Journal of Health, Medicine and Nursing
ISSN 2422-8419 An International Peer-reviewed Journal
Vol.30, 2016

Resources and Costs for Initiation and Sustainability of a Secondary Cervical Cancer Prevention Clinic at Mbarara Regional Referral Hospital, Uganda

Mayanja Ronald;MD[1] Chakura Andrew;MD[1] Mubiru Musa;MD[1] Masembe Sezalio;MD[1]
Nkonwa Innoncent;MD[1] Kasujja John,MD[2] Prof Emilio Sanchez,MD[1] Wasswa SsalongoMD[1]
Joseph Ngonzi;MD[1]
1.Department of obstetrics and Gynecology, Mbarara University of Science and Technology, Uganda
2.Department of anesthesia, Mbarara University of Science and Technology

All authors declared no conflict of interest in the study

Abstract

Background: Each year approximately 450,000 new cases of invasive cervical carcinoma are diagnosed worldwide. The cervical cancer incidence rate is highest in countries that have little or no cytologic cervical cancer screening. There are many barriers to establishing cervical cancer screening programs in resource-poor settings. The main objective was to determine the cost of setting up and sustaining secondary cervical cancer prevention services in Uganda. **Methods:** In order to evaluate the use of alternative screening methods in a resource-poor setting, we instituted a study at the colposcopy and cervical pathology clinic at Mbarara Regional Referral Hospital in Uganda. Previously unscreened women ages 25years and above were screened using a combination of conventional cytology and direct visual inspection (DVI). The outcomes included costs of clinic set up, training costs, cost of equipments, salaries and supplies. Screening strategies were distinguished by the number of clinical visits, the use of 1 or 2 screening tests and screening frequency. Screening tests included DVI and cytology. **Results:** The screening started in April 2009 through aid of an American non government organization known as Program for Appropriate Technology in Health (PATH) which provided the initial funding for equipment and clinic set-up. Out of 4659 women screened in 2013, 73.2% were below 50 years, 17.7% were 50 years and above. Majority of women (55.0%) come from Mbarara district, 71.3% were from rural areas outside Mbarara Municipality. The prevalence of HIV was 19.0%. Cervical intraepithelial neoplasia comprised (4.8%), 225cases, while cervical cancer comprised (2.7%) 125cases, 94.2% were treated with Cryotherapy, 5.3% were treated by LEEP and one total abdominal hysterectomy. The cost of reusable requirements for setting up a cervical cancer screening clinic was Ugshs 11,730,000.00. The cost of screening a population of 4659 in 2013 was 54, 302, 200.00, the cost of screening one woman using acetic acid was Ugshs 152.00, and Pap smear per woman is Ugshs 55,000.00, while the cost of screening one woman using lugol's iodine was Ugsh 4,000.00(the cost of reusable speculums, gloves,cotton and gauze is not included on individual patients). The cost of cin treatment of a population of 3569 women was Ugshs 9,800,000.00 plus 2280.00USD. Cryotherapy per woman was Ugshs 46,226.00.(the cost of gloves, cotton, guaze and reusable equipment such as speculums is not included). When using two stationary clinic nurses the cost in salaries and training will be Ugshs 23,204,000.00, however if using outreach model the cost in allowances and training will be 85,450,000.00. When using a group of 20 volunteers for the outreach model the cost in allowances and training will be Ugshs 33,050,000.00.(USD = Ugshs 4000.00). (The cost of gloves, cotton swabs and gauze is not included). **Conclusion:** Cytologic screening is several times more costly than direct visual inspection (DVI). Visual inspection screening of the cervical and treatment with Cryotherapy can be used as a cost effective alternative method to cytologic examination for control of cervical cancer in low resource areas. Using existing staff and integration of screening services into existing services into annual hospital budget helps in sustainability of donor initiated cervical cancer screening programs. **Recommendations:** Cervical cancer screening programs in low resource areas should adopt direct visual inspection using 3-5% acetic acid as the main screening method and "see and treat" approach for treatment of positive lesions. For program sustainability cervical cancer screening services should be integrated into the main hospital programs and annual budget. Existing personnel and infrastructure should be used for cost effectiveness and sustainability.

Keywords: Resources, Initiation, Sustainability, Cervical Cancer, Prevention

INTRODUCTION

Each year approximately 450,000 new cases of invasive cervical carcinoma are diagnosed worldwide. The cervical cancer incidence rate is highest in countries that have little or no cytologic cervical cancer screening. There are many barriers to establishing cervical cancer screening programs in resource-poor settings. These include the demands of competing health needs, such as communicable disease; poorly developed health care services that tend to be focused on curative rather than preventive care; war and civil strife; and the fact that women in poor countries often are uninformed as to their needs for preventive health care. The traditional

method of screening, cervical cytology, presents an additional barrier. Cytologic-based screening programs require a relatively sophisticated infrastructure, including highly trained personnel, adequately equipped laboratories, and referral systems to communicate results of the test (which usually is delayed) to women. Because of the problems intrinsic to cytologic screening, considerable attention is being given to developing alternative methods, such as direct visual inspection (DVI) and human papillomavirus (HPV) DNA testing, for cervical cancer screening in resource-poor settings(Denny et al., 2000).

The objective of cervical cancer screening is to reduce cervical cancer incidence and mortality by detecting and treating precancerous lesions. Conventional cytology is the most widely used cervical cancer screening test. Although cytology has been effective in reducing the incidence of and mortality from cervical cancer in developed countries in both opportunistic and—more dramatically—organized national programs, it has been less successful and largely ineffective in reducing disease burden in low-resource settings where it has been implemented. Liquid-based cytology, testing for infection with oncogenic types of human papillomaviruses, visual inspection with 3–5% acetic acid, magnified visual inspection with acetic acid, and visual inspection with Lugol's iodine have been evaluated as alternative tests(Sankaranarayanan et al., 2005).

