RESEARCH ARTICLE

Cervical Screening Using Visual Inspection with Acetic Acid (VIA) and Treatment with Cryotherapy in Fiji

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Abstract

The purpose of this study was to demonstrate the feasibility of VIA screening with cryotherapy and to record normative values for indicators anticipated in similar low resource settings. Women aged 30-49 years were targeted, resulting in 1961 women screened and treated at two primary health care (PHC) centres near Suva, Fiji. Recruitment was through provision of information, education and communication (IEC). Referrals to a gynaecology outpatient department (OPD) at a referral hospital occurred throughout the screening pathway. Participation was 32% (95%CI 31-33%), higher in iTaukei (Melanesians) women (34%, 95%CI 33-36) compared to Fijians of Indian descent (26%, 95%CI 24-28). Regression analysis, adjusted for confounders, indicated significantly lower participation in those of Indian descent, and age groups 35-39 and 45-49 years. Of those examined by VIA, 190 were positive with aceto-white lesions (9.9%), within the expected range of 8-15%, with minor geographic and ethnic variation. Positive VIA results were more common in the peri-urban area, and in those aged 35-39 years. Of women aged 30-49 years, 59 received cryotherapy (none of whom had significant complications), 91 were referred to OPD, two cervical carcinomas were identified and eight cervical intra-epithelial neoplasms (CIN) II-III were diagnosed. These results provide normative findings from a community-based VIA screening program for other similar low resource settings.

Keywords: Cervical cancer - cryotherapy - Fiji - screening - visual inspection

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Introduction

Globally, cervical cancer has a high disease burden (Arbyn et al., 2008). Fiji has one of the highest incidences of cervical cancer in the Pacific region (Kuehn et al., 2012; Foliaki et al., 2011). In 2012, cervical cancer was the second most common cause of death among Fijian women, after breast cancer (Ferlay et al., 2013) and no decline in mortality has occurred since 2000 (Kuehn et al., 2012).

Organised population-wide Pap test screening has led to decreases in incidence and mortality from cervical cancer in the years following screening introduction. In New South Wales, Australia, a sustained decrease in cervical cancer incidence commenced immediately after introduction of organised screening, and mortality began to decline three years later (Taylor et al., 2006). In Scandinavia, cervical cancer mortality reduction commenced three years after implementation of an organised cervical screening program (Laara et al., 1987; Sigurdsson, 1999). WHO has recently issued a recommendation to employ a screen-and-treat approach using Visual Inspection with Acetic acid (VIA) for screening, and treatment with cryotherapy (WHO, 2013) VIA has similar sensitivity and specificity to Pap tests (Arbyn et al., 2008; Sauvaget et al., 2011), and randomised trials of VIA screening with cryotherapy treatment have led to decreased mortality compared to controls in India (Sankaranarayanan et al., 2005, 2007a). However, unlike declines in population cervical cancer mortality associated with organised Pap test screening (Laara et al., 1987; Sigurdsson, 1995; Taylor et al., 2006), population-wide VIA service screening has yet to show consequent reduced cervical cancer mortality in populations. Although there have been a number of VIA projects in developing countries, none have been national. Projects reported from Thailand were service studies, with only incidence measured (which increased, as a consequence of case detection), and not mortality (Gaffikin et al., 2003; Chumworathayi et al., 2010). Only one involved close monitoring of cervical cancer incidence (no change) and mortality (decrease) (Shastri et al., 2014).

A national screening program in Fiji based on organised systematic recruitment has not been possible because of the limitation in provision of Pap tests and other failings of this approach, including the need to refer all abnormalities to outpatients with consequent overload

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of clinical services. Pap screening began in 1993, but the 20,000 Pap smears performed annually in Fiji are at the limit of resources for diagnostic microscopy and treatment services, with questionable levels of quality assurance (Prasad and Fong, 2007). Results are not immediately available and up to 50% of women with high-grade cytology readings do not return for follow-up. Impediments to a nationally organised and well publicised national screening program in Fiji have been: limited Pap test processing capacity (which can be circumvented by VIA); and hospital outpatient capacity (which can be circumvented by primary health care, PHC, cryotherapy). National screening programs using VIA is possible, as demonstrated in Bangladesh since 2004 (Nessa et al., 2013). Consumables required for VIA screening are acetic acid (main component of vinegar) and compressed carbon dioxide (CO_2) for cryotherapy-both of which are readily available and relatively inexpensive. Screening using DNA testing for HPV has limitations beyond costs in low resource settings. Fiji is an upper middle-income country and not eligible for HPV vaccine financial support, although vaccination is in progress.

