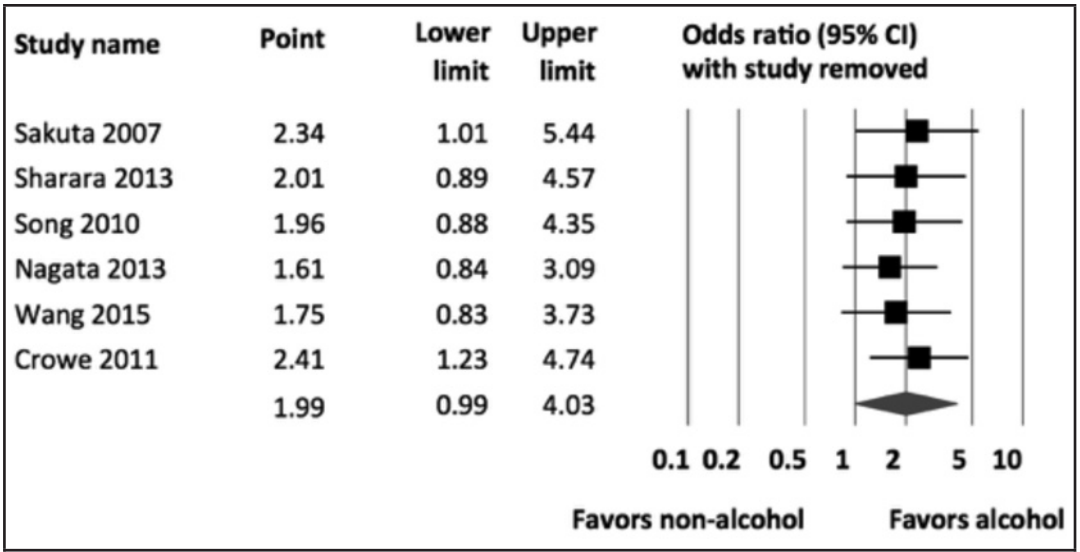
EMBASE

((('colon diverticulum'/exp or 'colon diverticulum') or (((colon or colonic) or 'colon'/exp) and (('diverticulosis'/exp or 'diverticulosis') or diverticular))) and (('alcohol'/exp or 'alcohol') or ethanol or (ethyl and alcohol) or ('alcoholic

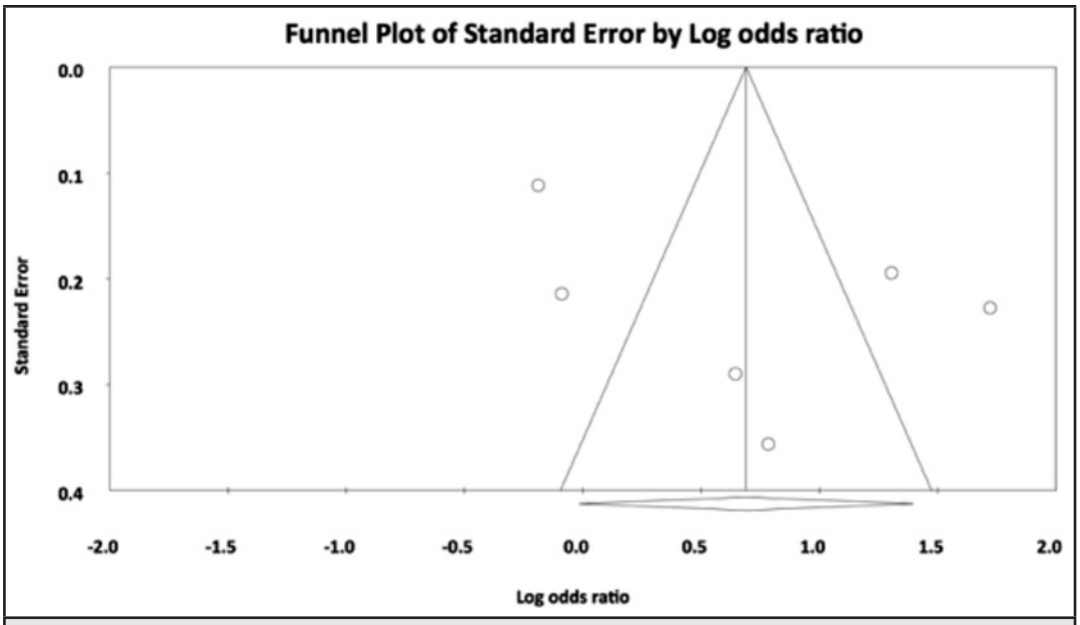
Supplementary Material
Item S1. Search Strategy



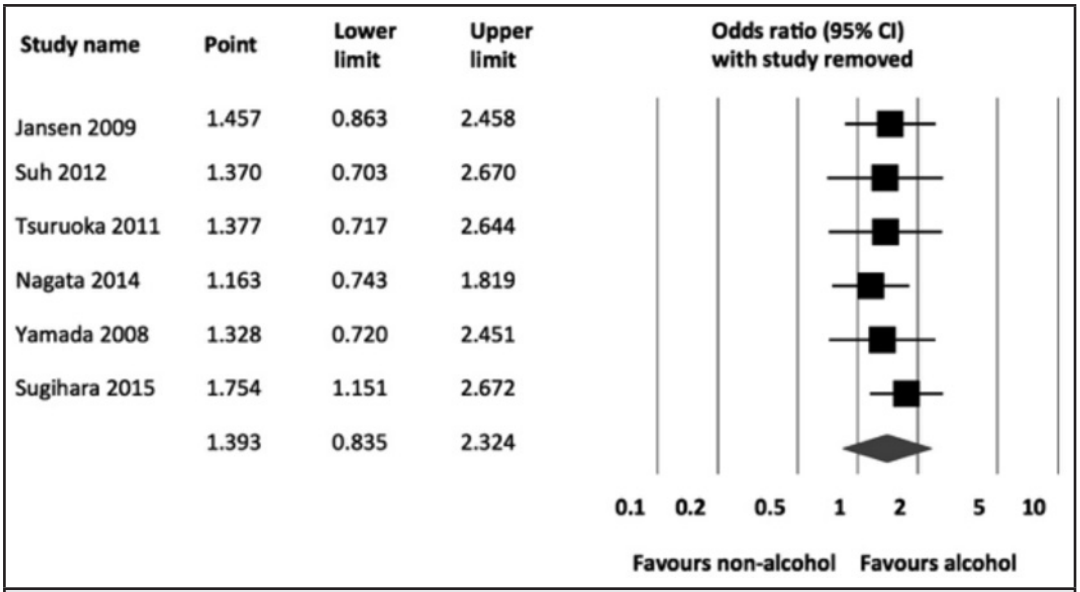
Supplementary Material
Item S2. Search Methodology and Selection Process



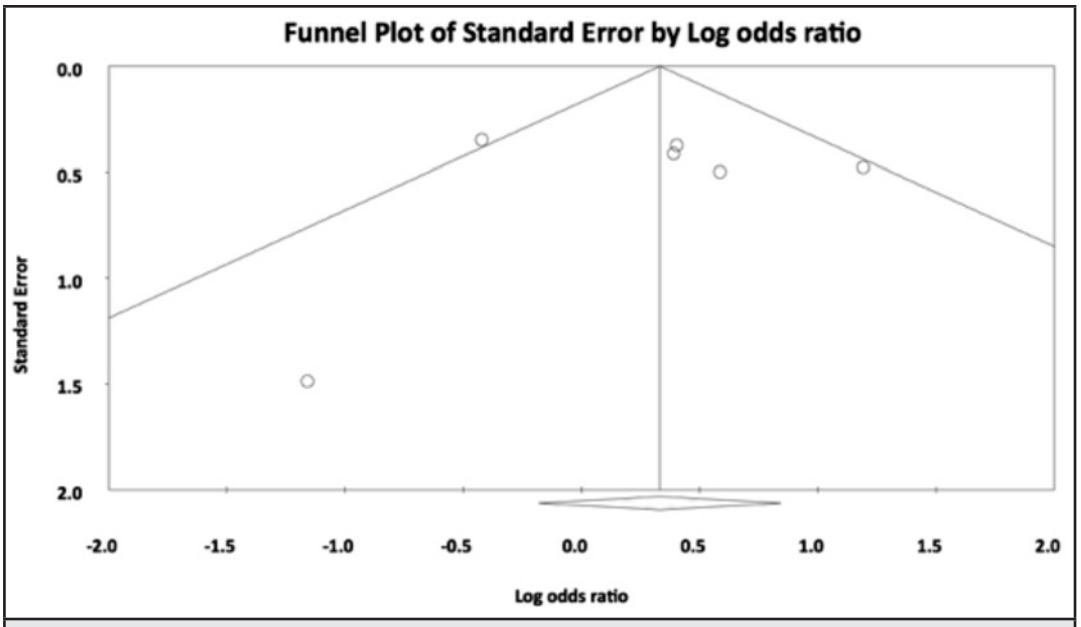
Supplementary Material
Item S3. Sensitivity analysis for the influence of individual studies on the pooled estimate for assessing the odds of diverticulosis as determined by the leave-one-out method. CI, confidence interval.



Supplementary Material
Item S4. Funnel plot of the included studies comparing odds of diverticulosis in patients who consumed alcohol on a regular basis and those who did not; A diamond data marker represents the overall odds ratios and 95% CI for the outcome of interest.



Supplementary Material
Item S5. Sensitivity analysis for the influence of individual studies on the pooled estimate for assessing the odds of diverticular bleeding as determined by the leave-one-out method. CI, confidence interval.



Supplementary Material
Item S6. Funnel plot of the included studies comparing odds of diverticular bleeding in patients who consumed alcohol on a regular basis and those who did not; A diamond data marker represents the overall odds ratios and 95% CI for the outcome of interest.

Conflict of Interest

None of the authors identify a conflict of interest.

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Red Snappers and Red Herrings: Pelvic Tuberculosis Causing Elevated CA 125 and Mimicking Advanced Ovarian Cancer. A Case Report and Literature Review.

Johnnie Alphonse Yates MD; Olivia Ann Collis; Thanasak Sueblinvong MD; and Tarquin Kamakana Collis MD

Abstract

Female genital tuberculosis (FGTB) is a form of extra-pulmonary tuberculosis that has been primarily described in developing countries, where it is an important cause of infertility, ectopic pregnancy, and miscarriage. FGTB is rare in the United States and because its clinical presentation is non-specific and often insidious, FGTB may be misdiagnosed as a gynecologic malignancy or endometriosis. The tendency of tuberculosis to dramatically increase serum CA 125 levels contributes to the potential for FGTB to be mistaken for ovarian cancer in particular. We describe the case of a young woman who presented with what was initially thought to be advanced ovarian cancer but who had tuberculosis of the peritoneum, uterus, and ovaries discovered at laparotomy. This case emphasizes the importance of considering tuberculosis in the differential of any patient presenting with an abdomino-pelvic mass and an elevated CA 125 level.

Introduction

Approximately one-third of the world's population is infected with tuberculosis (TB) and TB remains one of the top five causes of death among adult women worldwide.[1] Extra-pulmonary TB is common in the developing world and may involve virtually any organ. The prevalence of female genital tract tuberculosis (FGTB) is difficult to estimate, due in part to significant variability in both the reporting and classification of the various forms of extra-pulmonary TB.[2] It is clear, however, that tuberculous involvement of the female genital tract remains a common cause of morbidity and infertility among women in countries with a high prevalence of TB.[2,3]

Though TB in Hawai'i is much less common than in developing nations, the State of Hawai'i has one of the highest annual TB case rates in the United States. Hawai'i reported 127 new cases of active TB in 2015, a rate of 8.9 new TB cases per 100,000 people—roughly three times the national tuberculosis case rate of 3.0 per 100,000.[4] The incidence of FGTB in Hawai'i is not known, but is likely very low: of the 127 new Hawai'i TB cases in 2015, only three involved the urogenital tract (patient gender not reported).[4]

Because FGTB is uncommonly encountered in developed countries, awareness of its various clinical presentations is limited. FGTB can be difficult to distinguish clinically from malignancy, and from ovarian cancer in particular. The propensity of FGTB to markedly increase serum CA 125 levels is an additional confounder that is not widely appreciated in the United States, where many clinicians' experience with TB is limited to pulmonary disease.

CA 125 is a large transmembrane protein initially described in 1981 by Robert Bast and colleagues while studying an ovarian cancer cell line, and which subsequently became a useful and widely used tumor marker.[5] CA 125 is elevated in some 75%-90% of patients with advanced ovarian cancer,[6] though abnormally high levels may also occur in a variety of non-malignant conditions, including endometriosis, cirrhosis, and pancreatitis.

