



Estimating the lost benefits of not implementing a visual inspection with acetic acid screen and treat strategy for cervical cancer prevention in South Africa

Gwinyai Masukume¹

Plain Language Summary

Cancer of the cervix (mouth of the womb) is still very common in South Africa despite the country having a policy aimed at reducing the impact of this cancer for more than a decade.

One of the ways of preventing cervical cancer is by detecting abnormalities on the cervix that might later develop into cancer and treating them early. The Pap smear (named after its inventor Georgios Papanikolaou) is a way to detect such pre-cancerous abnormalities by scrapping cells off the cervix and viewing them under the microscope to see if they have the potential to turn into cancerous cells. The Pap smear thus relies on a laboratory, transport (to convey the cervical cell samples to the laboratory) and results take time to come back from the laboratory. Because of these factors, the South African policy that relies on the Pap smear has not been successful in preventing cervical cancer; only 14% of women are reached versus the planned 70%.

Another way to detect cervical abnormalities that could turn into cancer is by applying acetic acid (vinegar) to the cervix. By applying acetic acid, abnormalities that could turn into cancer are generally identified within ten minutes and can be treated immediately – this approach is termed visual inspection with acetic acid (VIA). Zambia has been using VIA successfully since 2006 on a wider scale to prevent cervical cancer in its women. Botswana and Zimbabwe also followed Zambia's example relatively quickly.

Because the Pap smear is not effective in a country like South Africa to reduce cervical cancer for most women, a mathematical model was built using reliable data to estimate what would have happened if South Africa had used VIA like Zambia did. The study found that South Africa could have prevented more cases and deaths from cervical cancer by using VIA rather than the Pap smear. The findings of this study provide important lessons for those responsible for delivering health care in South Africa to consider using VIA to prevent cervical cancer.

Editors summary

This article uses [Zambian](#) data on coverage rates of *visual inspection with acetic acid* (VIA), together with [Indian](#) data of mortality in a population screened by VIA, to reach the main estimation that one round of VIA screening would have prevented 50 cases of cervical cancer and 40 deaths from it, compared to [South African](#) data on cervical cancer mortality with prevailing cervical screening. - [Mikael Häggström](#)



Abstract

Introduction South Africa has had a national cervical cancer screening policy (2002) based on the Pap (Papanicolaou) smear for more than 10 years which has not been effective. Cancer of the cervix remains a very common cancer among women in South Africa. Zambia was able to integrate Visual Inspection with Acetic acid screening for cervical cancer and treatment successfully within its public sector HIV/AIDS treatment program while minimizing the need for additional resources. The aim of this study was to quantify the impact on cervical cancer high grade pre-cursor lesions, new cases and deaths from cervical cancer had South Africa implemented a nurse driven Visual Inspection with Acetic based screen and treat strategy like Zambia (Botswana and Zimbabwe) did. Using publicly available published evidence based data a statistical model was developed to estimate the aforementioned outcomes that could have been prevented in South Africa had the country followed Zambia's strategy.

Results South Africa could have prevented over five years at least 3 300 high-grade cervical pre-cursor lesions, and assuming one round of Visual Inspection with Acetic screening and treatment, 50 cases of cervical cancer and 40 deaths from cervical cancer.

Conclusion Had South Africa adopted a pragmatic low cost method to prevent cervical cancer like Zambia (Botswana and Zimbabwe) did, substantial morbidity and mortality from cervical cancer would have been prevented. Important public health lessons for politicians, policy makers and others can be drawn from this missed opportunity.

Key words: Cervical cancer, public health, screening, human papilloma virus, nurse, cryotherapy

Introduction

South Africa (SA) has had a national cervical cancer screening policy (2002) based on the Pap (Papanicolaou) smear - a cytology based screening method for more than 10 years.^[1] Despite the existence of this screening policy, screening coverage is estimated to be about 14% (2014),^[2] far less than the envisaged 70%;^[1] consequently cancer of the cervix remains a common cancer among women in SA.^[3]

This is not surprising because cytology based screening methods are difficult to establish and maintain in settings such as South Africa's, this fact has been known for several years, prior to 2006.^{[4][5]}

Because of the limitations of the Pap smear, Zambia,^[6] Botswana^[7] and Zimbabwe^[8] (which are on average less well-resourced than SA^[9] - see Figures 1, 2 and Supplementary figure) have implemented on a wider scale screening for pre-cancerous lesions of the cervix based on VIA (visual inspection with acetic acid aided by a digital camera), which is a safe method.^[4] VIA has been demonstrated to reduce the number of new cases of