Cervical cancer is a leading cause of cancer-related death among women in developing countries, with up to 80% of patients presenting with advanced disease. In resource-poor areas, such as sub-Saharan Africa, the growing number of women infected with human immunodeficiency virus (HIV) may further compound this problem because they have an increased risk of human papillomavirus (HPV) infection, the causal agent of cervical cancer. Cytology-based screening programs have decreased the incidence of invasive cervical cancer in many developed countries. However, cytologic screening requires an established laboratory, highly-trained cytotechnologists, and up to 3 visits for screening, evaluation of cytologic abnormal results, and treatment. In low-resource settings, such a strategy has proven difficult to implement and sustain. Recently, it has been suggested that less complex strategies may offer additional options. Such strategies replace the Papanicolaou smear with simple visual screening methods, such as direct visual inspection (DVI) in which the cervix is viewed after the application of an acetic acid solution, or HPV DNA testing. They also eliminate colposcopy, allowing for screening and treatment to be performed during the same visit. These screening approaches have shown promise in large trials conducted in low-resource settings; however, determining whether they will be clinically or cost-effective requires formal evaluation using analytic modeling methods(Goldie et al., 2001)

Cervical cancer is a serious health problem, with nearly 500 000 women developing the disease each year worldwide. Most cases occur in less developed countries where no effective screening systems are available. Risk factors include exposure to human papillomavirus, smoking, and immune-system dysfunction. Most women with early-stage tumours can be cured, although long-term morbidity from treatment is common.(Waggoner, 2003). Cervical cancer is highly preventable through cytologic screening programs that facilitate the detection and treatment of precancerous lesions. Such screening, however, requires an established laboratory, highly trained cytotechnologists, and up to three visits for screening, evaluation of cytologic abnormalities, and treatment and is therefore difficult to implement and sustain in settings with limited resources. Alternative methods, such as DNA testing for human papillomavirus (HPV) and simple visual screening, may prove more practical when incorporated into new strategies that are less dependent on existing laboratory infrastructure and require fewer visits. Consequently, timely implementation of a cost-effective screening strategy for use in developing countries is particularly critical (Goldie et al., 2005).

There are different cervical cancer screening tests ranging from Human Papilloma Virus (HPV) detection, Papanicolou(Pap) smears, Liquid Based Cytology(LBC), Visual Inspection with 3-5% acetic acid(VIA) and Visual Inspection with Lugol's iodne(VILI) also known as Schiller's test. All these tests have different sensitivities, specificities and costs. The methods of treatment of precancerous lesions range from Cryotherapy, LEEP or Cervical Cone Biopsy. Diagnostic methods such as colposcopy and biopsy all differ. The choices of methods used differ in different programs and ministries depending on available resources. These programs range from "see and treat" methods to Colposcopy, biopsy and treatment. Different programs choose the most cost effective and sustainable methods depending on resources available.

The total and individual annual expenditures on cervical cancer prevention and control in Uganda are not known. The colposcopy and cervical pathology (CCP) clinic at Mbarara Regional Referral Hospital (MRRH) handles all the clients and patients involved in cervical cancer prevention and care at MRRH. However there is no guidance for estimating the costs involved in cervical cancer prevention in low resource settings. The main objective was to determine the cost of setting up and sustaining secondary cervical cancer prevention services for a population of 5000 women (Sub County) for a period of one year, Uganda

METHODS AND MATERIALS

Study design:

The design of the study was a retrospective study using secondary date from the colposcopy and cervical pathology (CCP) clinic at Mbarara Regional Referral Hospital.

Study site:
The study was conducted in the CCP at Mbarara Regional Referral Hospital (MRRH). The hospital is located in Mbarara municipality which is 226 km (165 miles) south of Kampala, the capital city of Uganda. Mbarara Regional Referral Hospital is a 300 bed public hospital that serves as the referral hospital for ten districts in southwestern Uganda, with a population of about 4million people (Atukunda et al 2014). It is a teaching hospital for Mbarara University of Science and Technology, Faculty of Medicine and visiting students from other institutions. The hospital has obstetrics and gynecology department, with a maternity wing that conducts approximately 10,000 deliveries per year. The department is linked to four major operating theatres, a blood transfusion laboratory and is capable of providing comprehensive obstetric care. The department has a colposcopy clinic which runs on a daily basis from Monday to Friday starting at 0800houra to 1700 hours. The facility has a number of specialists who offer specialized services. This facility was thus suited to carry out this research. The data was collected between 1ST January and 31ST December 2013.

Study population:
All women who attended the colposcopy and cervical pathology clinic in the years 2013 were formed the study population.

Inclusion criteria:
All sexually active women who were in reproductive age and above were included in the study.

Exclusion criteria:
Women in reproductive age and above who were not sexually exposed were excluded from the study.

Outcome variables:
Cost of clinic set up, cost of training, cost of equipment of screening, cost of equipment for cervical pre-cancer treatment, cost of biopsies

Independent variables:
The independent variables included social demographic, obstetric and medical characteristics of clinic attendees.

Sample size estimation:
The sample size was 4659 that were screened in 2013.

Sampling method:
The method of sampling was by consecutive sampling.

Statistical data analysis:
The data was entered in an EXCEL spreadsheet and analyzed using SPSS statistical software, version 20 (SPSS, Chicago, IL, USA). Cross tabulations were conducted to obtain descriptive statistics which were presented as frequencies, percentages.

Ethical considerations:
Approval was sought from the department of Obstetrics and Gynecology Mbarara University of science and technology, Mbarara Regional Referral Hospital, Faculty of Medicine Research Committee and Mbarara University Institutional Research Board (IRB).

