

Cervical Cancer Screening in the United States–Affiliated Pacific Islands: Options and Opportunities

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Screening in the US Territories Pacific Island Jurisdictions

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GOALS

The aims of this article were (1) to educate health professionals interested in women's health and cancer prevention about the challenges of applying the standard US mode of cervical cancer screening in sparsely populated, geographically remote areas with unique cultural, economic, and sociopolitical environments and (2) to inform government agencies of accepted screening and management options that may offer these areas greater success in reducing the burden of disease in a resource-appropriate fashion.

INTRODUCTION

In countries where cytology-based programs have been successfully implemented, a 50% to 90% reduction of cervical cancer rates has been observed.¹ Although cervical cancer screening using cytology has been very effective in the United States as a whole, this approach does not reach the same proportion of women, nor has it achieved the same level of cancer prevention in the United States–Affiliated Pacific Islands (USAPI). Cervical cancer screening programs, such as those based on cytology, in which multiple clinical visits are required for diagnosis and treatment of abnormal results, are rendered ineffective by limited access, difficulties in processing, and complexities of follow-up. Consequently, the burden of cervical cancer is alarmingly high in America's Pacific Islands. The attendant mortality is also high, with a higher prevalence of cases diagnosed at a later stage where survival rates are lower. To build an effective cancer prevention strategy in this environment, screening strategies other than cytology should be considered. Ultimately, this can provide a stronger base for a comprehensive strategy that must also include immunization and cancer registries.

After World War II and during the nuclear weapons testing of the early postwar years, the United States created a strategic trust to enhance its military advantage in the Pacific. Upon dissolution of the various trusteeship agreements, the Northern Mariana Islands chose to become a US Commonwealth (Commonwealth of the Northern Mariana Islands [CNMI]), and Compacts of Free Association was established with the newly independent nations of the Federated States of Micronesia (FSM), Republic of the Marshall Islands (RMI), and the Republic of Palau. Guam became a US territory in 1898, and the Guam Organic Act of 1950 conferred US citizenship on Guamanians and established the territory's government.² American Samoa had become an unincorporated US Territory in 1900³ and adopted its own constitution in 1960; its citizens are considered US nationals. The Flag Territories (Guam and American Samoa) and Commonwealth (CNMI) are considered US soil, and their residents have US passports and nonvoting representation in the US Congress. The Freely Associated States (FAS)—FSM, RMI, and the Republic of Palau—are sovereign nations with their own passports, except

Objective: Successful cervical cancer screening in the United States–Affiliated Pacific Islands (USAPI) is limited by geographic, political, economic, and logistic factors. An expert panel convened to examine screening in each of the 6 island jurisdictions and to explore options beyond cytology-based screening.

Materials and Methods: Forty-one representatives of American Congress of Obstetrics and Gynecology, American Society for Colposcopy and Cervical Pathology, government agencies, the World Health Organization, Pan American Health Organization, health representatives of the 6 Pacific island jurisdictions, Puerto Rico, and several academic institutions met in a 2-day meeting to explore options to improve access and coverage of cervical cancer screening in the USAPI.

Results: Cytology-based screening is less widely accessed and less successful in the USAPI than in the United States in general. Barriers include geographic isolation, cultural factors, and lack of resources. Cytology-based screening requires multiple visits to complete the process from screening to treatment. Screen-and-treat regimens based on visual inspection with acetic acid or human papillomavirus requiring 1 or 2 visits have the potential to improve cervical cancer prevention in the USAPI.

Conclusions: The standard US algorithm of cytology screening followed by colposcopy and treatment is less effective in geographically and culturally isolated regions such as the USAPI. Alternate technologies, both high tech, such as primary human papillomavirus screening, and low tech, such as visual inspection with acetic acid, have shown promise in resource-poor countries and may have applicability in these US jurisdictions.

Key Words: cervical cancer screening, screen and treat, US Affiliated Pacific Islands, HPV, VIA

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that the United States provides military protection and governs access into their ports and air space. The Flag Territories and FAS, together referred to as the USAPI, are populated by little more than 500,000 people who live on more than 300 small islands and atolls spanning millions of square miles of ocean and crossing 5 Pacific time zones (see Figure 1).

