Received: 7 October 2020 | Revised: 19 January 2021 | Accepted: 11 February 2021

DOI: 10.1002/ijc.33549

CANCER THERAPY AND PREVENTION

IJC International Journal of Cancer

Uptake and safety of community-based "screen-and-treat" with thermal ablation preventive therapy for cervical cancer prevention in rural Lilongwe, Malawi

Lameck Chinula[1,2,3] | Hillary M. Topazian[1,4] | Clement Mapanje[1] | Amanda Varela[1] | John Chapola[1] | Laura Limarzi[1] | Christopher Stanley[1,6] | Mina Hosseinipour[1,5] | Satish Gopal[1,4,5] | Jennifer H. Tang[1,2,3]

[1]Department of Obstetrics & Gynecology, Division of Global Women's Health, University of North Carolina Project-Malawi, Lilongwe, Malawi

[2]Department of Obstetrics and Gynecology, University of North Carolina, Chapel Hill, North Carolina

[3]Department of Obstetrics and Gynecology, University of Malawi, College of Medicine, Malawi

[4]Department of Epidemiology, University of North Carolina, Chapel Hill, North Carolina

[5]Department of Medicine, University of North Carolina, Chapel Hill, North Carolina

[6]School of Public Health, Witwatersrand University, Johannesburg, South Africa

Correspondence
Lameck Chinula, University of North Carolina Project-Malawi, Lilongwe, Malawi.
Email: lameck_chinula@med.unc.edu

Funding information
National Institute of Health Fogarty International Center, Grant/Award Number: R25TW009340; U.S. National Institute of Health, Grant/Award Number: U54CA 190152

Abstract

Malawi has the highest invasive cervical cancer (ICC) mortality rate worldwide, and ICC is the leading cause of cancer death among women. In 2004, Malawi adopted visual inspection with acetic acid (VIA) and ablative treatment with cryotherapy. However, screening coverage has remained low (<30%) and few women (<50%) who require ablative treatment receive it. Additional barriers include long distances to health facilities and challenges with maintaining gas supplies. Thermal ablation is a safe and effective alternative to cryotherapy. We assessed the safety and uptake of community-based ICC screening with VIA and same-day treatment using a handheld thermocoagulator (HTU) in rural Malawi. We held educational talks alongside community leaders and conducted VIA screening in nonclinic community settings to nonpregnant women aged 25 to 49 years without history of hysterectomy or genital cancer/precancer. Eligible women received same-day thermal ablation and HIV testing/counseling. We collected cervical biopsies before treatment and followed up women at Weeks 6 and 12, with repeat biopsy at Week 12. Between July and August 2017, 408 (88%) of 463 eligible women underwent VIA. Overall, 7% (n = 30) of women had a positive VIA, of whom 93% (n = 28) underwent same-day thermal ablation. Among the 30 VIA-positive women, 5 had cervical intraepithelial neoplasia (CIN) 1, 4 had CIN 2/3 and 21 had benign histologic findings. Abnormal vaginal discharge (60%) and light vaginal bleeding (52%) were the most reported adverse events. There was high uptake of the community-based ICC screening in the study population and treatment was safe in this setting. Similar strategies that minimize false-positive results are urgently needed in Malawi.

KEYWORDS
community-based screening, invasive cervical cancer, screen-and-treat, thermal ablation, VIA

1 | INTRODUCTION

Cervical cancer is the fourth most common cancer among women worldwide. In 2018, invasive cervical cancer (ICC) caused 311 000 deaths with

Abbreviations: CAB, Community Advisory Board; CIN, cervical intraepithelial neoplasia; HPV, human papillomavirus; HTU, handheld thermocoagulation; ICC, invasive cervical cancer; KCH, Kamuzu Central Hospital; UNC, University of North Carolina; UNCPM, University of North Carolina Project-Malawi; VIA, visual inspection with acetic acid.

