Breast and Cervical Cancer Screening in Palau: Have We Improved Early Detection and Survival?

Irish M. Tutii; Christine Roseveare MPH; Kerri Viney PhD, MPH; Haley L. Cash PhD, MPH; Tmong Udui MPH; and Edolem Ikerdeu MA

Abstract

The Breast and Cervical Cancer Early Detection Program (BCCEDP) was first introduced in Palau in 1997. The program's aim is to recruit and screen women for early detection of breast and cervical cancers. An assessment of this screening program was conducted to evaluate its effectiveness, including impact on stage of diagnosis and survival time of patients diagnosed with breast and cervical cancers through both screening and clinical diagnosis. A retrospective cohort study using secondary data from 2004-2013 was conducted. There were 45 women diagnosed with breast or cervical cancer. Due to the small number of cases, a comparison of two time periods was made (2004-2008) and (2009-2013). There were more cancer cases detected through screening (26%) in the earlier time period (2004-2008), as compared to those diagnosed through screening (8%) in the later time period (2009-2013), though this difference was not statistically significant (P=.09). The proportion of breast and cervical cancers diagnosed at an earlier stage (0-3) may have decreased between the two time periods (42% to 23%, P=.3). A greater proportion of women who were diagnosed between 2004-2008 lived longer than 2 years (58%), than women who were diagnosed between 2009-2013 (39%; P=.23). The screening program has not shown improvement over the years despite the measures taken to detect the early onset of breast and cervical cancer, and survival outcomes in Palau remain poor.

Keywords

Cancer, Screening program, survival, Palau

Introduction

The Republic of Palau is a small independent island nation located in the Western Pacific Ocean. Palau consists of 340 islands, though only 8 of them are inhabited. The total population in 2012 was 17,501, with the majority of the population (96%) condensed on the two closely connected islands of Koror and Babeldaob.[1]

Although cancer is one of the leading causes of death,[2] there is no cancer treatment available in Palau. Diagnosed cancer cases are sent off-island for treatment through the country's medical referral program; however, referral off-island is dependent on cancer stage and the progression of the disease. A previous study reported that cancer is diagnosed at later stages and higher mortality rates exist in the US-Affiliated Pacific Islands compared with the overall US population.[3] Another recent study revealed that women of Pacific Islander descent tend to present for medical check-ups and treatment at a later age and stage of disease than their non-Pacific Islander counterparts.[4]

Palau has had a Breast and Cervical Cancer Early Detection Program (BCCEDP) funded by the United States Centers for Disease Control and Prevention (CDC) since 1997. This program follows CDC's screening guidelines for breast and cervical cancer screening.[5,6] Up until 2012, eligibility was as follows: if women were aged 18 years and older, or were sexually active they were eligible for clinical breast examination and Pap smear testing once a year. Women aged 50 to 74 years old were eligible for a yearly mammogram. In 2012, the eligibility criteria changed to only include women aged 21-64 years for clinical breast examination and Pap smear testing every three years, and a yearly mammogram for women aged 40-74 years.[7] There has never been an income requirement to be eligible for this program. The major goal of the screening program is to reach women who are underserved, uninsured, or under-insured who are rarely or never screened. Due to the fact that all women in Palau fall into these categories, all women in Palau are eligible for the program. This program is promoted through community meetings and the media. Screenings are performed by health care providers in the central public health clinic, community health centers in the outlying states, and in one local private clinic. Women are screened by Pap smear testing, clinical breast exams, and by mammography screening.

This study is the first of its kind in Palau. It aims to provide an understanding of the impact of breast and cervical cancer screening on stage of diagnosis and survival outcomes of patients diagnosed with breast and cervical cancers, and to determine if these factors are improving over time. The objectives of the study are to: (1) quantify the number of women screened by BCCEDP in Palau from 2004-2013 (2) describe the annual number of breast and cervical cancers diagnosed between 2004 and 2013 in Palau, (3) identify the proportion of breast and cervical cancers diagnosed through screening (2004-2008 vs 2009-2013), (4) describe the stage of cancer when first diagnosed (2004-2008 vs 2009-2013), and (5) describe survival outcomes for women with breast or cervical cancer (2004-2008 vs 2009-2013).

