Cervical Cancer in Developing Countries: Effective Screening and Preventive Strategies

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The members of the committee appointed to examine the project of IMMACULEE MUKAKALISA find it satisfactory and recommend that it be accepted.

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Abstract

The purpose of this paper is to examine cervical cancer screening methods available in developing countries, and to discuss alternative effective methods of screening. Cervical cancer is a preventable and curable disease. However, it continues to threaten the lives of women today. Annual world incidence is an estimated 529,000 and mortality is 275,000. Eighty-five percent of cases and the majority of deaths due to cervical cancer occur in developing countries. Cytology via Papanicolaou (Pap) smear, the golden standard method of screening over the past decades, is not generally a suitable method of screening in low-resource regions. The implementation and sustainability of Pap smear programs have not yet been possible in those countries. Alternative methods have been developed and tested for low-resource countries, including visual inspection by acetic acid (VIA), HPV-DNA, and careHPV-DNA. These screening methods, along with the preventive vaccine, have a greater potential for decreasing the incidence of cervical cancer in developing countries. Nurses play a vital role in educating both health care providers and women in developing countries about the importance of preventive immunization and cervical cancer screening.
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Introduction

Cervical cancer is the most common cancer among women in developing countries (Wright & Kuhn, 2012). According to the World Health Organization (WHO), in 2008 there were 529,000 new cases of cervical cancer, and more than 270,000 women die each year, 85% of them from developing countries (WHO, 2011). Cervical cancer is preventable and often curable if the right interventions are made available to those who are at risk or develop cervical cancer. Studies indicate that preventive strategies to reduce cervical cancer incidence should focus on preventing risk factors. Some of the human factors that have been shown to increase the likelihood of HPV exposure and subsequent development of cervical cancer include: young age at first intercourse, high parity, and multiple sexual partners (Kachroo & Etzel, 2009). Girls in Sub-Sahara Africa as young as 15 years old often engage in sexual and reproductive acts. Their male partners are usually older and often have multiple partners. Data indicates that young girls have lower rates for practice of safe sex; therefore, such behavior increases the risk of cervical cancer and other sexually transmitted diseases (Louie, de Sanjose & Mayaud, 2009). The practice of older men “initiating” young girls into sexual activity is prevalent in some communities in Africa and Asia, increasing the risk to young women who have little or no rights of refusal or ability to practice “safe sex”. Screening and education about screening programs therefore play a vital role in cervical cancer prevention. The successful decrease in the mortality from this disease in developed countries is attributable to effective screening and treatment (Sankaranarayanan, Budukh & Rajkumar, 2001). However, in developing countries, the disease continues to cause thousands of premature deaths among women.

Cytology smears are the gold standard for cervical cancer screening. However, this method has failed to achieve the same results in developing countries as it did in developed
countries. In South American countries such as Chile, Colombia, and Costa Rica, where cytology screening programs have been available since the 1970s and 1980s, there was no decline in the incidence of cervical cancer reported or decrease in mortality rate until after the 1990s. Studies indicated that the failure of effective diagnosis in the 1970s and 1980s was attributable to low quality cytology smears (Sankaranarayanan, Budhuk & Rajkumar, 2001). Workers with inadequate knowledge and sample collection skills produced poor quality specimen and cytology smears. Cervical cancer is preventable and curable if detected early; however, in order to minimize cervical screening barriers in low-resource settings, strategies should be socially and culturally appropriate, and health workers should be knowledgeable about correct procedures (Nene et al., 2007). Few women in developing countries have sufficient knowledge about cervical cancer and cervical cancer screening methods for effective diagnosis.

**Purpose of Study**

The purpose of this paper is to examine cervical cancer screening methods presently used in developing countries, and to discuss effective alternative screening and preventive programs that are available, economically feasible, and culturally suitable for those countries.