90% of these occurring in low- and middle-income countries.[1] In sub-Saharan Africa, ICC is the leading cause of cancer deaths among women.[2,3] Malawi has the highest incidence and mortality rates of ICC in the world, and ICC remains the leading cause of cancer deaths among Malawian women.[1] In 2018, the World Health Organization (WHO) estimated more than 4000 new cases and approximately 3000 deaths from ICC in Malawi.[1] Malawi also has one of the highest HIV prevalence in the world, 9% among all adults of 15 to 49 years, with higher rates among women (11% among women of 15-49 years, 17% among women of 45-49 years).[4] HIV-infected women have up to a 22-fold increased risk of developing ICC compared to HIV-negative women.[5-7]

ICC is preventable largely with screening and treatment of precancerous cervical lesions, or cervical intraepithelial neoplasia (CIN).[8] ICC screening and CIN treatment have been shown to reduce cervical cancer incidence in previously unscreened populations in high-income countries.[9] However, high HIV prevalence, lack of knowledge about ICC and limited access to screening and treatment have led to a high ICC burden in Malawi.[10-12] In 2004, Malawi adopted a screen-and-treat strategy using visual inspection with acetic acid (VIA) and ablative treatment with cryotherapy in the National Cervical Cancer Screening Program. Although VIA is not a high-performance screening test for ICC,[13,14] it is an appropriate screening test for resource-limited settings as VIA is simple, inexpensive, utilizes locally sourced supplies (vinegar/acetic acid and cotton) and does not require laboratory services. It also provides immediate results, allowing for single-visit service delivery ("screen-and-treat"). However, women's participation in the national screening program has remained low. Approximately 49 000 women out of the annual target of 186 000 women (26% population screening coverage) were screened in 2015, in the country,[10] largely due to limited awareness and access, particularly in rural areas.[15,16]

Even for women who undergo screening, another challenge has been limited ablative treatment, such that less than 50% of women who require treatment receive it.[10] This has largely been due to high cost and an erratic supply of cryotherapy gas.[10] There is now increasing evidence demonstrating the safety and efficacy of thermal ablation for CIN treatment,[17-19] as well as support for implementation models using mid-level providers.[20] The Liger Medical Handheld Thermocoagulator (HTU) (Lehi, UT) is a battery-operated device that can treat 20 to 30 women per battery life cycle, in 20 to 40 seconds per treatment. However, there are still limited data on the real-world effectiveness of thermal ablation in sub-Saharan Africa. We therefore assessed the uptake and safety of a community-based ICC screening with VIA and same-day treatment with an HTU device, delivered through a campaign approach, in rural Lilongwe, Malawi.

What's new?

Malawi has the world's highest incidence and mortality rates of invasive cervical cancer. In 2004, the country adopted a screen-and-treat program using visual inspection with acetic acid (VIA) and ablative treatment with cryotherapy. However, women's participation remained low, and the high cost of cryotherapy means that not all who need ablative treatment can receive it. Here, the authors test the safety and uptake of a screening program with same-day thermal ablation in a community setting. In rural Lilongwe, Malawi, 88% of eligible women participated in cervical screening, and thermal ablation was shown to be safe in a non-clinical setting.

2 | MATERIALS AND METHODS

2.1 | Study setting

We conducted the community-based demonstration study of ICC screening and treatment, and HIV testing and counseling, in four rural