Study procedures
To evaluate the use of alternative screening methods in a resource-poor setting, we instituted a study at the colposcopy and cervical pathology clinic at Mbarara Regional Referral Hospital in Uganda. Previously unscreened women ages 25years and above were screened using a combination of conventional cytology and direct visual inspection (DVI). In this article we present comparisons of the costs of clinic set up, training costs, cost of equipments, salaries, screening costs, cervical intraepithelial neoplasia (cin) treatment costs and cost of supplies. We adopted a societal perspective (i.e., all costs and benefits are included regardless to whom they accrue). During the five year period (2009-2013) every patient who underwent cervical cancer screening and treatment at MRRH was recorded and observed. These clients were then followed for a period of one year. The screening methods were recorded, as were the outcomes of all patients. Secondary clinic data was used to estimate the costs. The expenditures for each client were estimated from the records depending on the screening methods, treatment methods, diagnostic methods and supplies involved. The costs of screening by Pap smear, 5% acetic acid, and Lugol's iodine were directly determined. The cost of treatment by Cryotherapy was directly calculated from the cost of the Cryotherapy gun, the cost of nitrous oxide gas, transportation costs and others. The cost of LEEP and Hysterectomy was not calculated in this study. Reusable instruments that were used in clinic set were not considered for total or individual annual costs. The cost of screening a population of 4659 at Mbarara Regional Referral Hospital in 2013 was determined. From the results of 2013 estimates were made to determine the costs for screening a population of 5000women which is equivalent to a sub county in Uganda. We chose a population of 5000 because if we assume a clinic run by 2 nurses working for 20 days in a month and each nurse screening between 10 and 11 women per day this will translate into 4800-5820 women per year which is approximately 5000. We chose the year 2013 because this is when we screened 4659 women which were closest to our target of 5000 women per year.

RESULTS

We established that the screening started in April 2009 through aid of an American non government organization known as Program for Appropriate Technology in Health (PATH) which provided the initial funding for equipment and clinic set-up. The ministry of health of Uganda provided clinic space, personnel and consumables. For the Human resource, existing staff that were already on the government pay roll were recruited, except for the first 2 years whereby an extra nurse was hired by the donor. The nurses were supported by one gynecologist who was already employed by the neighboring Mbarara University of Science and Technology (MUST). Mobilization of women was through radios, television, churches and mosques, politicians and village health teams.

Out of 4659 women screened in 2013, 73.2% were below 50 years, 17.7% were 50 years and above, table: 1. The women came from the districts of southwestern Uganda and beyond, with majority (55.0%) coming from Mbarara district, table:2. Most of the women (71.3%) were from rural areas outside Mbarara Municipality. The prevalence of HIV was 19.0%. , table: 3. Cervical intraepithelial neoplasia(cin) comprised (4.8%), 225cases, while cervical cancer comprised (2.7%) 125cases, 94.22% were treated with Cryotherapy, 5.3% were treated by LEEP and one total abdominal hysterectomy, table: 4. The cost of reusable requirements for setting up a cervical cancer screening clinic was determined to be Ugshs 11,730,000.00, Table 5. The cost of screening a population of 4659 at Mbarara Regional Referral Hospital in 2013 was 54, 302, 200.00, the cost of screening one woman using acetic acid was Ugshs 152.00, and Pap smear per woman is Ugshs 55,000.00, while the cost of screening one woman using lugol's iodine will be Ugsh 4,000.00, Table: 6. The cost of cin treatment of a population of 3569 women is Ugshs 9,800,000.00 plus 2280.00USD. Cryotherapy per woman is Ugshs 46,226.00,(the cost of gloves ,cotton, gauze and reusable equipment such as speculums is not included on individual patients), table: 7. when using two stationary clinic nurses the cost in salaries and training will be Ugshs 23,204,000.00, however if using outreach model the cost in allowances and training will be 85,450,000.00, table 10. When using a group of 20 volunteers for the outreach model the cost will be Ugshs 33,050,000.00 in allowances and training, table: 11. The cost of gloves, cotton swabs and guaze is not included. (USD =Ugshs 4000.00)

Table: 1, Age distribution

Age group	Frequency (%)
20-25	560(12.0)
26-30	743(16.0)
31-35	582(12.5)
36-40	722(15.5)
41-45	453(9.7)
46-50	425(9.1)
51-55	223(4.8)
56-60	197(4.2)
>60	253(5.4)
Missing	416(8.9)
<50	3403(73.2)
50+	824(17.7)
25-49	2953(63.5)
Out of(25-29)	1277(27.5)

Out of 4659 women screened in 2013, 73.2% were below 50 years and therefore eligible for VIA, 17.7% were 50 years and above and hence required Pap smear screening .Table:1

Table 2, Geographical distribution

District	Frequency (%)
Bushenyi	520(11.2)
Foreign	9(0.2)
Ibanda	57(1.2)
Isingiro	711(15.3)
Kamwenge	36(0.8)
Kiruhura	223(4.8)
Mbarara	2564(55.0)
Ntungamo	177(3.8)
Other	158(3.4)
Rukungiri	62(1.3)
Missing	132(2.8)

The women came from the districts of southwestern Uganda and beyond, with majority (55.0) coming

from Mbarara district.Table:2

Table 3, Social demographic and medical characteristics

Variable	Frequency (%)
Pregnancy history	
Yes	3554(76.4)
No	205(4.4)
Missing	886(19.1)
HIV	
Negative	3241(69.7)
Positive	882(19.0)
Missing	525(11.3)
Residence	
Rural	3316(71.3)
Urban	1249(26.9)
Missing	418(9.0)
Phone availability	
Available	1628(35.0)
None	2963(63.7)
Missing	53(1.1)

Most of the women (71.3) were from rural areas outside Mbarara Municipality. The prevalence of HIV was 19.0%. Table:3

