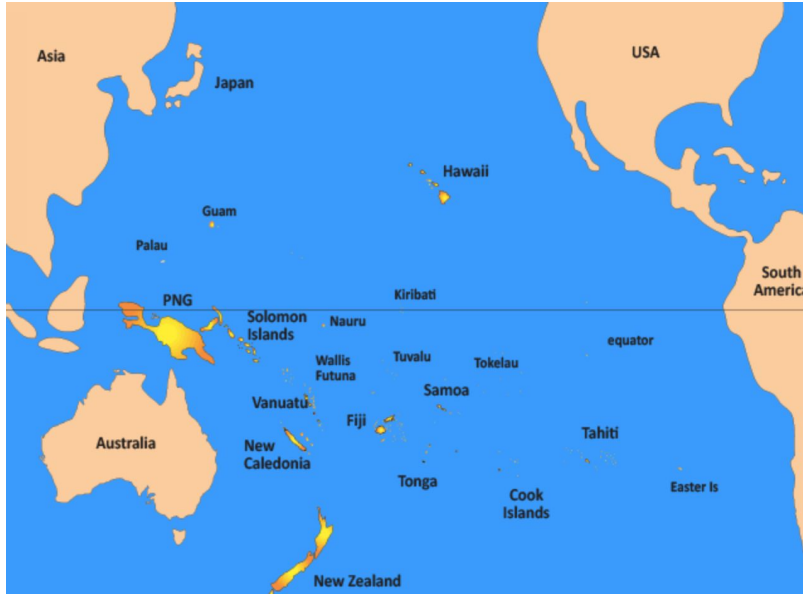


## How AI is Democratizing Access to Enhanced Healthcare in the Pacific

Researchers at the AI-PHI at the University of Hawai'i Cancer Center are using AI to bridge the gap between developing regions and state of the art medical centers in the Pacific.

One of the most valuable benefits of advanced technology is the potential to decrease disparities in healthcare. Researchers at the [AI Precision Health Institute](#) at the University of Hawai'i Cancer Center are using advanced technologies to extend the reach of care outside of hospitals to communities in Micronesia. Since 2003, the University of Hawai'i Cancer Center and the University of Guam have worked in partnership to explore the reasons for significant cancer health disparities among Pacific Islanders in Hawai'i, Guam, and on neighboring Pacific Islands. This is the only NCI program that addresses cancer health disparities and their impact on underserved and socio-economically disadvantaged populations in the Pacific. The partnership addresses health disparities through research, training, and community outreach.

Guam is located 3,950 miles west of the Hawaiian Islands in Micronesia. This is a region with 535,022 people spread out over 2100 islands. Cancer is the fourth leading cause of death in Micronesia where over 90% of cancer cases are diagnosed in late stages.



## Distinctive Data Collected in the Pacific

University of Hawai'i researchers are conducting population research to understand the reasons why cancer incidence and mortality vary substantially across different racial and ethnic populations. They are studying intervention strategies to help prevent cancer and to improve patient survival. The data collected from ethnic groups across the Pacific provides valuable insight that informs cancer prevention and research efforts worldwide. This racially-diverse population resource has been invaluable in demonstrating ethnic variations in cancer incidence and survival.



Native Hawaiians, Pacific Islanders, and Asians represent a very small fraction of patients enrolled in NCI-sponsored cancer clinical trials so data from these groups adds diversity to datasets and robustness to cancer research findings. The distinctive data collected is valuable to cancer researchers all over the world and will contribute to the global body of knowledge about cancer that will be used to develop new treatments and therapies.

Dr. John Shepherd is a Researcher and Professor in the Population Sciences in the Pacific Program (Cancer Epidemiology) at the University of Hawai'i Cancer Center. He's an expert in mining biomarkers from medical imaging using advanced machine learning techniques. He's researching if deep learning models for reading mammograms can reduce recall rates and unnecessary biopsies for women of the Pacific region. His groups in the [Shepherd Research Lab](#) and in the [AI-Precision Health Institute](#) develop medical imaging methods for detecting breast cancer and predicting future risk of cancer, and conduct biomedical imaging research to better detect and monitor metabolic disease and cancer risk. Dr. Shepherd is known worldwide for his work in quantifying breast density and for the use of big data and deep learning techniques in cancer research. He's also an avid surfer.