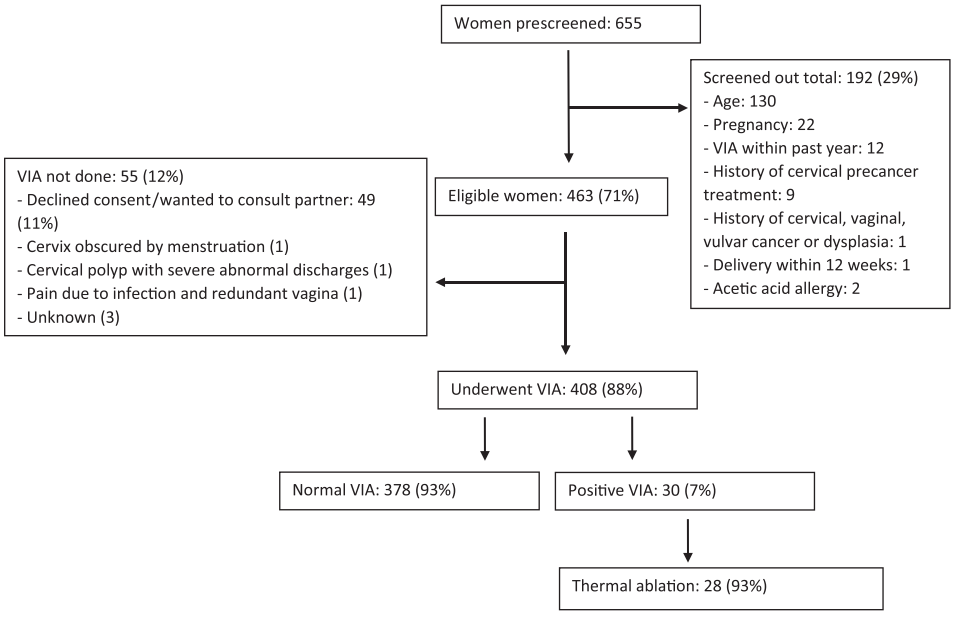

FIGURE 1 CONSORT diagram for study enrollment and procedures

communities in Lilongwe, Malawi. Lilongwe is the capital city of Malawi, and the surrounding Lilongwe district is the country's largest district. It is located in the central region of the country and has a population of 2.5 million people with 84% living in rural areas. Among women, HIV prevalence is 5.6% in rural areas in the central region.[4] The sites selected for the study were more than 20 km from the nearest health facilities where free ICC screening services were available. The sites included churches, primary schools, traditional court building in the communities and were temporarily renovated and divided into different rooms with block boards. Follow-up visits for treated women in the study were conducted at the University of North Carolina (UNC) Project-Malawi (UNCPM), a longstanding collaboration between UNC and the Malawi Ministry of Health. UNCPM is located at Kamuzu Central Hospital (KCH), a national tertiary and teaching hospital in Lilongwe city.

2.2 | Study population and procedures

Prior to study implementation, the study staff conducted consultative meetings with traditional leaders, community health workers (CHWs) and the UNCPM Community Advisory Board (CAB). The leaders and CHWs then shared information about our study at community gatherings including in churches and at funerals. The study information included study start date and designated study sites in their communities. Study nurses, clinicians, HIV counselors and community workers conducted educational talks targeting both men and women through a public address system; at the study sites and by driving around in the communities; about ICC prevention and HIV; screening with VIA and thermal ablation; and the referral cascade for those who may not have lesions treatable through thermal ablation or those who test HIV-positive. VIA-based ICC screening and same-day thermal ablation were offered to women who met the following eligibility criteria: age 25 to 49 years; nonpregnant; no history of hysterectomy, cervical, vaginal or vulvar cancer or dysplasia; not screened in the past 1 year; no known allergy to acetic acid; and more than 12 weeks postpartum if recently pregnant. HIV testing and counseling were also offered to women whose HIV status was unknown.

Study staff prescreened women for eligibility, and eligible women who were interested to participate were asked to provide written informed consent. Using an interviewer-administered questionnaire, study staff collected sociodemographic data including sexual and contraceptive history. Women were then offered individual counseling for VIA and thermal ablation. A urine pregnancy test was done to rule out pregnancy prior to VIA. Study nurses with prior practical experience in screening and certified through the national cervical cancer screening training program, which includes supervised mentorship, and underwent refresher training prior to the study performed VIA and interpreted results as per WHO International Agency for Research in Cancer guidelines.[21] The same nurses performed same-day thermal ablation if the VIA was positive and if the cervical lesion met the following criteria: visible in its entire extent on the ectocervix; covered less than three quarters of the ectocervix; no extension to the vagina and/or endocervix; not suspicious for ICC or glandular dysplasia; did not extend more than 3 mm into the canal; and no clinical evidence of pelvic inflammatory disease. Prior to treatment, a cervical biopsy was collected. Women with lesions not amenable to thermal ablation were referred to KCH for further care.