We present the case of a woman with FGTB whose clinical picture initially suggested advanced ovarian cancer, including a markedly elevated CA 125.

Case Presentation

A 36-year-old Filipino woman was admitted to Kaiser Moanalua Medical Center in September of 2016 for exploratory laparotomy, for staging and de-bulking a presumed large ovarian cancer. The patient immigrated from the Philippines to Hilo, Hawai'i in August of 2015. Her screening purified protein derivative (PPD) and chest X-ray (CXR) on entry to the United States were negative. She returned to visit family in the Philippines for several weeks in early 2016.

In May of 2016 she noted the onset of a dry cough, lower abdominal pain, intermittent emesis, and fevers. Her clinical evaluation by her primary care team was felt consistent with a viral syndrome: a complete blood count, metabolic panel, and urinalysis were unrevealing save for new anemia. In the context of a continued cough and intermittent fevers, a CXR was ordered in June and showed modest bilateral pleural effusions, prompting a CT scan of her chest, abdomen, and pelvis in August. Her CT (Figure 1) showed a 14 cm complex cystic/solid pelvic mass suggesting ovarian cancer. Enlarged epicardial and parasternal lymph nodes were also noted; no parenchymal lung lesions were present. A serum CA 125 level was markedly elevated (408.3 U/ml; upper limit of normal 35 U/ml), supporting a suspicion of ovarian CA.

Thoracentesis was arranged in an effort to establish a diagnosis and for possible cancer staging. Serous, non-bloody pleural fluid was aspirated, with negative cytology and acid fast bacilli (AFB) staining; AFB culture of the pleural fluid was subsequently sterile.

A CT-guided needle biopsy of a thoracic lymph node was performed; the pathology specimen showed focal necrosis and no clear evidence of malignancy. Several granulomas were noted, with negative AFB and fungal staining.

Preparations were made for hospital admission with a plan to establish a definitive diagnosis via laparotomy and to begin

chemotherapy if a malignancy was confirmed. In the interim, the patient's weight loss became severe—over 23 pounds lost from a baseline of 114 pounds. Periodic fevers continued, and her fatigue progressed to the point of prostration. She became increasingly concerned about terminal malignancy.

Upon hospital admission in September of 2016, the patient's physical exam revealed a very thin, weak woman who was afebrile. Her lungs were clear and a fixed, midline abdominal mass of about 15 cm was easily palpable. She had no ascites or lymphadenopathy. Admission labwork showed mild anemia with a hemoglobin of 11.3 gm/dl and a normal white blood cell count of 6.3 K/ul.

The patient was taken to the operating room for an exploratory laparotomy. On entering the patient's abdomen, multiple pale nodules studding the peritoneum and mesentery were immediately evident, along with a vigorous inflammatory exudate and dense adhesions (Figure 2).

Intraoperative frozen sections were sent from the peritoneum and showed granulomas without clear evidence of malignancy. A large pelvic mass was found, containing copious purulence; the abscess was drained and specimens were sent for culture. The mass encased the patient's uterus and ovaries, was tenaciously adherent to the anterior abdominal wall and surrounding structures, and could not be resected. She underwent lysis of adhesions, drain placement, multiple peritoneal biopsies, and abdomen closure. Several intra-operative specimens sent for formal pathology confirmed the presence of many granulomas and scattered acid-fast bacilli (Figure 3).

The Kaiser Permanente Infectious Diseases service was consulted and the patient was promptly started on four-drug treatment for presumed extra-pulmonary tuberculosis. Her HIV antibody test was negative. Her PPD, negative a year earlier, was repeated and was markedly positive at 30 mm. Fluid from within the patient's pelvic mass was sent for *Mycobacterium tuberculosis* (MTB) PCR which was positive. MTB grew in culture four weeks later from her operating room specimens (Figure 4).

The patient returned to Hilo seven days after her laparotomy, afebrile, and slowly gaining strength. Her CA 125 level decreased dramatically during the first two months of TB therapy (Figure 5). At least six months of tuberculosis treatment is planned.

Discussion

The patient's combination of vague abdominal pain, striking CT findings, and a relatively recent negative PPD led clinicians to suspect a diagnosis of advanced ovarian cancer. Her markedly elevated CA 125 level appeared to support a presumptive diagnosis of malignancy.

It is not widely known that tuberculosis involving the abdominal/ pelvic cavities is a cause of dramatic serum CA 125 elevations.[7-9] Markedly high CA 125 levels have played a "red herring" role in cases similar to this case outside of the US, leading clinicians to suspect ovarian cancer when tuberculosis of the genital tract/ peritoneum was in fact the culprit.[7-8,10] Our case demonstrates the importance of considering FGTB in the differential of ovarian/ uterine masses with an increased CA 125

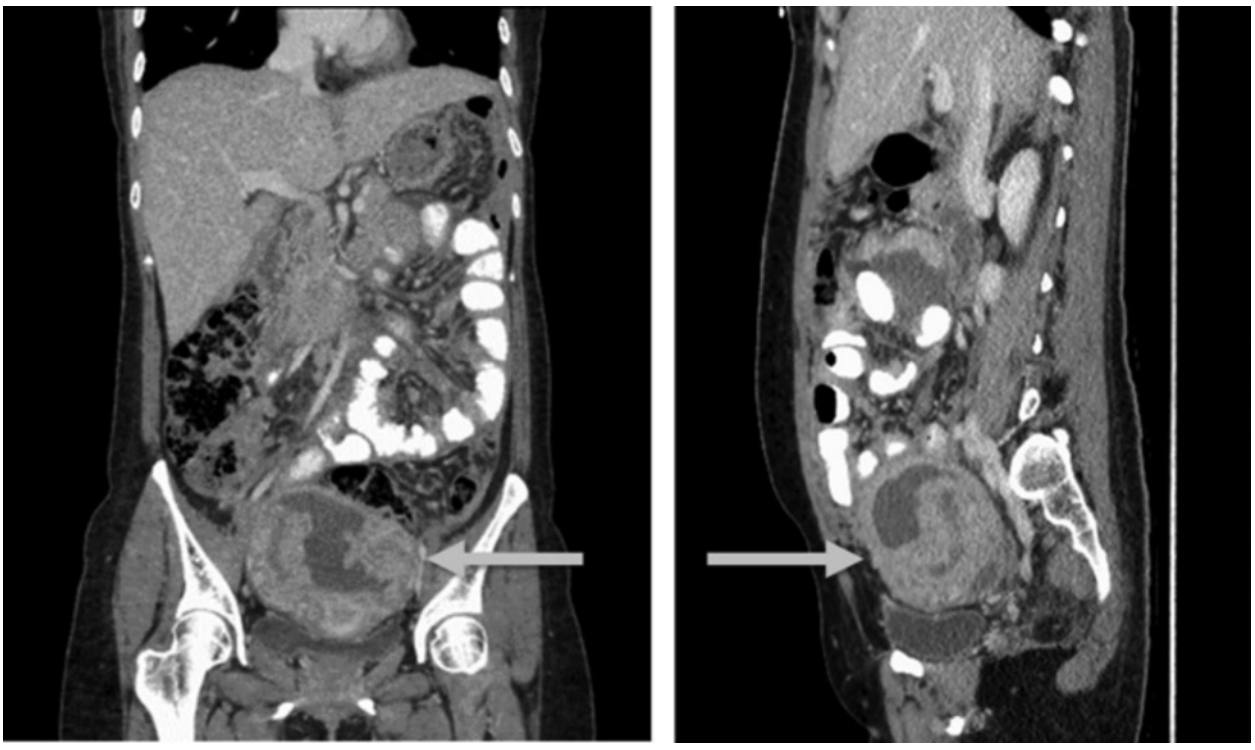

Figure 1. On CT scan, a 14 cm complex cystic/solid pelvic mass (as indicated by arrow) concerning for ovarian cancer was seen. Enlarged epicardial and parasternal lymph nodes were also noted; no parenchymal lung lesions were present. The findings were suspicious for advanced ovarian cancer.

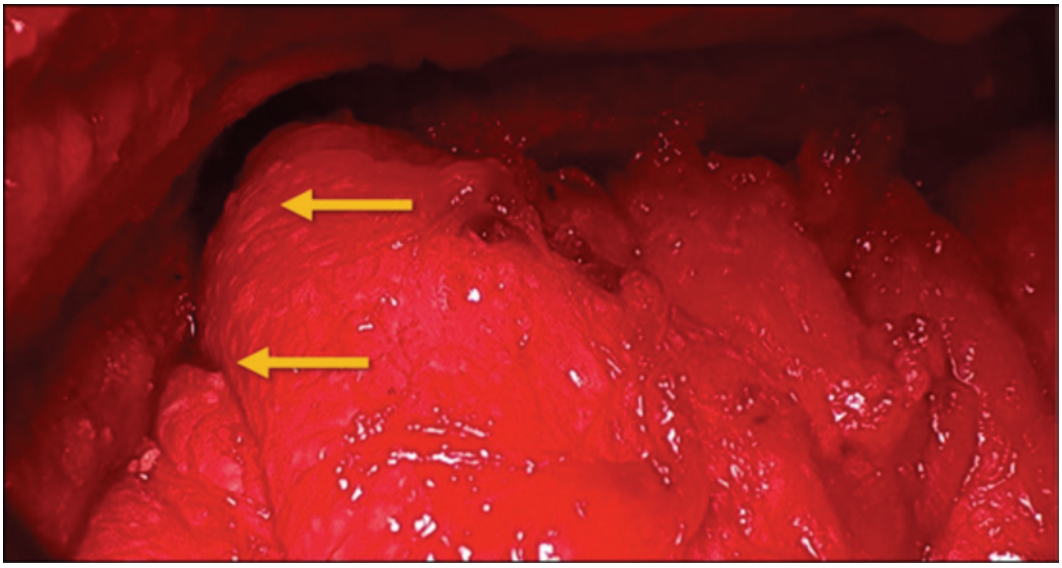

Figure 2. Innumerable pale, miliary nodules (arrows) were seen over the serosa of the small intestine and mesentery, with inflammatory, densely fibrinous adhesions throughout the pelvis. An amorphous pelvic mass encased the uterus and both ovaries.

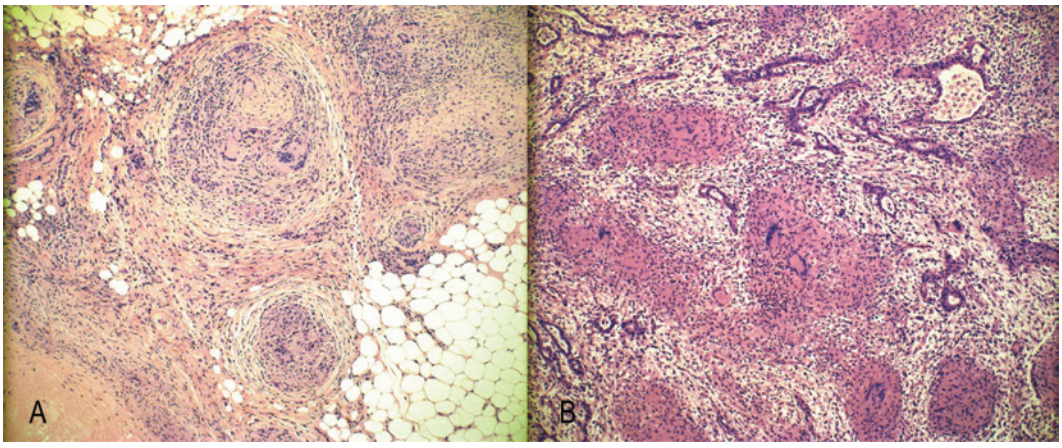

Figure 3. Multiple caseating granulomas and Langhans giant cells were seen in biopsy specimens of the peritoneum (A) and the pelvic mass (B). Rare AFB ("red snappers") were visible on Fite stain.

level, even in countries with low TB prevalence, if a patient's social or travel history is suggestive of possible TB exposure. This is particularly true for younger women, as ovarian cancer usually occurs after menopause while FGTB most commonly affects women younger than forty years old.[8,11] In our patient's case it appears likely that she contracted tuberculosis during a visit to the Philippines several months prior to the onset of her abdominal symptoms. The Philippines, which has made significant strides in controlling tuberculosis over the last decade,[12-13] remains a country with a high burden of TB with an estimated TB incidence of 324,000 cases in 2015.[13]

The mechanism by which TB increases serum CA 125 is not well understood. CA 125 has been localized by immunohistochemistry to mesothelial proliferation around tuberculous granulomas,[14] and CA 125 production by mesothelial cells is dramatically increased in the presence of various cytokines associated with tuberculosis, including IL-1 beta and TNF-alpha.[15] CA 125 levels appear to be generally higher in patients with abdominal, pelvic, or peritoneal forms of tuberculosis than with pulmonary/pleural space infections.[7,9,16-17] Because serum CA 125 levels normalize with successful TB treatment, some authors have suggested its potential utility as a biomarker to track the effectiveness of tuberculosis therapy.[9,17-19] Our patient's early, dramatic fall in CA 125 after initiating TB treatment would appear to support this approach.