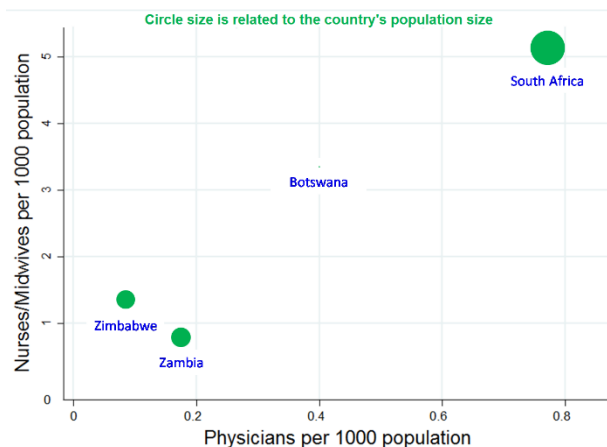


Figure 1 | Relative key human resources for health available in the four countries. Circle size proportionate to the country's population. *Data accessed 3 June 2015*

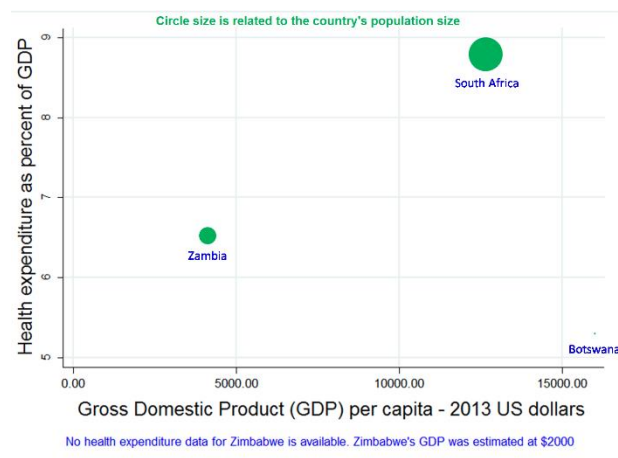


Figure 2 | Relative financial resources available for health in the four countries. Circle size proportionate to the country's population. *Data accessed 2 June 2015*

¹Division of Epidemiology and Biostatistics, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

ORCID: 0000-0002-9251-0264

Corresponding author: parturitions@gmail.com

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cervical cancer as well as deaths from it.^[10] The other advantages of VIA is that it is a low cost and effective method – one can see and treat worrisome cervical lesions in one sitting thereby reducing laboratory, transport, loss to follow-up, infrastructure and other costs associated with the Pap smear.^{[6][11]} Unlike the Pap smear, VIA can achieve higher coverage rates – high coverage is a known important factor in reducing the burden of cervical cancer.^[12]

It is known that VIA results in overtreatment, however using the Pap smear results in undertreatment (because of low coverage).^[12] Screening and treatment for cervical cancer has been demonstrated to result in reduced costs overall compared to relying on treatment alone.^[13]

Zambia started its nurse driven VIA program in 2006 and has managed to screen and treat almost 60 000 women in 5 years.^[6] What would have been the impact on cervical cancer high grade pre-cursor lesions, new cases and deaths from cervical cancer had SA implemented a nurse driven VIA based screening strategy in 2008 (when level one evidence^[14] existed that VIA was beneficial)? The lost benefits of not implementing a VIA based cervical cancer screen and treat programme in SA from 2008-2012 inclusive are estimated.

Methods

The central assumption made was that SA could have feasibly screened about 58 000 women with VIA in five years like Zambia did. Since SA has a Pap smear screening coverage of approximately 13.6% in 3 years for women aged 18-69 years,^[2] it was assumed that of the 58 000 women that SA could have screened with VIA only 44 853 not screened by Pap smear could have benefited from VIA. And about 85%^[7] of these 44 853 women could have been treated successfully (Figure 3).

Data for the expected proportion of high-grade cervical cancer precursor lesions in VIA screened and a control (unscreened) population was obtained from a South African study reported in 2005.^[4]

| Months | CIN 2+ rate if no screening ^[4] | Number of CIN 2+ cases if no screening | CIN 2+ rate if VIA screened ^[4] | Number of CIN 2+ cases if VIA screened | CIN 2+ prevented by VIA screening |
|--------|--|--|--|--|-----------------------------------|
| 6 | 3.55% | 1353 | 2.23% | 850 | 503 |
| 12 | 5.41% | 2063 | 2.91% | 1109 | 953 |

Table 1 | Number of high-grade cervical cancer lesions that could have been potentially prevented.

Assuming SA had screened 58 000 women like Zambia did (with an SA Pap smear screening coverage of 13.6% in 3 years, 44 853 women would have benefited from VIA screening and of these 85% - 38 125 - would have been treated successfully with VIA - these are the women included in the model). Data on the rate of high-grade cervical cancer pre-cursor lesions was available up to 12 months. Because more pre-cancerous lesions develop over 5 years, the model underestimates the benefit of VIA (see Discussion). CIN 2+, high-grade cervical cancer precursor lesions.

Data on the expected incidence and mortality from cervical cancer in a VIA screened (single round of screening) and a control (unscreened) population was obtained from an Indian study reported in 2007.^[10]

South Africa's population is approximately 3.5 times that of Zambia's (with females being almost half the population in both countries).^[15] The final assumption made was that SA could have screened a similar proportion of women as Zambia, thus the estimates were multiplied by 3.5.