Follow-up visits for women who received treatment were conducted at Weeks 6 and 12. At Week 6, an interval medical history was collected and reviewed for thermal ablation safety outcomes,

TABLE 1 Baseline characteristics of enrolled women who underwent VIA

Characteristics at enrollment	N = 408[a]	%
Age		
25 to <30	85	21
30 to <40	185	45
40 to ≤50	138	34
Marital status		
Never married	4	1
Married	358	88
Widowed/divorced	39	10
Parity		
<5	192	47
≥5	216	53
Education		
None	73	18
Primary	253	62
Secondary/tertiary	79	19
HIV status		
HIV+	25	6
HIV−	374	92
Ever smoked		
Yes	42	10
No	361	88
Economic status		
Electricity		
Yes	21	5
No	381	93
Tap water		
Yes	11	3
No	390	96
Number of sexual partners		
1 to 2	313	77
≥3	88	22
Age at sexual debut		
<16 y	35	9
≥16 y	369	90

[a]Number of missing observations for the following variables: marital status = 7; education = 3; HIV status = 9; ever smoked = 5; electricity = 6; tap water = 7; number of sexual partners = 7; age at sexual debut = 4.

including adverse events such as moderate to severe bleeding, fever, increased pelvic pain, abnormal vaginal discharge and any disorder requiring admission after treatment. Histologic results of cervical biopsies collected prior to thermal ablation were also reviewed with the women. At Week 12, VIA was performed on women who had CIN diagnosed at the time of thermal ablation. A directed cervical biopsy was performed if a lesion was present, or a random cervical biopsy if no lesion, to determine the histological resolution of CIN. Women were reimbursed for transport costs for follow-up visits as approved by the Malawi National Research Ethics Committee.

2.3 | Data management and statistical analysis

Data were entered into an electronic database. For the primary outcome of uptake of the ICC screening, we calculated the proportion of women who underwent ICC screening among those eligible women for screening in the study. We grouped continuous variables (ie, age, number of sexual partners and age at sexual debut) into informative categories. We used logistic regression for univariate analyses to model each covariate against the outcome of a VIA-positive result as an unadjusted odds ratios. We used Wald tests to determine statistical significance at $\alpha = 0.05$. All analyses were conducted in SAS 9.4 (SAS Institute Inc., Cary, North Carolina).

3 | RESULTS

3.1 | Baseline characteristics

A total of 655 women were prescreened over a 5-week period during business days in July and August 2017, and 463 (71%) women met the eligibility criteria for the study (Figure 1). Of women who did not meet the eligibility criteria, 130 (68%) and 22 (11%) were excluded due to age and pregnancy, respectively. Of 463 eligible women, 408 underwent ICC screening with VIA (VIA uptake = 88%; 95% confidence interval [CI]: 85-91), while 49 (11%) declined consent or wished to consult their partner first (Figure 1). The median age of women undergoing VIA was 35 years (range 25-49 years), 358 (88%) were married, 369 (90%) had an age of sexual debut ≥16 years and 77% reported one to two lifetime sexual partners. Among those with known HIV status, 25 (6%) were HIV positive (Table 1).

3.2 | VIA results

Of 408 women who underwent ICC screening with VIA, 378 (93%) were VIA negative and 30 were VIA positive (VIA positivity rate = 7%; 95% CI: 5-10). Of the 30 VIA-positive women, 28 (93%) had same-day thermal ablation. Two women were referred to KCH; 1 had a cervical lesion ineligible for thermal ablation and the other had redundant vaginal wall folds that hindered thermal ablation.

None of our study variables (age, HIV status, number of sexual partners, age at sexual debut) were significantly associated with a VIA-positive outcome in our study population (Table 2).

3.3 | Thermal ablation-related adverse events

At the 6-week follow-up visit, of 28 women who received thermal ablation, 25 women completed the visit. Fifteen (60%) women and 13 (52%) women reported experiencing abnormal vaginal discharge and light vaginal bleeding, respectively. One woman reported experiencing fainting some days after thermal ablation. None of the women visited any health facility for medical attention for the reported adverse events. On physical tracing, on multiple occasions,