The capacity of tuberculosis and other non-malignant conditions to increase serum CA 125 levels has encouraged the search for more specific cancer markers. Human epididymis protein 4 (HE4) is expressed at high levels in ovarian, endometrial, and lung cancers, and may have an important role in helping discriminate between benign and malignant causes of CA 125 elevation[20-21]—of relevance, recent reports suggest that HE4 does not appear to be increased in patients with tuberculosis.[22-24]

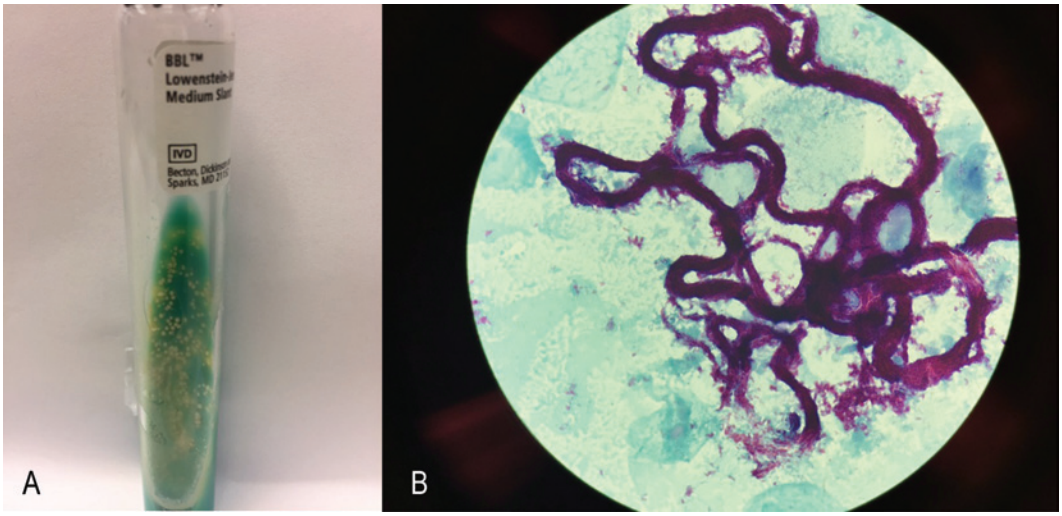

Figure 4. A culture of the patient's pelvic mass biopsy grew M. tuberculosis (MTB), shown here growing on Lowenstein-Jensen agar (A). In liquid media, "serpentine cords" of acid-fast bacilli were seen, typical of MTB (B).

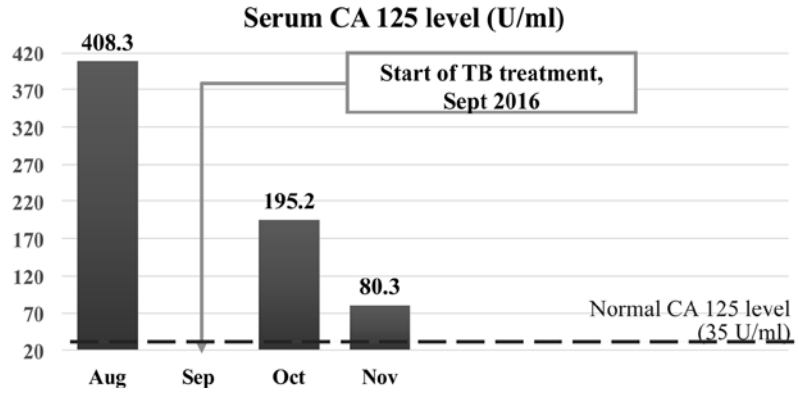

Figure 5. The patient's serum CA 125 was markedly elevated shortly prior to her diagnosis of TB, and was dramatically lower after two months of treatment.

Conclusion

Tuberculosis, like syphilis, has been termed "the great imitator." We hope that this case heightens awareness of the capacity of TB to mimic ovarian cancer in particular—mirroring not only its symptoms and radiologic findings but also raising CA 125, the tumor marker widely associated with this malignancy.

Conflict of Interest

None of the authors identify any conflicts of interest.

Acknowledgements

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Para I Famagu'on-Ta: Fruit and Vegetable Intake, Food Store Environment, and Childhood Overweight/Obesity in the Children's Healthy Living Program on Guam

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Abstract

This cross-sectional study examined the: (1) association between food store environment (FSE), fruit and vegetable (FV) availability and access, and prevalence of early childhood overweight/obesity (COWOB); and (2) influence of young child actual FV intake on the relationship between the FSE and early COWOB prevalence. Anthropometric and socio-demographic data of children (2 to 8 years; N=466) in baseline communities on Guam participating in the Children's Healthy Living (CHL) Program community trial were included. CDC year 2000 growth charts were used to calculate BMI z-scores and categories. FSE factors (fresh FV scores, store type) were assessed using the CX³ Food Availability and Marketing Survey amended for CHL. ArcGIS maps were constructed with geographic coordinates of participant residences and food stores to calculate food store scores within 1 mile of participant's residences. A sub-sample of participants (n = 355) had Food and Activity Log data to calculate FV and energy intakes. Bivariate correlations and logistic regression evaluated associations. Of 111 stores surveyed, 73% were small markets, 16% were convenience stores, and 11% were large grocery/supermarkets. Supermarkets/large grocery stores averaged the highest FV scores. Most participants did not meet FV intake recommendations while nearly half exceeded energy intake recommendations. Living near a small market was negatively correlated with BMI z-score (r = - 0.129, P < .05) while living near a convenience store was positively correlated with BMI z-score (r = 0.092, P < .05). Logistic regression analysis yielded non-significant associations. The high density of small markets may be an opportunity for FSE intervention but further investigation of Guam's FSE influence on health is needed.

Keywords

Guam, nutrition environment, dietary intake, childhood obesity, food store

Abbreviations

BMI = Body Mass Index
CHL = Children's Healthy Living Program
COWOB = childhood overweight and obesity
CX³ = Communities of Excellence in Nutrition, Physical Activity, and Obesity Prevention Food Availability and Marketing Survey and Store Environment Walkability Survey
DGA = Dietary Guidelines for Americans
FAL = Food and Activity Log
FSE = Food store environment
FV = Fruit and Vegetable
SNAP = Supplemental Nutrition Assistance Program
WIC = Supplemental Assistance for Women Infants and Children

Introduction

Childhood overweight/obesity (COWOB) is a growing global epidemic affecting many countries.[1–3] COWOB prevalence in Guam among children ages 3 to 5 years (39%) exceeds[4] the United States (US) national average (23%) for children aged 2 to 5 years.[1] Researchers have described certain "built environments"—the neighborhoods, roads, buildings, food sources, and recreational facilities in which people live[5]—to be obesogenic.[6–8] Previous studies examined the nutrition environment in Guam, looking at sodium in food stores and restaurants, fast food restaurants, and a community garden program.[9–11] A study by Fialkowski, et al, found Guam's retail food environment to have the highest number of small markets but the lowest percentage of fresh fruit availability compared to other jurisdictions in the Pacific Region.[12] Matanane, et al, found a significant negative correlation between children's BMI (ages 2 to 8 years; N=536) and community food environment readiness for change in 3 communities in Guam.[13] Little is known about the food store environment (FSE) in relation to weight status of young children in Guam.

Fruits and vegetables (FV) are a priority area in the nutrition environment and are one of five categories of target foods whose low dietary intakes are most closely related to obesity and non-communicable diseases.[14] Despite recommendations by the 2010 US Dietary Guidelines for Americans (DGA's) to eat more FV,[15] a study examining the nutritional status of a representative sample of adolescents in Guam in 1999 found that 75.3% reported consuming FV less than once a day.[16] Recent data in 2015 showed that 54% and 42% of adolescents reported consuming fruits and vegetables, respectively, less than once a day.[17] More data are needed that are representative of the nutritional status of young children in Guam.

Studies examining the role that the nutrition environment, especially the FSE, has on children's weight status, in addition to diet and activity behaviors, have produced inconsistent results. A cross-sectional study of Canadian adolescent students found no association between food retailers surrounding schools and childhood overweight,[18] while other studies found that the presence of convenience stores was positively associated with higher body mass index (BMI) in young children[19] and adolescents.[20] In the Pacific Region, the Healthy Foods Hawai'i Intervention found that increased store stocking of nutritious foods, point-of-purchase promotions, and interactive cooking sessions increased children's Healthy Eating Index scores.[21] A systematic review of the literature affirms the association of FV availability (eg, in food stores, schools, home) with increased consumption.[22]

This study was conceptualized according to the Children's Healthy Living Program (CHL) Framework for Community Engagement.[23] This framework emphasizes examining the upstream determinants of obesity-related behaviors. The primary objective was to test whether availability and access to FV in food stores was associated with early COWOB (2 – 8 years; ≥85th BMI percentile) prevalence. Secondary objectives were to describe Guam's FSE and examine if actual FV intake of young children influenced the relationship between the FSE and early COWOB prevalence. The authors hypothesized that increased FV availability and access in food stores would be negatively associated with early COWOB in Guam and that FV intake would mediate this relationship.

Methods

Study Design

This is a cross-sectional study of the FSE and weight status of children in Guam, participating in the CHL Program. CHL conducted a community randomized trial to prevent COWOB in children ages 2 to 8 years in Alaska, American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and Hawai'i.[24]

The current study focuses on the FSE in five communities that participated in the CHL Guam community randomized trial. Four of the communities were matched to form two matched pairs while the fifth community served as a temporal indicator of anthropometry status, as previously described in another publication,[24] where it did not receive the intervention program. Community selection criteria and other details about the CHL community randomized intervention trial, including power analysis, are described elsewhere.[24] Baseline measurement data were used in this study.

Participants and Recruitment

Children ages 2 to 8 years were recruited from Head Start, Elementary Schools, and Community Centers in the five communities from October 2012 through September 2013 (n=466). Parents/caregivers of child participants provided informed consent, and child participants provided assent to be measured.[24]

Community food stores were identified by field observation using grid-mapped Google Earth (Mountain View, CA) images to guide community boundaries that were obtained from the Government of Guam Department of Land Management. A comprehensive sample of food stores (ie, supermarket, large grocery, small market, convenience) in the CHL communities was surveyed from October 2012 to February 2013 with the exception of specialty stores (eg, bakeries, liquor stores).

The University of Hawai'i IRB and the University of Guam IRB approved all study protocols.

Instruments and Measures

Anthropometry. Height and weight were measured by trained CHL staff based on standardized procedures, protocols[25–27] and measurement tools (ie, stadiometer and scale). Further details regarding CHL rationale and design of measurement tools have been published elsewhere.[24]

Socio-demographic Information. Data on socio-demographic information were obtained through forms completed by a parent/caregiver. These forms asked parents to provide information about their educational attainment and participation in federal food assistance programs, such as Supplemental Nutrition Assistance Program (SNAP) and/or Supplemental Assistance for Women Infants and Children (WIC), as well as the child's age, sex, race/ethnicity,[24] and sleep duration.

Dietary Intake. FV and energy intake of child participants were collected from a subsample (n=355) using a two-day Food and Activity Log (FAL), completed by the parent/caregiver. The subsample was selected from the four matched communities at baseline. Instructions and training of record keeping techniques were provided by field research staff with the use of food models, service ware, and utensils in order to record the following: time consumed, amount consumed, detailed description of the food, where the food was consumed and other activities performed while eating.[24] Along with a tool kit of calibrated utensils (ie, measuring cups and spoons), parents were given the FAL and a Ziploc® (Racine, WI) bag in which to place food wrappers, labels, and packages.[24] The FAL was reviewed by a CHL staff person with the parent/caregiver upon collection after one week. Data were entered into the Pacific Tracker 3 (PacTrac3) food composition database and web application.[28] PacTrac3 originated from the MyPyramid Tracker developed by the US Department of Agriculture's Center for Nutrition Policy and Promotion, which was modified to include information on local foods of the Pacific Region.[28,29] PacTrac3 generated total energy as calorie intake, cups of fruits, and cups of vegetables.