Methods

Study Design

This was a descriptive retrospective cohort study involving a record review of secondary data.

Setting

There is one hospital in Palau (Belau National Hospital) located on the island of Koror where the majority of the population (67%) resides.[1] The BCCEDP is the only formal cancer screening program available in Palau. Screening for all other cancers is offered when deemed necessary by attending physicians. Palau does not provide radiotherapy, chemotherapy or any other form

of treatment for cancer. When patients are diagnosed with cancer, they may be referred off-island to the Philippines, Taiwan, or Hawai'i for treatment depending on the stage and progression of the cancer. This service is funded by the National Government as part of the medical referral scheme.[8]

Health care providers in Palau are mandated by law to report diagnoses of cancer to the Palau Cancer Registry.[9] Cancer data are then abstracted into a database and uploaded to the Regional Cancer Registry in Guam that serves as the repository of cancer data for the US-Affiliated Pacific Islands.[10]

The BCCEDP Screening Program

The screening program actively recruits women by conducting meetings with local women's groups, airing radio announcements, distributing flyers, targeting workplace wellness programs, and other community events. The program also offers evening clinic hours to accommodate women who work. Screening is free and is available at the community health centers located throughout Palau, the private clinic, and at the main hospital. Screening for cervical cancer is by Pap smear testing. Clinical breast examinations are performed during the time a patient is screened for cervical cancer. If the health care provider feels that a mammogram is necessary or if the woman is of age for mammography, she is referred for mammography screening at the Belau National Hospital. An off-island radiologist is contracted to read mammograms every three months.

Diagnoses of cervical cancers are confirmed when Pap smears that are sent to an off-island laboratory for testing are confirmed to be positive. Suspected breast cancers are identified by an off-island radiologist who is contracted to read Palau's mammograms, and biopsies are performed and sent off-island for confirmation. All women who receive screening are captured in the BCCEDP database and this includes those who are found to have cancer. No other breast and cervical cancer screening is performed outside of BCCEDP, therefore all breast and cervical cancer screenings are captured in the BCCEDP database.

Participants

All women diagnosed with breast and/or cervical cancer in Palau between 2004 and 2013 were included in this study.

Data Variables

The following variables were extracted: patient identification number, date of diagnosis, primary site of cancer, sex of patient, age of patient, method of cancer detection, and date of death. The databases used were the Cancer Registry Database at the Non-Communicable Disease Unit (NCDU), Bureau of Public Health (BPH), Palau Ministry of Health (MOH) and the BCCEDP database at the NCDU, BPH, Palau MOH. Stage of cancer was captured from the patient's medical record that is updated when a patient returns from off-island treatment. Cancer staging is done off-island if a patient is referred outside of Palau, although some cancers can be staged in Palau. However, there were cases that didn't have any information on staging. Data from the Cancer Registry database and the BCCEDP database were extracted according to the years of study and imported into an Excel spreadsheet. We cross-checked both datasets to identify cases of cancer that were detected through BCCEDP. All other cancers were considered to be clinically diagnosed for the purpose of this study.

Analysis and Statistics

Cleaned data were imported into an Excel spreadsheet and were assigned identification numbers. Epi Info 7 Software (CDC, Atlanta, GA) was used to calculate proportions and a survival analysis was done with the statistical software R (version 3.1.2, R Core Team, Vienna, Austria).[11] Survival was defined as the time between date of diagnosis and death, or as at the end of the study period if the woman was still alive. The chi square test was used to compare differences in proportions and the Wilcoxon test was used to compare differences in survival outcomes. The level of significance for both tests was set at $P<.05$.

Ethics Approval

Permission for this study was first obtained from the Public Health management at Palau MOH, and then from the Palau Institutional Review Board and the Ethics Advisory Group, International Union against Tuberculosis and Lung Disease, Paris, France.