Table: 4, Diagnosis and treatment methods

Variable	Frequency (%)
Diagnosis	
Cervical cancer	125(2.7)
Pre-cancer	225(4.8)
Normal	4300(92.5)
Missing	1(0.0)
Pre-cancer treatment	
No	0(0.0)
Yes	225(100.0)
Total	225
Method of treatment	
Cryotherapy	212(94.22)
LEEP	12(5.33)
TAH	1(0.0)

Cervical intraepithelial neoplasia comprised (4.8%), 225cases, while cervical cancer comprised (2.7%) 125cases, 94.22% were treated with Cryotherapy, 5.3% were treated by LEEP and one total abdominal hysterectomy. Table: 4

Table 5: Cost involved in Clinic set up

Item	Freq.	Unit	Unit cost	Units	Total
Lithotomic bed	1	1	300.000	2	600.000.
Autoclave	1	1	8,000,000	1	8,000,000.
Sterilizing drums	1	1	300,000.	2	600,000.
Kidney dishes	1	1	50,000.	5	250,000.
Galipots	1	1	20,000.	10	200,000.
Linen	1	Meter	5000.	100	500,000.
Sponge holding forceps	1	1	10,000.	100	1,000,000.
Table	1	1	100,000.	2	200,000.
Chairs	1	1	100,000	2	200,000.
Buckets	2	1	30,000.	3	180,000.
Total					11,730,000.

The cost of reusable requirements for setting up a cervical cancer screening clinic was determined to be Ugshs 11,730,000.00, Table 5.(USD = Ugshs 4000.00)

Table 6: Cost of screening, diagnosis of 4659women in 2013

Item	Freq.	Unit	Unit cost	Units	Total
Acetic acid 5%	1	1ml/woman(20mls)	100.	3822	382,200.00
Distilled water	1	Jelly can	50,000	4	200,000.00
Pap smears kit	1	Kit	5000	824	4,120,000.00
Reading pap smear	1	1	50,000	824	41,200,000.00
Total					45,902,200.00
Colposcopy					
Lugol's iodne	1	20ml/woman	200	225	900,000.00.
Monsel's paste	-	-	-	-	-
Biopsy reading icc	1	1	60,000.	125	7,500,000.00
Total					54,302,200.00

The cost of screening a population of 4659 at Mbarara Regional Referral Hospital in 2013 was 54, 302, 200.00, the cost of screening one woman using acetic acid was Ugshs 152.00, and Pap smear per woman is Ugshs 55,000.00 which is 361 times higher than acetic acid screening. While the cost of screening one woman using lugol's iodine will be Ugsh 4,000.00, Table: 6, 500mls of acetic acid cost Ugshs 50,000.00, 500mls of Lugols iodine cost Ugshs 100.000.00, (USD = Ugshs 4000.00). The cost of gloves, gauze and cotton has been excluded.

Table 7: Cost of treatment of 4659 women

Item	Freq.	Unit	Unit cost	Units	Total
Cost of CIN Treatment One Cryotherapy unit, LEEP and Nitrous Oxide gas					
019000 MedGyn Cryotherapy system MGC-200	1	1	1,300.00USD	1	1,300.00USD
019010 British adaptor for CO_2	1	1	90.00USD	1	90.00USD
019002/1905 MedGynTipGT-1905 Exocervical convex ,19mm	1	1	185.00USD	1	185.00USD
019002/1910 MedGyn croyotherapy Tip GT1910 Endo/Exocervical cervical small	1	1	185.00USD	1	185.00USD
Carrying case for Cryotherapy system	1	1	55.00USD	1	55.00USD
Cryopart Exhaust Filter 100-1419	1	1	15.00	1	15.00USD
Shipping costs	1	1	450.00USD	1	450USD
Total					2280.000USD
Nitrous oxide cylinder deposit	1	Cylinder	500,000.00	6	3,000,000.00Ugs
Gas price	1	Cylinder	800.000	212=Each cylinder 40pple= 5.3cylinders=6	4,800,000.00Ugs
Transport costs	1	1	2,000,000.00	1	2,000,000.00
Total					9,800,490.00
LEEP machine	1	1	7,000,000.00	1	7,118,209

The cost of cin treatment of a population of 3569 women is Ugshs 9,800,000.00 plus 2280.00USD. Cryotherapy per woman is Ugshs 46,226.00, Table:7.(USD= Ugshs 4,000.00)

Table 8: Cost of screening and diagnosis (5000people)

Item	Freq.	Unit	Unit cost	Units	Total
Acetic acid 5%	1	1ml/woman(20mls)	100.	(73.2/100x5000) =3660	366,000.00
Distilled water	1	Jelly can	50,000	5	250,000
Pap smears kit	1	Kit	5000	(17.7/100x5000) =885	4,425,000.00
Reading pap smear	1	1	50,000	885	44,250,000.00
Colposcopy					
Lugol's iodne	1	20ml/woman	200	240	960,000.00
Monsel's paste	-	-	-	-	-
Biopsy reading , icc	1	1	60,000.	(2.7/100x5000) =135	8,100,000.00
Total					58,351,000.00

The total cost of screening a population of 5000 will be 58, 255,000.00. . The cost of acetic acid screening per woman is Ugshs 100.00 and Ugshs 55,000.00 (550 times higher) with Pap smear, but Ugshs 4,000.00 with lugol's iodine. Table:8.(USD =Ugshs 4000.00).

