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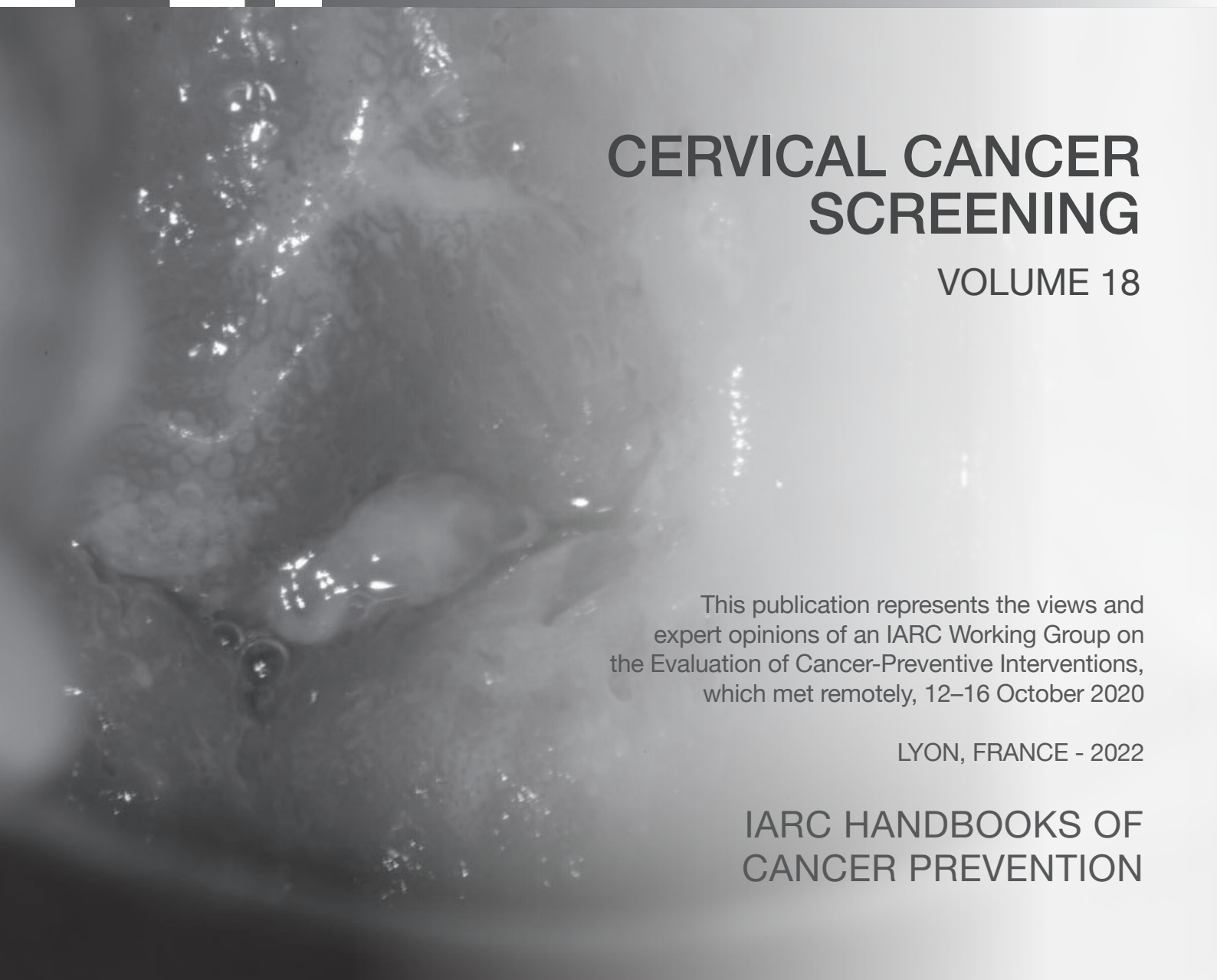

CERVICAL CANCER SCREENING

VOLUME 18

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4.2 Screening by visual inspection

4.2.1 Visual inspection techniques

Visual techniques used in cervical screening include naked-eye examination with acetic acid (VIA) or Lugol's iodine (VILI) and camera-enhanced visual inspection. Naked-eye examination (with VIA or VILI) is a simple test for the early detection of cervical precancerous lesions and early invasive cancer and has been widely used in low- and middle-income countries (LMICs) to screen women for cervical precancer (Sankaranarayanan et al., 1998; Sankaranarayanan & Wesley, 2003). More recently, camera-enhanced image capture has been used to improve the performance of VIA (e.g. digital cervicography, smartphone attachments, intravaginal endoscopes, and portable monoscopic devices) (Parham et al., 2015; Goldstein et al., 2020; Xue et al., 2020) (see also Section 4.6.1). To date, no large randomized controlled trials (RCTs) have been performed that would enable the objective assessment of the effectiveness of enhanced VIA systems to detect precancer compared with routine VIA.