Results

Figure 1 shows the number of each type of cancer by year. There were 45 women diagnosed with breast or cervical cancer in the Republic of Palau during the years 2004-2013. Of these, 27 (60%) were diagnosed with breast cancer and 18 (40%) were diagnosed with cervical cancer. There was a mean of 3 breast cancer cases and 2 cervical cancer cases diagnosed annually during this time period.

Table 1 presents the number of screenings performed in Palau by BCCEDP from 2004-2013. Overall, a total of 9367 Pap smears, 8423 clinical breast exams, and 2174 mammograms were performed during this ten year study period. Annual average number of screenings decreased dramatically from the earlier time period (2004-2008) (1188 Pap smears, 1143 clinical breast exams, 362 mammograms) to the later time period (2009-2013) (686 Pap smears, 542 clinical breast exams, 73 mammograms).

Table 2 presents characteristics of women diagnosed with breast or cervical cancer in Palau from 2004-2013. Overall, the majority of breast or cervical cancer cases were among Palauan women (87%) and among women aged 35-65 (69%). Most cancers were detected clinically (84%) rather than by screening, and almost half of all cancers were diagnosed at Stage 4 or higher (44%). Over one-third of women diagnosed with breast or cervical cancer survived less than one year (36%).

Table 3 shows the number and proportion of cases detected by screening and by clinical methods from 2004-2013. There were more cancer cases detected through screening (26%) in the earlier time period (2004-2008), as compared to those diagnosed through screening (8%) in the later time period (2009-2013), though this difference was not statistically significant ($P=.09$).

Table 4 shows the stage of cancer when the women were diagnosed. The proportion of breast and cervical cancers diagnosed at earlier stages (0-3) decreased between 2004-2008 and 2009-2013, from 42.1% to 23.1%, however this was not a statistically significant finding (*P*=.31).

Table 5 shows the length of survival of women diagnosed with breast and cervical cancer. A greater proportion of women who were diagnosed between 2004-2008 lived longer than 2 years (58%), than women who were diagnosed between 2009-2013 (39%). However, this difference was not statistically significant (*P*=.23). Figure 2 shows the survival pattern for all women in the study, regardless of detection method, and highlights the poorer survival outcomes for cervical cancer. Overall, women with cervical cancer had a significantly shorter survival time after diagnosis than women with breast cancer (*P*=.04). Figure 3 shows survival time for those women whose cancer was detected by means other than the screening program (N=38). The poor survival outcomes for cervical cancer, compared to breast cancer are even clearer among this group *(P*=.0012).