The purpose of this study is to demonstrate the feasibility of VIA screening with cryotherapy and to document normative outcomes and data to be expected in similar low resource settings.

Materials and Methods

Populations. Women aged 30-49 years were targeted for the study. Two Medical Areas (MA) near the capital, Suva, were selected for the study: one peri-urban and the other semi-rural. Populations were based on the 2007 Census (by ethnicity) using age/sex distribution of the Rewa sub-division to obtain estimates of eligible women: peri-urban (n=3257) and semi-rural (n=2248). Ethnicity was designated by project nurses. Women in the target age group were invited to attend VIA testing. Of participants, 77% were iTaukei (Melanesians), and 21% were Fijians of Indian descent. Screening took place from July 2011 to July 2012 (13 months). The research protocol was approved by the Fiji National Research Ethics Review Committee. Consent for VIA and cryotherapy was verbal and similar to current arrangements for Pap test screening and treatment.

Training and supervision. A one week training course was conducted by the Cervical Cancer Prevention Network of the Philippines, supported by Family Planning Health NSW (Australia). The training team included two gynaecologists and one nurse. Training was provided for selected registered nurse-midwives and medical officers from the two MAs, and trainee gynaecologists. The course focussed on cervical screening with VIA and treatment of non-referable abnormalities with cryotherapy using compressed CO_2. Continued training, clinical audit and supervision were accomplished with review of digital photography of suspected abnormalities on visual inspection.

Recruitment. Women in the two MAs were recruited through provision of information, education and communication (IEC) including pamphlets and posters, etc. distributed through various local channels, and by direct invitation to participate through community and church groups and door-to-door outreach by the Reproductive and Family Health Association of Fiji (RFHAF). Information sessions for women were held at convenient sites in the MAs with the aim of recruiting 1000 women from each area aged 30-49 years for VIA testing. Information sessions were facilitated by the RFHAF or the VIA project team. If the session was held by RFHAF, the VIA testing was scheduled for a future date, but when the sessions were held by the project team, the VIA testing usually followed at the same time. Information sessions were usually held at times and places which corresponded to local community events that would involve attendance of women in the local area. Not all women who participated in the information sessions attended for subsequent VIA screening, and some women who did not attend the session attended for VIA.

Screening pathway. The screening protocol involved: *(1)* visual inspection of the cervix, with significant abnormalities referred to the Colonial War Memorial (CWM) Hospital Gynaecology Outpatient Department (OPD) in Suva; *(2)* VIA performed by a trained registered nurse-midwife if the cervix appeared normal; *(3)* following consent, cryotherapy using compressed CO_2 if a repeat VIA was positive, and advice to return for a 3-month follow-up visit for repeat VIA; *(4)* OPD referral and treatment at various stages of the screening pathway for cervical abnormalities and for aceto-white lesions too large or anatomically inappropriate for cryotherapy. VIA was undertaken at PHC facilities (Nursing Stations and Health Centres), and cryotherapy, where indicated, was performed at Health Centres. A visit for each VIA procedure took approximately 10 minutes and cryotherapy treatment, if required, took approximately 20min. Referral to OPD involved travel and waiting time, and transport costs.

Data analysis. The participation rate was calculated as the number presenting for cervical screening divided by the estimated population in the area. Actual response rates would be higher since the denominator included those who have had a hysterectomy or who had a recent Pap test, and those not reached by the IEC campaign, information sessions or invitation, including those who were geographically or otherwise inaccessible. Chi-square tests were used to determine heterogeneity within age groups, medical areas and ethnicities. Predictors of likelihood of screening attendance and of a lesion being detected (with 95% confidence intervals) were assessed by Poisson and logistic regression, respectively. Variables in the regression models were age, ethnicity and MA. Statistical analyses were conducted using SPSS v22 (IBM, Armonk, NY, USA), SAS v9.4 (SAS Institute, Cary, NC, USA) and STATA v12.1 (StataCorp, College Station, TX, USA).