Table: 9 Cost of treatment of CIN in population of 5000 women

Item	Freq.	Unit	Unit cost	Units	Total
Cost of CIN Treatment One Cryotherapy unit, LEEP and Nitrous Oxide gas					
019000 MedGyn Cryotherapy system MGC-200	1	1	1,300.00USD	1	1,300.00USD
019010 British adaptor for CO_2	1	1	90.00USD	1	90.00USD
019002/1905 MedGynTipGT-1905 Exocervical convex ,19mm	1	1	185.00USD	1	185.00USD
019002/1910 MedGyn croyotherapy Tip GT1910 Endo/Exocervical cervical small	1	1	185.00USD	1	185.00USD
Carrying case for Cryotherapy system	1	1	55.00USD	1	55.00USD
Cryopart Exhaust Filter 100-1419	1	1	15.00	1	15.00USD
Shipping costs	1	1	450.00USD	1	450USD
Total					2280.00USD
Nitrous oxide cylinder deposit	1	Cylinder "F" 2 atmospheres(2x273)	500,000.00	6	3,000,000.00Ugs
Gas price	1	Cylinder	800,000.00	(94.22/100X240)= 226 each cylinder 40pple= 5.6= 6 cylinders	4,800,000.00Ugs
Transport costs	1	1	2,000,000.00	1	2,000,000.00
Total					9,800,000.00
LEEP machine	1	1	7,000,000.00	1	7,329,295

The cost of Cryotherapy per woman will be Ugshs 9,800,000.00; the cost of Cryotherapy per woman is Ugshs 43,363.00 .The cost of LEEP has been excluded, Table: 9 ,USD = Ugshs 4000.0

Table 10: Cost of salaries and/ or, allowances 2nurses

Item	Freq.	Unit	Unit cost	Units	Total
Nurses payments	12	1	800,000	2	19,200,000.00
Cost of training 2 nurses					
Trainees per deim	5	1	100,000.	2	1,000,000.
Trainees transport	5	1	5000.	2	50,000.
Note book	1	1	2000.	2	4000.
Training materials	1	1	100,000.	1	100,000.
Training venue	1	1	100,000.	5	100,000.
Projector	1	1	250,000.	5	750,000.
Trainers fee	5	1	100,000.	2	1,000,000.
Trainer per diem	5	1	100,000.	2	1,000,000.
Total					4,004,000.
Out reaches 2 nurses/5000people					
Per diem	5000pple/40per day=125days	1	100,000.00	2	25,000,000.00
Fuel	125	1	4000.00	40	20,000,000.00
Care hire	125	1	70,000.00	1	8,750,000.00
Mobilization	125	1	100,000.00	1	12,500,000.00
Total					66,250,000.00

When using two stationary clinic nurses the cost will be Ugshs 23,204,000.00 in salaries and training,

however if using outreach model the cost in allowances and training will be 85,450,000.00, Table 10. USD = Ughs 4000.00

Table: 11, Cost of using volunteers

Item	Freq.	Unit	Unit cost	Units	Total
Cost of training 20 volunteers					
Trainees per deim	5	1	100,000.	20	2,000,000.
Trainees transport	5	1	5000.	20	100,000.
Note book	1	1	2000.	20	40,000.
Training materials	1	1	100,000.	1	100,000.
Training venue	1	1	100,000.	5	100,000.
Projector	1	1	250,000.	5	750,000.
Trainers fee	5	1	100,000.	2	1,000,000.
Trainer per diem	5	1	100,000.	2	1,000,000.
Total					5,090,000.
Cost of out reaches (20 volunteers)/5000women					
Per diem	(20x20)=400ppper day=12days	1	100,000.00	20	24,000,000.00
Fuel	12	1	4000.00	40	1,920,000.00
Care hire	12	1	70,000.00	1	840,000.00
Mobilization	12	1	100,000.00	1	1,200,000.00
Total					27,960,000.

When using a group of 20 volunteers for the outreach model the cost will be Ugshs 33,050,000.00 in allowances and training, Table: 11, USD = Ugshs 4000.00

DISCUSSION

We established that the screening started in April 2009 through aid of an American non government organization known as Program for Appropriate Technology in Health (PATH) which provided the initial funding for equipment and clinic set-up. The ministry of health of Uganda provided clinic space, personnel and consumables. For the Human resource existing staff that were already on the government pay roll were recruited, except for the first 2 years whereby an extra nurse was hired by the donor. The nurses were supported by one gynecologist who was already employed by the neighboring Mbarara University of Science and Technology (MUST). Using already existing staff helps in reducing costs of recruitment and payment of additional staff which may not have been budgeted for by the ministries concerned. This can be achieved by training in service staff in cervical cancer screening methods as was the case at MRRH. Clinic space was achieved by rehabilitation of already existing infrastructure.

Mobilization of women was through locally available means such as local FM radios, televisions, churches and mosques, politicians and village health teams. This kind of mobilization helps in cutting costs of holding outreaches for mobilization and sensitization.

Out of 4659 women screened in 2013, 73.2% were below 50 years and therefore eligible for VIA, 17.7% were 50 years and above and hence required Pap smear screening .This results shows that majority of women can be screened by DVI and therefore a few Pap smear will be needed in the program and hence reduce the costs and burden to the Laboratory.

The women came from the districts of southwestern Uganda and beyond, with majority (55.0%) coming from Mbarara district. Most of the women (71.3%) were from rural areas outside Mbarara Municipality. This shows that since women come from far hence screening methods that require multiple visits will necessitate "large" sums of money in transport which will discourage women from coming for screening.

The prevalence of HIV was 19.0%. Though this is not the population figure, the prevalence is quite high and since literature has shown a strong association between HIV and cervical cancer, there is great need for finding a cost effective and sustainable screening policy at MRRH and other low resource setting where the burden of both HIV and human papilloama virus (HPV) the virus that causes cervical cancer are high.

Cervical intraepithelial neoplasia comprised (4.8%), 225cases, while cervical cancer comprised (2.7%) 125cases. This means that whereas most patients had cin and can be treated by "see and treat" approach, there is a need for incorporating biopsies to address women with a diagnosis of suspicious for cancer.