Recently, the combination of related novel technologies has enabled the development of artificial intelligence (AI) devices, which may supersede current technologies (see Section 4.6.1).

(a) Description of procedures

Visual inspection is appropriate for use in women in whom the squamocolumnar junction (SCJ) is visible (typically those younger than 50 years). In older, postmenopausal women, the SCJ gradually recedes into the endocervical canal, and it is possible to miss lesions when relying on visual inspection. Similarly, visual inspection cannot be used in younger women with a type 3 transformation zone (TZ). Therefore, before visual inspection is performed, the TZ type first needs to be accurately assessed (see Section 1.2.5, Fig. 1.18).

(i) Visual inspection with acetic acid (VIA)

Acetic acid causes dehydration of the cells of the cervical epithelium and some surface coagulation of cellular proteins, which reduces the transparency of the epithelium. These changes are more pronounced in abnormal epithelium, because of the higher nuclear density and consequent high concentration of proteins (Sankaranarayanan et al., 1998). After the application of acetic acid, more light is reflected back, making the epithelium appear white. The cervix is viewed with the naked eye through a vaginal speculum with the patient in either the left lateral position (dorsal with legs flexed) or the lithotomy position. VIA requires a good light source and freshly prepared 3–5% acetic acid in distilled water, and the examination should be carried out by a trained health-care provider (Sankaranarayanan & Wesley, 2003; WHO, 2014).

After gently removing any mucus from the cervix, the provider applies the acetic acid solution using a soaked swab or a spray bottle, and then looks to see if any white changes appear. The results of VIA examination are categorized as negative, positive, or suspicious for cancer (Table 4.2; Sankaranarayanan & Wesley, 2003; WHO, 2017). Acetowhite changes on the cervix that do not recede after 1 minute are likely to be associated with cervical precancer or cancer. If these changes are seen in the TZ and have well-defined borders, it is considered a positive result (WHO, 2013a, 2014). A positive VIA test result will reveal an area or areas of intense acetic acid uptake with distinct margins, usually close to or arising from the SCJ. If the TZ is fully visible, a woman with a positive VIA test result can be treated immediately with cryotherapy or thermal ablation, subject to certain requirements, in a single-visit screen-and-treat approach (see Section 5.1; WHO, 2013a, 2019), or may be referred for triage with colposcopy and treated in the conventional manner.

Table 4.2 Categories of results of visual inspection with acetic acid (VIA) examination

Test result	Clinical findings 1 minute after application of 3–5% acetic acid
Negative	No acetowhite lesions or faint acetowhite lesions due to squamous metaplasia or regenerating epithelium, cervicitis, inflammation; acetowhitening of polyps, Nabothian cysts; acetowhitening of the SCJ; satellite acetowhite lesions far away from the SCJ
Positive	Sharp, distinct, well-defined, dense (opaque/dull or oyster white) acetowhite area with or without raised margins touching the SCJ; leukoplakia and warts
Suspicious for cancer	Large chalky white acetowhite lesions obliterating the endocervical canal with irregular surface and raised and rolled-out margins; bleeding on touch; clinically visible ulcerative, cauliflower-like growth or ulcer

SCJ, squamocolumnar junction.
Table compiled by the Working Group.

VIA positivity rates vary considerably, partly because of the intrinsic subjectivity of the method (Almonte et al., 2015). The diagnostic accuracy of VIA has been shown to be variable and dependent on several factors, including the training and experience of the test provider, the adequacy of the light source, the concentration of acetic acid used, participant characteristics such as age (Castle et al., 2014; Raifu et al., 2017), the presence of infection with carcinogenic HPV types (Castle et al., 2014), and coexisting cervical inflammation (see Section 4.2.2).