Results

In total, 2626 women presented for screening, with 1961 (74.7%) within the target age group, 30-49 years (Table 1). Out-of-age screening was considerably reduced

in the latter part of the study when it became apparent this was occurring, by discouraging attendance for screening by women <30 years and >50 years. In the first six months, 1577 women presented and their cervix was visually inspected. Of those, 518 (32.8%) were out-of-age (315 <30 years, 203 >50 years). In comparison, during the last seven months of screening 1046 women presented with only 146 (14.0%) out-of-age (86 <30 years, 60 >50 years). Two women were not visually inspected due to pregnancy. The visual examinations resulted in 1924 VIA examinations (98.2%); 963 in semi-rural MA and 961 in peri-urban. VIA was not performed on 35 women (19 semi-rural, 16 peri-urban) because: cervical abnormality (n=23); squamo-columnar junction (SCJ) not visible (n=7); prolapsed cervix or uterus (n=2); unable to visualise cervix (n=1); pregnant (n=1); or cervical polyp (n=1). Figure 1 describes the screening, referral and treatment pathway.

Overall, the cumulated participation rate for women 30-49 years at the conclusion of screening was 31.8% (95%CI 30.9-32.8) (Table 1). There were significant differences in participation between MAs: 43.7% in the semi-rural MA and 30.0% in the peri-urban MA ($\chi^2_{(1)}$=108.7; p<0.001). There was a greater uptake of screening in iTaukei women (34.3%) compared to women of Indian descent (25.7%, $\chi^2_{(1)}$=40.5; p<0.01). The age pattern of screening was different between ethnicities. The lowest rate of screening in iTaukei women was in those aged 35-39 years (22.6%), and the highest in women 45-49 years (43.6%, $\chi^2_{(1)}$=103.8; p<0.01). Among women of Indian descent, the lowest screening rate was in women 45-49 years (1.4%), and the highest in women 35-39 years (50.8%, $\chi^2_{(1)}$=230.0; p<0.01). Poisson regression analysis (excluding 'other ethnicity') indicated lower participation in those of Indian descent with Relative Risk (RR)=0.35 (95%CI 0.15-0.84; p=0.02) compared to iTaukei (RR=1.0); and lower participation of 35-39 years with RR=0.35 (95%CI 0.13-0.91; p=0.03) and 45-49 years with RR=0.11 (95%CI 0.04-0.35; p<0.001) compared to 30-34 years (RR=1.0)-adjusting for ethnicity, age and MA, and interaction between age and ethnic groups. MA was not a significant predictor (RR=1.01 p>0.99).

Of 1924 initial VIA examinations performed on 30-49 year old women, 190 were positive with aceto-white lesions (9.9%). The positivity rate in the semi-rural MA was 7.5% and significantly higher in peri-urban MA at 12.3% ($\chi^2_{(1)}$=12.4; p<0.05). The positivity rate was not

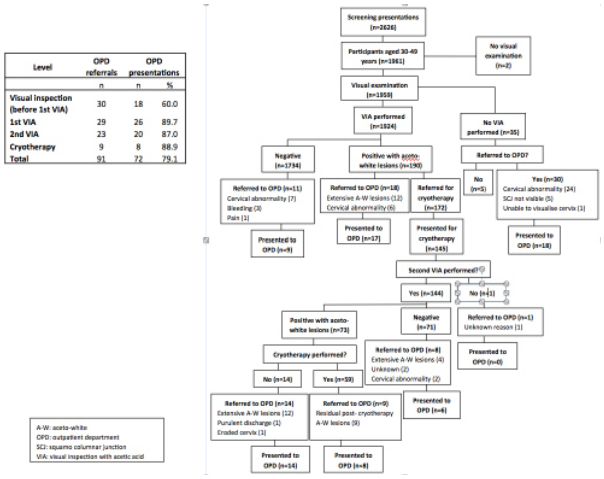

Figure 1. Screening Pathway

Table 1. Participation Rates (%) of Women who Undergoing Cervical Screening by VIA, by Age, Medical Area and Ethnicity