Most of the women, 94.2% were treated with Cryotherapy, 5.3% were treated by LEEP and one total abdominal hysterectomy. This means that majority of women will fit in a single visit approach and therefore reduce costs. When well trained Cryotherapy can safely be used by nurses and midwives, which can be done as outpatient procedure and also reduce on waiting time in absence of a doctor. However we recommend that LEEP services should be accessible either at the primary screening site or referral site to address women with large

lesions and those ineligible for Cryotherapy.

The cost of reusable requirements for setting up a cervical cancer screening clinic was determined to be Ugshs 11,730,000.00. The cost of screening a population of 4659 at Mbarara Regional Referral Hospital in 2013 was Ugshs 54, 302, 200.00, the cost of screening one woman using acetic acid was Ugshs 152.00, and Pap smear per woman is Ugshs 55,000.00 which is 361 times higher than DVI with acetic acid. While the cost of screening using lugol's iodine will be Ugsh 4,000.00, which is 26 times higher than DVI with acetic acid. The cost of cin treatment in a population of 3569 women is Ugshs 9,800,000.00 plus 2280.00USD. Cryotherapy per woman is Ugshs 46,226.00. (The cost of gloves, cotton, gauze and reusable equipment such as speculums and Cryotherapy unit is not included is not included). This result shows that VIA and Cryotherapy is the most cost effective methods for screening and treatment of cin.

The total cost of screening a population of 5000 will be 58, 351,000.00. The cost of acetic acid screening per woman is Ugshs 152.00 and Ugshs 55,000.00 (361times higher) with Pap smear, but Ugshs 4,000.00 with lugol's iodine. The cost of Cryotherapy in a population of 5000woman will be Ugshs 9,800,000.00; the cost of Cryotherapy per woman is Ugshs 43,363.00(the cost of gloves, cotton, gauze and reusable equipment such as speculums and Cryotherapy unit is not included).

When using two stationary clinic nurses to screen a population of 5000 women the cost will be Ugshs 23,204,000.00 in salaries and training, however if using outreach model the cost in allowances and training will be Ugshs 85,450,000.00. When using a group of 20 volunteers for the outreach model the cost will be Ugshs 33,050,000.00 in allowances and training. The most cost effective method in terms of money is a stationary clinic. However when you consider time outreaches by volunteers are the most cost effective because a stationary clinic will take 240 days, two clinic nurses in outreaches will take 125 days while volunteer outreaches will take 12 days to screen a population of 5000 women. .Below is some of the studies that evaluated the cost effectiveness of the different cervical cancer screening and treatment methods.

Cervical cancer is an important public health problem among adult women in developing countries in South and Central America, sub-Saharan Africa, and south and south-east Asia. Frequently repeated cytology screening programs either organized or opportunistic have led to a large decline in cervical cancer incidence and mortality in developed countries. In contrast, cervical cancer remains largely uncontrolled in high-risk developing countries because of ineffective or no screening. This article briefly reviews the experience from existing screening and research initiatives in developing countries.

Substantial costs are involved in providing the infrastructure, manpower, consumables, follow-up and surveillance for both organized and opportunistic screening programmes for cervical cancer. Owing to their limited health care resources, developing countries cannot afford the models of frequently repeated screening of women over a wide age range that is used in developed countries. Many low-income developing countries, including most in sub-Saharan Africa, have neither the resources nor the capacity for their health services to organize and sustain any kind of screening programme. Middle-income developing countries, which currently provide inefficient screening, should reorganize their programmes in the light of experiences from other countries and lessons from their past failures. Middle-income countries intending to organize a new screening programme should start first in a limited geographical area, before considering any expansion. It is also more realistic and effective to target the screening on high-risk women once or twice in their lifetime using a highly sensitive test, with an emphasis on high coverage (>80%) of the targeted population.

Efforts to organize an effective screening programme in these developing countries will have to find adequate financial resources, develop the infrastructure, train the needed manpower, and elaborate surveillance mechanisms for screening, investigating, treating, and following up the targeted women. The findings from the large body of research on various screening approaches carried out in developing countries and from the available managerial guidelines should be taken into account when reorganizing existing programmes and when considering new screening initiatives.(Sankaranarayanan et al., 2001).

A study was conducted whose objective was to evaluate the cost-effectiveness of human papillomavirus (HPV) DNA testing as a primary screening test in combination with cervical cytology in women aged 30 years or more. A state-transition mathematical model was used to simulate the natural history of HPV and cervical cancer in a cohort of U.S. women. Strategies included no screening and screening at different frequencies with conventional cytology, liquid-based cytology with HPV testing used for triage of equivocal results, and HPV DNA testing and cytology in combination after women had reached the age of 30. Outcomes measured included cancer incidence, life expectancy, lifetime costs, and incremental cost-effectiveness ratios. The results showed that the estimated reduction in lifetime risk of cervical cancer varies from 81% to 93% depending on the screening frequency, type of cytology, and test strategy. Every 3-year screening with liquid-based cytology administered to women at all ages and every 3-year screening using HPV DNA testing and cytology in combination administered to women aged 30 years or more provide equivalent or greater benefits than those provided by annual conventional cytology and have incremental cost-effectiveness ratios of $95,300 and $228,700 per year of life gained, respectively. In comparison, annual screening with HPV DNA testing and

cytology in combination provides only a few hours of additional life expectancy and has a cost-effectiveness ratio of more than $2,000,000 per year of life gained. In conclusion for women aged 30 years and more, every 2- or 3-year screening strategy that uses either HPV DNA testing in combination with cytology for primary screening or cytology with reflex HPV DNA testing for equivocal results will provide a greater reduction in cancer and be less costly than annual conventional cytology.(Goldie et al., 2004).