(ii) Visual inspection with Lugol's iodine (VILI)

Lugol's iodine (5%) is relatively expensive. It can be prepared locally and should be discarded after 3–6 months. VILI may also be used as an adjunct to VIA and as an aid to precise treatment. Normal mature squamous epithelium takes up iodine and becomes a mahogany brown colour because of its high glycogen content. Dysplastic, metaplastic, and glandular epithelial tissues have minimal or no glycogen and do not take up iodine; they appear as well-defined, thick, mustard or saffron yellow areas. For women indicated for treatment, Lugol's iodine is valuable in demarcating the outer limit of the TZ, enabling the size of the TZ to be estimated so that the dimensions of the probe or the number of applications to be used can be calculated. Lugol's iodine is also a reasonably effective antiseptic agent (Sankaranarayanan & Wesley, 2003).

As observed for VIA, VILI has variable sensitivity, ranging from 50% (95% CI, 31–69%) to 100% (95% CI, 70–100%), and specificity, ranging from 69% (95% CI, 68–70%) to 97% (95% CI, 97–98%), for precancerous lesions (Catarino et al., 2018). In studies that evaluated VIA and VILI in head-to-head comparisons, the sensitivity of VILI for CIN2+ was higher than that of VIA (relative sensitivity, 1.11; 95% CI, 1.06–1.16), without significant loss in specificity (relative specificity, 0.98; 95% CI, 0.95–1.01). The higher sensitivity of VILI may be because the colour changes produced by the application of Lugol's iodine are more apparent visually than the whitening observed after the application of acetic acid.

(b) Strengths and limitations

The strengths and limitations of cervical screening using VIA are summarized in Table 4.3. Naked-eye examination of the cervix with acetic acid and/or Lugol's iodine as a means of detecting cervical precancer arose because of the absence or suboptimal performance of the screening methods used in high-income countries (i.e. cytology followed by colposcopy) when used in LMICs. VIA and VILI have several advantages. Any type of health-care worker can perform the test, and the results are available

Table 4.3 Strengths and limitations of cervical screening using visual inspection with acetic acid (VIA)

Strengths	Limitations
Simple, affordable, safe, and easy to learn and practise clinical testing, which requires minimal infrastructure and no or minimal laboratory support	Provider-dependent test outcome
Acetic acid is widely available and affordable	Test accuracy, particularly sensitivity, is highly variable in different settings and is dependent on training, supervision, and regular quality assurance
Different categories of health-care providers can learn and perform VIA	No standardized training and quality assurance methods for ensuring provider competency
Rapid, real-time test with immediately available test results, which enables a single-visit screen-and-treat approach or immediate triage with colposcopy or colposcopy-directed biopsy	Less accurate in postmenopausal women, because the SCJ recedes into the endocervical canal with increasing age
Low start-up and sustaining costs, which may enable use of the VIA screen-and-treat approach in primary care services	Moderate to low specificity to distinguish CIN2+ leads to resources being spent on unnecessary treatment of women who are free of precancerous lesions in a single-visit approach; leads to unnecessary investigations, such as colposcopy or biopsy, in settings where triage in VIA-positive women is done. Variable sensitivity leads to some women with CIN2+ or CIN3+ being incorrectly classified as disease-free
Focused visualization of the cervix enables early diagnosis of preclinical, asymptomatic early cervical cancer	Health and cost implications of overtreatment because of low specificity and/or missed cases because of low sensitivity

CIN2+, cervical intraepithelial neoplasia grade 2 or worse; CIN3+, cervical intraepithelial neoplasia grade 3 or worse; SCJ, squamocolumnar junction; VIA, visual inspection with acetic acid.
Table compiled by the Working Group.

immediately, which enables a screen-and-treat protocol. The tests are laboratory-independent and inexpensive. Finally, a screening programme established using naked-eye examination will familiarize women and health-care providers with the concept of cancer prevention. VIA was formally endorsed by WHO in 2013 as a legitimate means of screening, particularly as part of a screen-and-treat approach in LMICs (WHO, 2013a). The application of 3% or 5% acetic acid is also used in some regions to determine eligibility for ablative treatment in women with a positive HPV test result, and also to determine the site, size, and type of the TZ.

