International Journal of Gynecology and Obstetrics xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

www.figo.org

CLINICAL ARTICLE

Estimating the costs of cervical cancer screening in high-burden Sub-Saharan African countries

Mercy Mvundura [a,*], Vivien Tsu [b]

[a] PATH, Technology Solutions Program, Seattle, USA
[b] PATH, Reproductive Health Global Program, Seattle, USA

ARTICLE INFO

Article history:
Received 23 October 2013
Received in revised form 17 February 2014
Accepted 1 April 2014

Keywords:
Cervical cancer
Economic costs
Financial costs
Scale up
Screening
Sub-Saharan Africa
Visual inspection with acetic acid

ABSTRACT

Objective: To estimate the capital investment and recurrent costs of national cervical cancer screening and precancer treatment programs in 23 high-incidence countries in Sub-Saharan Africa in order to provide estimates of the investment required to tackle the burden of cervical cancer in this region. These 23 countries account for 64% of the annual cervical cancer deaths in this region. *Methods:* Secondary data were used to estimate the financial costs of equipment purchases and economic costs of screening and treating eligible women over a 10-year period. Screening would be by visual inspection with acetic acid and treatment by cryotherapy or loop electrosurgical excision procedure. *Results:* Approximately US $59 million would be required to purchase treatment equipment if cryotherapy were placed at every screening facility. Approximately 20 million women would be screened over 10 years. Cost per woman screened in a screen-and-treat program was either US $3.33 or US $7.31, and cost per woman treated was either US $38 or US $71 depending on the location of cryotherapy equipment. *Conclusion:* It would take less than US $10 per woman screened to significantly decrease the cervical cancer deaths that will occur in Sub-Saharan Africa over the next 10 years.

1. Introduction

Cervical cancer is the leading cause of cancer death for women in Sub-Saharan Africa, with approximately 50 000 women dying from it each year and 64% of these deaths occurring in 23 countries [1]. During a 10-year period, this means that approximately 320 000 women will die. This high burden of disease is largely attributable to the lack of cervical cancer screening programs, as evidenced by low incidence and burden in high-resource countries that have established screening programs [2–4]. Screening enables detection of precancer that nearly always can be eliminated by treatment, preventing the development of cancer. While HPV vaccination is an important part of a comprehensive cervical cancer prevention program, the present paper focuses on screening and the benefits that can be expected from it in the next decade.

Screening using visual inspection with acetic acid (VIA) has been shown to be an effective method for low-resource settings, and VIA is more feasible operationally than cytology-based screening [4,5]. VIA can be performed at health centers with limited supplies and has the advantage that results are available immediately, enabling the option of single-visit screening and treatment at the same facility or immediate counseling and referral for treatment.

Several studies and pilot projects have been undertaken in Africa, either to show feasibility or to demonstrate a program of screening for cervical cancer [4,6–9], but none of the Sub-Saharan African countries has successfully scaled up a national cervical cancer screening program for all eligible women. Some countries, such as Ethiopia, Tanzania, and Zambia, have cervical cancer screening programs for HIV-positive women, while others, such as Kenya and Uganda, have developed strategic plans for national screening and control and are slowly phasing in services.

Cost is an important factor to consider when deciding to scale up services. The objective of the present analysis was to estimate the financial cost of equipment purchases and economic costs of national screening and treatment programs for cervical cancer in the Sub-Saharan African countries that have a high rate of cervical cancer, defined here as an age-standardized incidence rate greater than or equal to 30 cases per 100 000 women. The aim was to provide preliminary estimates of some of the costs of tackling the cervical cancer burden in Africa.

2. Materials and methods

The GLOBOCAN database [1] was used to identify the 23 countries that have a cervical cancer age-standardized incidence rate greater than or equal to 30 per 100 000 women. This includes approximately 34% of the population of women aged 30–49 years in the region and nearly 65% of the cervical cancer deaths.

* Corresponding author at: PATH, PO Box 900922, Seattle, Washington 98109, USA. Tel.: +1 206 285 3500; fax: +1 206 285 6619.
E-mail address: mmvundura@path.org (M. Mvundura).

http://dx.doi.org/10.1016/j.ijgo.2014.02.012
0020-7292/

Please cite this article as: Mvundura M, Tsu V, Estimating the costs of cervical cancer screening in high-burden Sub-Saharan African countries, Int J Gynecol Obstet (2014), http://dx.doi.org/10.1016/j.ijgo.2014.02.012

The financial and economic costs were estimated for a hypothetical screening and treatment program, where VIA would be used for screening and precancer treatment would be by cryotherapy or, when cryotherapy was not suitable, loop electrosurgical excision procedure (LEEP). (Financial costs capture only actual expenditures associated with a program, while economic costs value all resources used). It was assumed that screening would occur at the lowest level of the health system, and LEEP would be provided only at tertiary level referral facilities, such as regional hospitals. Two scenarios were considered for treatment by cryotherapy: (1) a single-visit approach, which implies that cryotherapy would be available at all facilities offering screening; and (2) a two-visit approach assuming that cryotherapy would occur only at the district level (the level above the lowest level). The costs were estimated for a screening program that would target women aged 30–39 years and used 2010 population data [10] to estimate the number of women eligible for screening in each country. The reported population was adjusted to 2013 levels using population annual growth rates [11]. It was assumed that the same number of women would be screened every year and each woman would be screened once during a 10-year time period.