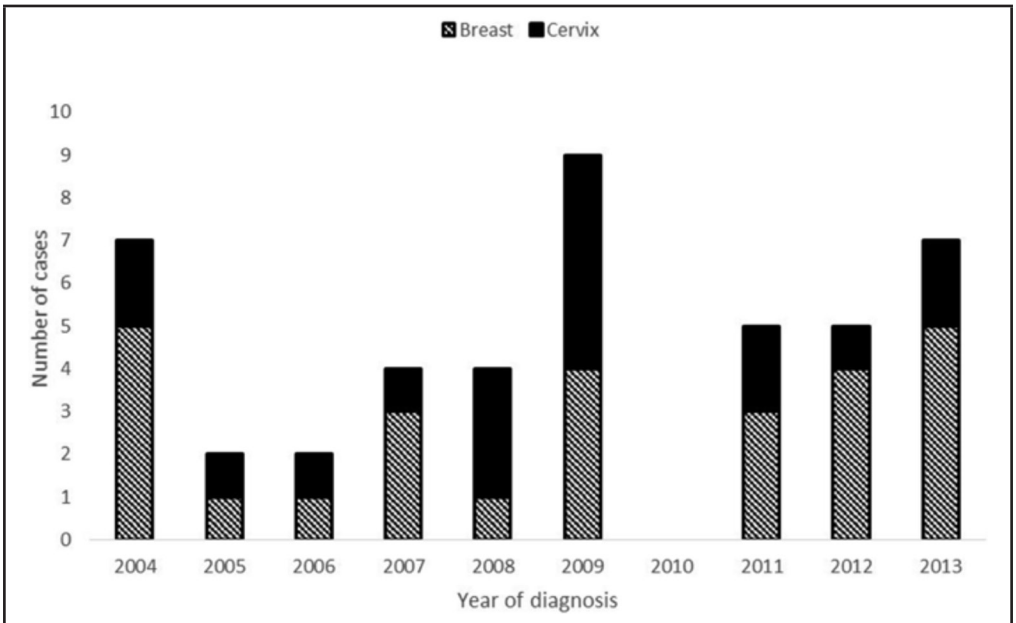

Figure 1. Number of breast and cervical cancer cases by year of diagnosis in Palau, 2004-2013

Table 1. Number of annual female screenings performed in Palau, 2004-2013

Year	Pap Smear	Clinical Breast Exam	Mammogram	Total
2004	1647	1582	563	3792
2005	1103	1070	409	2582
2006	1002	976	261	2239
2007	1174	1131	311	2616
2008	1012	954	266	2232
2009	839	546	254	1639
2010	892	761	1	1654
2011	783	607	14	1404
2012	388	298	29	715
2013	527	498	66	1091
Total	9367	8423	2174	19,964

Table 2. Demographic characteristics of women diagnosed with breast or cervical cancer screening in Palau, 2004-2013

	2004-2008, n (%)	2009-2013, n (%)	Total, n (%)
Site of Cancer			
Breast	11 (58)	16 (62)	27 (60)
Cervix	8 (42)	10 (38)	18 (40)
Method of Diagnosis			
Clinical	14 (74)	24 (92)	38 (84)
Screening	5 (26)	2 (8)	4 (17)
Stage of Diagnosis*			
0 or 1	7 (37)	3 (12)	10 (22)
2 or 3	1 (5)	3 (12)	4 (16)
4+	8 (42)	12 (46)	20 (44)
Unknown	3 (16)	8 (31)	11 (24)
Survival Time			
<1 year	6 (32)	10 (38)	16 (36)
1-<2 years	1 (5)	0 (0.0)	1 (2)
2+ years	10 (53)	10 (38)	20 (44)
Age Group			
20-<35	3 (16)	2 (8)	5 (11)
35->50	8 (42)	7 (27)	15 (33)
50-<65	5 (26)	11 (42)	16 (36)
65+	3 (16)	6 (23)	9 (20)
Ethnicity			
Palauan	18 (95)	21 (81)	39 (87)
Non-Palauan	1 (5)	5 (19)	6 (13)
Total	19 (42)	26 (58)	45 (100)

Table 3. Breast and cervical cancer cases by method of detection and time period of diagnosis in Palau, 2004-2013.

Time Period of Diagnosis	Detection Method		Total n (%)	*P*-value
	Clinical (not screened) n (%)	Screening n (%)		
2004-2008	14 (74)	5 (26)	19 (100)	.09
2009-2013	24 (92)	2 (8)	26 (100)	
Total	38 (84)	7 (16)	45 (100)	

Table 4. Stage of breast and cervical cancer cases by time period of diagnosis in Palau, 2004-2013

Year Group of Diagnosis	Stage of Cancer			Total, n (%)	*P*-value
	0-3, n (%)	4+, n (%)	Unknown, n (%)		
2004-2008	8 (42)	8 (42)	3 (16)	19 (100)	.31
2009-2013	6 (23)	12 (46)	8 (31)	26 (100)	
Total	14 (31)	20 (44)	11 (24)	45 (100)	

Table 5. Length of breast and cervical cancer survival by time period of diagnosis in Palau, 2004-2013				
Year Group of Diagnosis	Length of Survival at Two Years		Total, n (%)	*P*-value
	0-<2 Years, n (%)	2 Years or More, n (%)		
2004-2008	8 (42)	11 (58)	19 (100)	.23
2009-2013	16 (62)	10 (39)	26 (100)	
Total	24 (53)	21 (47)	45 (100)	