**Search Strategies**

The search included journal articles from 2001 until 2013. The search engine of CINAHL was used and eighty-one articles were identified. Search terms included: *cervical cancer, screening, assessment prevention, HPV, Sub-Saharan Africa, developing countries.* After the review of located articles, only 25 met the search criteria for the purpose of this paper, addressing studies done on cervical screening in developing countries as well as on prevention and supportive interventions for effective screening.
Conceptual Model

The Health Belief Model (HBM) is a conceptual framework that helps health care providers understand and influence behavioral factors that impact individual willingness to engage in specific health behaviors (Abotchie & Shokar, 2009). In the past, research has indicated that the model is useful to determine the factors that might positively or negatively influence the uptake of cervical cancer screening. The HBM assumes that feeling vulnerable to a condition and claiming it as a serious health problem is a motivational factor that will increase people’s action in taking preventive measures. Given acceptable screening methods, the challenge becomes how to help women in developing countries understand their risk of cervical cancer, and that early detection of cervical cancer is not a death sentence. According to this model, a person’s willingness to engage in a health-seeking behavior is influenced by perceived risks, perceived seriousness of the disease, perceived susceptibility, and perceived benefits, and barriers to actions. The Behavior Health Model is known for its effectiveness in assessing educational needs. Education is one key to preventing cervical cancer. Kachroo & Etzel (2009) indicated that low literacy and poverty are barriers to achieving preventive measures. Health literacy is essential for participation in health education. Understanding cervical cancer, the screening process, and preventive measures, requires women to have a basic understanding of their internal and external anatomy, as well as basic physiologic processes. They also require education about cofactors of cervical cancer such as smoking tobacco. In addition, education is deemed necessary to encourage seeking of screening and treatment at an earlier stage of the disease. Education can also address myths as well as cultural health beliefs associated with cervical cancer. Patients require explanations to be able to utilize the materials provided to educate about cancer (Kochroo & Etzel, 2009).
It might be challenging to attempt to change health behaviors of any specific population group. However, once health policies and interventions are in place and address social and cultural characteristics, beliefs and attitudes, the HBM can guide providers in raising community awareness of cervical cancer, availability of screening, and risks and benefits of screening through women’s groups. Other health care barriers include lack of funds, insurance to access care, and health services inaccessibility. Many women in villages and rural areas have to walk long distances before they can attend a health facility. Sending teams of female providers into the countryside to perform testing on a regular basis might help overcome this barrier (Mupepi, Sampselle, & Johnson, 2011).

**Literature Review**

This literature review begins with a description of the methods of screening for cervical cancer. It then proceeds to other methods of prevention, discussion of review articles, and more current literature not included in the reviews.

**Methods of screening for cervical cancer**

*Cytology or Papinicolaou.* Cytology or “Pap” smear is the most effective and common screening method. Cervical cytology consists of spreading and staining a smear of collected cervical cells and analyzing them under the microscope to detect lesions. The method enables professionals to accurately detect and stage high grade lesions. This approach can contribute to early detection, thereby decreasing the incidence of advanced cervical cancer and associated mortality. However, PAP smears are challenging to perform in developing countries because the process requires trained personnel and certified laboratories that are often unavailable (Maine, Hurlburt & Greeson, 2011).
Human Papilloma Virus - Deoxyribonucleic Acid (HPV-DNA) and careHPV. A common cause of cervical cancer is HPV. HPV-DNA approach is a newer option for cervical cancer screening. The HPV-DNA testing consists of screening for high-risk strains of HPV. In some studies, HPV testing has been shown to reduce mortality in high grade lesions in advanced invasive cervical cancer and even in women with human immunodeficiency (HIV) (Louie, de Sanjose, Silvia, & Mayaud, 2009). The HPV-DNA test has shown promising results with high sensitivity and specificity to detect high grade lesions, and therefore is used as a primary screening test in women aged 30 years or older. Samples can be either self-collected or provider collected. However, there are some limitations: the test is expensive, requires a laboratory, and the time needed to process the test is at least 7 hours. Although suitable for low resource settings, it requires a sophisticated laboratory to read the samples. Unfortunately, most developing countries do not have reliable laboratory facilities (Maine et al., 2011).

In India, studies indicated that HPV testing reduced cervical cancer incidence and mortality rate up to 50%. The testing is done either with cervical or vaginal samples collected with a brush by a trained provider in the case of cervical screening or by the woman herself in the case of the vaginal sample. The sensitivity of HPV-DNA testing ranged from 66% to 95% for all women tested, but most studies indicated a sensitivity of 85% among women 30 years old or greater (Sherris et al., 2009).