## Breast Cancer Study in Guam

In July, Dr. Shepherd and Dr. Stephanie Rania, also from the University of Hawai'i Cancer Center, traveled to Guam to collaborate on a breast cancer screening project with the University of Guam. Dr. Shepherd (right) and Dr. Rania(left) shown here with Dr. Teo Cruz (center) from the University of Guam, went to Guam to investigate the effectiveness of using portable early detection devices to screen women on Guam for breast cancer. The objective was to assess a new device and to assess the acceptance of the device in the local community. The device is a portable, hand-held tool that was designed to be used in areas without access to mammogram machines. The hypothesis is that using a hand-held device combined with Clinical Breast Exam will help clinicians in the Pacific find invasive breast cancer lesions sooner than Clinical Breast Exam alone and with a lower biopsy rate than screening mammography.



In Guam, Dr. Shepherd and Dr. Rania met with the Governor of Guam, Lou Leon Guerrero(second from left) and Dr. Teo Cruz (left) from the University of Guam to discuss the possibility of expanding the [Hawaii and Pacific Islands Mammography Registry](#) (HIPIMIR) to Guam. Dr. Shepherd and Dr. Rania also visited three mammography centers to interview women who are participating in the study. The primary purpose of the trip was to train local partners to operate a portable breast cancer screening device and set up a study site on Guam to test the device.



Dr. Shepherd and Dr. Rania met with Senator Therese Terlaje (second from left) and Dr. Teo Cruz (second from right) from the University of Guam to discuss expanding the HIPIMIR to Guam. The HIPIMIR is a collaboration between the Tumor Registry, the AI-PHI, the University of Hawaii Data Science Institute, and medical centers throughout Hawai'i. The mission is to provide accurate risk of breast cancer assessment for women in Hawai'i using all available breast health information including clinical risk factors, omic markers, and radiomic biomarkers. The goal is to amass approximately 80% of the screening mammograms, tomosynthesis, and breast MRI images acquired throughout Hawaii to develop the radiomic biomarkers specific to Hawaiian women.



While in Guam, Dr. Shepherd and Dr. Rania met with the Guam Medical Society to discuss the HIPIMIR and the *Accessible Screening Study in the Pacific*. Three students from the *University of Hawai'i John A. Burns School of Medicine (JABSOM)* attended the meeting. The two students (left) are residents in Pharmacy in Hawai'i who are currently doing a rotation in Guam.



Dr. Shepherd and Dr. Rania also met with potential partners for the HIPIMIR including FHP Health, Guam Radiology Consultants, and MDX Imaging Center. These three mammography centers comprise 80% of all mammography in Guam. They are shown here with Gerald Patricio (far left) who is the Sr. Clinical Manager at FHP Health.

## The Hawai'i Tumor Registry

The University of Hawai'i Cancer Center has established resources for population-based research one of which is [The Hawai'i Tumor Registry](#). The Tumor Registry plays a vital role in cancer research and cancer control activities in Hawai'i and across the US. The Registry is particularly notable for its contribution to addressing the burden of cancer in Asian and Pacific Island ethnic groups that are underrepresented in the US. The Registry collects detailed information on the more than 7,000 new cases of cancer diagnosed in Hawai'i residents annually, as well as follow-up and survival data. Since 1973, the Registry's surveillance has covered over 200,000 cancer cases. The Registry's database contains more cancer cases of Native Hawaiians than any other registry worldwide. It also contains a large amount of data from Chinese, Filipino, Japanese, and Pacific Islanders.



### A hand-held and radiation-free breast cancer screening device

The University of Hawai'i Cancer Center is investigating a device called iBreastExam (iBE) to potentially use to screen women for breast cancer in a new study in Guam. The iBE was invented by doctors and scientists at Drexel University in Philadelphia. It's a hand-held, painless, and radiation-free mobile device designed to detect breast lesions. The device, which is FDA cleared and CE certified, uses tactile sensor technology to measure changes in tissue elasticity. It locates lumps but does not characterize the findings. If a lump is detected during screening, the woman is referred to a doctor for follow-up diagnostic imaging. A bi-lateral breast exam with iBE takes only ten minutes.



Comparison Parameters	iBreastExam	Tech Solutions		Non-Tech
		Ultrasound	Mammogram	Clinical Breast Exam
Radiation Free	✓	✓	✗	✓
Painless	✓	✓	✗	✓
Works on Dense breasts	✓	✓	✗	✗
Point-of-Care	✓	✗	✗	✓
Operable by Nurse	✓	✗	✗	✓
Affordable	✓	✗	✗	✓
PNDT Not Required	✓	✗	✓	✓
Ultra-Portable	✓	✗	✗	✓
Clinical Sensitivity	✓	✓	✓	✗
Objective	✓	✓	✓	✗
Works on Battery Power	✓	✗	✗	-
Bilateral Breast Screening Time	7 - 10 mins	20 – 30 mins	15 mins	20-30 mins

The iBE's sensors assess and identify tissue elasticity differences between hard and stiff breast tumors versus normal breast tissue. The patented tactile sensor technology initially used (Generation 1) a 16-pixel Piezoelectric Sensor Array invented at Drexel University. The current Generation 2 device uses a 640 pixel capacitor array. It is a novel, quantitative, and low-cost elastic modulus sensor that can measure tissue compression and stiffness by top down touching of the skin surface. iBE's ability to apply a gentle force and measure the subtle displacements electrically, all within the sensor, makes for an ideal 'electronic palpation' sensor for in-vivo breast imaging.