The US government, under the terms of the Amended Compacts of Free Association Treaties with the individual FAS,^{4,5} provides funding for infrastructure support in health and other sectors. The Compact funding, although austere and declining, helps support health systems in the FSM and RMI.⁶ The Compacts of Free Association also grants eligibility for many, but not all Federal services, programs and grants. Most of the 6 island jurisdictions support cervical cancer screening using Title X Family Planning and Maternal Child Health program grant funds. All but the FSM and RMI receive funding from the Centers for Disease Control and Prevention (CDC) National Breast and Cervical Cancer Early Detection Program (NBCCEDP).⁷ The people of the Flag Territories and Commonwealth are eligible for Medicare and a limited form of Medicaid; those living in the FAS are not. The main provisions of The Affordable Care Act do not apply to the US territories. The Affordable Care Act does not apply to the FAS, and the mandated coverage provision, guarantee of essential health benefits, and provision of federal subsidies have been waived in the Flag Territories.⁸

Cytology remains the principal cervical cancer screening method in the USAPI. Screening rates are, however, low. Although 31% of mainland Title X recipients received a cervical cytology in 2011, only 11% of USAPI women did so and only 5% of eligible women were screened in the FSM.⁹ A 2009 CNMI survey modeled after the CDC's Behavioral Risk Factor Surveillance System survey reported that only 30% of CNMI women had a cervical cytology within 1 to 3 years. In Palau's 2012 Behavioral Risk Factor Surveillance System, only 47% of women reported having

had a cervical cytology within the previous 3 years. By contrast, a composite of 3 surveys from the mid-1990s reported that 82% of US women, who had not had a hysterectomy, received a cervical cytology test within the previous 3 years.¹⁰ Before 2007, reporting of accurate cancer rates in the USAPI was limited by a lack of coordination between hospital-based and public health systems and the absence of standardized disease registries. In response to a regional cancer registry assessment completed in 2005,¹¹ the CDC National Program of Cancer Registries provided funding to the University of Hawaii to establish, develop, and implement the Pacific Regional Central Cancer Registry, which includes cancer registries in each USAPI jurisdiction and regionally. Between 2007 and 2012, 155 cases of invasive cervical cancer were documented with an age-adjusted incidence rate of 19.6 cases per 100,000 (Pacific Regional Center Cancer Registry).¹² The total number of invasive cervical cancer cases does not include complete capture, especially from the CNMI and Chuuk, which are in the process of entering backlogged data. Nevertheless, the adjusted USAPI rate remains twice as that of the overall US rate of 9.9, which reflects approximately 12,000 cases a year.¹³ The incidence rates were highest in the RMI with an incidence rate of 70.0 per 100,000. The mortality from cervical cancer in the Marshall Islands is very high, with 48% of women diagnosed with cervical cancer who died within 7 years. Of those who died, 83% of women died within a year of diagnosis. Of cancers diagnosed throughout the USAPI, only 26% were diagnosed at early stage.¹²

There are social and political challenges to effective, sustainable, resource-appropriate, and culturally appropriate high-quality cervical cancer screening in the USAPI. Poverty and lack of education as well as localized belief systems and cultural values accompanying geographic isolation may contribute to low health literacy related to cancer screening. For example, 61% of American Samoa residents live below the poverty level.¹⁴ The Gross Domestic Product per capita of the FSM in 2014 was