The alternative to HPV-DNA testing in low-resource setting countries is careHPV. This moderated HPV test was developed by Qiagen Gaithersburg Incorporated Laboratories in collaboration with the Bill and Melinda Gates Foundation and the Non-Government Organization PATH for those developing countries. The test is simple and rapid; the results can be produced within 2.5 hours or less. A portable compact unit with a battery is operated by
workers with minimal laboratory training. The test does not require a refrigerator, electricity, or running water. In the case of careHPV testing, HPV infection is detected with cervical or vaginal swabs and the woman can collect the sample herself. The method was tried in China for the first time and it showed reasonably promising results for the future (Louie, de Sanjose, & Mayaud, 2009; Wright & Kuhn, 2011).

The sensitivity of careHPV testing in China was 90% compared to Visual Inspection with Acetic Acid (VIA) (described below) and Pap smear at 41% and 85% respectively (Qiagen group, 2009). Unlike CareHPV, the HPV-DNA test is more costly, requires more technology and time to process. Costs of testing vary by country; for example, for HPV-DNA, the price ranges from $26-29 per person in India to $82 per person in South Africa (Goldie et al., 2005).

**Visual Inspection with Acetic Acid (VIA).** VIA screening is the simplest method of screening with the lowest cost and relative ease of use. The approach does not require high technology and has been demonstrated to reduce the deaths of women in developing countries (Wright & Kuhn, 2012). During VIA, 5% acetic acid or vinegar is applied to the cervical mucosa. Normal tissue is unaffected by vinegar wash, but abnormal cells including dysplastic and cancerous cells turn white. The screening method allows the practitioner to diagnose and treat abnormal cells almost immediately in a health center, typically using cryotherapy which is the application of liquid nitrogen or carbon nitrogen to the dysplastic area. The process is also inexpensive; in a Chinese study, the cost for VIA was estimated at $2.64 per test (Shi, et al, 2012).

According to a review of studies done in India comparing cytology, HPV, and VIA testing, VIA had the highest level of sensitivity ranging from 50%-96%. HPV-DNA was second with sensitivity of 61%-90%, and cytology had a lower sensitivity of 31%-78%. High
sensitivity can result in false positives with subsequent unnecessary treatment. However, cryotherapy commonly used after VIA or VILI testing is a safe procedure with low incidence of tolerable side effects. However, cytology had the highest specificity at 91% -99%. The specificity for VIA and HPV- DNA testing were 44%-97% and 62%-94% respectively (Maine & al., 2011). See Appendix A for a comparative table on sensitivity and specificity of screening programs.

**Vaccination - Cervical Cancer Prevention Method.** Studies indicate that preventive strategies to reduce cervical cancer incidence should focus on preventing risk factors. Another more recent preventive approach involves immunization. Women often become infected by HPV shortly after becoming sexually active. Eighty-seven percent of cases of cervical cancer are caused by 7 types of the 40 HPV genotypes that infect the vaginal tract. However, 2 types, HPV 16 and HPV 18, are responsible for 70 percent of all cases (Maine et al., 2011). Human papillomavirus (HPV), the acquired causative agent of most cervical cancer, is preventable by prophylactic vaccines (Louie, de Sanjose, & Mayaud, 2009). The HPV vaccine has been available since 2006 and can prevent 70% of HPV-caused cervical cancers if the 3 dose vaccine series is completed. The series begins with one injection and is followed by a second 2 months later and a third at the end of 6 months. The available vaccines are Quadrivalent Gardasil which prevents HPV 6, 11, 16, and 18; Bivalent Cervarix prevents only HPV 16 and 18. The cost for 3 doses of the Quadrivalent Gardisil vaccine is $360 in the United States. Cervarix costs $240 in Canada for the recommended 3 dose regime (Canada Free Press, 2010). Few governments and even fewer women in developing countries can afford either drug. In 2011 Mexico, Panama and South Africa arranged to receive the Gardisil vaccine for US $40 (Maine, Hurlburt, & Greenson, 2011). In 2011, Rwanda was the world’s first low-income country to provide universal access coverage.
for the HPV vaccine. Rwanda received an offer from Merck & Co. Inc. for 3 free years’ coverage of the HPV vaccine (Binagwaho et al., 2011). The Gardasil Access Program (GAP) is managed by Axios Healthcare Development that distributes free HPV vaccines to organizations and institutions within eligible low-income countries as long as they are capable of covering all other costs related to the vaccination program, including transportation, storage, community outreach, distribution of the vaccine, and data collection (Ladner et al., 2012). The achievement of over 93% coverage of 3 doses of the HPV vaccine in Rwanda was made possible through school-based vaccine clinics, and community involvement in tracking and locating missing eligible enrolled and non-enrolled school girls. The prophylactic HPV vaccine offers a new promise for primary prevention of cervical cancer. However, the HPV vaccine does not replace cervical screening. Immunization can be ineffective due to missing follow-up doses and cost (Louie, de Sanjose, & Mayaud, 2009). It is clear that education and resources are key components to all cervical cancer screening and prevention programs.