Cervical cancer is the most common cancer among women in developing countries. Assessment was done to determine the effect of screening using visual inspection with 4% acetic acid (VIA) on cervical cancer incidence and mortality in a cluster randomised controlled trial in India. Of the 114 study clusters in Dindigul district, India, 57 were randomised to one round of VIA by trained nurses, and 57 to a control group. Healthy women aged 30 to 59 years were eligible for the study. Screen-positive women had colposcopy, directed biopsies, and, where appropriate, cryotherapy by nurses during the screening visit. Those with larger precancerous lesions or invasive cancers were referred for appropriate investigations and treatment. Cervical cancer incidence and mortality in the study groups were analysed and compared using Cox regression taking the cluster design into account, and analysis was by intention to treat. The primary outcome measures were cervical cancer incidence and mortality. Of the 49 311 eligible women in the intervention group, 31 343 (63·6%) were screened during 2000–03; 30 958 control women received the standard care. Of the 3088 (9·9%) screened positive, 3052 had colposcopy, and 2539 directed biopsy. Of the 1874 women with precancerous lesions in the intervention group, 72% received treatment. In the intervention group, 274 430 person years, 167 cervical cancer cases, and 83 cervical cancer deaths were accrued compared with 178 781 person-years, 158 cases, and 92 deaths and in the control group during 2000–06 (incidence hazard ratio 0·75 [95% CI 0·55–0·95] and mortality hazard ratio 0·65 [0·47–0·89]). This shows that VIA screening, in the presence of good training and sustained quality assurance, is an effective method to prevent cervical cancer in developing countries.(Sankaranarayanan et al., 2007).

Cervical cancer is a leading cause of cancer-related death among women in developing countries. In low-resource settings, cytology-based screening is difficult to implement, and less complex strategies may offer additional options. The objective was to assess the cost-effectiveness of several cervical cancer screening strategies using population-specific data. Cost-effectiveness was determined by analysis using a mathematical model and a hypothetical cohort of previously unscreened 30-year-old black South African women. Screening tests included direct visual inspection (DVI) of the cervix, cytologic methods, and testing for high-risk types of human papillomavirus (HPV) DNA. Strategies differed by number of clinical visits, screening frequency, and response to a positive test result. Data sources included a South African screening study, national surveys and fee schedules, and published literature. The main outcome measures years of life saved (YLS), lifetime costs in US dollars, and incremental cost-effectiveness ratios (cost per YLS). The results showed that when analyzing all strategies performed as a single lifetime screen at age 35 years compared with no screening, HPV testing followed by treatment of screen-positive women at a second visit, cost $39/YLS (27% cancer incidence reduction); DVI, coupled with immediate treatment of screen-positive women at the first visit was next most effective (26% cancer incidence reduction) and was cost saving; cytology, followed by treatment of screen-positive women at a second visit was least effective (19% cancer incidence reduction) at a cost of $81/YLS. For any given screening frequency, when strategies were compared incrementally, HPV DNA testing generally was more effective but also more costly than DVI, and always was more effective and less costly than cytology. When comparing all strategies simultaneously across screening frequencies, DVI was the nondominated strategy up to a frequency of every 3 years (incremental cost-effectiveness ratio, $460/YLS), and HPV testing every 3 years (incremental cost-effectiveness ratio, $11 500/YLS) was the most effective strategy. The conclusion was that cervical cancer screening strategies that incorporate DVI or HPV DNA testing and eliminate colposcopy may offer attractive alternatives to cytology-based screening programs in low-resource settings.(Goldie et al., 2001).

In another study was conducted who's objective was to determine the potential effects on costs and outcomes of changes in sensitivity and specificity with new screening methods for cervical cancer. Using a Markov model of the natural history of cervical cancer, the effects of sensitivity, specificity, and screening frequency on cost-effectiveness were estimated. The estimates of conventional Papanicolaou test sensitivity of 51% and specificity of 97% were obtained from a meta-analysis. The effect of reducing false-negative rates from 40–90% and increasing false-positive rates by up to 20%, independently and jointly estimated. The marginal cost of improving sensitivity varied from $0 to $15. When specificity was held constant, increasing sensitivity of the Papanicolaou test increased life expectancy and costs. When sensitivity was held constant, decreasing specificity of the Papanicolaou test increased costs, an effect that was more dramatic at more frequent intervals. Decreased specificity had a substantial effect on cost-effectiveness estimates of improved Papanicolaou test sensitivity. Most of those effects are related to the cost of evaluation and treatment of low-grade lesions. It was concluded that policies or technologies that increased sensitivity of cervical cytologic screening increased overall costs, even if the cost of the technology was identical to that of conventional Papanicolaou smears. These effects

appear to be caused by relatively high prevalence of low-grade lesions and are magnified at frequent screening intervals. Efficient cervical cancer screening requires methods with greater ability to detect lesions that are most likely to become cancerous.(Myers et al., 2000).