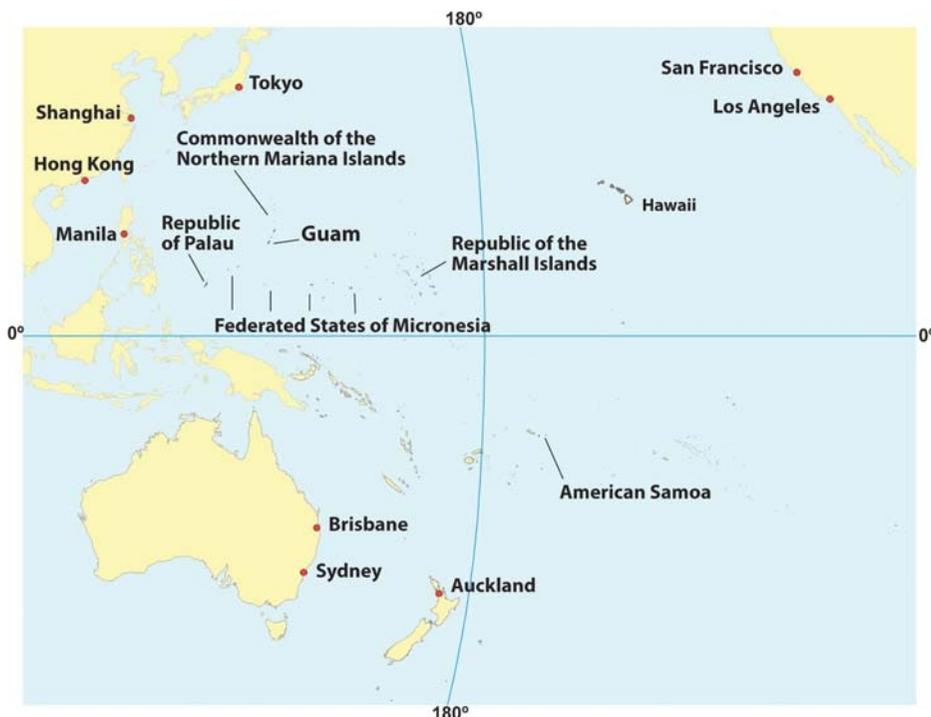


FIGURE 1. Map showing location of US-Affiliated Pacific Island jurisdictions.

\$3,200,¹⁵ in comparison with the US Gross Domestic Product of \$54,800.

Political factors influence the success of cervical cancer screening programs. Political diversity, unique and complex political interdependence, and variability in political relationship to the United States contribute to inequalities in resources. Lack of durable health policies with changing governments and an international workforce also challenge the implementation of effective screening. These factors add to the challenges in establishing a well-functioning health care delivery infrastructure. Technology options are limited, and health information systems and data collection in these jurisdictions are problematic.

METHODS

Recognizing the limited success of cervical cancer screening in the USAPI, representatives of the CDC Office of International Cancer Control, Division of Cancer Prevention and Control, and the Office of Population Affairs (Title X) asked the American Society for Colposcopy and Cervical Pathology and the American College of Obstetricians and Gynecologists (ACOG) to convene an expert panel to explore screening strategies, which might overcome the barriers inherent in cytology-based screening in these geographically remote, culturally diverse, and resource-poor regions. Forty-one representatives of ACOG, American Society for Colposcopy and Cervical Pathology, Government agencies, the World Health Organization (WHO), and the Pan American Health Organization, health representatives of 5 of the 6 Pacific island jurisdictions (American Samoa was represented by conference call), Puerto Rico, as well as several academic institutions including the University of Hawaii, which administers the Pacific Regional Cancer Programs, met on September 9 and 10, 2013 at the headquarters of Pan American Health Organization in Washington, DC (See Appendix, Supplemental Digital Content 1, <http://links.lww.com/LGT/A23>). In February 2015, ACOG published recommendations for cervical cancer screening in low-resource settings on the basis of the deliberations and findings of this expert panel.¹⁶ This present report summarizes the expert panel's findings and its recommendations specifically for the USAPI.

Programmatic Challenges

Decisions about selecting appropriate screening methods in these diverse insular areas must consider that multiple options may be needed within the same jurisdiction on the basis of variations in geography, remoteness, and community acceptability. A sustainable, organized screening system with appropriate quality control and evaluation components should be simple, have few steps, and include resource-appropriate surveillance and treatment algorithms. Selection of screening methods should consider resource-appropriate emerging technologies with known performance characteristics. Program managers should identify and target age groups and populations at greatest risk, while maximizing coverage of the entire eligible population.