These data were used to estimate the number of high-grade cervical cancer precursor lesions, new cases and deaths from cervical cancer that could have been prevented had SA implemented a VIA screen and treat (cryotherapy) or refer strategy.

Ethical approval for this study was not required because publicly available data was used for estimation.

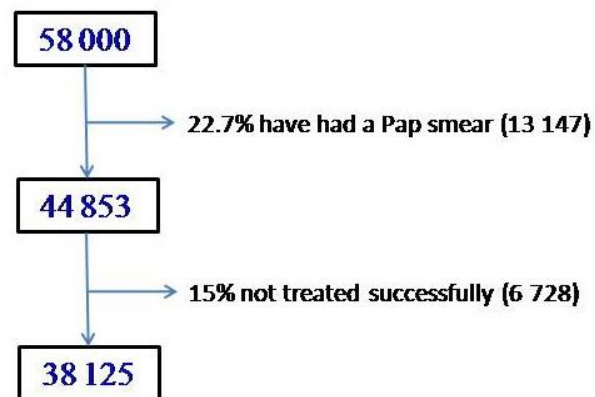


Figure 3 | Flow chart depicting the assumptions made to arrive at the final population that would have benefited from VIA screening. (22.7% five-year Pap smear coverage obtained from 13.6% 3 year coverage - [13.6%/3] x 5).

Results

SA could have prevented over five years at least 3 300 high-grade cervical pre-cursor lesions, and assuming one round of VIA screening, 50 cases of cervical cancer and 40 deaths from cervical cancer (see Tables 1 and 2



| Crude incidence rate per 100 000 per year ^[2] | Expected cases of cervical cancer in 5 years without VIA | Crude mortality rate per 100 000 per year ^[2] | Expected deaths from cervical cancer in 5 years without VIA |
|--|--|--|---|
| 30.2 | 58 | 16.6 | 32 |
| Incidence hazard ratio ^[10] | Expected cases of cervical cancer in 5 years with VIA | Mortality hazard ratio ^[10] | Expected deaths in 5 years with VIA |
| 0.75 | 43 | 0.65 | 21 |
| | Cases prevented | | Cases prevented |
| | 14 | | 11 |

Table 2 | Number of cervical cancer cases and deaths that could have been potentially prevented.

Assuming SA had screened 58 000 women like Zambia did (with an SA Pap smear screening coverage of 13.6% in 3 years, 44 853 women would have benefited from VIA screening and of these 85% - 38 125 - would have been treated successfully with VIA - these are the women included in the model)

– final estimates were multiplied by 3.5 because South Africa’s population is larger than Zambia’s by approximately that factor).

Discussion

The consequences of SA not implementing timely and feasible public health intervention in the form of antiretroviral therapy for HIV treatment, while its neighbours were doing so, have been described previously.^[16] This study quantified the consequences of SA not implementing a feasible and timely public health intervention for prevention of cervical cancer that countries in the region implemented.

Zambia was able to integrate VIA screening and treatment (cryotherapy, loop electrosurgical excision procedure and so on) successfully within its public sector HIV/AIDS treatment program while minimizing the need for additional resources.^{[6][17]} South Africa with the world’s largest HIV/AIDS treatment program and the most people living with HIV in the world^[18] could have also possibly managed to follow in Zambia’s pragmatic low cost approach and saved lives. Additionally, Botswana and Zimbabwe (neighbouring countries to SA) relatively quickly, in 2009^[7] and 2010^[8] respectively followed Zambia’s example and have been offering VIA as a standard screening procedure while SA has considered it as an experimental approach (2011).^[19]

Screening and treatment for cervical pre-cursor lesions is even more pertinent because HIV infection is a known factor that increases the risk of developing cervical cancer.^[20]

Primary prevention of cervical cancer by vaccination^[21] does not obviate the need for secondary prevention by cervical cancer screening.^[22] Despite human papilloma virus (HPV) screening being more effective and sensitive than VIA, a positive HPV result still requires visual methods in a setting like South Africa’s.^[17] It has been acknowledged that the Pap smear has not been effective in SA^[21] because it is difficult to establish and maintain screening with the Pap smear on

a wide scale in SA.^{[4][5]} Given this scenario, a VIA based screen and treat strategy appears to be a very viable solution for SA.

The strength of this study is its use of publicly available evidence based data to generate the estimates. These estimates are however underestimates because the data from India used to calculate mortality from cervical cancer is from a population with a lower prevalence of HIV infection - a known risk factor for developing cervical cancer - compared to SA. Also, only one round of screening was assumed, more screening rounds would have led to a bigger impact. As mentioned previously, the Zambian program has been running for almost a decade, thus the five-year period considered here minimizes the potential impact in SA.

Conclusion

Had SA adopted a pragmatic low cost method to prevent cervical cancer like Zambia did substantial morbidity and mortality from cervical cancer would have been prevented. Important public health lessons can be drawn from this missed opportunity for politicians, health policy makers and others.

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