**Challenges to cervical cancer screening in developing countries**

The lack of screening and prevention for cervical cancer in developing countries has made it extremely challenging and difficult to decrease mortality rates. In developed countries where cytology-based cervical cancer screening is the standard of care, cervical intraepithelial neoplasia is often detected and treated before the development of invasive cancer. The failure to adopt and implement an effective screening program in low-resource countries is due to a complexity of multiple barriers, including cost, lack of quality-assured infrastructure, non-available or untrained cytotechnologists or pathologists, and competing public health priorities such as communicable diseases. Based on findings on cervical cancer in multiple studies conducted by different international health organizations, the Alliance for Cervical Cancer
Prevention (ACCP) was formed. ACCP supported development of alternatives to cytology that were more appropriate for low-resource settings (ACCP, 2011). Resulting programs were suitable for developing countries and were found to be cost-effective and have remarkably impacted the lives of many women (Sherris et al., 2009).

**Experiences with various screening mechanisms**

ACCP researchers conducted several studies examining VIA and HPV-DNA screening in developing countries including Africa, Asia, and Latin America. In India, 49,000 women aged 30-59 years were screened using the VIA approach over a seven year period. Over the course of the study, the incidence and mortality of cancer declined by 25% for the whole cohort. For 30-39 year olds, the screening had a huge impact on women’s lifetime cancer risks, reducing the incidence of cancer by 38% and mortality by 66%. The program was recognized as efficient and effective to detect and treat cervical cancer precursors in developing countries (Sherris et al., 2009).

The sensitivity of VIA testing has been assessed in studies conducted in India, Latin America, Africa, Thailand, and China. Sensitivity of the test ranged from 41% to 79%. When iodine was used instead of acetic acid, the sensitivity was higher, at 57% to 98% (Sherris et al., 2009). Visual Inspection with Acetic acid (VIA) has limitations in postmenopausal woman due to the cervical changes (Sherris et al., 2009).

