

The Pacific Island Health Care Project: easing the cancer burden in the United States Associated Pacific Islands

Abstract: Cancer is a serious and ever increasing problem in the United States Associated Pacific Islands (USAPIs). Nearly 30% of all consultations and referrals are for cancer. Depending on the type of cancer, the prognosis for long-term survival is often poor and the cost of caring for such patients is considerable. Tripler Army Medical Center (TAMC) provides tertiary medical care to patients from the USAPIs in support of Graduate Medical Education (GME) at no cost to the patient or jurisdiction. Continuing its tradition of leading telemedicine initiatives in the Pacific, TAMC has developed a web-based electronic consultation and referral network, the Pacific Island Health Care Project (PIHCP). Ten sites in Micronesia and one in American Samoa were provided with computer equipment. Local clinicians request consultation from TAMC specialists through the internet, attaching supporting imagery. The consults are posted on a secure web page, where they are viewed, evaluated, forwarded, and commented on by the consultants. Experience with more than 2,100 cases indicates that the Internet can be easily used as a store-and-forward consultation format and offers a cost effective means for distance consultation, referral, and learning. This format has provided for a more rational evaluation of all patients but especially patients with cancer. Patients who are terminally ill, have widely metastasized disease, and/or have inoperable tumors or recurrences are excluded so that limited resources can be used for those most likely to benefit. There has been overwhelming enthusiasm for such Internet consultations between referring physicians and consultants. Many Pacific Islander patients have received state-of-the-art medical care through this program. At the same time, the training of TAMC physicians and residents has been enhanced by their opportunity to care for these remarkable and deserving patients from the Pacific. **Key Words:** Oncology services, Pacific Islanders, quality of health care

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Introduction

Throughout the 20th century, the United States (US) Federal Government has exerted various influences in the Western Pacific ranging from liberator after World War II; to administrator under the Department of the Navy and later the Department of the Interior; to benefactor and ally after the signing of the Compact of Free Association in 1986 and the New Compact of 2003. During each phase of involvement, the US government has attempted to assist in the development and improvement of health care for all USAPI beneficiaries. TAMC has historically been involved in the overall healthcare of USAPI through assistance visits, personnel training, and provision of tertiary care for island patient referrals. In recent years, TAMC has initiated several

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telemedicine programs in attempts to increase access to healthcare for USAPI residents, as well as meet Continuing Medical Education (CME) requirements for TAMC's nearly 200 medical trainees. Video teleconferencing, Picasso phone consultations, and now an Internet-based consultation and referral network have all been designed to assist local physicians in better caring for their patients¹.

Background

Six island jurisdictions, spread over a massive expanse of ocean (larger than the continental US), make up the USAPI. Two of these, Guam and American Samoa, are US Flag territories. The Commonwealth of the Northern Mariana Islands (CNMI) is a commonwealth of the US, and the other three jurisdictions are independent nations that are freely associated with the US. These include: the Republic of the Marshall Islands (RMI); the Federated States of Micronesia (FSM) including the states of Chuuk, Kosrae, Pohnpei, and Yap; and, the Republic of Palau (ROP).

Medical care for the indigenous peoples of the jurisdictions was, and continues to be, provided by medical officers, expatriate physicians, midwives, medexes, health assistants, and traditional healers. Off-island referrals became commonplace during the Trust Territory era. Often patients with minimal problems, others with terminal conditions including cancer, and those with political influence were preferentially referred to the Philippines, Hawai'i, Guam, and the Continental US². Trust Territory Beneficiaries (TTBs) were eligible for care in Department of Defense (DoD) Medical Treatment Facilities (MTFs) on a reimbursable basis³. However, interagency transfer of funds rarely, if ever, occurred, forcing the MTF to absorb the expense of patients so referred. With the signing of the Compacts of Free

Association of the RMI (1986), FSM (1986), and ROP (1994), more formal guidelines for medical referrals to military MTFs were established on reimbursable and as-available bases^{3,4}. The new compact of 2003 reinforces the referral of Pacific Islanders to MTFs with similar stipulations⁵.

Recognizing the unique training opportunities provided by Pacific Island patients, several "Teaching Chiefs" and Residency Training Program Directors at TAMC approached the Commanding General in 1988 to request a more formal means of increasing the number of patients from the USAPI with medical conditions that would uniquely benefit Graduate Medical Education (GME). This coincided with increasing requirements by the Residency Review Committees of the American Colleges for Graduate Medical Education regarding the number and mix of cases used in medical training. In 1988, Hawai'i Senator Daniel K. Inouye introduced legislation that provided round-trip travel funds for qualifying Pacific Island patients to TAMC for care, which would benefit these underserved patients while enhancing GME.