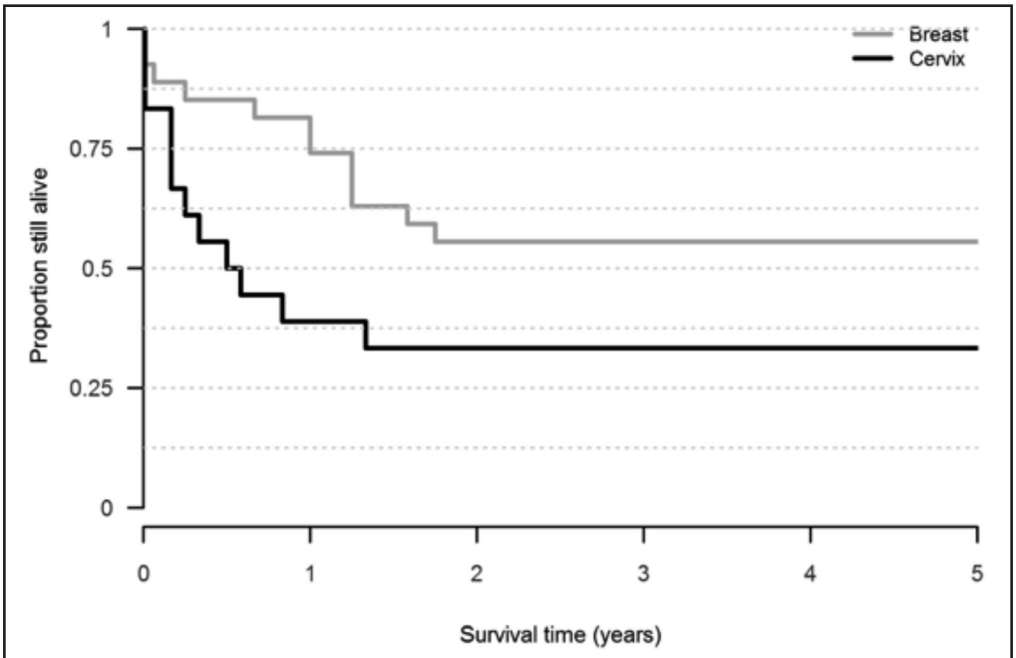

Figure 2. Survival time after diagnosis for 45 women diagnosed with breast and cervical cancer (includes those diagnosed by both screening and clinical methods only) in Palau, 2004-2013