**Comparative studies**

To determine factors associated with cervical cancer screening, treatment follow-up, efficacy, and cost effectiveness, randomized control projects were implemented. Screening programs that worked for developed countries did not work for developing countries where they
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existed, due in large part to barriers such as lack of knowledge about the disease, unfamiliarity with prevention concepts, economic inaccessibility of care, poor quality of services, and lack of family support, specifically from husbands (Nene et al., 2007). To compare the effectiveness of three screening strategies: (VIA, cytology and HPV-DNA), a trial was conducted in rural areas of India, involving multi-component strategies for service delivery. Community stakeholders, husbands, and health workers of both genders participated in the preventive activities, sensitization, education, and counseling (Nene et al., 2007). The project was a collaboration of Nargis Dutt Memorial Hospital (Barshi, India), the Tata Memorial Centre (Mumbai, India), and the International Agency for Research center (Lyon, France). The area included in the project was 4 sub-districts of the Osmanabad district in Maharashtra state. This was an underdeveloped rural region with a high prevalence of cervical cancer (27.4/100 000 women). The study took place between October 1999 and November 2003 at Nargis Dutt Memorial Hospital, a cancer hospital for diagnosis and treatment. Education and counseling were provided before and after screening and treatment. Proper hygiene, privacy, screening, and treatment were also provided at no cost. Female health workers provided education and counseling while male health workers organized clinics and played the role of liaison with husbands and community leaders. Clinics were organized in villages, primary health centers, and schools. A total of 497 rural village women ages 30-59 years participated in a study and included a control group. Women in the VIA group with precancerous lesions had a colposcopy during the same session followed by a biopsy for those with abnormality; follow-up appointments for treatment at the central clinic were provided as needed. For the cytology and HPV screening, the specimens were collected and sent to the project’s laboratories for analysis. The tests for both of these types of screening were performed by female nurses. The results of cytology and HPV were provided by a female
health worker who at the same time arranged appointments for a colposcopy for those whose results were positive. Treatment options offered for women with positive cervical cancer included cryotherapy, a loop electrosurgical excision procedure, or conization. Those with low lesions were given options of follow-up or same day treatment. The report results indicated that the compliance with colposcopy among all women whose screening was positive differed by screening method. For visual inspection, compliance was 98.65%, cytology screening compliance for a colposcopy was 87.1%, and for HPV it was 88.1%. A colposcopy for visual inspection was carried out in the same clinic on the same day after the test. In the case of HPV and cytology screening, women were visited and received explanations about the test results and given appointments. According to the study, having to contact women again and use an extra appointment for a colposcopy, reduced compliance and increased loss to follow-ups. Researchers concluded that the VIA method has the potential to reduce loss to follow-up and increase the coverage of those needing treatment (Nene et al., 2007).

The Alliance for Cervical Cancer Screening and Prevention (ACCP) reviewed studies which examined women’s perspective on cervical cancer screening and treatment approaches from developing countries including South Africa, Ghana, Thailand, India, Kenya, Peru, and El Salvador. The review concluded that women considered screening, regardless of type, performed by other women as highly acceptable. Also, women appeared to consider screening which was closely followed by treatment as very acceptable as well (Bradley et al., 2008). The report also identified VIA, VIA Magnification (VIAM), and HPV-DNA as recommended alternatives to Pap smears in developing countries. The rationale for this recommendation is that Pap smears require the client to return to the clinic for a repeat smear or colposcopy and biopsy prior to treatment. Pap smears also require high quality laboratories and qualified lab technicians which may not be
available in developing countries (Bradley et al., 2008). HPV-DNA testing also involves some delays since the cervical cell samples are sent to the laboratory for reading (Bradley et al., 2008).

**Summary of findings**

ACCP (2011) concluded that HPV-DNA should become the standard test in developing countries because it is sensitive, requires little technology, and lengthens the interval between screenings. However, where HPV-DNA screening is not available, VIA is preferred.

Overall, women were satisfied with the services they received with VIA Screening. In El Salvador, the satisfaction was very good. The satisfaction was correlated with overall services, the confidence of the staff nurses, and technical ability during examination. In India, satisfaction was correlated with staff attitude, the service delivery strategies used, invitation process, health education, accessible clinics, and completing both screening and treatment in one visit in the primary health care facility. Most importantly, screening by female nurses rather than a doctor was more comfortable for patients (Bradley et al., 2008). In Thailand, patients were very satisfied with the care they received from nurses (Bradley et al., 2008). In South Africa, the screening was done by female nurses from the same ethnic group and according to the author; this was a key to overcoming barriers. Women in South Africa, originally viewed screening as a service provided by men, but in this study they were satisfied because it was done by female nurses. They did not feel frightened and ashamed related to challenges and societal objections to vaginal examinations (Bradley et al., 2008).

Early and effective screening programs can make a difference in decreasing cervical cancer. While a woman in the United States has a 70 % chance of surviving cervical cancer due to relatively easy access to screening, only 58 % of women in Thailand, 42 % in India, and 21 %
in sub-Saharan Africa are likely to survive the disease (WHO, 2005). The uptake of screening remains low in developing countries due to lack of basic knowledge among women. A study conducted on Ghanaian women’s knowledge and beliefs about cervical cancer screening indicated that the most important barriers to cervical cancer screening were lack of knowledge about screening and how to get screening services (Abotchie & Shoker, 2009).