Initially \$500,000 was allocated for the travel of 250 patients. The first such patients were accepted under the Pacific Island Health Care Project (PIHCP) in 1990. The cost of medical care was borne by TAMC. With decrements in budgets over the years and the mounting cost of medical care, additional funds were required to help offset shortfalls in the program which, during some periods, approached \$8,000,000 annually. Since the PIHCP was initiated, more than 5,000 patients have been treated with inestimable benefits, both educational and humanitarian. Pacific Islanders suffer from all the common and not so common scourges not only of the tropics and sub-tropics, but also those conditions associated with the developing and developed world. Cancer patients have required a disproportionate amount of time and resources of the PIHCP.

Referrals were, in the early years, made by letter, facsimile and telephone, with all of the attendant problems of access, delay, distance, and time and date differences. Data passed during telephone conversations were lost to all except the participants, and relay of crucial patient information relied on memory. Faxed consults were re-faxed to different departments, resulting in confusion over patient identification and diagnosis. TAMC specialists without Internet mail accounts capable of receiving attachments precluded the rapid transfer of supporting images from one specialty department/division to the next. Video teleconferencing was not a viable alternative due to limited telecommunications bandwidth, scheduling challenges with time/date differences between providers and consultants, limitations

in image quality, prohibitive cost of equipment, and lack of infrastructure and technical expertise. Many consults were pending over a period of months, as remote clinicians gathered additional patient data, or waited for a distant patient to return from an outer island for follow up. This paper describes how many of these problems were resolved with the addition of a web-based, electronic consultation and referral network.

Methods

In 1997, TAMC created and hosted an internet-based consultation and referral network. Several steps were needed to implement the sites in the Pacific. First, the consult webpage was created in Hyper Text Markup Language (HTML) and Cold Fusion Markup Language (CFML) with a clinical consultation form designed by the PIHCP Medical Director to ensure that the TAMC consultants would get sufficient information about the case to respond to the request. Second, a webpage was created to post all current or recent consults received from the Pacific. The use of a web-based system is a flexible approach to patient

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In 1998, hospitals in four communities were selected as test sites: Weno, Chuuk State; Kolonia, Pohnpei State; Koror, ROP; and Majuro, RMI. Each location had a relatively inexpensive Internet Service Provider (ISP) and 24-hour access to the Internet. Each site was provided with:

- Desktop computer (Pentium II300MHz, 64MBRAM, 4.3GB hard drive, 56KB modem, 8MB video card, video capture board, 17-inch 0.26 dot pitch monitor)
- Digital camera (Olympus D-6600L)
- Flatbed scanner with transparency adapter (Microtek Scanmaker E6 Professional)
- Digital video camera (Sony DCR VX-1000)
- Printer (Epson Stylus 800)

Additionally, two of the sites were provided with a digital otoscope and ophthalmoscope.

Training was conducted in two stages. The system was first presented to the group of clinicians attending the 1998 Annual Pacific Basin Medical Association (PBMA) conference in Chuuk State (FSM), and then at each site in small groups. For many clinicians, this was the first opportunity to use a computer of any type. Additionally, five senior physicians in Yap, Pohnpei, and Palau accessed the webpage using their personal computers, further adding to the referral base. Subsequently, work stations were added in American Sa-

Table 1. Cancer cases and total cases in TAMC's Pacific Islander Health Care Project (PIHCP)

Jurisdiction	Cancer cases	Total cases	Percent
American Samoa	31	118	26.3%
CNMI*	9	81	11.1%
FSM**			
Chuuk	94	332	28.3%
Kosrae	20	97	20.6%
Pohnpei	46	231	19.9%
Yap	52	127	40.9%
Guam	7	32	21.9%
Republic of the Marshall Islands			
Ebeye	34	87	39.1%
Kwajalein	13	139	9.4%
Majuro	145	442	32.8%
Republic of Palau	155	428	36.2%
Total	606	2,114	28.7%

*CNMI, Commonwealth of the Northern Mariana Islands

**FSM, Federated States of Micronesia

moa, Ebeye (RMI), Kosrae State (FSM), Guam, CNMI, and Yap State (FSM). Furthermore, the US Army Kwajalein Atoll (USAKA) medical facility was granted guest use privileges, although the PIHCP did not provide any equipment to that site. In 2001, the original four sites were provided replacement work stations.

The earliest internet referrals were received in 1997 from Drs. Joe Flear, Greg Dever, and Victor Yano⁶. Sporadic consultations were fielded from practitioners using their personal laptop computers for several months up until the first four workstations were outfitted in February and March 1998. The PIHCP Medical Director individually forwarded those early consultations to various consultants at TAMC.