Cytology-Based Screening

Cervical cancer screening in those jurisdictions with NBCCEDP funding, i.e., all USAPI except FSM and RMI, is based on current US screening guidelines that use cytology^{17,18} and/or cytology plus human papillomavirus (HPV) testing (cotesting). In 2009 and 2010, respectively, FSM¹⁹ and RMI²⁰ developed their own national screening standards, on the basis of a WHO framework of "core," "expanded," and "desirable" depending on resource level. In both jurisdictions, visual inspection with acetic acid (VIA) is the core screening method and cytology

is either expanded or desirable depending on the resources available to the outer island populations.^{19,20} In the USAPI island communities, cervical cancer screening using cytology-based methods is a primarily opportunistic screening and is less widely accessed and less successful as a strategy than in the United States as a whole.^{21,22} This model is labor intensive and costly and requires an organized follow-up system, maintenance of supplies and equipment, and regular training of staff. The logistics of transportation, physical community outreach, timely communication, and disease management makes the model of cytology and colposcopy impractical for many of these communities. Guam, for example, is located 3,700 miles west southwest of Honolulu and 1,500 miles east of Manila. The one laboratory on the island does not process cytology specimens. All are sent to Honolulu. For several years, cervical cytology tests could not be performed in the FSM, because there was no funding to ship the slides off island. Transportation for women to get to clinics for screening or to take screening to them is a problem throughout the islands. Guam and the CNMI, for example, have no public bus system and cabs are very expensive. As a result, many women hitchhike to clinics for screening.²³ Most women do not have phones, which makes follow-up even more difficult. In RMI and the FSM, the health workers who perform cervical cytology tests travel to the outer islands only sporadically. If urgent follow-up or care is needed, women living on islands within 50 miles of the main hospital may travel by small boat with an outboard motor, but only when weather, tides, and availability of fuel permit. Privacy in small communities where patients and health care workers may be related is an ongoing issue as is resistance of male partners to having their female spouses tested.

There is also difficulty in maintaining adequate, high-quality colposcopy services. Requiring multiple visits to complete the screening-biopsy-treatment process and the costs of off-island transportation to accomplish the several steps in management are highly limiting factors.

Treatment of cervical intraepithelial neoplasia (CIN) may be hindered by the inability to perform loop electrosurgical excision procedures (LEEPs) or the nonavailability of compressed medical grade CO₂ for cryotherapy.

The expert panel recognized that sustainability and success of cytology-based screening in the USAPI depend on several key issues relating to the capacity, reach, and quality of the current programs as well as their financial sustainability. Quality programs must include a reliable means of processing and evaluating cervical cytology and histology specimens, defined metrics and regular evaluation of key process and health outcomes, and the means to train and maintain staff. Equally important, there must be timely communication of results to provider and patients, convenient and affordable transportation and logistic support for outreach and follow-up visits, and a culturally appropriate screening environment.

Visual Inspection With Acetic Acid (Screen and Treat)

An alternative to cytology, widely used in resource-poor countries, is visual inspection with dilute 3% to 5% acetic acid (VIA), which is currently used in the FSM and RMI. It is not, however, reimbursable by the NBCCEDP or Title X and is performed by systematically examining the cervix through a speculum after it has been bathed for 1 minute with dilute acetic acid. Magnification is usually not used. A positive VIA is defined as the presence of a thick, well-delineated acetowhite lesion abutting or very close to the squamocolumnar junction.²⁴

One important reason that VIA-based screening programs are useful in remote isolated areas such as the USAPI is that its use allows programs to be designed around a single-visit screen-and-treat approach that does not require women to return for multiple visits.²⁵ Cost-effectiveness analysis predicts that the lifetime risk of cervical cancer incidence can be reduced by 25% when 35-year-old women are screened with VIA once in their lifetime.²⁶ At minimum, the materials required for a program include a speculum, a good light source (such as a flashlight, a gooseneck lamp, or light-emitting diode light), vinegar or dilute acetic acid, and an applicator or cotton ball to bathe the cervix with vinegar. Programatically, screening must be linked with treatment access, either at the same visit or soon after if a precancer lesion is identified. "Screen-and-refer" programs are not as effective as "screen-and-treat" programs.^{27–29}

For most women, the high negative predictive value of VIA (>99%)³⁰ lets them know in real time that they do not have visible lesions consistent with precancer or cancer. An added advantage of VIA is that the start-up materials are relatively inexpensive and easy to obtain. Moreover, the procedure can be completed by uniformly trained mid-level health providers (such as nurses and midwives) deployed at the community level.^{31–33} Visual inspection with acetic acid also helps promote the initial setup of referral networks, which can be important as additional technologies, such as HPV testing, are introduced. In addition, patient satisfaction with the single-visit approach is high. Women surveyed report that they appreciate receiving their diagnosis the same day.^{27,28,34}

As with any other intervention, VIA programs have their own set of limitations including the necessity for effective training and supervision of providers and a functional quality assurance approach linked with effective monitoring and evaluation processes. As with any cervical cancer prevention modality, follow-up and quality assurance procedures can be expensive and time demanding, requiring investment costs and manpower effort to ensure effectiveness and reliability of the program.