Another study was performed to determine the effect of noncytologic methods of screening for cervical carcinoma and its precursor lesions are needed for resource-poor settings in which cervical carcinoma continue to be an important cause of morbidity and mortality. Two thousand nine hundred forty-four women ages 35–65 years were recruited from Cape Town, South Africa and screened using a combination of a Papanicolaou (Pap) smear, human papillomavirus (HPV) DNA testing, direct visual inspection after the application of a 5% acetic acid solution (DVI), and cervicography. Cervicography was considered primarily as a method with which to quality control the DVI examinations. Women with squamous intraepithelial lesions (SIL) or carcinoma on Pap smear, positive DVI examination (acetowhite lesion or cervical ulcer/growth), high levels of high risk HPV DNA (relative light units [RLU] > 10× positive control), or positive Cervigram™ were referred for colposcopy and cervical biopsy. Pap smears were positive in 8.1% of all women screened and identified 65 (78%) of all cases of biopsy confirmed high grade disease (high grade SIL or invasive carcinoma). DVI and cervicography were classified as positive in 18.1% and 10.5%, respectively, of women screened and identified 58 (67%) and 46 (58%) of all cases of high grade disease, respectively. The results of HPV DNA testing varied depending on the cutoff value used to define a positive result. At the standard cutoff level (RLU > 1× positive control), 16.2% of women screened were classified as high risk HPV DNA positive, as were 63 women with high grade disease (73%). DVI and HPV DNA testing identified similar numbers of high grade SIL (cervical intraepithelial neoplasia Grade 2,3) and invasive carcinoma cases as Pap smears. However, both classify considerably more women without cervical disease as being test positive. Cancer 2000; 89:826–33. © 2000 American Cancer Society.(Denny et al., 2000)

Conclusion

Cytologic screening is several times more costly than direct visual inspection (DVI). Visual inspection screening of the cervical and treatment with Cryotherapy can be used as a cost effective alternative method to cytologic examination for control of cervical cancer in low resource areas. Using existing staff and integration of screening services into existing services into annual hospital budget helps in sustainability of donor initiated cervical cancer screening programs.

Recommendations

Cervical cancer screening programs in low resource areas should adopt direct visual inspection using 3-5% acetic acid as the main screening method and “see and treat” approach for treatment of positive lesions. For program sustainability cervical cancer screening services should be integrated into the main hospital programs and annual budget. Existing personnel and infrastructure should be used for cost effectiveness and sustainability. The primary screening clinic for a population of 5000 women should have 5liters of 100% acetic acid, a Cryotherapy unit, 5 medium cylinders of nitrous oxide gas, 2 nurses and enough consumables per year for effective running and sustainability. In addition to the above there should be an accessible referral clinic/hospital which can do Pap smears, colposcopy, biopsy, LEEP, hysterectomy and radiotherapy.

Competing interests: Authors did not have any conflict of interest

Authors' information:

1. Mayanja Ronald, MBChB(MUST), MMed O&G(MU), Lecturer, Department of obstetrics and Gynaecology, Mbarara University of Science and Technology, Uganda
2. Mubiru Musa, MBChB (MUST), chief resident MMed Department of obstetrics and Gynaecology, Mbarara University of Science and Technology Uganda
3. Masembe Sezalio, MBChB(MUST), chief resident MMed Department of obstetrics and Gynaecology, Mbarara University of Science and Technology, Uganda
4. Nkonwa Innocent, MBChB(KIU), MMed O&G(MUST), Department of obstetrics and Gynaecology, Mbarara University of Science and Technology, Uganda
5. Chakura Andrew, MBChB(MUST),chief resident MMed Department of obstetrics and Gynaecology, Mbarara University of Science and Technology, Uganda
6. Ngonzi Joseph, MBChB(MUST), MMed O&G(MUST), PhD candidate, Senior lecturer, Chair Department of obstetrics and Gynaecology, Mbarara University of Science and Technology, Uganda

Acknowledgements:

We would like to acknowledge the following groups, the administrations of Mbarara Regional Referral Hospital who allowed us to carry out the study in the hospital and the nurses in the colposcopy clinic who

helped in data collection.

References

DENNY, L., KUHN, L., POLLACK, A., WAINWRIGHT, H. & WRIGHT, T. C. 2000. Evaluation of alternative methods of cervical cancer screening for resource‐poor settings. *Cancer,* 89**,** 826-833.

GOLDIE, S. J., GAFFIKIN, L., GOLDHABER-FIEBERT, J. D., GORDILLO-TOBAR, A., LEVIN, C., MAHÉ, C. & WRIGHT, T. C. 2005. Cost-effectiveness of cervical-cancer screening in five developing countries. *New England Journal of Medicine,* 353**,** 2158-2168.

GOLDIE, S. J., KIM, J. J. & WRIGHT, T. C. 2004. Cost-effectiveness of human papillomavirus DNA testing for cervical cancer screening in women aged 30 years or more. *Obstetrics & Gynecology,* 103**,** 619-631.

GOLDIE, S. J., KUHN, L., DENNY, L., POLLACK, A. & WRIGHT, T. C. 2001. Policy analysis of cervical cancer screening strategies in low-resource settings: clinical benefits and cost-effectiveness. *Jama,* 285**,** 3107-3115.

MYERS, E. R., MCCRORY, D. C., SUBRAMANIAN, S., MCCALL, N., NANDA, K., DATTA, S. & MATCHAR, D. B. 2000. Setting the target for a better cervical screening test: characteristics of a cost-effective test for cervical neoplasia screening. *Obstetrics & Gynecology,* 96**,** 645-652.

SANKARANARAYANAN, R., BUDUKH, A. M. & RAJKUMAR, R. 2001. Effective screening programmes for cervical cancer in low-and middle-income developing countries. *Bulletin of the World Health Organization,* 79**,** 954-962.

SANKARANARAYANAN, R., ESMY, P. O., RAJKUMAR, R., MUWONGE, R., SWAMINATHAN, R., SHANTHAKUMARI, S., FAYETTE, J.-M. & CHERIAN, J. 2007. Effect of visual screening on cervical cancer incidence and mortality in Tamil Nadu, India: a cluster-randomised trial. *The Lancet,* 370**,** 398-406.

SANKARANARAYANAN, R., GAFFIKIN, L., JACOB, M., SELLORS, J. & ROBLES, S. 2005. A critical assessment of screening methods for cervical neoplasia. *International Journal of Gynecology & Obstetrics,* 89**,** S4-S12.

WAGGONER, S. E. 2003. Cervical cancer. *The Lancet,* 361**,** 2217-2225.