Age Group	Presentation	Population	Rate (%)	Presentation	Population	Rate (%)	Presentation	Population	Rate (%)
	Semi-rural Medical Area			Peri-urban Medical Area			Total		
<20	3	3669	0.1	3	5382	0.1	6	9051	0.1
20-24	68	619	11	55	1639	3.4	123	2258	5.4
25-29	148	592	25	124	1462	8.5	272	2054	13.2
30-34	262	622	42.1	327	1130	28.9	589	1752	33.6
35-39	239	563	42.5	228	1027	22.2	467	1590	29.4
40-44	244	590	41.4	230	938	24.5	474	1528	31
45-49	237	473	50.1	192	811	23.7	429	1284	33.4
50-54	80	368	21.7	95	708	13.4	175	1076	16.3
55-59	17	295	5.8	32	509	6.3	49	804	6.1
>60	16	817	2	23	948	2.4	39	1765	2.2
30-49	982	2248	43.7	977	3257	30	1959	6154	31.8
95%CI		41.9-45.4			28.7-31.3			30.9-32.8	
Age		$\chi^2_{(3)}$=10.2; p=0.02			$\chi^2_{(3)}$=14.5; p=0.002			$\chi^2_{(3)}$=29.0; p=0.03	
Medical Area								$\chi^2_{(1)}$=108.7; p<0.001	
All ages	1314	8608	15.3	1309	14,554	9	2623	23,162	11.3
	iTaukei			Fijians of Indian descent (FID)			Other ethnicities		
30-34	473	1269	37.3	111	470	23.6	5	47	10.6
35-39	252	1114	22.6	203	400	50.8	12	41	29.3
40-44	373	1076	34.7	96	389	24.7	5	40	12.5
45-49	421	966	43.6	5	356	1.4	3	36	8.3
30-49	1519	4425	34.3	415	1615	25.7	25	164	15.2
95% CI		33.2-35.5			23.9-27.5			11.0-20.1	
χ^2(3) Age		$\chi^2_{(3)}$=109.4; p<0.001			$\chi^2_{(3)}$=242.8; p<0.001			$\chi^2_{(3)}$=8.6; p=0.04	
Ethnicity (iTaukei *vs* FID)								$\chi^2_{(1)}$=40.5; p<0.001	

*VIA: visual inspection with acetic acid

Table 2. Rates (%) of Positive VIA by Age, Medical Area and Ethnicity

Age Group	Positive VIA	VIA (n)	Rate (%)	Positive VIA	VIA (n)	Rate (%)	Positive VIA	VIA (n)	Rate (%)
	Semi-rural MA			Peri-urban MA			Total		
30-34	18	260	6.9	38	324	11.7	56	584	9.6
35-39	25	235	10.6	36	224	16.1	61	459	13.3
40-44	16	240	6.7	28	229	12.2	44	469	9.4
45-49	13	228	5.7	16	184	8.7	29	412	7
30-49	72	963	7.5	118	961	12.3	190	1924	9.9
95%CI		6.1-8.9			10.5-14.0			8.8-11.0	
Age		$\chi^2_{(3)}$=4.8; p=0.19ns			$\chi^2_{(3)}$=5.3; p=0.15 ns			$\chi^2_{(3)}$ =9.9; p=0.02	
Medical Area								$\chi^2_{(1)}$ =12.5; p<0.001	
	iTaukei			Fijians of Indian descent (FID)			Other ethnicities		
30-34	50	470	10.6	6	109	5.5	0	5	0
35-39	30	246	12.2	30	201	14.9	1	12	8.3
40-44	33	369	8.9	11	95	11.6	0	5	0
45-49	29	404	7.2	0	5	0	0	3	0
30-49	142	1489	9.5	47	410	11.5	1	25	4
95% CI		8.3-10.8			9.0-14.1			0.0-12.0	
$\chi^2_{(3)}$Age		$\chi^2_{(3)}$=5.4; p=0.14ns			$\chi^2_{(3)}$=6.8; p=0.08ns			$\chi^2_{(3)}$ =1.1; p=0.77ns	
Ethnicity (iTaukei *vs* FID)									

*VIA: Visual Inspection with Acetic Acid

significantly different between iTaukei (9.5%) and those of Indian descent (11.5%) ($\chi^2_{(1)}$=1.3; p=0.2) (Table 2). Logistic regression analysis indicated the Odds Ratio (OR) for a positive VIA in the semi-rural MA was 0.6 (95%CI 0.4-0.8, p=0.001) compared to the peri-urban MA (OR=1.0); and those aged 35-39 years were less likely to have a positive result (OR=0.7, 95%CI 0.4-1.0, p=0.04) compared to women 30-34 years (OR=1.0), adjusted for ethnic and age groups, and MA. Ethnicity was not significant in the model.