TABLE 2 Univariate analysis of variables associated with a positive VIA outcome

Variable	VIA negative; N = 379 (93%)	VIA positive; N = 30 (7%)	Unadjusted odds ratio	95% CI	*P*-value
Age (y)					
25 to 29	78 (21)	7 (23)	1	—	—
30 to 39	170 (45)	15 (50)	0.98	0.39-2.51	.7
40 to 49	130 (34)	8 (27)	0.69	0.24-1.97	.4
HIV status					
HIV+	22 (6)	3 (10)	1.75	0.49-6.23	.4
HIV−	347 (92)	27 (90)	1	—	—
Number of sexual partners					
1 to 2	292 (77)	21 (70)	1	—	—
≥3	80 (21)	8 (27)	1.39	0.59-3.26	.4
Age at sexual debut					
<16 y	33 (9)	2 (7)	0.77	0.18-3.37	.7
≥16 y	342 (90)	27 (90)	1	—	—

Note: Number of missing observations for the following variables: HIV status = 9, number of sexual partners = 7 and age at sexual debut = 4.

of the 3 women who received thermal ablation but did not complete 6-week follow-up visit on, they promised to report to the UNCPM for follow-up but still did not visit our facility.

3.4 | Histologic results and treatment outcomes

Of the 30 VIA-positive women, 29 had baseline cervical histologic results, except the woman who had redundant vaginal wall folds. Nine (31%) had CIN1-3, of which 4 were CIN2/3. The remaining 20 women had no cervical dysplasia, including 10 who had a histologic diagnosis of cervicitis. At the 12-week follow-up, only four of the nine women with CIN1-3 reported for a visit. Posttreatment cervical histology was cervicitis on all four women who attended the final follow-up visit. For the two women who were referred to KCH, the one with a lesion not amenable to thermal ablation had hysterectomy following a baseline cervical histologic result of CIN3, and the second woman's referral outcome was not known.

4 | DISCUSSION

In our study, we showed that ICC screening using a community-based approach was feasible and resulted in a high participation rate among eligible women in rural Lilongwe district, Malawi. Addressing access barriers, including removal of women's out-of-pocket transport to cervical cancer screening and preventive therapy, resulted in high utilization of the screening services. However, addressing access barriers alone might not have been sufficient to screen all women. We engaged traditional leaders, CHWs and the UNCPM CAB members in the planning phase of the study. A retrospective study in Zambia showed that leveraging the influence of the traditional chiefs facilitated access to cervical cancer prevention services and resulted in high uptake of the screening services.[22] In our study, we provided public education to raise awareness of cervical cancer. Inadequate knowledge about cervical cancer negatively influences women's participation in cervical cancer screening services.[11,23-25] Furthermore, health education for recruitment of women was identified as one of the major themes that facilitated implementation of screening programs in community-based settings in India.[26] Targeting both men and women for public education likely also contributed to the high uptake of the screening services in our study. Lack of involvement of husbands has been cited as one of the major barriers to women's participation in cervical cancer screening in Malawi.[27]

In our study, VIA positivity, 7%, was comparable to the 6% VIA positivity rate observed in another "screen-and-treat" program of cervical screening in rural Malawi,[20] but lower than, but not statistically significantly different from, the overall VIA-positive rate, 9%, in the National Cervical Cancer Screening Program.[10] Unlike other studies that have shown that sexual debut before age 16 and HIV-positive status are independent predictors of VIA-positive result,[10,28] none of the variables tested were significantly associated in our study, likely due to our small number of VIA-positive women.

In our study, 28 of the 30 VIA-positive women were eligible for thermal ablation and all received treatment on the same day. Though we had a small number who needed thermal ablation, we had a high proportion of women, 93%, receiving treatment compared to the 43% treatment rate reported in the national screening program.[10] However, less than half of women who had CIN presented for their 12-week follow-up visit, despite the provision for transport reimbursement to and from the research clinic. Thus, addressing out-of-pocket transport costs did not guarantee adherence to follow-up after primary cervical cancer screening in our community-based approach.