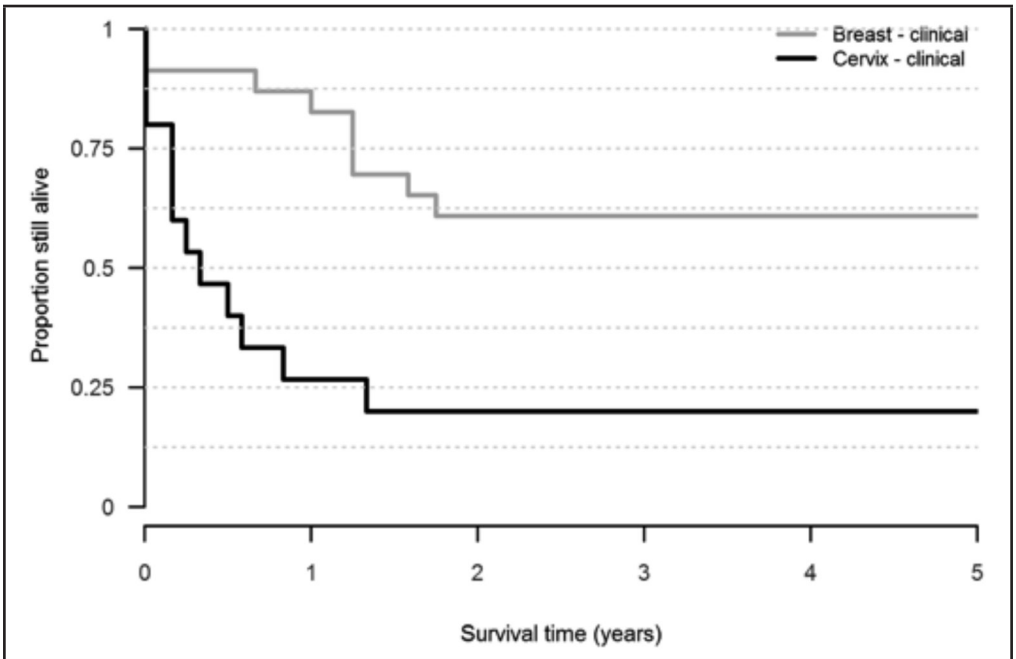

Figure 3. Survival time for women diagnosed clinically with breast and cervical cancer in Palau 2004-2013 (n = 38)

Discussion

This was the first evaluation of the Palau BCCEDP since its establishment in 1997, almost twenty years ago. Our results failed to show improvement over the study period in our outcome measures despite efforts to promote early screening of women for breast and cervical cancer. Only one in six women diagnosed with breast or cervical cancer was detected through screening, which is disappointing. However, it was clear that screening rates have decreased over time in Palau. When comparing our two time periods there was no significant difference in the proportion detected through screening, stage of cancer at diagnosis, or survival at two years. In fact, the proportion of cases detected through screening actually decreased, although this was not significant. Our findings also highlight that the timely diagnosis and care of these cancers remains problematic in the Palauan context. This seems to be particularly important for cervical cancer where outcomes were worse. It should be acknowledged that cancer incidence and outcomes may be strong predictors of socio-economic disparity in the Pacific context, therefore the findings in this study are of particular concern.

One of the main strengths of this study is that we used two national databases. Data used were from the Palau Cancer Registry which is a nationwide population based registry. The registry staff have close and regular contact with the single national hospital and all health care providers in the nation. Also, reporting of all diagnoses of cancer is mandated by law, so it is likely that few, if any diagnosed cases are missing from the registry. Since the BCCEDP is the only program of its kind in Palau, we also have a complete picture of the extent and results of screening in the nation. Another strength is that the study adhered to the Guidelines for STrengthening the Reporting of OBservational studies in Epidemiology (STROBE).[12]

Our study does have some limitations. Due to the lack of access to diagnostic technology in Palau, there may be women who died with undiagnosed cancer that should have otherwise been detected, and therefore were not included in our study. For the same reason, the staging of disease may be unclear or not accurate in some cases. Some women with cancer could potentially be missing from the registry if they self-refer for diagnosis. However, this is very uncommon in Palau as overseas medical care is expensive and the universal health insurance in Palau which covers off-island medical referrals does not cover costs for people who self-refer. Also, cancer screening in Palau is free and accessible as previously mentioned, so there is little incentive for a woman to receive cancer screening off-island. If these women opt to pay for treatment out-of-pocket after diagnosis in Palau, they will still be in the Palau cancer registry and as much information as possible is abstracted from off-island medical records. Finally, and infrequently, the registry may not be updated with all available medical information. There have not yet been any studies done on the Palau cancer registry to determine the completeness of the data. These potentially missing data may have affected our results and ability to find significant differences, though health care conditions were consistent throughout the study period, so comparison of our time periods should still be valid. Additionally, staging information is missing on many of the diagnosed cancers which is a reflection of the limited medical technology available in Palau. Unknown staging appears to increase in the later time period likely due to the increased number of clinically diagnosed cancers which are often diagnosed in later stages than cancers diagnosed via screening and specimens are not always shipped off-island for these very advanced cancers. In addition, we reported small numbers of incident cases in our study and findings that were not statistically significant. As is the case in many Pacific Island settings, small overall numbers of patients may limit the ability to achieve statistical significance.

It should be noted that there was an abrupt decline in mammograms from 2009 to 2010. This decline is due to maintenance issues with the only mammography machine in Palau. The machine was in need of repair and there was no one on-island who was qualified to maintain and/or repair the machine, and replacement parts were difficult to get. Therefore the machine was almost entirely inoperable for years. However, The Palau BCCEDP worked with CDC and was able to get funding to purchase a new mammography unit in September 2012.