Of the 172 cases referred to the Health Centre because of aceto-white lesions, 145 (84.3%) presented. From these, 144 had a second VIA, with 73 positive. The positivity agreement between the first and second VIA performed by nurses and doctors was significantly different between MAs: 77.3% in semi-rural MA and 38.6% in peri-urban MA ($\chi^2_{(1)}$=20.4; p<0.01). Most women who had a second positive VIA had cryotherapy performed (59/73, 80.8%). Nine who received cryotherapy (15.3%; 95%CI 8.5-23.7%) were referred and presented to the OPD for residual aceto-white lesions. There were a total of 91 women were referred to OPD throughout the screening pathway, of which 72 presented (79.1%). OPD presentations were significantly different between peri-urban (81.5%) and semi-rural MAs (59.4%); $\chi^2_{(1)}$=5.5; p<0.05; but not between iTaukei (78.9%) and those of Indian descent (80.0%); $\chi^2_{(1)}$=0.01; p=0.9.

Four cervical cancers were identified at OPD, two of which were in the target 30-49 years age group, a rate of 1.02/1000 (95%CI 0.8-1.2) from 1959 women screened over one year. One case was stage 2B/3A and received palliative care. Eight cases of CIN II-III (4.1/1000; 95%CI 3.8-4.3) and ten cases of CIN I (5.1/1000; 95%CI 4.8-5.4) were detected. One woman returned for an early follow-up one-week post-cryotherapy because of foul smelling discharge (1.7%; 95%CI 0.0-5.1).

Discussion

This study has demonstrated that it is feasible to train nurses and doctors for VIA and cryotherapy at PHC level in Fiji, with continued supervision and clinical audit. This is evidenced by appropriate referrals to OPD at various stages of the screening pathway, satisfactory aceto-white lesion positivity rate by specially trained nurses, and low rates of cryotherapy side effects. Furthermore, satisfactory population participation rates can be achieved in some ethnic and age categories. Anecdotal information suggested that women expressed a preference for VIA compared to Pap test screening as they were informed of the result of the screening at the same visit, with earlier referral, diagnosis and treatment of detected gynaecological pathology. Similar results were found in qualitative studies of VIA screening programs in India (Basu et al., 2006).

The large differences in screening rates between MAs were partly a consequence of their differing demography. The semi-rural MA is reasonably modernised (it is approximately 50km from the capital), but community organisation is likely to be stronger, and fewer women are in paid employment (therefore more available for screening), compared to the peri-urban MA affected by recent migration and higher levels of female employment. Communities outside the urban areas in Fiji often follow more traditional societal practices, and support from community leaders, including health staff, was crucial to recruitment in the semi-rural MA.

Women outside the target age group were not refused screening and treatment, but were excluded from analysis. Out-of-age screening was considerably reduced from 33% to 14% in latter part of study following discouragement of attendance for screening by women <30 and >50 years. The lower limit of the target age range is to prevent over-treatment due to transitory acute HPV infection in women <30 years, and the upper limit a consequence of the movement of the SCJ into the cervical canal in women >50 years.

The participation rates of iTaukei and those of Indian

descent were markedly different, with iTaukei women participating at higher rates. Ethnic differences by age in participation found in this study may be attributed to different cultural factors, and/or previous screening practices by Pap test associated with age and ethnicity. These findings need further investigation. Possible explanations could be the lack of study nurses of Indian descent and different attitudes in younger versus older cohorts of women in the major ethnic groups. Development of targeted systematic local recruitment, community awareness, and understanding of cultural requirements are crucial in the success of screening programs in low resource settings (Isaac et al., 2012; Demirtas, 2013).

The rate of aceto-white lesions was within the expected range of 8-15% (Sankaranarayanan et al., 2003) with no large discrepancies by geography or ethnicity. This indicates an overall satisfactory competency achieved in performing VIA during the study by specially trained nurses. Similar community-based PHC see-and-treat studies in low resource settings found comparable rates of aceto-white lesions in Thailand (13%) (Gaffikin et al., 2003), Mozambique (9%) (Moon et al., 2012), and Laos (7%) (Phongsavan et al., 2011), but lower than in Peru (Chamot et al., 2010), which did not include treatment (Luciani et al., 2011).

There were differences by MA in concordance of the first and the repeat VIA in those referred for cryotherapy. The agreement rate in the semi-rural MA was 77.3% but only 38.6% of referred cases were read as positive at the second VIA in the peri-urban MA. Local doctors performed the repeat VIA in each area and it is possible the variation is attributable to different sensitivities of doctors in assessing VIA, which has also been seen in other VIA screening programs. Further supervision, audit and training may have reduced the disagreement rate. A low agreement rate was also found in a PHC VIA screening study in Peru where 36% (never-screened) and 33% (previously screened) of women were confirmed positive when re-evaluated by doctors (Luciani et al., 2011). However, a 70% agreement (or higher) should be anticipated in line with the WHO standard (Arbyn et al., 2008; WHO, 2013), as found in our study for the semi-rural MA.