There are obstacles to cervical cancer prevention and treatment in developing countries where screening is rarely available and almost unknown to many women. Obstacles include poverty, lack of effective screening, lack of women’s knowledge of risks and treatment options, lack of trained practitioners, and an efficient system of health care delivery. Even when screening is offered, women sometimes do not use the service. Winkler and colleagues found that in Peru, attitudes and beliefs about screening, as well as lack of supportive systems were major contributors to the lack of screening. In addition, lack of privacy in health centers, poor levels of staff courtesy, high cost, and women’s fear of knowing that they indeed have cancer, all contributed to screening program failures in Peru where cervical cancer had the highest incidence in the world (Winkler, Bingham, Coffey, & Handwerker, 2006).

An additional significant barrier to screening is lack of government efforts and planning, especially when there are competing health needs and diseases with high visibility and international attention that take priority over cancer screening (Egilman, Bird, Mora & Druar, 2011). Lack of government investment in facilities and inadequate financial resources for training and services to enable successful screening programs are also significant barriers (Denny, Quinn, & Sankaranarayanan, 2006). The success of a screening program depends on it being not only affordable and acceptable, but also actively involving women and communities in program planning and implementation. Accessible referral sources upon diagnosis, treatment,
and follow-up are necessary for a successful screening program (Louie, de Sanjose, & Mayaud, 2009).

**Nursing Implications**

The HBM can help nurses tailor approaches to respond to both the need for acceptability of the program and the involvement of the community in program planning for cervical cancer screening. In developing countries, nurses provide the majority of health care; they are the first responders and advocates for patients. They can apply the HBM theoretical model to plan programs that address women’s perspectives about cervical cancer, and their perceived risks and benefits of cervical cancer screening. In the majority of African communities, especially in rural areas, nurses assume doctor’s roles. They are expected to integrate cervical screening into primary care settings. These nurses need special training programs and continuing education on the job in order to acquire necessary knowledge to inform their female clients and communities about cervical cancer and screening. Studies in Uganda, Ghana, Tanzania, Nigeria, and Turkey indicated that health care professionals were not updated with cervical cancer screening information. A study done in Uganda on 310 health workers (physicians, nurses and others), ninety-two percent of those receiving the survey responded. Sixty-five percent of female health workers eligible for screening did not think they were susceptible to cervical cancer, and eighty-one percent had never been screened (Mutyaba et al., 2006). Female patients in that community did not get screened, not because they did not feel vulnerable, but because according to the author, it was unlikely that medical workers could motivate them or advise them to get screened when nurses were lacking cervical cancer screenings themselves (Mutyaba et al., 2006).
A study was carried out in Nigeria to learn about the level of knowledge of cervical cancer among urban and rural women. The results indicated that there was a need to make changes in education and establishment of effective screening control programs. Only 15.5 percent of the women who participated in the study were aware of availability of cervical screening. The poor knowledge of cervical cancer screening and prevention resulted in poor attendance at cervical screening programs. As in Uganda, women in Nigeria did not believe that they were at risk for cervical cancer. Other reports cited poor practices of nurses and doctors and indicated that they must not only be trained and retrained, but also that they have to change attitudes about cancer screening and improve their practice of cervical cancer screening (Nwankwo, Aniebue, Aguwa, Anarado & Agunwah, 2011).