Nurses, lab technicians, and community health workers can be trained to operate the iBE device. The device was designed so that it does not require a doctor to operate it, and the results do not need interpretation by a doctor. The device gives a yes/no - red/green result on finding a lump in the breast. Gauri Navalkar (far right) from UE LifeSciences, the makers of iBE, traveled to Guam with the team from Hawai'i to personally provide training on how to operate the iBE device. Dr. Shepherd and Dr. Rania also set up a study site in Guam to test the device.

Data collection for the HIPIMIR will begin in 2019 and is expected to continue through 2025. Over 20 mammography centers in Hawai'i will be invited to participate and to contribute data including demographic, clinical and risk factor information, breast imaging interpretations, cancer outcomes, and vital status obtained through linkage with the Hawai'i Tumor Registry. The objective is to understand how well imaging tests find breast cancer in women of various ages and ethnicities, provide information to radiologists to improve interpretation of mammograms, and assist participating radiology facilities to meet federal standards for quality control.

## **The University of Hawai'i Cancer Center**

The University of Hawai'i Cancer Center is one of only 69 NCI designated cancer centers in the US and the only one in all of the Pacific Region. The NCI designation signifies the depth and quality of the research they are doing. Their research is unique because they research how cancer affects people with different ethnic, cultural and environmental characteristics. Since Hawai'i has one of the most diverse populations in the world, it's an ideal place to study why some ethnic populations are more susceptible to certain cancers and how genetic susceptibility interacts with environmental factors to influence cancer risk. Since gene-environment interaction is a force in cancer development, the University of Hawai'i Cancer Center has developed state of the art laboratory facilities to measure genetic and molecular factors associated with cancer risk and tumor progression and the effects of behavioral and lifestyle interventions for cancer prevention.



*The AI-PHI at the University of Hawai'i Cancer Center in Honolulu*

The [AI Precision Health Institute](#) (AI-PHI) at the University of Hawai'i Cancer Center is the world's first AI Precision Health Institute. John Shepherd, PhD, the Founder and Director of the AI-PHI, is known worldwide for his expertise in quantitative X-ray imaging using AI, machine learning, and deep learning to extract more cancer risk information from various forms of medical imaging including dual-energy X-ray absorptiometry, digital mammography, tomosynthesis, and 3D optical images. He has over 200 peer reviewed papers and has been cited in other publications over 10,000 times. Dr. Shepherd was one of the first to show that volumetric breast density measures are a stronger risk predictor for breast cancer than areal density measures. He was in the Radiology Department at UCSF for 19 years prior to joining the University of Hawaii. He is a UCSF BIRCWH Fellow (NIH K-12) and a 2013 Fulbright Scholar.

For information about the iBreastExam see the [UE Life Sciences website](#).

*This article was written by Margaretta Colangelo and Dmitry Kaminskiy.*

[Margaretta Colangelo](#) is Managing Partner of Deep Knowledge Ventures and Managing Partner at Longevity Capital. She is Co-Founder of Aging Analytics Agency, Co-founder of Deep Knowledge Analytics, and Co-founder of Longevity.Capital. Margaretta serves on the Advisory Board of the AI Precision Health Institute at the University of Hawai'i Cancer Center. Margaretta is based in San Francisco.

[Dmitry Kaminskiy](#) is General Partner of Deep Knowledge Ventures and Founding Partner at Longevity Capital. He is Founder of Aging Analytics Agency, Founder of Deep Knowledge Analytics, and Founder of Longevity.Capital. Dmitry is the Head of International Development of the Secretariat for the UK All-Party Parliamentary Group for Longevity and Managing Trustee of the Biogerontology Research Foundation. Dmitry is based in London.

[Deep Knowledge Ventures](#) is a leading investment fund focused on the synergetic convergence of DeepTech, frontier technologies and technological megatrends, renowned for its use of sophisticated analytical system for investment target identification and due-diligence. Major investment sectors include AI, Precision Medicine, Longevity, Blockchain and InvestTech.

[@DeepTech\\_VC](#)