One possible reason for our findings of low screening coverage and a decreasing number of screenings performed annually, could be we are not doing a sufficient job reaching the target population. This possibility should be investigated further. Possible reasons for poor coverage may be that women could still be unaware of the benefits of early screening and are therefore not accessing it. Alternatively, women may feel uncomfortable with the screening providers, and, due to the fact that breast and cervical cancer screening is highly personal, some women may not be comfortable receiving a physical examination or providing a medical history. This may be especially true in a small population like Palau, where anonymity is difficult.[3] A more tailored and culturally-adapted screening program could help to improve breast and cervical cancer screening rates in Palau.[13] Qualitative research about knowledge, attitudes, and behavior would be highly beneficial to the development of these programs.[14,15]

Additionally, barriers to treatment in Palau may result in women dying early after diagnosis. Cancer treatment is not available on-island, off-island referrals are not always available for patients, and some patients opt not to treat because they do not want to leave Palau when ill. All these could potentially contribute to the poor survival demonstrated in our data. Also, Palau does not have a cancer survivorship program or any other forms of support for cancer patients after their diagnosis, which may also result in women dying early after diagnosis, thus further contributing to poor survival rates found in this study.

Finally, some women may not utilize screening programs in Palau due to lag time in receiving results. Sometimes, especially in the early stages of the BCCEDP there were long delays in women receiving their test results. All diagnostic tests are shipped to laboratories outside of Palau and mammograms are only read every three months. The delay of test results as well as difficulties with follow-up may have affected the confidence of women in the effectiveness of the services, thus negatively impacting our screening rates.

Comparison with Previous Studies

As far as we know there have been no similar studies conducted to assess screening programs in the US Affiliated Pacific Islands.

Implications

The screening program has not shown substantial improvement over the years and there is a need to discuss the problem with Ministry of Health officials. To more fully understand the reasons for these findings a number of actions need to be taken. To start, it would be useful to review screening coverage rates on a regular basis and set targets. This would involve an initial in-depth analysis of the BCCEDP database to determine coverage rates among target age groups to identify those who are being missed. Also, it would be helpful to evaluate the health promotion and advocacy activities around breast and cervical cancer screening in Palau and develop more effective, evidence-based strategies. Efforts to prevent cervical cancer, including prioritizing the country's human papilloma virus (HPV) vaccination program are essential.

Conclusions

In conclusion, we found that despite the measures taken to detect the early onset of breast and cervical cancer in Palau, the proportion of women detected through screening has decreased over time and survival outcomes remain poor. This is likely due to the fact that overall number of female cancer screenings has decreased over time in Palau.

As cervical cancer is ranked as the 8th leading cause of death among women in the Pacific Islands,[16] options to increase timely detection of these cancers should be explored. From this study, it is evident that Palau needs to evaluate its current breast and cervical cancer screening efforts to strategize ways to increase screening rates among women in target age groups, improve timeliness of screening results and follow up among those women screened, and provide further support for treatment and survivorship programs in order to improve survival of these cancers among women in Palau.

Acknowledgments

This publication was partially supported by the Grant or Cooperative Agreement Number, 5 NU58DP003939, funded by the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services.

This research was conducted through the Structured Operational Research and Training Initiative (SORT IT), a global partnership led by the Special Programme for Research and Training in Tropical Diseases at the World Health Organization (WHO/TDR). The model is based on a course developed jointly by the International Union Against Tuberculosis and Lung Disease (The Union) and Medécins sans Frontières (MSF/Doctors Without Borders).

The training was run in the South Pacific by the International Union Against Tuberculosis and Lung Disease (The Union) and the Public Health Division of the Pacific Community (SPC), New Caledonia.