This study found 3.7% of women 30-49 years received services at OPD, higher than in comparable studies in Mozambique (0.3%, of 4651 screened) (Moon et al., 2012), Laos (1.1% of 1926 screened) (Phongsavan et al., 2011), and Thailand (1.1% of 5958 screened) (Gaffikin et al., 2003). In our study, referrals occurred during multiple stages of the screening pathway which may partly explain the higher OPD attendance. In other studies, women were referred to the hospital only after a positive initial VIA screen. Nonetheless, investigation needs to be undertaken in Fiji as to how to reduce rates of referral to OPD and patient load at various stages of the screening and treatment pathway without compromising clinical care, and how to increase the rate of attendance at OPD in those referred (including travel subsidies).

A systematic review of the safety of cryotherapy administered by mid- and lower-level health workers in low resource settings (combined sample n=6902) found short-term harms of cryotherapy to be similar to those found in studies from high-income countries, with the rate of side effects <11% (Chamot et al., 2010). In the present study one woman returned because of a foul smelling discharge after cryotherapy.

Previous estimates of annual cervical cancer incidence from the Fiji Cancer Registry found women aged 35-54 had annual incidence of 0.65/1000 (2003-2009) (Kuehn et al., 2012), although from histopathology only prior to 2010. This is lower than the finding of 1.02/1000 (in one year) from this study of women 30-49 years. The difference is likely due to the effect of introducing screening to largely unscreened populations. Previous population studies implementing VIA screening through PHC in low resource settings have found cancer detection rates range from 0.67-9.79/1000 (Gaffikin et al., 2003; Phongsavan et al., 2011; Moon et al., 2012; WHO, 2012). Screening programs using VIA and cryotherapy in Africa found a cancer rate of 0.40 per 1000 in 19,665 women (WHO, 2012).

DNA testing for HPV enables detection of HPV infection (but does not detect consequent lesions) and avoids the complexities of reading Pap smears. However, HPV screening has several drawbacks in low resource settings, as tests require: *(1)* trained technicians at appropriate facilities; *(2)* imported machines, which can malfunction and require maintenance and imported consumables; *(3)* 2-3 hours to produce results, likely to be much longer in practice since efficiency and feasibility dictate batch processing which may require wait times of days; *(4)* a follow-up test with VIA and/or colposcopy (latter not available at PHC level) for HPV DNA positives to determine presence of cervical lesions; and *(5)* continued follow-up of HPV positive women without lesions (not practical in most developing countries), or *(6)* cone excision or LEEP of the squamous epithelial area of the cervix in all HPV DNA positive women (with or without dysplasia) requiring specialist gynaecological intervention, and which carries risk of immediate side effects and of cervical incompetence affecting future pregnancies in younger women. Cryo-ablation of the squamous epithelial area could be undertaken at PHC level, although many may consider this, and cone excision or LEEP, as over-treatment in women with no lesions. HPV testing and evaluation trials of HPV DNA testing on samples could be integrated into population VIA/cryotherapy screening programs.

A cluster randomised trial of VIA through PHC in Mumbai found that, after 12 years, age-adjusted cancer incidence remained the same (29/100,000 in both arms), but cancer mortality rates fell in the screening arm (14/100,000) compared to control arm (20/100,000) (Shastri et al., 2014), indicating mortality reduction through secondary prevention (early diagnosis) rather than reduced incidence. Two randomised trials in India found the mortality ratio in the intervention arm was 0.65 compared to the control arm (1.00) after 6 years (Sankaranarayanan et al., 2007a), and 0.86 after 8 years (Sankaranarayanan et al., 2009), with the greatest effect in women 30-39 years (Sankaranarayanan et al., 2007b).

Our study demonstrates it is feasible to select and train nurses to deliver a VIA cervical screening program through PHC in low resource settings. Continued supervision and clinical audits are essential to maintain standards and ensure care uniformity and service delivery. In light of new WHO recommendations to use VIA and cryotherapy (Arbyn et al., 2008; WHO, 2013) to screen and treat cervical lesions, these results contribute to the literature in providing normative values for indicators from a community-based screening program for other similar low resource settings.

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