The primary problem with naked-eye techniques is that they are highly subjective and consequently have variable sensitivity and specificity to detect precancer. Quality control and quality assurance for visual screening are important to maintain uniform and reproducible criteria for test positivity, and to ensure that the provider accurately differentiates between true-positive and true-negative cases (WHO, 2013b). Ensuring adequate training, supervision, and continuing quality assurance can be challenging in practice. Furthermore, visual examinations are an assessment of the ectocervical epithelium and cannot detect either glandular disease or endocervical squamous disease. In perimenopausal and postmenopausal women, the SCJ recedes into the endocervical canal and thus cannot be adequately observed with naked-eye examination. Even a proportion of women of reproductive age have a TZ of type 2 or 3 (see Fig. 1.18).

Table 4.4 Pooled sensitivity and specificity of visual inspection with acetic acid (VIA) to detect CIN2+ lesions

Reference	Study population Reference standard	Pooled sensitivity (%) (95% CI)	Pooled specificity (%) (95% CI)
Arbyn et al. (2008)	58 679 women from 11 studies Colposcopy with or without biopsy	79 (73–85)	85 (81–89)
Zhao et al. (2010)	28 848 women from 17 studies Four-quadrant biopsies	48 (42–54)	90 (87–94)
Chen et al. (2012)	99 972 women from 22 studies Colposcopy with or without biopsy	77 (75–78)	87 (87–88)
Bobdey et al. (2015)	57 225 women from 11 studies Colposcopy with or without biopsy	69 (32–100)	84 (53–91)
Fokom-Domgue et al. (2015)	61 381 women from 15 studies Colposcopy with or without biopsy	82 (76–87)	87 (78–93)
Adsul et al. (2017)	313 553 women from 20 studies Colposcopy with or without biopsy	17–83[a]	82–97[a]
Catarino et al. (2018)	101 273 women from 23 studies Colposcopy followed by colposcopy-directed biopsy or excision biopsy	78 (73–83)	88 (85–91)

CI, confidence interval; CIN2+, cervical intraepithelial neoplasia grade 2 or worse.
[a] Range in included studies; pooled estimates are not presented.

(c) Quality assurance for VIA

Quality assurance includes (but is not limited to) competency-based training of VIA providers, supervision, periodic refresher training, evaluation of current programme activities and long-term impact, a mechanism for constructive feedback from women and health-care providers, and an effective information system (see also Section 2.3). Training requirements for VIA providers are highly variable; WHO recommends a 10-day training (WHO, 2017), but in different programmatic settings the duration of training varies between 5 days and a few months (Blumenthal et al., 2005). Training is mainly non-standardized and is one of the weakest components of VIA screening initiatives. Some training manuals are available, which have been adapted by many countries (Sankaranarayanan & Wesley, 2003; WHO, 2013a, 2017), and a guide for quality control and quality assurance for VIA-based programmes has been published by WHO (WHO, 2013b).

4.2.2 Beneficial effects of screening using VIA

(a) Accuracy of VIA screening

VIA has been evaluated for its accuracy to detect CIN2+ lesions in cross-sectional studies in various settings in Africa, Asia, and Latin America. In most of these studies, the diagnostic reference standard used to establish the final diagnosis was colposcopy plus colposcopy-directed biopsy (Table 4.4), although some studies in China used four-quadrant biopsies to establish the final diagnosis (Belinson et al., 2001; Zhao et al., 2010, 2020; Holt et al., 2017). In studies that relied on colposcopy as the reference standard, no biopsies were directed when no colposcopic abnormalities were detected; directed biopsies were reserved for women with colposcopic abnormalities. In some studies the reference standard was used for all cases, thereby eliminating verification bias to a large extent, whereas in other studies the reference standard was used for all screen-positive women plus a proportion of screen-negative women. When the colposcopic

impression did not suggest precancer, no biopsy was taken, and this outcome was accepted as absence of precancer. [Given that standard colposcopy can miss up to 40.0% of prevalent precancers (Wentzensen et al., 2015), and given the inherent verification bias in studies and the close correlation of colposcopy with visual screening approaches, the reported sensitivity estimates of VIA are likely to be inflated.]

There is wide variation in VIA positivity rates across studies, from 1% to 36%. This indicates that VIA performance is subjective and depends on the study and the provider; there is little reproducibility, and provider training and thresholds used for test positivity vary (Jeronimo et al., 2014; Shastri et al., 2014; Huchko et al., 2015a, b; Poli et al., 2015).