Food Store Environment (FSE). Community food stores were surveyed by CHL staff using the *Communities of Excellence in Nutrition, Physical Activity, and Obesity Prevention* (CX^3) Food Availability and Marketing Survey and Store Environment Walkability Survey that were previously validated for reliability as an indicator of the FSE.[30] The survey tool defined store type based on the food items sold (canned/frozen foods, produce, bread, and snacks), number of employees and cash registers, number of stores, and chain/franchise business.[30]

Availability and access to FV variables were assessed using the CX^3 validated scoring system.[30] Preliminary results showed that few of the food stores (10 out of 111 stores surveyed) met the published standard (score of 18) for fruit (n=10, 9%) and vegetables (n=28, 25%), or a combined FV availability score of 36 out of 40 total. Considering the dependence on imported foods in the Pacific Region;[31] the standards for FV were adjusted to give credit to moderate variety and mixed quality for a score of 14 each for fresh FV based on the CX^3 to explore the research questions.[30]

Procedures and Data Analysis

Analysis was limited to participants with complete data for anthropometry, socio-demographics, and with a verified residential address (N=466). BMI z-scores and percentiles were calculated using the 2000 CDC growth charts, which defined

children ages 2 to 19 in the ≥85th to <95th BMI percentile as overweight and ≥95th BMI percentile as obese.[32] BMI was analyzed by CDC growth reference data using SAS® 9.3 Statistical Software (SAS Institute, Cary, NC).[33] All variables followed normal distributions, so no adjustments were needed. BMI was categorized into two categories: <85th percentile (healthy weight and underweight) and ≥85th percentile (overweight and obese), to create dichotomous variables. Consolidation of BMI categories allowed for more inclusive analysis since fewer participants were classified as underweight, overweight or obese.

FSE data were analyzed at both the community and participant levels.[14] At the community level, food store data assessed the number, type, and location of food stores, in addition to the availability of fresh FV. Mean scores were analyzed by community, as well as by store type using one-way ANOVA tests in IBM® SPSS® Statistics version 22 (Armonk, NY).

At the participant level, food store data were analyzed based on relative access from participants' residences. Residential addresses of participants and food stores were verified in-person using the Garmin Oregon® 600 GPS handheld unit. Waypoint geographic coordinates (ie, latitude, longitude) were recorded and uploaded to Garmin BaseCamp Version 4.3.5 (Olathe, KS). Figure 1 shows the mapping of coordinates in one community on Guam, which was done using ArcGIS Version 10.2 (ESRI; Redlands, CA). ArcGIS Buffer and Point Distance analysis toolkits identified stores within 1 mile of residential addresses. A previous study examining the FSE's influence on dietary fat intake in four counties in Southwest Georgia surveyed food stores less than 1 and within 1 to 5 miles of participants' homes.[34] Given the geography of Guam (210 square mile area), the distance of 1 mile was used to evaluate direct access to food stores at the participant level. Food store scores were analyzed in two ways: (1) all scores averaged within a 1-mile radius of each participant's residence; (2) nearest store scores to each participant residence.

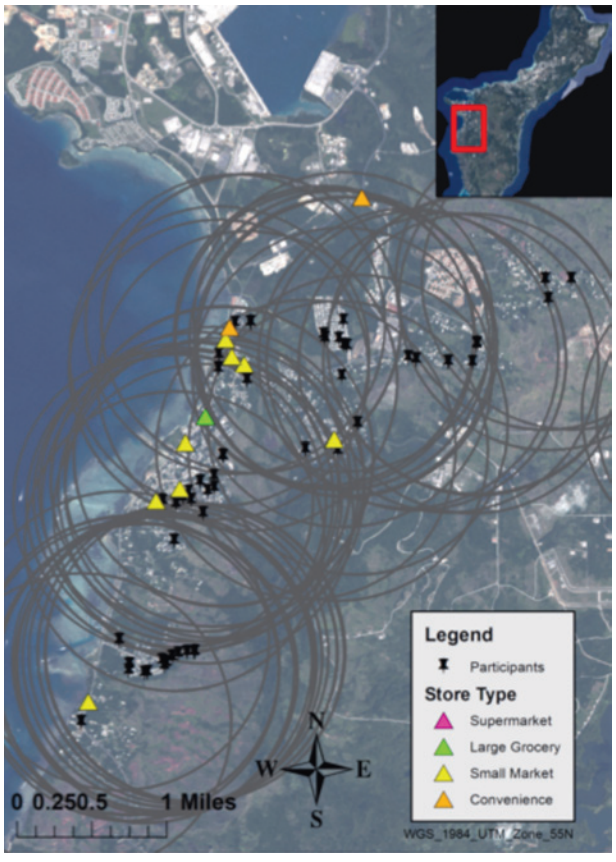

Figure 1. Map of food stores in relation to participants within a 1 mile buffer (indicated by gray circle) in 1 community participating in the Children's Healthy Living (CHL) Program on Guam.

FV intake and total calorie intake were averaged between the two days. FV intake variables were coded as meeting appropriate age recommendations or not.[15] Likewise, energy was computed according to energy needs of children by age and sex, as above or below the cutoff for moderately active children in the 2010 DGA's as this is considered the middle range of physical activity for children.[15]

Bivariate correlation was used to test associations between FV availability scores (independent variable; mean and nearest scores), dietary intakes (mediator variable; cups of FV), and BMI (dependent variable; z-scores) of child participants. Logistic regression was then used to test associations between dichotomous variables for fresh FV availability scores (14 or above) and BMI (<85th percentile and ≥85th percentile), while controlling for socio-demographics, and to determine if FV intake mediates this relationship.[35] All statistical tests were performed using IBM® SPSS® Statistics version 22 (Armonk, NY).

Results

Univariate Analyses

Characteristics of study participants (N=466) and their parent/caregiver are summarized in Table 1. The mean age of study participants was 5 years. The predominant race/ethnic group was Chamorro (56%). Prevalence of COWOB in this study was 29%. There were no significant differences in FV or energy intakes by sex. Fewer participants met vegetable intake recommendations (11%) in comparison to fruits (21%). More than half of participants (54%) exceeded estimated energy intake recommendations.

Descriptive food store analyses. A total of 111 food stores were surveyed, with the majority being small markets, and more stores were located in Community E in comparison to the other communities (Table 2). Supermarkets and large grocery stores were most similar in all scores, although supermarkets had the highest total store scores, while convenience stores scored lowest (Table 3). Of all stores surveyed, 85 (77%) had fresh FV for sale, but in regard to variety and good quality, only 23 (21%) and 41 (37%) met the modified cutoff score for FV, respectively (Table 3).

Bivariate Analyses

The mean number of food stores within 1 mile of a participant's residence was 6, while the mean FV availability scores were 7.9 and 11, respectively, out of 20 possible points (Table 2). Few stores (n=6; 5%) fell outside of participant buffer of 1 mile. Several participants (n=32, 7%) had no stores within 1 mile (data not shown). The mean distance to any store within 1 mile of a participant's residence was 0.07 miles (about 374 feet) and 0.09 miles (about 472 feet) for children categorized <85th BMI percentile and ≥85th BMI percentile, respectively, although not significantly different (data not shown). An inverse correlation was found between having a small market closest to participant residence and BMI z-score ($R = -0.129$, $P < .05$), while a positive correlation was found between having a convenience store closest to participant residence and BMI z-score ($R = 0.092$, $P < .05$) (Table 4).

Multivariate Analyses

The multivariate logistic regression model testing the relationship between FSE meeting FV standards and a child being ≥85th percentile adjusted for presence of supermarket/large grocery/small market/convenience store, parent/caregiver education, SNAP and WIC assistance, race/ethnicity, and sleep did not show significant association (Table 5). No significant interactions were found during the model-fitting.

Mean Scores within 1 mile Distance. Neither the availability of FV nor the presence of individual store types within participant buffers were associated with an increased likelihood of being ≥85th BMI percentile (Table 5).

Nearest Store Scores. Despite the correlations between the presence of small market or convenience stores nearest to participant residence and BMI z-scores, no significant association was evident in the logistic regression analysis (Table 5).

Dietary Fruit and Vegetable Intake. The current FV intake analysis is based on participants (n=355) with valid FAL data. Given that no association was found between the FSE and BMI, further mediation analysis with dietary FV intake was not warranted.

Table 1. Characteristics of children ages 2 to 8 years who participated in baseline measurements for the Children's Healthy Living Program in 5 communities on Guam.

	Boys	Girls	All
TOTASL SAMPLE			
Sex [n (%)]	238 (51%)	228 (49%)	466 (100%)
Age years (mean ± SD)	5.5 ± 1.9	5.4 ± 1.8	5.4 ± 1.8
Education of parent/caregiver [n (%)]			
Less than high school graduate/GED	76 (32%)	73 (32%)	149 (32%)
High school graduate/GED or more	162 (68%)	155 (68%)	317 (68%)
Food Assistance [n (%)]			
SNAP	169 (71%)	164 (72%)	333 (71%)
WIC	75 (32%)	64 (28%)	139 (30%)
Race/ethnicity [n (%)]			
Native Hawaiian/ Pacific Islander (NHPI)	177 (74%)	172 (75%)	349 (75%)
Chamorro	130 (55%)	130 (57%)	260 (56%)
Asian	24 (10%)	22 (10%)	46 (10%)
White	2 (1%)	0 (0%)	2 (0%)
More than one race	35 (15%)	34 (15%)	69 (15%)
Sleep categories [n (%)]			
Less than 8 hours	44 (18%)	36 (16%)	80 (17%)
8 hours or more	194 (82%)	192 (85%)	386 (83%)
Weight Status (mean ± SD)			
Body mass index (BMI) z-score	0.4 ± 1.2	0.4 ± 1.1	0.4 ± 1.2
BMI percentile	59.7 ± 29.5	61.5 ± 29.9	60.6 ± 29.7
Weight categories [n (%)]			
Underweight	10 (4%)	7 (3%)	17 (4%)
Healthy weight	164 (69%)	151 (66%)	315 (68%)
Overweight	30 (13%)	42 (18%)	72 (16%)
Obese	34 (14%)	28 (12%)	62 (13%)
FOOD AND ACTIVITY LOG (FAL) SAMPLE			
Sex [n (%)]	177 (50%)	178 (50%)	355 (100%)
Dietary Intake (mean ± SD)			
Fruit, cups	0.82 ± 0.8	0.87 ± 0.9	0.84 ± 0.8
Vegetable, cups	0.61 ± 0.5	0.57 ± 0.6	0.59 ± 0.5
Calories/day	1675 ± 513	1608 ± 593	1641 ± 555
Meets Recommendations [n (%)]			
Fruits/day	37 (21%)	38 (21%)	75 (21%)
Vegetables/day	20 (11%)	19 (11%)	39 (11%)
Calories/day	70 (40%)	94 (53%)	164 (46%)

GED = General Education Development; SNAP = Supplemental Nutrition Assistance Program; WIC = Supplemental Program for Women, Infants, and Children. Percentages may not add up to 100% due to rounding; numbers rounded to the nearest tenth of a decimal.

Table 2. Type and characteristics of food stores by community using the CX^3 Food Marketing and Availability Survey in 5 communities (A-E) participating in the Children's Healthy Living Program in Guam.

	Max Store	A n=10	B n=10	C n = 22	D n = 13	E n = 56	All n = 111
Store Type [n(%)]							
Supermarket		0 (0)	1 (10)	1 (5)	0 (0)	5 (9)	7 (6)
Large Grocery		1 (10)	0 (0)	1 (5)	1 (8)	2 (4)	5 (5)
Small Market		7 (70)	7 (70)	17 (77)	10 (77)	40 (71)	81 (73)
Convenience		2 (20)	2 (20)	3 (14)	2 (15)	9 (16)	18 (16)
Store Scores [mean ± stand deviation (Minimum / Maximum)]							
WIC/SNAP	10	4.6 ± 3.4^{w} (0/10)	4.9 ± 3.3^{w} (0/10)	2.9 ± 2.7^{wx} (0/9)	5.7 ± 2.3^{wy} (4/10)	3.5 ± 2.2^{wxz} (0/8)	3.9 ± 2.6 (0/10)
Fresh Fruit (F)	20	3.6 ± 6.7 (0/18)	5.4 ± 7.5 (0/20)	7.5 ± 6.4 (0/18)	9.1 ± 5.6 (0/16)	8.9 ± 7.0 (0/20)	7.9 ± 6.9 (0/20)
Fresh Vegetable (V)	20	8.0 ± 7.5 (0/18)	8.8 ± 6.8 (0/20)	11.0 ± 7.0 (0/18)	12.9 ± 5.5 (0/20)	11.6 ± 7.3 (0/20)	11.0 ± 7.1 (0/20)
Fresh FV	40	11.6 ± 13.3 (0/36)	14.2 ± 13.5 (0/40)	18.5 ± 12.7 (0/36)	22.0 ± 9.7 (0/36)	20.5 ± 13.8 (0/40)	18.9 ± 13.2 (0/40)

CX^3= Communities of Excellence in Nutrition, Physical Activity, and Obesity Prevention; WIC= Supplemental Program for Women, Infants, and Children; SNAP= Supplemental Nutrition Assistance Program. ^{wxyz}Mean values within a row with unlike superscript letters were significantly different (P<.05). Percentages may not add up to 100% due to rounding; numbers rounded to the nearest tenth of a decimal.