Studies indicated that some women felt embarrassed to be physically exposed, especially when they saw a male doctor, while some feared pain from the test. The role of nurses should be to address women’s concern about privacy during and after the exam. Nurses can also provide education in order to help overcome family and social belief barriers. Women need to know exactly what will happen during and after the test. In addition, every step of the test needs to be explained as it is done. Nurses need to use whatever means they have to gain the trust of their female clients, whether they come to them for regular health services or they travel to their clients’ communities to meet them. They also need to involve families, churches, and community leaders. Ofi & Ndikom (2011) indicate that prescreening counseling would help women in making informed choices about cervical cancer screening. Women empowered by education and advice from their nurses are more likely to make the wise decision to get screened as soon as they become eligible (Ndikom & Ofi, 2011).
A Turkish study explored knowledge, behaviors, and beliefs related to cervical cancer in Turkish’s women and revealed that the ineffective use of cervical cancer screening was due to poor knowledge and impractical behaviors of practitioners. The study indicated that nurse practitioners are needed to address cervical cancer screening, educate women and other health workers about attitudes, and explain the truths about cervical cancer screening (Reis et al., 2009).

In Thailand, patients were very satisfied with the care they received from nurses. In South Africa, cervical screening was done by the female nurses from the same ethnic group and this was a key to overcoming barriers. Women in South Africa, who originally viewed screening as a service provided by men, were more satisfied when the screening was done by female nurses. They did not feel frightened or ashamed about challenges and societal objections to vaginal examinations (Bradley et al., 2008). Female nurses recognize their acceptance by women and the important role that they play in providing cervical cancer screening.

In summary, nurses play an important role in screening and prevention of cervical cancer in developing countries. Nurses should increase their level of knowledge about the disease and its prevention, as well as work within communities to educate women and plan for effective approaches to screening and immunization. Barriers should be examined and eliminated so that women’s programs can be implemented successfully. Studies have shown HPV-DNA testing in developing countries to be effective and reliable with higher sensitivity than cytology and VIA. Promises are even greater with CareHPV for cost-effectiveness and simplicity in collecting samples. The HPV vaccine is now available in many developing countries and it has been shown to effectively reduce cervical cancer deaths. However, health professionals should not automatically assume immunization to be more effective than screening and treatment. Rather, a combination of programs for immunization and screening would yield the greatest benefit.
References


Appendix A.

Table 1.  Sensitivity & Specificity of Cervical Cancer Screening Methods in Several Studies.

<table>
<thead>
<tr>
<th>Methods of screening</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Study location</th>
<th>Author and Date</th>
</tr>
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<tbody>
<tr>
<td>CYTOLOGY</td>
<td>53-57%</td>
<td>99%</td>
<td>Latin American</td>
<td>Sherris et al. (2009)</td>
</tr>
<tr>
<td></td>
<td>53-57%</td>
<td></td>
<td>Sub-Saharan Africa</td>
<td>Wright &amp; Kuhn (2012)</td>
</tr>
<tr>
<td></td>
<td>31-78%</td>
<td>91-99%</td>
<td>India</td>
<td>Maine, Hurlburt, &amp; Greeson (2011)</td>
</tr>
<tr>
<td>VIA</td>
<td>50-96%</td>
<td>92%</td>
<td>India</td>
<td>Maine, Hurlburt, &amp; Green (2011)</td>
</tr>
<tr>
<td></td>
<td>77%</td>
<td>86%</td>
<td>India</td>
<td>Denny, Quinn &amp; Sankaranarayanan (2006)</td>
</tr>
<tr>
<td></td>
<td>55-73%</td>
<td></td>
<td>South Africa</td>
<td>Wright &amp; Kuhn (2012)</td>
</tr>
<tr>
<td></td>
<td>56-58%</td>
<td>44-97%</td>
<td>Kolkata &amp; Mumbai respectively (India)</td>
<td>Wright &amp; Kuhn (2012)</td>
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<tr>
<td></td>
<td>75-77%</td>
<td></td>
<td>Jaipur &amp; Congo respectively</td>
<td>Wright &amp; Kuhn (2012)</td>
</tr>
<tr>
<td>HPV-DNA</td>
<td>97%</td>
<td>86%</td>
<td>China</td>
<td>Louie, de Sanjoe, &amp; Mayaud (2009)</td>
</tr>
<tr>
<td></td>
<td>61-90%</td>
<td>62-94%</td>
<td>India</td>
<td>Maine, Hurlburt, &amp; Green (2011)</td>
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<tr>
<td>CareHPV-DNA</td>
<td>90%</td>
<td>84%</td>
<td>China</td>
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