In meta-analyses, the pooled sensitivity of VIA to detect CIN2+ lesions ranged from 48% to 83%, and the pooled specificity varied from 84% to 97% (Table 4.4). The sensitivity of VIA declines substantially in postmenopausal women. In a pooled analysis of 17 population-based studies in postmenopausal women, the sensitivity of VIA to detect CIN2+ lesions was 31.0% (95% CI, 21.8–41.4%) and the specificity was 94.6% (93.7–95.4%) (Holt et al., 2017). [The interpretation of VIA in perimenopausal and postmenopausal women is challenging, because the epithelium is pale, degenerated, and brittle and it bleeds on touch, and the TZ is partially visible or not visible. Given the methodological limitations, estimates of the absolute accuracy of VIA should be interpreted with caution.] It has been shown that low-level magnification does not improve the performance of naked-eye VIA (Basu et al., 2003; Sankaranarayanan et al., 2004; Shastri et al., 2005; Chen et al., 2012; Bobdey et al., 2015). Variation in test positivity is partly responsible for the varying accuracy of VIA in detecting high-grade lesions; the quality of the diagnostic reference standard used in different settings, which is also highly variable, is another factor that determines the variability of accuracy estimates (Sankaranarayanan et al., 2012).

HIV-positive women have a higher prevalence of HPV infection and a higher incidence of cervical cancer compared with HIV-negative women, partly because of the modifying effect of HIV on HPV pathogenesis (see Section 5.2.1). The screening methods used for HIV-seropositive women are the same as those used for HIV-negative women, with varying clinical performance and accuracy. In HIV-positive women, the use of VIA to detect CIN2+ had a sensitivity of 48.0–80.0% and a specificity of 65.0–92.0% (Ghebre et al., 2017; Mapanga et al., 2018). Visual screening tests might be expected to perform better in HIV-positive women than in the general population, because of the higher prevalence of high-grade lesions and the possibility of large lesions in HIV-positive women (Sahasrabuddhe et al., 2012; Joshi et al., 2013), although a high prevalence of HPV infection and other infections as well as inflammation may adversely affect the specificity of VIA.

(b) Cervical cancer incidence and mortality

VIA screening has been evaluated for its effect on cervical cancer incidence and/or mortality compared with control populations receiving usual care (very low prevalence of screening) in three large cluster-randomized trials in India (Sankaranarayanan et al., 2007, 2009; Shastri et al., 2014). The cervical cancer incidence rates, the detection rates of CIN2+ lesions, and the cervical cancer mortality rates in the VIA and control groups are given in Table 4.5. VIA positivity rates ranged from 2% (Shastri et al., 2014) to 13.9% (Sankaranarayanan et al., 2009), which indicates the subjective nature of VIA interpretation, differences in training and quality assurance, and possibly different thresholds used for VIA positivity.

In the study in Dindigul District, India, the intervention was a single round of VIA by trained nurses (Sankaranarayanan et al., 2007).

Table 4.5 Detection rates of CIN2/CIN3 lesions and cervical cancer incidence and mortality rates in randomized trials of screening with visual inspection with acetic acid (VIA)

Reference Study design	Cervical cancer incidence rate per 100 000 person-years		Detection rate of CIN2/CIN3 lesions per 1000 women invited		Screen-negative cervical cancer incidence rate per 100 000 person-years	Cervical cancer mortality rate per 100 000 person-years	
	VIA group	Control group	VIA group	Control group		VIA group	Control group
Sankaranarayanan et al. (2007) 49 311 women aged 30–59 yr in the VIA group and 30 958 women in the control group; single round of VIA screening by nurses	75.2[a]	99.1[a]	4.84	NA	NA	39.6[a]	56.7[a]
Sankaranarayanan et al. (2009) 34 074 women aged 30–59 yr in the VIA group and 31 488 women in the control group; single round of VIA screening by trained auxiliary-nurse midwives	58.7[a]	47.6[a]	5.72	0.48	16.0[b]	20.9[a]	25.8[a]
Shastri et al. (2014) 75 360 women aged 30–64 yr in the VIA group and 76 178 women in the control group; 4 rounds of VIA at 2-yr intervals by primary health workers	29.0[a]	29.4[a]	1.44	0.17	NA	14.4[a]	19.8[a]

CIN2, cervical intraepithelial neoplasia grade 2; CIN3, cervical intraepithelial neoplasia grade 3; NA, not available; VIA, visual inspection with acetic acid; yr, year or years.