Additional support for the course was provided by the School of Population Health, The University of Auckland, New Zealand; the Research Unit, College of Medicine, Nursing and Health Sciences, Fiji National University; Regional Public Health, Hutt Valley District Health Board, New Zealand; University of Melbourne, Australia; The Victorian Tuberculosis Program, Melbourne; Australian National University; Pacific Island Health Officers' Association.

Funding

Funding for the course was provided by The Union and SPC.

Conflict of Interest

None of the authors identify a conflict of interest.

Authors' Affiliations:
- Department of Public Health, Ministry of Health, Republic of Palau (IMT, TU, EI)
- Regional Public Health Service, New Zealand (CR)
- Research School of Population Health, Australian National University (KV)
- Pacific Island Health Officers Association, Honolulu, HI, (HLC)

Correspondence to:
Irish M. Tutii; Non Communicable Disease Unit, Ministry of Health, P.O. Box 1292, Koror, Republic of Palau; Email: irish.tutii@palauhealth.org

References

1. Population Census. Republic of Palau. Available at: http://palaugov.pw/executive-branch/ministries/finance/budgetandplanning/population-census/. Accessed August 18, 2016.
2. MOH Annual Report 2014. Available at: http://www.palauhealth.org/files. Accessed August 20, 2016.
3. Committee Opinion No. 624. *Obstetrics & Gynecology*. 2015;125(2):526-528. doi:10.1097/01.aog.0000460763.59152.9e.
4. Robison S, Dietrich C, Person D, Farley J. Ethnic Differences in Survival among Pacific Island Patients Diagnosed with Cervical Cancer. *Gynecologic Oncology*. 2002;84(2):303-308. doi:10.1006/gyno.2001.6518.
5. Centers for Disease Control and Prevention. Cancer screening tests. Available at: https://www.cdc.gov/cancer/dcpc/prevention/screening.htm. Accessed on July 19, 2017.
6. Centers for Disease Control and Prevention. Engaging, building, expanding: An NBCCEDP partnership development toolkit. 2011. Atlanta, United States of America: Centers for Disease Control and Prevention.
7. Centers for Disease Control and Prevention. National Breast and Cervical Cancer Early Detection Program (NBCCEDP). Available at: www.cdc.gov/cancer/nbccedp/. Accessed on Aug 21, 2016.
8. Palau National Code (PNC 34). Public Health, Safety, and Welfare. §333 Medical Referral. Available at: www.palaulegal.org. Accessed on August 21, 2016.
9. Cancer Registry Act. August 1999. Available at: https://palaulegal.org/rppls-2/rppls-5th-oek/5-30-to-5-39/rppl-no-5-33/. Accessed August 18, 2016.
10. Regional Cancer Registry. Available at: http://www.pacificcancer.org /programs/pacific-regional-central-cancer-registry.html. Accessed on August 20, 2016.
11. R Core Team (2014). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available at: http://www.R-project.org/. Accessed August 19, 2016.
12. STROBE guidelines. Available at: http://www.strobe-statement.org/?id=available-checklists. Accessed August 22, 2016.
13. Gotay CC, Banner RO, Matsunaga DS, Hedlund N, Enos R, Issell BF, DeCambra H. Impact of a Culturally Appropriate Intervention on Breast and Cervical Screening among Native Hawaiian Women. *Preventive Medicine*. 2000;31:529-537.
14. Balajadia RG, Wenzel L, Huh J, Sweningson J, Hubbell FA. Cancer-related knowledge, attitudes, and behaviors among Chamorros on Guam. Cancer Detection and Prevention. 2008;32(Suppl 1):S4-15.
15. Wu L, Colby E, Iongi-Filiaga A, Maskarinec GG. American Samoan Women's Health: Experiences and Attitudes toward Breast and Cervical Cancer Screening. *Hawaii Med J*. 2010;69(6Suppl3):17–20.
16. Obel J, Souares Y, Hoy D et al. Systematic Review of Cervical Cancer Incidence and Mortality in the Pacific. *Asian Pacific Journal of Cancer Prevention*. 2014;15(21):9433-9437. doi:10.7314/apjcp.2014.15.21.9433.