Store-and-Forward. Consultation has evolved to quite a standardized process. The referring practitioner keys in the patient's history and physical examination information using Microsoft Word. This is copied and pasted into the referral form. Images are captured using either of the cameras or the scope. When the referral form is complete with digital attachments, the clinician connects to the internet and submits the form to PIHCP. Depending on the quantity and size of the supporting image(s), this process can take up to several minutes. The resulting electronic patient record is an episodic patient record that is easily archived and retrieved. Once the form is received, the data populates a Microsoft Access database utilizing Cold Fusion Software. An automated e-mail notification to the Medical Director of the PIHCP begins the consultation process.

The Medical Director queries the database to find the case, which is dynamically displayed on the TAMC server. The folders are protected by Secure Socket Layer (SSL) encryption and a username and password challenge. This

level of data security meets the current federal guidelines for secure clinical use of the internet. The consult is displayed as the provider types it in, with appropriate images displayed if included. The Medical Director then comments on the case and forwards it to other consultants as necessary. All comments are stored in the database, complete with time/date stamp and user information. This appropriately credits all consultants and workloads.

Currently, clinician notification is done via automated electronic mail. The consultant is notified of the case number and its working diagnosis, and then logs onto the internet and the consult webpage to view that specific case. After reviewing the case and images (if any) the specialist can comment directly onto the page. If necessary, the TAMC consultant can ask for further information or testing to be done. The remote provider is notified by e-mail of the change in case status, and then reviews the

consult on the internet. If further testing is required, he or she can enter the answers or results directly on the webpage. In this manner, a difficult case can be discussed through a web-based discussion group.

Results

From the inception of the store-and-forward methodology through May 2004, more than 2,100 electronic referrals and consultations have been accessioned. This represents a rich database of case material on cancer, which can be useful for researchers and educators.

With this database, we can, for example, search by type of cancer using key words such as: cancer, carcinoma, tumor, growth, sarcoma, osteogenic sarcoma, Ewing's sarcoma, chondrosarcoma, lymphoma, leukemia, myelodysplasia, fibroma, myoma, brain tumor, space occupying lesion, cervical cancer, ovarian cancer, buccal cancer, squamous cell carcinoma, retinoblastoma, choriocarcinoma, pregnancy, hydatiform mole, synovial sarcoma, villonodular synovitis, actinic keratitis, basal cell carcinoma, cyst, preleukemia, hairy cell leukemia, and keloid. These records can be ordered by jurisdiction of origin and displayed in a spreadsheet format with links directly to the case in the PIHCP database.

Patients served through the PIHCP by jurisdiction are shown in Table 1. Of the 2,114 records archived in the PIHCP database through May 2004, 606 (28.7%) of them were cancer cases. It should be noted that Guam and the CNMI referred very few patients, and of those referred, most had immigrated to Guam or the CNMI from the FSM, primarily Chuuk and Pohnpei States. Most of the non-cancer cases from Guam and CNMI were for consultation and advice

Table 2. Fifteen leading types of cancer referred to TAMC through PIHCP, by jurisdiction

Cancer	Federated States of Micronesia						RMI*			Totals	
	AS*	CNMI*	Guam	Chuuk	Kosrae	Pohnpei	Yap	Ebeye & Kwajalein	Majuro		ROP*
Cervix		2		5			7		31	20	72
Breast	2			9	4	3	2	6	7	22	55
Thyroid	1			7		2	1	1	5	26	43
Mouth					4	3	19	4	1	10	41
Uterus	5			14		1	1	2	9	6	38
Lung	1			2	1	4	6	5	3	15	37
Brain	2		1	7	1	2	2	3	7	7	32
Ovary	3			2	2	1			16	4	28
GI Tract	2					2	2	3	8	10	27
Bone	4		2	6	1	3	3		3	3	25
Lymphoma				4	1		3	1	6	4	19
Leukemia	3		2	2	3	1	1	1	2	2	17
Nasopharynx	1			2		2	3	1	5	1	15
Prostate				1		4		1		5	11
Hemangioma				5		1		2	3		11
Other cancers	7	7	2	28	3	10	9	10	39	20	135
Total	31	9	7	94	20	46	52	47	145	155	606

*AS, American Samoa; CNMI, Commonwealth of the Northern Mariana Islands; RMI, Republic of the Marshall Islands; ROP, Republic of Palau

regarding patients intended to be cared for in their own facilities within the jurisdiction. Thus, proportionately fewer cases with cancer originate in those jurisdictions. Referrals from Kwajalein Island are also skewed because most of their consultations relate to requests for advice regarding American contract personnel working for the DOD at USAKA. Patients consulted on or referred to the PIHCP with cancer or other serious medical conditions are Marshallese citizens who may work on Kwajalein Island but who live on Ebeye Island, the next island in the Kwajalein Atoll, which explains the small percentage of cases with cancer as contrasted to the total number of consultations and referrals for Kwajalein.