Despite its tangible benefits, VIA also has some significant limitations. The most important limitation is that it is a relatively subjective test. Even experts do not always agree on what is a positive VIA. Sensitivity is highly variable with sensitivity ranging from 61% to 91%.³⁰ Another concern is that to keep sensitivity high, quality assurance programs, which are likely to be labor, time, and cost prohibitive, must be in place.^{29,35}

Visual inspection with acetic acid compares poorly with HPV-based testing. A study by Denny et al.³⁶ evaluated cumulative detection of CIN 2+ for 3 years of follow-up. The HPV arm had a 73% reduction of cancer precursors compared with VIA with a 32% reduction.

The expert panel affirmed that VIA with cryotherapy provided as a screen-and-treat approach should have a role when cytology-based screening is not feasible or practical. This is particularly true for the geographically isolated and remote areas of USAPIs.

As with all cervical cancer screening programs, screen-and-treat VIA programs are inherently associated with overtreatment; 1 of 10 women with a positive VIA result has true precancer lesions. Two recent meta-analyses reported the sensitivity to detect CIN 2+ to be 70% to 80% with VIA.^{37,38} A meta-analysis of 11 studies reported the positive predictive value of a single VIA test to be 11.6% (CI = 8.1%–15.1%).³⁰ These performance parameters compare favorably with the cervical cytology test. In countries where morbidity and mortality from cervical cancer are high, some level of overtreatment might be acceptable, i.e., treatment in cases of false-positive result, particularly with the use of cryotherapy, which has only minimal discomfort and low morbidity.

Success rates up to 3-year postcryotherapy for eradicating CIN 3 have been reported at 70%.³⁹ Cryotherapy in selected patients presents an excellent balance of effectiveness, safety, and minimal complications both immediate and long term. A limitation of VIA see-and-treat regimens with cryosurgery discussed by the expert panel is the episodic nonavailability of medical grade refrigerant gas (N₂O or CO₂) in some of the island jurisdictions. New technologies for treatment that could be explored for low-resource settings include cold coagulation and newer cryotherapy devices.⁴⁰

It is important to note that for screen-and-treat programs, approximately 12% of VIA positive women will not be eligible for cryotherapy because their lesions are too large (>75% of the cervix) or extend into the cervical canal or onto the vagina.⁴¹ Additional women will have findings suspicious for cervical cancer. It is therefore vital that VIA screen-and-treat programs include a referral option for women requiring biopsy, LEEP, cold knife conization, or treatment for invasive cancer.

Screening With HPV DNA

An expanding body of literature supports HPV testing as a primary screening test for cervical cancer. In 1 prospective, cluster randomized study in rural India, a single round of HPV testing, was superior to VIA and cervical cytology.⁴² Human papillomavirus testing was shown to decrease cervical cancer deaths by approximately 50%, and cervical cancer was diagnosed at an earlier stage in the HPV testing group. Moreover, there was no significant difference in mortality among the VIA, cytology, and control groups. Researchers in many countries in Western Europe, North America, and Australia with traditional cytology-based screening programs have conducted clinical trials comparing cervical cytology with HPV testing. Australia has recently implemented primary HPV testing starting at the age of 25 years. The Food and Drug Administration (FDA) recently approved a single proprietary HPV test using a specific algorithm for primary screening in the United States. The algorithm triages patients to colposcopy on the basis of the presence of HPV types 16 or 18, with cytology triage for women positive for 12 other high-risk types.⁴³ The FDA approved approach is not currently available in the USAPI, and the requirements for triage with cytology invalidate its value in a screen-and-treat setting such as the USAPI.