Table 3. Characteristics of stores by store type using the CX^3 Food Marketing and Availability Survey in 5 communities participating in the Children's Healthy Living Program on Guam.

	Max Score	Supermarket n = 7	Large Grocery n = 5	Small Market n = 81	Convenience n = 18	Total n = 111
Store Scores [mean ± stand deviation (Minimum / Maximum)]						
WIC/SNAP	10	7.3 ± 2.4^{w} (4/10)	4.6 ± 3.6^{wx} (0/10)	4.2 ± 2.1^{xy} (0/10)	0.7 ± 1.7^{z} (0/5)	3.9 ± 2.6 (0/10)
Fresh Fruit (F)	20	18.3 ± 2.1^{w} (14/20)	17.6 ± 0.9^{wx} (16/18)	8.0 ± 6.0^{y} (0/20)	0.6 ± 2.4^{z} (0/10)	7.9 ± 6.9 (0/20)
Fresh Vegetable (V)	20	18.9 ± 1.1^{w} (18/20)	18.4 ± 0.9^{wx} (18/20)	12.1 ± 5.8^{xy} (0/20)	1.1 ± 3.2^{z} (0/10)	11.0 ± 7.6 (0/20)
Fresh FV	40	37.1 ± 3.0^{w} (32/40)	36.0 ± 0.0^{wx} (36/36)	20.1 ± 10.9^{y} (0/40)	1.7 ± 5.1^{z} (0/20)	18.9 ± 13.2 (0/40)
Store Type [n(%)]						
FV Available		7 (100)	5 (100)	71 (88)	2 (1)	85 (77)
Meets F Score (18)[a]		5 (71)	3 (60)	2 (2)	0 (0)	10 (9)
Meets F Score (14)[b]		6 (86)	3 (60)	14 (17)	0 (0)	23 (21)
Meets V Score (18)[a]		7 (100)	4 (80)	17 (21)	0 (0)	28 (25)
Meets V Score (14)[b]		7 (100)	4 (80)	30 (37)	0 (0)	41 (37)

CX^3= Communities of Excellence in Nutrition, Physical Activity, and Obesity Prevention; WIC= Supplemental Program for Women, Infants, and Children; SNAP= Supplemental Nutrition Assistance Program. ^{wxyz}Mean values within a row with unlike superscript letters were significantly different (P<.05). [a]FV score of 18 is the published standard for adequate availability. [b]FV score of 14 is the modified cutoff for adequate availability.

Table 4. Bivariate analysis examining the associations between access to food stores, availability of fruits and vegetables and childhood overweight/obesity (COWOB) in the total sample (N=466) in addition to the association between fruit and vegetable intake and COWOB in a subsample (n=355) of participants in the Children's Healthy Living Program in Guam.

	BMI Z-Score		COWOB	
	Correlation	***P*-value**	**Correlation**	***P*-value**
Within 1 Mile Distance (n=466)				
Presence of Supermarket	0.039	.403	0.033	.475
Presence of Large Grocery	-0.049	.291	-0.054	.245
Presence of Small Market	-0.043	.359	-0.034	.468
Presence of Convenience	0.041	.378	0.019	.690
Mean Distance to Store	0.029	.526	0.013	.781
Number of Stores	0.028	.550	0.027	.566
Fruit Scores	-0.008	.868	-0.009	.839
Vegetable Scores	-0.023	.613	-0.039	.407
Nearest Store (n=466)				
Presence of Supermarket	0.065	.162	0.029	.529
Presence of Large Grocery	-0.012	.802	0.008	.861
Presence of Small Market	*-0.129*	*.005*	-0.063	.177
Presence of Convenience	*0.092*	*.047*	0.033	.473
Distance to Store	0.013	.783	0.014	.758
Fruit Score	0.015	.740	0.035	.445
Vegetable Score	-0.047	.307	-0.006	.900
Fruit/Vegetable Intake (n=355)				
Fruit cups per day	-0.034	.527	-0.007	.898
Vegetable cups per day	-0.030	.577	0.015	.781

Correlation generated using Spearman's rho 2-tailed test.

Table 5. Multivariate logistic regression examining the associations between access to food stores, availability of fruits and vegetables and childhood overweight/obesity in 5 communities participating in the Children's Healthy Living Program in Guam (N=466).

	Model 1[a]			Model 2[b]		
	***P*-value**	**OR**	**95% CI**	***P*-value**	**OR**	**95% CI**
Mean Scores within 1 Mile						
High school/GED or higher	.231	1.32	.84-2.1	.252	1.31	.82-2.1
SNAP	.803	0.94	.59-1.5	.780	0.94	.58-1.5
WIC	.228	0.75	.47-1.2	.384	0.81	.50-1.3
Race/ethnicity is NHPI	.809	1.06	.66-1.7	.637	1.12	.69-1.8
≥ 8 hours sleep/day	.728	1.10	.64-1.9	.725	1.11	.63-1.9
Above mean number of stores[c]				.304	1.38	.75-2.5
Presence of Supermarket				.483	0.81	.46-1.5
Presence of Large Grocery				.525	0.75	.31-1.8
Presence of Small Market				.365	1.38	.69-2.8
Presence of Convenience				.197	0.61	.29-1.3
Meets Fruit Score				.617	0.78	.29-2.1
Meets Vegetable Score				.723	1.14	.54-2.4
P-value			.571			.797
Nearest Store Scores						
High school/GED or higher	.231	1.32	.84-2.1	.216	1.34	.84-2.1
SNAP	.803	0.94	.59-1.5	.729	0.92	.57-1.5
WIC	.228	0.75	.47-1.2	.301	0.78	.48-1.3
Race/ethnicity is NHPI	.809	1.06	.66-1.7	.669	1.10	.69-1.8
≥ 8 hours sleep	.728	1.10	.64-1.9	.773	1.08	.62-1.9
Presence of Supermarket				.586	0.72	.22-2.4
Presence of Large Grocery				.833	0.76	.06-10.3
Presence of Small Market				.303	0.65	.28-1.5
Presence of Convenience				.996	1.00	.39-2.6
Meets Fruit Score				.743	1.11	.60-2.1
Meets Vegetable Score				.546	1.18	.69-2.0
P-value			.571			.848

GED = General Education Development; SNAP = Supplemental Nutrition Assistance Program; WIC = Supplemental Program for Women, Infants, and Children; NHPI = Native Hawaiian / Pacific Islander; OR=odds ratio; CI=confidence interval. [a]Model 1 evaluated participant characteristics (education, SNAP, WIC, race/ethnicity, sleep) with childhood overweight/obesity in the regression model. The groups: 'less than high school graduate/GED', 'no' SNAP or WIC benefits, non-NHPI race/ethnicity, and 'less than 8 hours sleep' served as the reference categories. [b]Model 2 included access to food stores by store type and availability of fruits and vegetables in the regression model. For each food store type, the 'no' exposure group served as the reference category, while for availability of fruits and vegetables, the group not meeting the score cutoff served as the reference category. [c]The variable included to indicate high access to food stores within 1 mile of participant residence. The group falling below the mean served as the reference category.

Discussion

This study examined the relationship between the FSE and a child's likelihood for being ≥85th BMI percentile. This is a novel study in that it examines multiple influences on child weight status, including the nutrition community environment (eg, access to food stores nearby a residence), consumer environment (eg, availability of fresh FV within nearby food stores), and dietary intake. COWOB prevalence (29%) in this study was lower than previous estimates for Guam children ages 3 to 5 years from WIC and Head Start (39%),[4] but higher than the US national average (23%) for ages 2 to 5 years.[1]

Significant correlations were found in the bivariate analysis, which showed lower BMI z-scores in participants having a small market closest to their residences. This may be an area of interest for future studies considering the popularity of small markets in all communities. Resources have been allocated to the improvement of small markets in other Pacific jurisdictions,[21] but causation cannot be inferred at this time.

Additionally, participants having a convenience store closest to their residences were found to have higher BMI z-scores. These findings corroborate other studies such as Galvez, et al,[19] which found an increased risk for obesity in children ages 6 – 8 years who lived near convenience stores and fast-food restaurants in East Harlem, New York. Similarly, the availability of convenience stores in school zip codes has been associated with higher BMI in adolescents.[36]

However, the multivariate correlations were not found to be significant between the FSE and increased risk for being ≥85th BMI percentile. These findings are supported by Seliske, et al, who found no association between food retailers surrounding schools within a 1 km and 5 km radius and overweight among adolescent students in Canada.[18]

For FV intake, most study participants did not meet FV or energy DGA recommendations, which is in alignment with the high prevalence of COWOB. Michimi and Wimberly found that as distance to supermarket increased the odds of adult obesity increased, and also that consuming ≥5 FV decreased the odds of adult obesity in contiguous US metropolitan areas.[37] Likewise, other studies found that FV availability in food stores and in the home were associated with increased consumption among children and adolescents.[38,39] In Hawai'i, a positive association was found between adults with a greater density of total or healthy food outlets and mean intakes of FV at 0.5 km.[40]

There are limitations to this study. This study did not examine all food stores on Guam but rather only those within the communities participating in CHL. Participants may have had food stores in adjacent communities that were within their 1 mile buffer that were not included in this analysis. Data were also not collected from participants to determine where they shop for groceries, so it cannot be assumed that participant families buy food within 1 mile of their homes. Data was also not collected from community farmer's markets as they were not operating during the survey collection period. In addition, other food outlets (eg, fast-food) were not surveyed and other consumer nutrition variables (eg, product placement, price comparison) were not evaluated. This could be a potential area to explore in the future as Rose, et al,[41] found that FV shelf-space was not significantly associated with BMI, but that cumulative shelf-space of energy-dense snack foods was positively associated with BMI. A study by Snowdon, et al, found approximately 67% of Guam's food supply is imported from the US, Philippines, and Japan.[31] Further, food stores alone in island communities may not adequately represent access and availability to FV because it does not account for produce grown locally (eg, family farm). With Guam's agricultural movement currently growing, this is an opportunity to compare changes in subsistence farming, community markets and their effects on FV intake.

This study did not reveal any association of the FSE on COWOB prevalence. Still, it is the first of its kind to evaluate the FSE using ArcGIS mapping on Guam. This is also the first study to evaluate dietary intake of young children ages 2 – 8 years on Guam. To date, there is no surveillance system in place to monitor health behaviors of Guam's young children.[42] In addition, this relationship may need to be examined in other islands, which may be as geographically isolated and remote as Guam, and may have even greater difficulties with access to FV in food stores.

Conclusions and Implications

There is still much to be learned about the FSE on Guam, and its influence on dietary behaviors and weight status, before policies and interventions targeting this domain can be effective in promoting and maintaining child health. This study found lower BMI z-scores in participants having a small market closest to their residences in bivariate analysis, but future research is needed to explore other aspects of the FSE, such as the consumer environment, the growing popularity of farmer's markets, community gardens, and subsistence farming. Comprehensive studies of all communities using ArcGIS mapping will provide a clearer picture of Guam's FSE. Further studies should establish temporality of relationships between the FSE, dietary intakes, and weight status of children. The physical activity environment should also be explored to examine its impacts on the lifestyles and weight outcomes of children on Guam.

Conflict of Interest

The authors declare that there is no conflict of interest.

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MEDICAL SCHOOL HOTLINE

Annual Report for John A. Burns School of Medicine — 2017

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

Annually the leadership of the University of Hawai'i – Manoa (UHM), John A. Burns School of Medicine (JABSOM) report and reflect upon the accomplishments of the medical school during the fiscal year. This report summarizes major activities across the JABSOM missions, JABSOM's performance against predefined outcome measures, and the contribution of JABSOM to UHM strategic goals.

Major Activities During FY 2017

In July 2016, I transitioned out of the dual capacity of UH Cancer Center (UHCC) Interim Director and JABSOM Dean. The Interim Director role provided the opportunity to work with the UHCC faculty and begin developing cost-efficient operations achievable through unification of the Kaka'ako Health Sciences campus. Also during FY 2016 and early FY 2017, JABSOM prepared for the FY 2017 medical doctorate (MD) program accreditation site visit by the Liaison Committee for Medical Education (LCME).