Further assumptions regarding the numbers of women screened and treated are presented in Table 1. Note that it is assumed that all women with positive screen results will be treated either with cryotherapy or LEEP, implying that no women in this 30–39-year-old cohort would have cancer or lesions requiring other treatment methods.

An Excel-based model was used for the analysis. To begin, the financial cost of procuring cryotherapy and LEEP equipment was estimated, assuming that no equipment was currently available. For cryotherapy equipment, the cost of the units was included (approximately US $1100 each), and for LEEP, the LEEP machine (approximately US $5200 each), smoke evacuator (US $2000 each), and colposcope (US $3200 each) were included. Equipment prices were obtained from procurement documents for the Screening Technologies to Advance Rapid Testing for Cervical Cancer Prevention–Utility and Program Planning (START-UP) demonstration study in Uganda [12]. The financial cost of other (lower-priced) equipment, such as speculums, or international and local shipping costs or customs duties were not included, since these costs vary greatly by country.

The economic costs were then estimated, for which the main categories were supplies, clinical staff, and annual costs of equipment. All costs were reported in 2012 US dollars, and future expenditures were not discounted.

Data from an unpublished study conducted under the START-UP project were used to inform the estimates of the costs of supplies per woman for each screening and treatment procedure and it was assumed that these costs would not vary by country (Table 1). The same costing study was used as the source of data on the average number of minutes spent per woman for each screening and treatment procedure, and it was assumed that those costs would not vary by country. Country-specific salary data from comprehensive Multi-Year Plans (cMYP) [13] were used to estimate cost per minute of staff time, after adjusting salaries to 2012 US dollars using inflation rates on salaries reported in the cMYP. No ethics approval was sought for this study as it uses only secondary data. However, the unpublished cost study was submitted to the PATH Research Determination Committee and deemed non-human subjects research and did not need to be reviewed by an ethics committee. Informed consent was not needed for the cost study because only study staff were interviewed, not the women receiving services.

Total costs of screening supplies were estimated by multiplying the cost of supplies per woman by the number of women screened. Total clinical staff costs were estimated as the product of the number of minutes spent per woman, the country-specific clinical staff cost per minute, and the number of women screened. Similar methods were used to estimate total costs of supplies and clinical staff costs for each treatment method, multiplying by the number of women treated.

The economic costs of equipment were also estimated, which included the cryotherapy and LEEP equipment as well as speculums, basins, and examination tables. The study assumed a 10-year useful life for equipment and a 3% discount rate to determine the annualization factor, and annualized equipment costs were estimated by dividing the price of each type of equipment by the annualization factor. Total annual economic costs for equipment were estimated by multiplying the annualized cost for each equipment unit, the assumed quantity of equipment per facility, and the number of facilities at that level of the health system. The number of facilities at each level of the health system was obtained from each country's cMYP.

Table 1
Key assumptions and cost estimates for cervical cancer screening and treatment in Sub-Saharan Africa.

Variable	Value	Source and comments
Proportion of eligible women presenting for screening	80%	Assumed
Proportion of women having an abnormal VIA screening result	11.5%	WHO [4]
Proportion of women eligible for treatment with cryotherapy	87.7%	WHO [4]
Proportion of eligible women receiving cryotherapy when cryotherapy is offered at the health center	95%	Assumed
Proportion of eligible women receiving cryotherapy when cryotherapy is offered at the district	80.8%	Assumed a 15% loss to follow up with referral to the district
Proportion of women eligible for treatment with LEEP	12.3%	Assumed; this implies that all women are effectively treated with cryotherapy or LEEP
Proportion of eligible women treated with LEEP	50%	Assumes 50% loss to follow up with referral to tertiary level care
Costs of supplies for VIA	US $0.32	START-UP project – Uganda (unpublished study)
Costs of supplies for cryotherapy	US $1.99	START-UP project - Uganda
Costs of supplies for LEEP	US $31.48	START-UP project - Uganda
Amount of time to perform VIA screening	10 minutes	START-UP project - Uganda
Staff time per woman to perform cryotherapy procedure	25 minutes	START-UP project - Uganda
Amount of time to perform LEEP procedure	25 minutes	START-UP project – Uganda
Salaries for medical personnel	Varied by country	WHO Comprehensive multi-year plans [14]
Annual economic costs of equipment used for VIA (costs per facility)	US $40	START-UP project – Uganda
Annual economic cost for equipment used for cryotherapy when at the health post (costs per facility)	US $167	START-UP project – Uganda Assumed that there is one cryotherapy machine per facility
Annual economic cost for equipment used for cryotherapy when at the district (costs per facility)	US $309	START-UP project – Uganda Assumed that there are two cryotherapy machines per facility
Annual economic cost for equipment used for LEEP (costs per facility)	US $1300	START-UP project – Uganda
Number of health facilities at each level	Varied by country	WHO Comprehensive multi-year plans [14]

Abbreviations: VIA, visual inspection with acetic acid; LEEP, loop electrosurgical excision procedure; WHO, World Health Organization.

Please cite this article as: Mvundura M, Tsu V, Estimating the costs of cervical cancer screening in high-burden Sub-Saharan African countries, Int J Gynecol Obstet (2014), http://dx.doi.org/10.1016/j.ijgo.2014.02.012