The 15 most common cancers by jurisdiction that were referred to TAMC are listed in Table 2. Carcinoma of the cervix is the most frequently referred cancer with 72 cases. This was followed by cancers of the breast (55), thyroid (43), mouth (41), uterus (38), lung (37), brain (32), ovary (28), gastrointestinal tract (27), bone (25), lymphoma (19), leukemia (17), nasopharynx (15), prostate (11), and hemangioma (11).

The intent of the program has always been to assist in the care and treatment of the patient in their home island where possible⁷. When specialized tertiary care is required, the patient is transported to TAMC, expeditiously treated, and returned home as soon as possible. When this is not

realistic, attempts are made to ameliorate the condition if possible and, if not, provide palliative, end-of-life care and return the patient home so that they are with supportive loved ones during their last days.

A large number of unusual, uncommon, rare, and far advanced tumors are referred to the PIHCP. For some TAMC physicians and many of the medical residents, it is the first time that they are seeing patients with these unique conditions. Examples of especially challenging cases referred to TAMC included two children thought to have retinoblastoma. Both children were treated with enucleation; one child had a retinoblastoma confined to the orbit, the other child had a staphyloma, a benign condition. An infant with very rare congenital acute lymphocytic leukemia (ALL) was referred and successfully induced, but subsequently died of sepsis at TAMC. A young, pregnant woman with a disseminated T-cell lymphoma infiltrating her breasts and abdominal wall was referred. It was clear upon internet-based consultation that her cancer was so far advanced that there were no options for treatment. Thus, TAMC physicians and residents provided physicians in her jurisdiction with recommendations for palliative care, and the woman has since died. Many cancers in Yap and Palau are associated with the chewing of betel nut. One man presented with a buccal squamous cell carcinoma that affected the entire lower right quadrant of his face. Although he underwent radical surgery, his cancer could not be cured. A case of primary

cancer of the trachea, which is very uncommon, was referred and treated. Keloid formation is very common in Pacific Islanders. Although not malignant per se, keloids represent new growth, and the PIHCP has successfully removed a number of keloids. We also consulted on a case of a young Marshallese woman with a phyllodes tumor of the breast that secreted an anti-insulin antibody.

Discussion

The use of a standardized, electronic referral and consultation network has greatly improved PIHCP and has enhanced the medical education of our residents-in-training. Patients from the USAPIs provide a unique opportunity for training and challenge our traditional approaches to the practice of medicine and surgery.

Although telemedicine technology has improved, streamlined, and expedited the referral and consultation service, other factors work to delay access to health care by indigenous peoples of the Pacific. Even after patients are accepted into the PIHCP, it may take months or even years before the patient arrives at TAMC. It should be noted that these people live in some of the most remote places on earth. Many Pacific Islanders live on distant atolls and islands, hundreds of miles from the limited resources and infrastructure of their capital or main islands. Access is often limited to boat travel, and this is dependent on the weather. In some distant atolls, getting out of the lagoon into the open sea is only possible once or twice a year. Many Pacific Islanders with cancer or other chronic diseases seek out traditional healers and alternative therapies prior to conventional medical treatment.

Another barrier to cancer care in the Pacific is expense. For TAMC, the cost of treating patients with leukemia, head and neck cancer, or sarcoma often exceeds \$100,000 per patient. As medical care has shifted to day surgery and outpatient therapies, the burden of the cost of daily living falls to the jurisdiction of the patient's origin. Some of the island nations provide the patient a modest stipend of \$20 per day. Children and adults with leukemia may need to stay in Honolulu for 1 to 2 years. Twenty dollars a day amounts to \$7,300 per year, a sum more than twice the average annual income in some of the jurisdictions, but barely enough to live on in Honolulu. Some patients have waited months to save enough money to apply for a passport. Others have had to sell land to make ends meet. Several jurisdictions cannot afford to pay a per diem, and it is no wonder that some patients elect to go on welfare and move to Hawai'i permanently. Sadly, when this occurs, the patient, now in Hawai'i, must be disengaged from the PIHCP because only one federal program can be in effect at a given time.

Despite the barriers to care and numerous problems outlined above, the application of the store-and-forward tele-technology to the PIHCP has made a huge impact. It has

cut across the barriers of time, distance, and accessibility to provide underserved indigenous peoples of the USAPIs with access to cutting-edge medical and surgical care. The burden of cancer in the Pacific is enormous. In a small way the PIHCP has reduced that burden, and the training of TAMC physicians and residents is enhanced by being exposed to and caring for these remarkable and deserving patients from the Pacific.

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