In preparation for the LCME accreditation site visit in early 2017, a number of organizational changes were made to the medical school including the transition of the Associate Dean for Medical Education role into the Associate Dean for Academic Affairs. This new role provides oversight responsibility across the continuum of education at JABSOM. Also in FY 2017, a number of successful re-accreditations were achieved in the JABSOM Graduate Medical Education (GME) – resident/fellow programs. These included a successful Clinical Learning Environment Review (CLER) coordinated by Dr. Lee Buenconsejo-Lum, the new JABSOM Designated Institutional Official (DIO).

Medical student education (the M.D. degree program) continues to be strong with the gradual enlargement of the entering class size (70 entering students in July 2016) – up from 62 entering students in 2008 upon my arrival. Nearly 90% of incoming students are residents of Hawai'i, thus demonstrating a continued emphasis on supporting the educational aspirations of Hawai'i's citizens and enhancing retention of graduates in Hawai'i where like much of the United States, a significant physician shortage exists. The first cohort of students (n=2) from the UHM Early Acceptance Program entered JABSOM as MD students in July 2016.

In March, the 2017 senior medical student class members were notified of their post-graduate training assignments ("residency training"). All but one matched into a residency program. Nearly 2/3 matched into a primary care (medicine, pediatrics or family practice) or initial patient contact specialty (obstetrics/gynecology or emergency medicine). Nearly 1/3 the graduating class will start residency training in Hawai'i and thus directly increase JABSOM's impact on the Hawai'i physician workforce.

JABSOM's continued efforts to strengthen primary care continue with the opening of a more stable hospital affiliation for the family medicine residency program with Hawai'i Pacific Health's Pali Momi Hospital. In addition, efforts to obtain additional legislative support for the physician shortage were successful with extension of the medical license fee to extend JABSOM efforts to recruit and retain physicians in Hawai'i and support for an educational loan repayment program to recruit physicians and other needed health professionals to underserved areas. The university practice plan has contracted with a national firm to explore a federal matching program to help increase the support for clinical faculty members while expanding access to care for underserved patients.

JABSOM's undergraduate degree program is a BS degree in Medical Technology offered through the Department of Medical Technology. This program has an active educational and research exchange with Japan and is the only nationally accredited Medical Technology program in the State of Hawai'i. The curriculum uses a 2+2 format where students with Medical Lab Technician (MLT) credentials (largely from Kapi'olani Community College) are admitted so that they may complete the baccalaureate curriculum at Manoa and become eligible for career advancement to the Medical Lab Scientist (MLS, equivalent to the Medical Technologist). In FY 2017, the program received permission from its accreditation body to add a track for candidates who have already earned a BS degree in a different but related field, thus increasing the potential to graduate a larger number of medical technologists in this critical shortage specialty.

The Graduate Programs (for Masters and Ph.D. candidates) have been reviewing options for re-organization under an umbrella health sciences graduate degree program as recommended during an external site visit and review in spring 2016.

JABSOM continues to be a steady contributor to the UHM international educational programs, and updated its many Memoranda of Understanding with international medical schools, as required by the LCME. Approximately 40 undergraduate and graduate medical students from Asian medial schools participate in a one-month exchange program in Hawai'i hospitals, with 10-15 JABSOM students receiving reciprocal experiences at Asian institutions. In November 2017, the UH Post Graduate Medical Education Program in Okinawa, will celebrate its 50th anniversary. Each year 10 consultants are sent to Okinawa under JABSOM's sponsorship. Additional JABSOM students participate in Area Health Education Center activities in the Western and South Pacific.

Over 30 students from Japan attended two-week Problem Based Learning workshops conducted by the Office of Medical Education. In FY 2017, UHM undergraduate students (under the sponsorship of the JABSOM Department of Tropical Medicine's MHIRT-Hawai'i program) spent the summer in Thailand, Cameroon, and India conducting locally relevant research. The Step-up Program continues to mentor, high school and community college students from the Pacific Islands, Guam and Hawai'i in basic science activities. The Sim Tiki simulation center (one of only 13 simulation centers accredited for research as well as education) provided international medical education for more than 30 overseas programs, including programs in Japan, Thailand, the Philippines, and Poland.

JABSOM faculty members continued to teach and provide research opportunities for undergraduate students from UHM and other campuses. JABSOM supports the UROP (Undergraduate Research Opportunities Program), the Undergraduate Research Opportunity Council (Dr. Michelle Talquist from JABSOM is on the committee), and the Honors Program. JABSOM has numerous internships available through the NIH funded INBRE program that Dr. Robert Nichols leads and the Department of Native Hawaiian Health Summer Internship (https://www2.jabsom.hawaii.edu/native/index.htm). Students have the opportunity annually in April to present at the JABSOM Biomedical Sciences and Health Disparities Symposium (http://jabsom.hawaii.edu/events/51903/). JABSOM also continues to teach undergraduate courses in Anatomy, Biochemistry, and Physiology at UHM.

JABSOM faculty members continued to provide educational enrichment experiences for thousands of Hawai'i's youth this past year. Through field trips, Teen Health Camps, Keiki Health Camps, teacher training programs, student research experiences, and a new Pre-Health Career Corps, our faculty and medical students give back to the community that supports us. New educational grant awards in 2017 will strengthen our clinician/medical scientist and teacher partnerships, thus augmenting our capacity to mentor the next generation of health professionals for Hawai'i.

The College of Health Sciences & Social Welfare leadership, including the Deans of the Schools of Medicine, Nursing and Social Work, along with the Director of the Office of Public Health Studies, continued to advance academic inter-professional education programs and used the Research Centers in Minority Institutions (RCMI) U54 RMATRIX-II renewal to help strengthen inter-professional health disparities research at UHM. JABSOM investigators (including PI Neal Palafox) work within the UH Cancer Center on an additional U54 grant focusing on reducing health disparities in Micronesian peoples and building cancer research capacity at the University of Guam.

The school remains competitive in its research mission. Of the 139 medical schools receiving NIH awards annually (2016), JABSOM continues to rank in the top 60th percentile among public and private US medical schools (as reported by Blue Ridge Institute for Medical Research at http://www.brimr.org/NIH_Awards/2016/NIH_Awards_2016.htm). Additionally, of the 14 community-based public medical schools that receive NIH awards, JABSOM has ranked #1 for the last 16 consecutive years. Michigan State University ranks second and the University of South Carolina at Columbia ranks third. Locally, JABSOM's annual research activity spending (ie, employing people, purchasing goods and services), research start-up, and research based spin-off company activity equals $53.3 million annually; adding income to O'ahu's economy equivalent to 466 new jobs (as reported by EMSI-Economic Modeling Specialists International, March 2016).

JABSOM's Kaka'ako buildings are now a decade old. In FY 2017, JABSOM was successful is receiving Legislative approval to expend its remaining $5.6 million of revenue bond interest dollars. These monies will be used to repair and renovate JABSOM's medical education building. These repairs and renovations will enhance all classrooms by incorporating up-to-date audio-visual capacity, improve the safety throughout the building including major outdoor trip hazards resulting from landscape settling and shifting, and renovate the cafeteria and bookstore spaces into multi-use learning facilities.

JABSOM's FY 2017 Internal Giving Campaign, was another success with $697,427 raised with the participation of 406 donors benefitting 73 funds. The Dean's Advisory Council, comprised of private and public sector thought leaders, was formed to give input and guidance on future directions, challenges, priorities, and the resources necessary to fulfill the school's mission. All total, philanthropic gifts to JABSOM through the UH Foundation totaled $3M in FY2017. Philanthropic highlights include:

- Whelan Gala in August attracted more than 300 guests and raised funds for the new Thomas J. Whelan, Jr. MD Endowed Chair in Surgery;
- Whelan Society established in the Department of Surgery to honor Whelan Chair donors;
- New Kosasa Endowed Professorship in support of Gynecologic Oncology established;
- Two new endowed scholarships were established;

- The first 50th Anniversary Scholarships were awarded to seven first year and three previously matriculated medical students;
- 114 donors attended the Dean's Circle reception in March.

On the alumni front:
- Annual reunion in July attracted more than 100 guests
- JABSOM Alumni Association was revitalized with new bylaws and leadership
- Alumni dinners attracted 22 guests in Seattle and 32 in Hilo

FY 2017 Benchmarks and Performance

1. Prepare for and execute on the LCME re-accreditation for the MD program at JABSOM.

Although compromised by the transition of oversight of the UH Cancer Center and other fiscal/administrative support, the JABSOM leadership team was able to assemble the over 500 pages of material needed for LCME re-accreditation by November 2016. The site visit was successfully conducted at the end of January 2017. Final word on the visit should be provided by June 2017. Many medical school operations hinge upon this continued accreditation.

2. Work with faculty and dean's office leadership to implement the re-organization of JABSOM's educational mission structure & function.

The JABSOM re-organization was a major undertaking and consumed much personnel time, given the cumbersome UH multi-stage process and multiple required consultations. This process was completed in time for the LCME re-accreditation and thus permitted the school to demonstrate a more streamlined, mission-focused organization that is consistent with its operation.

3. Work with Cancer Center leadership to achieve Kaka'ako Campus fiscal savings and efficiencies through implementation of the one-campus model for the Cancer Center and JABSOM at Kaka'ako.

Much remains to be done regarding this goal. JABSOM looks forward to working with the new Cancer Center leadership. At this point, the one campus concept primarily focuses on some early-stage sharing of research cores.

4. Guide the development of a leadership transition plan in the faculty practice (formerly known as UCERA – now Doing Business As – University Health Partners of Hawai'i)

This goal is well underway. Vice Dean Satoru Izutsu (also serving as an ex officio member of the University Health Partners of Hawai'i (UHP) Board of Directors) has headed up a search process for the UHP of Hawai'i CEO. Two finalists have undergone a site visit and discussions are underway with one candidate. A recent UHP strategic planning meeting has prepared the UHP Board of Directors for building a better path forward for the clinical departments.

5. Guide the transition of the DIO-GME leadership.

Dr. Lee Buenconsejo-Lum has fully assumed the role as the new DIO for Graduate Medical Education after a mentorship year under Dr. Naleen Andrade and led a successful ACGME CLER site visit. She is leading a GME strategic planning effort that involves the community teaching hospital CEOs, other medical education leaders and community representatives. Dr. Buenconsejo-Lum is actively engaged in legislative efforts to strengthen physician recruitment and retention in Hawai'i.

6. Enhance the student status of JABSOM residents/fellows via entry into the UHM Banner System of student registration.

This initiative was started by former DIO Dr. Naleen Andrade and is being continued by Dr. Buenconsejo-Lum. Together we have worked with the UH Office of General Counsel to further define the role of residents and fellows as a special class of trainees at UH and build additional opportunity for these learners to benefit from their affiliation with UH and serve as a future source of alumni support.

7. Assess and refocus biomedical research efforts.

The JABSOM research efforts have faced a number of fiscal challenges linked to financial decisions made by UHM, rising infrastructure costs, reduced national availability of NIH grant support, and the increased cost of meeting regulatory mandates in the highly technical research facilities maintained by JABSOM on behalf of UHM.

Strategically, JABSOM has emphasized synergy between clinical departments and its basic science units/centers/institutes (eg, OB/GYN working with the Institute for Biogenesis Research to enhance the health of babies; Internal Medicine & Pediatrics working with Tropical Medicine for treatment of HIV/AIDS and other infectious diseases; Internal Medicine working with the Center for Cardiovascular Research to strengthen cardiovascular fellowship training), partnerships in health disparities research (eg, Native Hawaiian Health, Public Health, and Social Work collaborating on community-engaged health disparities research), and partnerships with community teaching hospitals (eg, Geriatric Medicine & multiple basic science departments working with the Kuakini Medical Center aging research program). Furthermore, JABSOM has invested in key personnel (biostatistics, bioinformatics, epigenetics) to further cross-disciplinary research and community partnerships.

Much of the planning for the next phase of JABSOM's integrative, translational research initiative was incorporated into the NIMHD U54 Ola HAWAII grant submission that was submitted in March 2017. This grant, if funded, will help sustain some key UHM basic science cores and the clinical translational research currently provided through the JABSOM & Myron B. Thompson School of Social Work NIMHD U54 RMATRIX-II collaboration. Further, Research Director Mariana Gerschenson represented JABSOM in the recent UHM external advisory committee visit focusing on research opportunities and emphasized the critical need for UHM investment in JABSOM junior investigator development and supporting the growing infrastructure costs that JABSOM is bearing on behalf of the UHM campus.