A rapid turnover point-of-care HPV test could have a great potential in settings such as the USAPI. If such a test was effective and inexpensive and could be performed without extensive infrastructure, it would lend itself well to a see-and-treat approach. There are currently multiple investigators and several companies working on this approach, and one such test is already available in some parts of the developing world.^{44,45}

There are several practical advantages to an HPV-based screening algorithm. These include (1) greater sensitivity in detection of both squamous and glandular preinvasive disease than cytology,^{43,46–50} (2) higher negative predictive value than cytology with a large majority of women older than 30 years testing negative,⁵¹ (3) isolation of HPV nucleic acids that would allow genotyping, and (4) longer screening intervals after negative screening.⁵¹ A pooled analysis of 4 European clinical trials of cotesting with cytology plus HPV screening was recently published.⁵² The authors found that HPV-based screening provided 60% to 70% greater protection against invasive cervical cancer than cytology alone. This pooled analysis involved more than 1 million person-years of observation in 2 rounds of screening. Previous studies have shown that the cytology component of cotesting adds little to the relatively high sensitivity provided by HPV testing alone.^{53,54} The pooled analysis also confirms the

high negative predictive value of HPV testing. In other words, women with a negative HPV test are highly unlikely to have cervical neoplasia including cervical cancer. A regimen of HPV testing and treatment with cryotherapy has also been shown to reduce the risk of CIN 3 or worse more effectively than VIA and cryotherapy.³⁶ The higher sensitivity and negative predictive value of HPV testing compared with cytology are offset by a lower specificity with the inherent risk of overtreatment. This has led some to recommend the use of an intermediate triage test such as VIA, cytology, or colposcopy before treatment. Direct data on this approach are lacking. The WHO pointedly does not state a preference of a screen-and-treat regimen with HPV alone versus HPV with VIA triage. They point to the reduction in cancer inherent in an HPV-based screen-and-treat regimen without a secondary triage test. They observe, however, the lack of data on the performance of VIA in the setting of a positive HPV screen and note the negative impact of adding a secondary triage that requires an additional visit, additional costs, and logistic support.⁵⁵ The relative performance of VIA or another intermediate test as triage for women screening positive with high-risk HPV is an important area for future research.

An opportunity for overcoming logistic and cultural barriers to screening in remote settings such as the USAPI would be afforded by offering self-collection of HPV test samples. Self-collected samples have a similar HPV detection rate as clinician collected samples.⁵⁶ The sensitivity of self-collected sampling is comparable with cytology and is almost as high as physician collected, yet with a similar specificity.⁵⁷

Self-sampling can be conducted in private and has been found acceptable to women in different settings.⁵⁸ Women in these studies came from varied populations in Mexico, Argentina, and the Mississippi Delta of the United States.⁵⁹⁻⁶¹ Self-collected

sampling overcomes several common barriers to screening; it is less embarrassing and less uncomfortable. The risk of stigmatizing those women testing positive on a self-sampled test and the issues of recall for triage or treatment of patients who are HPV positive will pose programmatic challenges to the use of this technology. In addition, although self-sampling conducted in settings other than a clinic may save the patient the time and expense of traveling to a clinic, screening in other than a clinical setting risks distancing women from the health care system. Members of the expert panel felt that qualitative research with focus groups within the USAPI would be helpful to assess the acceptability of the method among women and providers. Although self-sampling for HPV testing potentially promises increased access to screening and improved coverage in settings such as the USAPI, the technology is not yet widely available and no product is FDA approved.

In summary, clinical trials consistently demonstrate the superior sensitivity of HPV testing as a screening modality. The success of HPV testing in a low-resource setting such as the USAPI will depend on the widespread availability of an inexpensive, clinically validated point-of-service HPV test and the ability to pair treatment with screening to minimize the number of visits. The expert panel was enthusiastic about the potential benefits to the women of the USAPI from the addition of innovative strategies using HPV testing to screen for cervical cancer precursors.