[a] Standardized rate using world standard population.

[b] Invasive cervical cancer.

The study involved women aged 30–59 years, with 49 311 in the VIA group and 30 958 in the control group. Of the 3088 (9.9%) women with a positive test result on VIA, 3052 (98.9%) underwent colposcopy and 2539 (82.2%) had directed biopsy. Of the 1874 women with precancerous lesions, 72.0% received treatment. During 2000–2006, in the VIA group, for 274 430 person-years, 167 cervical cancer cases and 83 cervical cancer deaths were recorded, whereas in the control group, for 178 781 person-years, 158 cervical cancer cases and 92 cervical cancer deaths were recorded (incidence hazard ratio, 0.75; 95% CI, 0.55–0.95; mortality hazard ratio, 0.65; 95% CI, 0.47–0.89). The Dindigul District study was the first randomized trial of VIA screening to report a significant reduction in cervical cancer incidence and mortality after VIA screening.

In the study in Osmanabad District, India, a single round of VIA was administered by trained paramedical workers (Sankaranarayanan et al., 2009). The study involved women aged 30–59 years, with 34 074 in the VIA group and 31 488 in the control group. In the VIA group, the VIA positivity rate was 13.9%; this decreased from 17.8% in women aged 30–39 years to 6.4% in women aged 50–59 years. In the VIA group, 195 women with CIN2 and CIN3 lesions, 157 cervical cancers, and 56 cervical cancer deaths were recorded, whereas in the control group 15 women with CIN2 and CIN3 lesions, 118 cervical cancers, and 64 cervical cancer deaths were recorded (incidence hazard ratio, 1.30; 95% CI,

0.95–1.78; mortality hazard ratio, 0.86; 95% CI, 0.60–1.25) (Sankaranarayanan et al., 2009).

[The differing results for VIA screening in the two above-mentioned studies may be due to a lack of power to detect a significant reduction in mortality in the Osmanabad District study and the higher frequency of treatment of precancerous lesions in the Dindigul District study. In the Osmanabad District study, screening with HPV testing was associated with a significant reduction in advanced disease and mortality, indicating a better accuracy to detect precancerous lesions.]

The third trial, in Mumbai, evaluated four rounds of VIA screening provided by trained primary health workers every 2 years (Shastri et al., 2014). The VIA positivity rate varied from 1.3% to 2.5%. This study recruited 75 360 women aged 30–64 years from 10 clusters in the VIA group and 76 178 women from 10 comparable clusters in the control group. A significant 31% reduction in cervical cancer mortality (incidence rate ratio [IRR], 0.69; 95% CI, 0.54–0.88; $P = 0.003$) and a non-significant 7% reduction in all-cause mortality (mortality IRR, 0.93; 95% CI, 0.79–1.10; $P = 0.41$) was associated with VIA screening compared with the control group, but no reduction in the incidence of cervical cancer was observed (IRR, 0.97; 95% CI, 0.80–1.19; $P = 0.79$). [The low detection rate of high-grade lesions, possibly as a consequence of low VIA positivity rates (1.3–2.5%) in the four rounds of VIA screening, along with stage shift of invasive cancers, possibly led to the reduction in mortality only rather than reductions in both incidence and mortality in the Mumbai trial.

(c) Single-visit VIA screen-and-treat approach

In an RCT in women aged 35–65 years in South Africa, HPV DNA screen-and-treat (2163 women) and VIA screen-and-treat (2227 women) protocols were compared with a delayed-evaluation group (2165 women). At 6 months after randomization, the prevalence of CIN2+ lesions was significantly lower in the two screen-and-treat groups than in the delayed-evaluation group (Denny et al., 2005). In both screened groups, 22% of women underwent cryotherapy. At 6 months, CIN2+ lesions were detected in 2.23% (95% CI, 1.57–2.89%) of women in the VIA group compared with 3.55% (95% CI, 2.71–4.39%) of women in the delayed-evaluation group ($P = 0.02$); in the HPV DNA group, CIN2+ lesions were detected in 0.80% (95% CI, 0.40–1.20%) of women. At 12 months, the cumulative prevalence of CIN2+ lesions in a subset of women was 2.91% (95% CI, 2.12–3.69%) in the VIA group and 5.41% (95% CI, 4.32–6.50%) in the delayed-evaluation group; in the HPV DNA group, the cumulative prevalence of CIN2+ lesions was 1.42% (95% CI, 0.87–1.97%). There were no differences in HIV seroconversion rates 6 months after randomization; this was reassuring about possible virus transmission during screen-and-treat procedures, but the study was underpowered to detect small increases.