Contributions to the New UHM Strategic Plan

Goal 1: Hawai‘i Graduation Initiative

JABSOM is committed to MD students completing their training and graduating as rapidly as possible. As we are highly selective in who enters medical school, the attrition is limited. Nonetheless, considerable effort is placed into assessing learning style, teaching study skills, and providing multiple formats for an interactive and stimulating student experience. Our innovative problem based learning format emphasizes the synthesis of basic science and clinical skills. Support for remediation is available where needed. Furthermore, JABSOM provides a well-known post-baccalaureate program (Imi Ho‘ola) to prepare those students with educational disadvantages prior to entering medical school.

Goal 2: the Hawai‘i Innovation Initiative

JABSOM has submitted a U54 grant that will in part replace the NIMHD supported BRIDGES G-12 basic science infrastructure grant that has promoted collaborative research and mentoring at the basic science level. A renewal of the INBRE P-20 inter-institutional grant that helps sustain a science pipeline in Hawai‘i was recently submitted and the RMATRIX-II U54 grant supporting clinical & translational research support is mid-way through its 5-year cycle. This second phase of RMATRIX focuses on community-based investigators and developing bridges with other UH health science units. Through Ola HAWAII, RMATRIX, INBRE, and other grant programs (eg, JABSOM based COBRE's), interdisciplinary translational research continues to be championed by JABSOM. The number of R01 grants has increased significantly in the last decade although current initiatives by NIH to push more grant awards to junior investigators will compromise JABSOM due to the growing inability to invest in developing junior investigators. Established investigators are working with OTTED to secure intellectual property and launch biotech businesses.

Goal 3: Twenty-First Century Facilities

JABSOM is blessed to have relatively new educational and basic science buildings – now ten years old. Each year, JABSOM engages in repairs and maintenance to keep the facility strong and productive. JABSOM separately sustains a clinical practice site for its teaching speech & hearing clinic in a building adjacent to the Kaka‘ako campus. A small clinical & translational research clinic has been opened for research use by JABSOM and Cancer Center investigators on the Kaka‘ako campus.

Goal 4: High Performing System of Higher Education

JABSOM has been a campus leader in collaborative higher education and resource & energy conservation. The fiscal underpinnings of JABSOM have been made transparent and available to the JABSOM leadership team, faculty, staff and students. JABSOM contributes academically across UHM and the entire UH System. In compliance with new LCME accreditation guidelines and the continuing interest of JABSOM leadership, alliances and shared programs with Asian medical schools help JABSOM graduates contribute toward the development of a healthy world community.

Goal 5: Hawaiian Place of Learning

The Hawaiian Sense of Place is a part of the essence of JABSOM. Although the Department of Native Hawaiian Health is a visible leader in sustaining Hawaiian values within JABSOM and the medical community, JABSOM embraces Hawaiian values and practices throughout its endeavors, including its MD student pipeline projects, community-based research programs, and its underlying shared values.

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Screening Brief Intervention and Referral to Treatment (SBIRT): One of the way's the Hawai'i Department of Health is working to "Make Health Hawai'i's Shared Value"

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

Introduction

Addiction. One would be hard pressed to find a chronic illness more complex and enigmatic in its etiology. Yet the study of addiction, its variations and causes, has been around for over 200 years. In 1816, Dr. Benjamin Rush's "An Inquiry Into Effects of Ardent Spirits Upon The Human Mind And Body"[1] explored the consequences of chronic drunkenness and argued the condition was a "disease that physicians should be treating." Since then we have simultaneously learned so much about the disease of addiction yet still grapple understanding how or why people acquire it. What we do know all to well is the devastation the disease causes on both an individual and societal level. It is measured in the lives lost each year to addiction, the economic and social burden suffered, and the crippling weight it has on our public health systems.

The Surgeon General's Report published last year estimates substance use disorders cost $400 billion annually; much of which is attributed to health care costs for direct treatment of addiction and treatment of associated health conditions.[2] The national opioid crisis is one indicator that the problem continues to worsen, with 12.5 million Americans reporting misuse of prescription pain medication in the past year and an estimated 78 deaths from opioid overdose occurring every day.[2] However, as alarming as this is, opioid abuse is only part of the picture. For example, alcohol misuse accounts for 1 in 10 deaths among working adults annually.[2] Similarly, 35% of 12th graders have used marijuana in the past year and studies show that attitudes about the risk of marijuana use has declined despite evidence that use of the drug among adolescents can have lasting impact on brain development.[3] Additionally, methamphetamine is estimated to account for around 90% of all drug offenses in Hawai'i; more than any other state.[4]

The reality is that while use of specific drugs such as those discussed above are of major concern and must be addressed, the prevalence of substance misuse, abuse, and addiction is a far-reaching problem in both Hawai'i and across the country; some would say it is the apex predator of social issues. Indeed, it would be difficult to identify a prevalent major social issue such as homelessness or crime in Hawai'i where prevalence estimates are neither caused or exacerbated by some form of substance use, misuse, or addiction.

Historically the United States' response to this issue has been predominantly one of law enforcement, criminalization, and interdiction with minimal success. This has nothing to do with any failing of dedication or commitment on the part of law enforcement or a desire on law enforcement's part to address the issue and see people succeed. The complexity of substance use and addiction is simply too broad to expect success unless the approach is sufficiently multi-faceted and coordinated. The key is a balanced public health/public safety response on a policy level.

Screening, Brief, Intervention, Referral to Treatment (SBIRT) is a vital element of the public health half of this type of harmonized policy. This article seeks to explore the role of SBIRT as both a public health intervention and philosophical basis for proactive health care around preventing chronic addiction and for integrating health in all policy.

Defining SBIRT

SBIRT is a comprehensive, integrated public health approach to implementing early screening and delivery of early intervention services and treatments. The SBIRT model is based on a 1990 Institute of Medicine report which recommended integrated service systems that link community screening and interventions for alcohol problems.[5] This recommendation was based on the emerging evidence at that time that most people who misuse alcohol in a way that is causing some disturbance in their functioning, but which did not meet diagnostic criteria, were more inclined to seek medical care for the acute health consequences of their alcohol use. For example, they might present with stomach problems or trouble concentrating "… without recognizing the critical role that may be played in such problems by excessive alcohol consumption".[5]

The report explored the vital role of primary care in detecting, intervening, and if necessary, referral for patients with emerging alcohol problems. As with so many other chronic diseases of

our time, when the symptomology and the debilitating effects of the disease become readily observable it has often already progressed to an advanced stage of chronicity with significantly diminished prognosis. In practice, SBIRT for behavioral health conditions follows much the same pattern as screening and intervention for physical diseases.

Screening
Screening involves a short, often self-administered, but standardized check for any signs of substance use or misuse. If the screen identifies risk beyond a minimum threshold, the provider discusses the screen with the patient and may conduct further assessment.

Brief Intervention
If hazardous use patterns are evident, the provider might provide a brief intervention usually in the form of motivational interviewing and education around risk factors and issues with which to be aware. The provider would monitor the patient for further developments while simultaneously encouraging the patient to make better choices.

Referral to Treatment
If there is an indication that more specialized interventions or treatment is needed, the provider would refer the patient for specialized care and continue to monitor while coordinating patient care with the specialist. In the context of medical conditions such as heart disease, this process may seem so standard and second nature to physicians as to warrant no discussion at all. However, in spite of the steady increase and associated health impacts of addiction, the medical system does not universally treat or manage addiction as a chronic disease. Incorporating SBIRT practices into primary care to address addiction is an evidenced base solution to reduce negative health outcomes.

SBIRT – A Public Health Approach

The United States is spending more money on healthcare than virtually every other developed country in the world but has the worst health outcomes of those countries.[6] One of the reasons postulated by experts as to why this is the case has to do with the prevalence of vast health disparities across the country. These disparities, having more to do with a person's zip code that their genetic code, leave the healthcare system ill-equipped and unfairly burdened with the aftermath of these health inequalities.[7]

The aftermath comes in the form of the increasing prevalence of chronic disease's such as diabetes and heart disease that are far more expensive to treat than to prevent. For many of these diseases, the risk factors are easily identified and most of them can be effectively addressed and minimized if detected early enough, thus avoiding the onset of the disease. Research indicates that many of the risk factors that predetermine chronic disease have more to do with social determinants than the overall health care received;[7,8] highlighting the disconnect between what we know about how to effectively prevent chronic disease and what we actually achieve. The most alarming aspect of this disconnect is the predictability of these risk factors along with the relative ease of identification of those factors through routine screening. Yet, prevalence continues to rise along with cost.

Addiction risk factors are no different. Like diabetes and heart diseases, there is currently no cure for chronic substance use disorders. They are expensive to treat once the condition becomes chronic but they generally can be prevented with early detection and intervention.[2] The public health approach to chronic disease has four basic aims: define the problem, identify risk and protective factors, develop and test prevention strategies, and assure widespread adoption.[9] This is the reason blood pressure is checked for every patient; because blood pressure is an effective indicator of a wide range of risk factors or potential conditions.

The same is true for SBIRT when it comes to early detection of addiction and other conditions.[2,5] It's the blood pressure test for mental health. So, health care settings are by far the most logical and effective interface for screening and preventing substance use or misuse by patients before any progression into addiction might occur. Just like with heart disease, providers can identify risk through routine screening, work with a patient to address and mitigate the identified risk, and if necessary refer to a specialist.

More importantly, primary care can play an essential role in the de-stigmatization of addiction the way it has successfully done with other chronic diseases such as HIV. Patients are are generally open to discussing their substance misuse with their health care provider. Research indicates a 92% likelihood that patients will provide an honest answer when asked by their doctor about how much they drink. Additionally, 96% of patients surveyed felt that their doctor should tell them to cut down on their alcohol use if it is affecting their health.[10]

Reducing Addiction and Improving Health Outcomes Through Universal SBIRT

SBIRT in primary care and other medical settings has been effective in reducing hazardous or unhealthy substance use and misuse. It is also being evaluated for its efficacy with other behavioral health conditions such as depression and anxiety and indicate the benefits of behavioral health screenings in primary care settings as a more formalized method of identifying and treating individuals at risk for these conditions.[11]

The cost savings realized from SBIRT in primary care settings makes good financial sense as well. One study estimates a savings of four dollars of healthcare cost savings for every dollar spent on SBIRT activities amounting to an 89% cost savings for each patient screened through SBIRT.[12] Additionally, SBIRT can result in improved prognosis for an individual's comorbid medical conditions because of reduced substance use.[2] By intervening with patients who display hazardous use patterns, providers are able to address other issues that may be caused or exacerbated by the hazardous use. Most importantly, the potential for increased care coordination for patients with multiple chronic conditions and the associated positive outcomes is reason enough to implement SBIRT.

Hawai'i Department of Health's SBIRT Initiatives

The Hawai'i Department of Health is involved in two major SBIRT initiatives that support its overall goal of making health Hawai'i's shared value. The first is the pre-natal SBIRT project, which is supported through the Hawai'i Maternal and Infant Health Collaborative (HMIHC) of which the Department is a member. The project, funded by Aloha United Way and the Omidiyar Ohana Fund, and led by Hilopa'a has been instrumental in paving the way for universal SBIRT among prenatal care providers.[13] This effort supports a primary goal of the Department's strategic plan to "Invest in Healthy Babies and Families."[14]

The second initiative is a federal grant received by the Department's Alcohol and Drug Abuse Division (ADAD) to implement SBIRT in primary care settings across the state. The grant is awarded through the Substance Abuse and Mental Health Administration (SAMHSA) and provides $8.4 million dollars over 5 years to support the project. Together, the two projects have made great headway laying a foundation for a universal system of SBIRT across medical systems in the state.

The goals of both projects are to:

- Implement SBIRT across the state health system.
- Expand upon behavioral health and primary health care efforts initiated by the state through the State Health Innovation Plan (SHIP).
- Develop and expand state and community infrastructure to support universal and sustainable behavioral health screening throughout the state's healthcare system.

The ADAD recently awarded contracts to several health care provider groups throughout the state which will work to assist providers with integrating SBIRT into their daily workflow and begin to implement universal screening. The project will be implemented through 3 primary components:

(1) Implementation of screening and brief intervention strategies within participating practices and Health Centers. This component includes the administration of universal screening to identify risk for substance use disorders and other major behavioral health issues.
(2) Training for providers and other health care staff in SBIRT techniques. The training will be ongoing and supportive of SBIRT workforce development through training of trainers as well as focusing on integration of SBIRT into practice workflows.
(3) A centralized referral coordination component that will focus on receiving and coordinating referrals to specialized substance abuse treatment for individuals who are identified as needing more intensive interventions and care. This allows for simplified and consistent referral practices and assists providers by having a single point of contact when referral is needed.

The Department will continue to work with providers and other state systems such as the Department of Human Services as well as private sector stakeholders to ensure that resource coordination and sustainability remain cornerstones of the project. The result of these efforts and the hard work of all involved will create a future where behavioral health screening is as commonplace and routine in health care settings as checking a patient's blood pressure.