World Health Organization Recommendations

The WHO completed a resource-based hierarchy of recommendations in 2013 for cervical cancer screening and treatment in 1 or 2 visits, i.e., the screen-and-treat approach (see Figure 2).⁵⁵ The evidence-based guidelines were developed considering resource-poor countries where a well-developed high-quality

Decision-making flowchart for programme managers

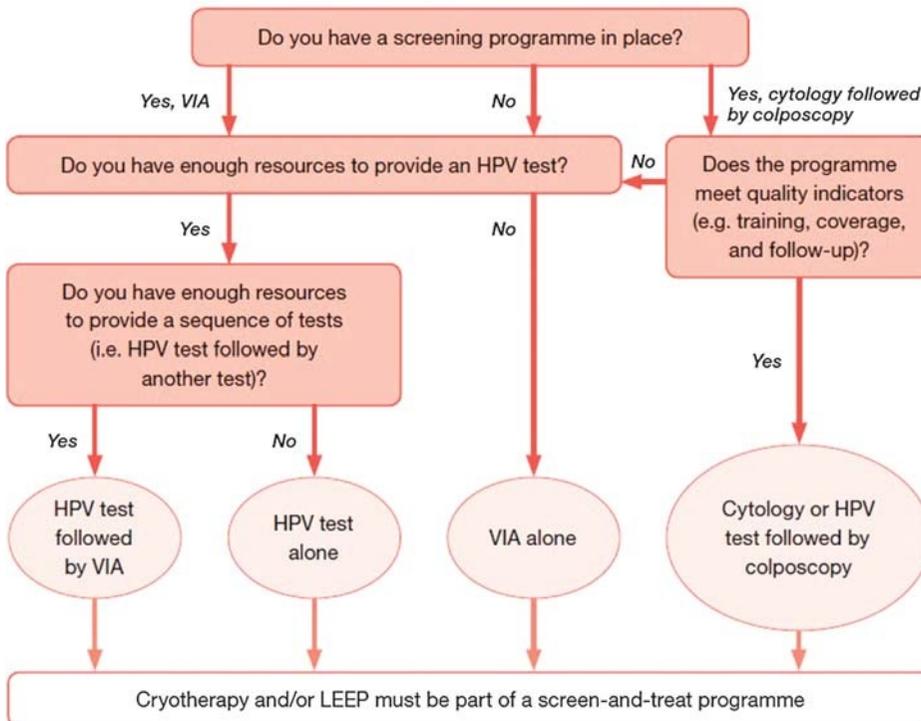


FIGURE 2. The WHO Algorithm for Screen and Treat Strategies. “Decision-making flowchart for programme managers.” Reprinted with permission from World Health Organization.⁵⁵

system of cytology, colposcopy, and pathology is not in place. The WHO recommendations may be very appropriate to consider in the context of the USAPI jurisdictions. The guidelines were developed using the Grading of Recommendations, Assessment, Development, and Evaluation approach for evaluating risks and benefits and document both the strength of recommendation and the quality of evidence for each recommendation. They relied on evidence available in the literature and on the use of modeling to compare different screen-and-treat strategies. The authors comment on the paucity of randomized controlled trials, the criterion standard of evidence. Their guidelines are based on the premise that any of the 3 screening approaches evaluated—cytology, HPV testing, and VIA—are preferable to no screening. Given the lack of randomized controlled trials, all recommendations were ultimately based on weak evidence. A strong recommendation was made favoring VIA and treatment more than cytology with colposcopy triage before treatment. This was largely due to the resources required for the latter. The strength of all other recommendations was “conditional,” i.e., carried the weight of “suggestions” rather than hard recommendations. With the exception of countries with well-developed high-quality systems of cytology, colposcopy, and pathology with appropriate training and quality control already in place, they suggest HPV testing followed by treatment with or without intermediate VIA triage. Where HPV testing is not available, they recommended screening with VIA followed by treatment. They made a strong recommendation against cold-knife cone biopsy as treatment in this context, preferring cryotherapy in those for whom it is appropriate, with LEEP/large loop excision of the transformation zone⁶² for women whose lesions are not appropriate for cryotherapy and referral for those suspected of having cancer. The members of our expert panel strongly recommend considering triage algorithms such as those offered by the WHO in the USAPI.

Recommendations and Research Needs

The challenges presented to cervical cancer control in the US-Affiliated Pacific Island jurisdictions require adaptation of present knowledge and evidence to find suitable strategies for a wide variance in resources, physical environments, and community needs. These remote areas, where transportation, education, environmental characteristics (water crossings, inaccessibility), and low resources exist, challenge us to find innovative ways of reaching women. The continued development of new strategies beyond screening based on cytology will offer a larger set of options from which to choose. These strategies will need to be accessible, reliable, and suitable to both culture and environment. This argues for analysis of each environment of care as well as ongoing research to continue to advance cervical cancer control.