4.2.3 Harms of screening using VIA

Although VIA has been evaluated for its performance in cross-sectional studies in Africa, Asia, and Latin America and has been implemented opportunistically as a point-of-care screening approach or in programmes, there is very little systematic documentation of associated harms (Muwonge et al., 2010; Poli et al., 2015). Given the simplicity of VIA as a screening procedure, the innocuous nature of acetic acid, and the lack of documentation of serious adverse events in studies, VIA is assumed to be safe. A few studies have documented the rate of important potential harms, including adverse reproductive outcomes (from treatment) and complications that can be directly attributed to VIA, although the evidence is of low quality (Fokom-Domgue et al., 2014). Arguably the major risk of VIA as a screening test is that it will not always recognize

Box 4.1 Harms of visual screening

- Physical harms associated with true-positive test results (i.e. accurate screening, correct diagnosis and treatment):
  - pain and discomfort during screening and treatment
  - discharge, pain, bleeding, and infection risk after treatment
  - long-term treatment complications (premature labour, threatened miscarriage, and cervical stenosis)
- Psychological harms:
  - periprocedural anxiety
  - psychological stress and fear of pelvic examination, VIA screening, and downstream procedures of diagnosis, treatment, and follow-up care
- Harms associated with false-positive test results:
  - unnecessary investigations (if triage of women with a positive test result is done)
  - unnecessary biopsy
  - overtreatment (with attendant risk of short-term and long-term physical harms as detailed above)
  - costs of unnecessary medical care
- False reassurance and risk of future cervical neoplasia because of a false-negative test result
- Harms associated with overdiagnosis

an endocervical TZ and thus may falsely reassure a woman that she does not have precancer when in fact she does.

(a) Physical harms

There is very little documentation of either immediate physical harm (such as bleeding, pain and irritation due to insertion of the speculum, lower abdominal cramps, syncope, febrile illness, or allergic reactions) or late adverse events (such as delayed bleeding, cervicitis, cervical ulceration, pelvic inflammatory disease, pregnancy loss, preterm labour, or cervical stenosis) from examination with VIA.

Given the well-documented limitations in the accuracy of VIA, there are likely to be harms from overtreatment of women with false-positive test results (Parra et al., 2020), particularly in the screen-and-treat setting, as well as the potentially serious harm of a failure to detect a lesion that may develop into invasive cancer (false-negative test result). Potential harms of false-positive and false-negative test results are given in Box 4.1. False-positive test results lead to unnecessary investigations and costs of unnecessary medical care (in settings using triage with colposcopy of women with a positive test result), unnecessary biopsy, and harms associated with treatment, such as excessive discharge, risks of bleeding, infection and pelvic inflammatory disease, and long-term sequelae such as premature labour, threatened miscarriage, and cervical stenosis. [Variations in the accuracy of visual screening are caused by variations in the performance of VIA providers rather than underlying variations in the prevalence of disease; this indicates

that harms associated with VIA can be reduced if providers are well trained in the procedure (Raifu et al., 2017).]

(b) Psychological harms

Psychological harms include anxiety and fear caused by the procedure itself and by a positive test result, and the stress associated with making the decision to accept screen-and-treat in the same session (in a single-visit approach) and to give consent for eligibility determination and treatment procedures. Women undergoing pelvic examination can experience anxiety, fear, and embarrassment, and the associated stress can lead to exacerbation of procedure-related discomfort, which may discourage women from undergoing the procedure and may induce low patient compliance (Galaal et al., 2011; O'Connor et al., 2016a, b; Vorsters et al., 2017). In one study in Cameroon, enabling women to watch the VIA procedure on a digital screen in real time improved their emotional state but did not reduce periprocedural anxiety as measured by the Spielberger State-Trait Anxiety Inventory (STAI) score (Camail et al., 2019).

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