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Guidelines for Publication of HJM&PH Supplements

The following are general guidelines for publication of supplements:

1. Organizations, university divisions, and other research units considering publication of a sponsored supplement should consult with the editorial staff of HJM&PH to make certain the educational objectives and value of the supplement are optimized during the planning process. It is important that the sponsoring editor is aware of all steps to its publication. Please contact Drs. Kalani Brady or Michael Meagher for further information.

2. Supplements must have educational value, be useful to HJM&PH readership, and contain data not previously published to be considered for publication.

3. Supplements must have a sponsoring editor who will be involved in every step of the development, editing, and marketing of the publication since HJM&PH staff will only be reviewing final proofs.

4. Supplements should treat broad topics in an impartial, unbiased manner. Please prefer specific classes of drugs, rather than products, unless there are compelling reasons or unique properties of the drug (product) that justifies its treatment.

5. The authors are solely responsible for the content of their manuscripts and the opinions expressed. They are also responsible for the replicability, precision, and integrity of the data and may be asked to sign a statement to that effect prior to publication. All authors are required to disclose any primary financial relationship with a company that has a direct fiscal or financial interest in the subject matter of products discussed in submitted manuscripts, or with a company that produces a competing product. The sponsoring editor must ensure that each article submitted incorporates a disclosure statement from the authors within the body of the text. For more information, please refer to the Disclosure Statement within "Instructions to Authors" on the journal website.

6. All supplement manuscripts should undergo editorial and peer review. It is the responsibility of the sponsoring editor to ensure the integrity of authorship and review process. In addition, sponsorship implies compliance with all federal, state and local laws, rules and regulations that may be applicable in connection with its publication.

7. Publication of a HJM&PH supplement is a flat fee of $3,000 (electronic edition) plus the required State of Hawai'i sales tax. The subscription manager will email an invoice to the designated editor for payment. Checks may be made out to UCERA. (There may be additional costs for hard copy prints. Please contact Drs. Brady or Meagher.)

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10. It is the responsibility of the supplement editor and contributing team members to manage all editorial, marketing, sales, and distribution functions. If you need assistance, please contact our production manager. We may be able to help for an additional fee.

11. Timing of a supplement issue publication will be formalized once all required materials have been submitted to the production manager and payment made.

THE WEATHERVANE

RUSSELL T. STODD MD; CONTRIBUTING EDITOR

LAW SCHOOL IS THE OPPOSITE OF SEX. EVEN WHEN IT'S GOOD IT'S LOUSY.

A former practicing attorney, Patrick Krill, moved into addiction counseling when he became aware of drug and substance abuse in some of his colleagues. Many law firms have long considered the subject taboo, but now are willing to recognize the problem, following a study of mental health issues among U.S. lawyers. The study released last year in the Journal of Addiction Medicine, researchers found 20.6% of those surveyed were heavy drinkers and 28% experience symptoms of depression. That compares with 8% or less on both issues in the general population. The Centers for Disease Control and Prevention (CDC) recorded the legal industry had the 11th highest suicide rate in 2012. The adversarial nature of law practice, where one side typically wins at the expense of another, plus the emotional toll of taking a client's personal issues, makes for a chronic mental grind. Lawyers are less likely to seek help than others out of confidentiality concerns and a fear of telling others they have a problem. Anxieties about mental health start early as law students often avoid seeing a doctor when feeling depressed so as not to get tagged with a diagnosis. Clinical neuropsychologist Joel Becker says endless client demands are often a contributing factor. He suggests lawyers take a cellphone reprieve by turning off all devices at 2 a.m. until 6 a.m. Dr. Becker visits law office of Hogan Lovells (2500 attorneys) once a week, but leaders at several major firms take issue with bringing in a therapist. "Our competitors will say we have crazy lawyers." And that tells why practicing attorneys do not seek help.

YES WE CAN TRY IT, BUT IT WILL COST YOU A BUNDLE.

Occlusion of the central retinal vein within the eye is a not rare event especially in the elderly, with extensive retinal hemorrhage and blood splashing at the back of the eye. Often described as "blood and thunder," the hemorrhage can involve half or the entire posterior pole with major or partial loss of eyesight. The damage may be due to capillary ischemia as well as complications of abnormal endothelial growth factor (VEGF) produced by the damaged retina. These complications can lead to macular edema and if left untreated, may cause substantial vision loss. For the past decade anti-VEGF agents approved by the Food and Drug Administration (FDA) have resulted in substantial improvement for some patients compared with no treatment. In one cohort, acuity improved from 20/100 to 20/30. Cost is a factor as each intra-vitreal injection runs over $2,000.

IN SEARCH OF A BUCK THEY CAN REALLY MESS UP YOUR LIFE.

The FDA has requested Endo Pharmaceuticals remove its Opana ER (Oxymorphone) from the market due to serious concerns about its addiction potential and injection abuse. FDA Commissioner Scott Gottlieb said, "We are facing an opioid epidemic—a public health crisis, and we must take all necessary steps to reduce the scope of opioid misuse and abuse." Abuse of Opana ER via injection was linked to a serious outbreak of HIV and hepatitis C in Indiana in 2015. Endo's parent company Endo International said it is reviewing the full range of potential options. Endo shares fell 12% in trading. Andrew Kolodny, co-director of Brandeis University's Opioid Policy Research Collaborative, said he hoped the FDA's move indicated a stronger approach toward opioids. Geez, it's about time the FDA acknowledged there is a serious drug problem with opioid overdose, addiction and deaths.

I REALLY DON'T CARE. JUST TELL ME WHERE I CAN GO.

North Carolina's legislature passed a 'bathroom bill' in 2016 stating that people should use the public restroom of the sex stated on their birth certificate. LGBT people claimed discrimination and the Trump Justice Department brought a lawsuit. Now the suit has been dropped because North Carolina rescinded the statute. The National Collegiate Athletic Association had pulled business from the state as a reaction, but they stated they would no longer blacklist North Carolina. However, the American Civil Liberties Union (ACLU) plans to continue their litigation against the state. Perhaps the ACLU is seeking to punish the Tarheel state or maybe their staff needs a pointless workout. Alert to ACLU: Wake up! The issue no longer exists.

SCIENCE? WHO CARES ABOUT MEDICAL SCIENCE?

Johnson and Johnson was hit with a jury decision for $10 million in favor of a woman who claimed the talc in the baby powder gave her ovarian cancer. J&J will appeal as it has others where the court ruled the "testimony lacked credible scientific evidence behind the plaintiffs' allegations." In its natural form talc contains asbestos. "which can cause cancers in and around the lungs when inhaled," according to the American Cancer Society. Manufacturers have been removing asbestos since the 1970s and any link between asbestos-free talc and cancer "is less clear." An independent review of 16 studies examining whether there is a link to talc and ovarian center, conducted for the National Cancer Institute found the "weight of evidence does not support an association." If talc does raise the rate of ovarian cancer the increased risk "is likely to be very small," according to the American Cancer Society. These statements from trusted organizations will not discourage trial attorneys looking for work.

THIS IS A WEIRD MEDICAL SPECIALTY.

Calling herself Dr. Pimple Popper, dermatologist Sandra Lee has gathered 2.5 million subscribers on YouTube, 2.4 million Instagram addicts and 56,000 followers on Twitter. Zit popping has joined the ranks of internet subcultures and many watchers admit to being pop-a-holics. Amy Wechsler, a New York psychiatrist and dermatologist says the satisfaction of watching a pimple pop is almost universal, especially if the pimple is your own. Rachel Lewis a stay-at-home mom had a thing on her back and wanted to know what it was. After it was gone, she kept returning to a variety of pimple popping YouTube channels. "I watch them incognito. When someone comes up behind me I'll shut it down quickly. It's almost like watching porn." Okay. Whatever turns you on.

ADDENDA

- The Mayflower was dismantled by the Pilgrims and turned into a barn.
- What's your sign? Mickey Mouse is a Scorpio born November 18, 1928.
- Bumper sticker: Sex Appeal – Give Generously.
- The town was so dull that when the tide went out it refused to come back.
- God created man, but I could do better (Erma Bombeck).
- What a man enjoys most about a woman's clothes is how she would look without them.
- Sign in a Scottish bar: "Carlsberg beer: helping ugly people have sex since 1864."

ALOHA AND KEEP THE FAITH rts

(Editorial comment is strictly that of the writer.)

WRITING CONTEST

HAWAI'I JOURNAL OF MEDICINE & PUBLIC HEALTH

The Hawai'i Journal of Medicine & Public Health invites students and professionals at public health, medical, nursing, pharmacy, and dental schools or programs to enter in its **3rd Annual Writing Contest**.

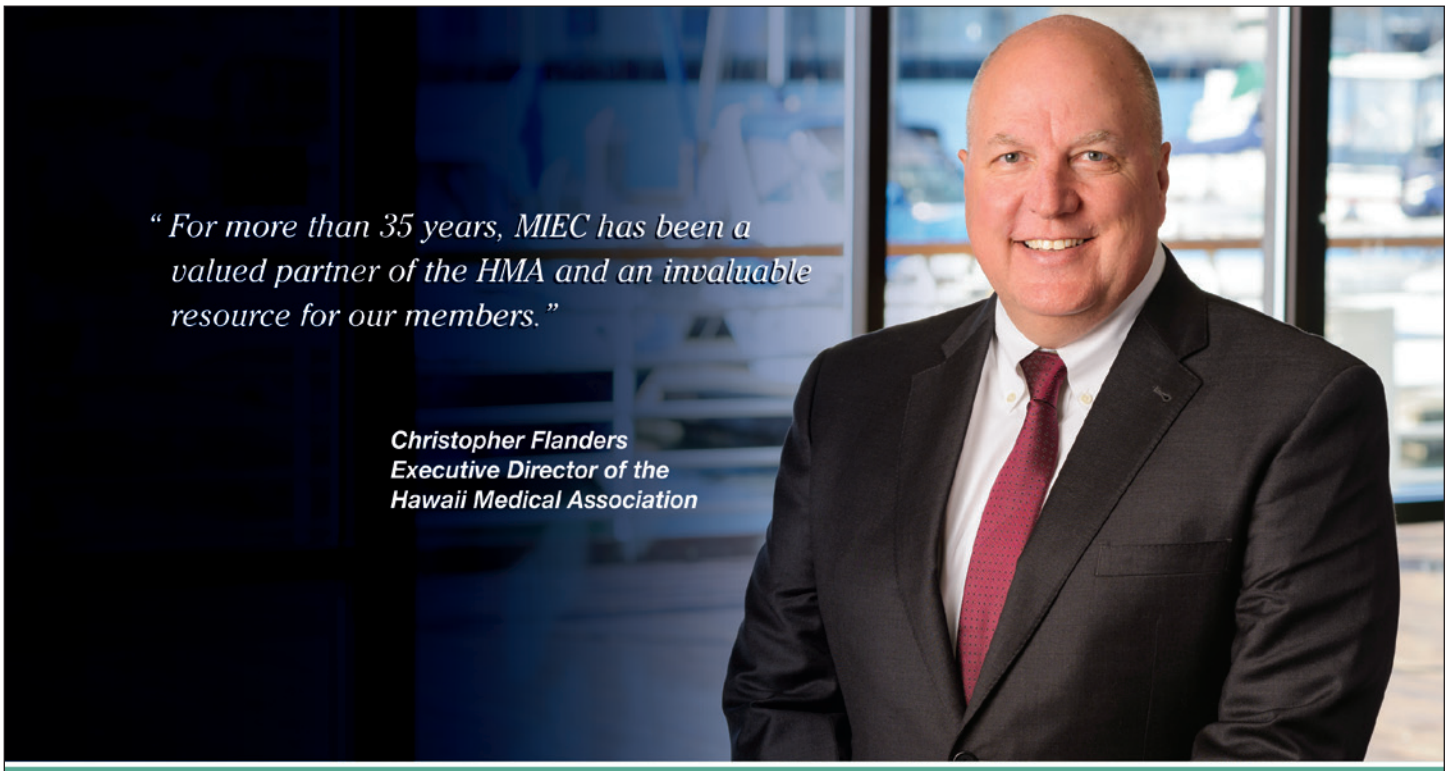
Submissions must be original works related to the practice of medicine or public health, with a focus on Hawai'i or Pacific Rim region.

Eligibility:
Undergraduates, masters- and doctoral-level students, post-doctoral fellows, and residents.
Applicants must have an advisor who can attest to the individual's contributions and provide final approval.

DEADLINE 12/29/17

$500 in cash prizes.
Winners will have their photographs and works featured in a future issue.

WWW.HJMPH.ORG/CONTEST



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