Accessibility

Transportation challenges for people, equipment, and specimens particularly in settings lacking access by roads and scheduled air transport combine to challenge conventional screening in many of these settings. Additional research is needed into systems of screening that can use fewer resources in terms of people and equipment. In addition, the development of rugged testing and treatment equipment that is not dependent on availability of either medical gas or electricity could enhance the treatment of preinvasive disease. Additional research into the efficacy, acceptability, and systems integration of HPV self-testing and rapid point-of-care HPV testing is likely to improve access. The ideal system would link lower technology solutions in the field to centralized laboratory testing in a reproducible, responsive, and sustainable fashion to avoid movement of costly equipment and

enhance quality assurance and assure follow-up care in a timely fashion.

Reliability

Beyond the demonstration of the reliability of a test in the research setting where the temperature, time to testing, and the fragility of the testing substrate are easily controlled, the efficacy of such tests must be demonstrated in the real-world settings of the Pacific Islands. Unpredictable factors such as loss of tests from water damage, delay in use, delay in processing, and rate of turnaround of results all will have direct impact on the success of an intervention. Few screening tests have been adequately evaluated in these environments.

Suitability

It is important that any research to be initiated and strategies to be implemented must be designed with maximum input from and buy-in by the communities to be served. Education and input must extend to the broader community as well as the women to be screened. This will not only help assure that studies and resulting protocols are culturally appropriate but will increase the likelihood of success by attaining community-wide acceptance and trust.

Other areas, which impact suitability, must also be addressed. Initiatives that offer standard cytology testing in the face of inadequate transport, lack of staffing, and prolonged turnaround times lead to harm by offering the potential of screening but at such a low quality that the community loses confidence in the initiative and needed follow-up fails. Research initiatives in remote areas frequently offer spurts of testing with often costly underpinnings that are not sustainable. These also are accompanied by changing requirements for record keeping when even basic record keeping for follow-up is unreliable. There is an ethical mandate for research to fit the needs of the population, collaborate with other entities and researchers, and enhance the development of sustainable strategies rather than solely meeting the needs of the research design or enhancing chances of grant renewal.

Efforts should be judged by their ability to reach the intended populations over time, with follow-up and record keeping (including centralized cancer registries) that is simple and sustainable. Furthermore, record keeping throughout the region would benefit from common requirements, indicators, and dataset maintenance. Capacity building strategies should take precedence even if they limit initial screening start-up. Exploration of community-based participatory associations for screening and health may be helpful in addressing these needs. In addition, coordination within and among islands or the region and among all providers of services including Health Resources and Services Administration, Title X, CDC, and others has the potential to ultimately decrease costs and increase capacity and sustainability.

Future Needs

The implementation of HPV vaccination has the potential to change screening tests and patterns as well as initial treatment of preinvasive disease. How this applies to these challenged care settings needs attention, particularly if implemented variably across the region. Furthermore, emerging technologies for communication and data management, e.g. use of cellular technology, and for diagnosis (simpler on-site testing) are critically important for these settings. Finally, the challenges of education for screening, including self-screening, in remote and widely geographically dispersed settings require new approaches that have still to be fully developed.

CONCLUSIONS

The standard US algorithm of cytology screening followed by colposcopy and treatment as needed is not effective in geographically and culturally isolated regions such as the USAPI. Alternate technologies, both high tech, such as primary HPV screening and low tech such as VIA have shown promise in resource-poor countries and may have applicability in these US jurisdictions.

In the development of cervical cancer control strategies, the dynamic interplay of political systems and relationships, health system funding, and unique aspects of small populations in wide geographic areas challenge economic and quality related to scale. The strategies chosen must be best adapted to the circumstances that result in sustainable and ethical cervical cancer control. Along with the strategies chosen, a solid program for sustainable training, quality control, and a system of tracking and follow-up including regional cancer and screening registries are required. Ultimately, ongoing research into technology and vaccine implementation offers the best long-term hope for ongoing improvements in meeting the challenges of these environments.

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