None of the four women with CIN who had follow-up cervical histologic results had persistent cervical dysplasia. However, the number of women with CIN was very small, likely due to lower prevalence of HIV of 6% among our study population than the HIV prevalence of 16% observed among screened women in the national screening program.[10] In Malawi, HIV prevalence is 9% and 18% among women in rural and urban areas, respectively.[4] Furthermore, among the women who came for follow-up visit, only one woman had CIN3 at baseline and the other three had CIN1. Naturally, at 2 years, only 2.1 per 100 (95% CI 1.7-2.4) women with CIN1 progress to severe dysplasia or worse.[29] There is no consensus for intervention and treatment of CIN1, with the majority of cases resolving spontaneously. Our study was not powered to evaluate the effectiveness of thermal ablation. As in other studies, thermal ablation did not cause any significant side effects, and the most common side effects were abnormal vaginal discharge and light vaginal bleeding.[20,30-32] These reported side effects are comparable and less common than those reported for cryotherapy, the most widely used ablative therapy for CIN in sub-Saharan Africa.[33]

False VIA-positive results were high among our study population; 20 (69%) of 29 VIA-positive women with histologic results did not have CIN. VIA sensitivity (0.69; 95% CI: 0.54-0.81) and specificity (0.87; 95% CI: 0.79-0.92) are known to be lower than human papillomavirus (HPV) sensitivity (0.95; 95% CI: 0.84-0.98) and specificity (0.84; 95% CI: 0.72-0.91).[14] In community-based cervical cancer screening programs using VIA in India, the sensitivity rate ranged from 0.17 to 0.83.[26] Therefore, the false VIA-positive rate observed in our small study is not unexpected. However, with technologic advances of HPV-based screening and the high performance of HPV testing, the WHO is now advocating for HPV-based screening where feasible.[34]

We showed that ICC screening using a community-based approach was feasible and resulted in high participation of women in rural Lilongwe, Malawi. Thermal ablation was safe to use in a non-health facility setting for ICC screening. Community-based screening programs for cervical cancer have the potential to increase women's participation and should be complimentary to facility-based screening programs, particularly for rural areas. Community-based approach to ICC screening should not focus on primary screening alone, but also utilize similar approaches to follow-up with screen-positive women who receive treatment. High-performance screening tests such as HPV DNA testing combined with thermal ablation might be the promising combination for the future. Compared to the current largely

facility-based cervical cancer screening approach, screen-and-treat strategies that can ensure high uptake and are implementable in rural communities and which minimize false-positive results are urgently needed in settings such as Malawi.

ACKNOWLEDGEMENTS

This work was supported by the National Institutes of Health (NIH) U54CA 190152 Malawi Cancer Consortium Grant and the NIH Fogarty International Center grant R25TW009340. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

De-identified data are available from the authors upon reasonable request.

ETHICS STATEMENT

Ethical approval for our study protocol and the informed consent was obtained from the National Health Sciences Research Committee at the Malawi Ministry of Health (IRB00003905, FWA#00005976) and the University of North Carolina at Chapel Hill (FWA#4801).

ORCID

Lameck Chinula https://orcid.org/0000-0003-3690-4207
Laura Limarzi https://orcid.org/0000-0001-9052-4956

REFERENCES

1. Bray F, Ferlay J, Soerjomataram I, et al. GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;68(6):2018.
2. Parkin DM, Sitas F, Chirenje M, et al. Cancer in indigenous Africans-burden, distribution and trends. *Lancet Oncol*. 2008;9(7):683-692.
3. UNAIDS Global HIV & AIDS Statistics—2018 fact sheet, UNAIDS http://www.unaids.org/en/resources/fact-sheet Accessed December 19, 2018.
4. National Statistical Office—NSO/Malawi and ICF. 2017. Malawi Demographic and Health Survey 2015-16. Zomba, Malawi: NSO and ICF.
5. Denny LA, Franceschi S, de Sanjosé S, Heard I, Moscicki AB, Palefsky J. Human papillomavirus, human immunodeficiency virus and immunosuppression. *Vaccine*. 2012;30:F168-F174.
6. Gaym A, Mashego M, Kharsany ABM, Walldorf J, Frohlich J, Karim QA. High prevalence of abnormal pap smears among young women co-infected with HIV in rural South Africa—implications for cervical cancer screening policies in high HIV prevalence populations. *S Afr Med J*. 2007;97(2):120-123.
7. Smith JA, Sharma M, Levin C, et al. Cost-effectiveness of community-based strategies to strengthen the continuum of HIV care in rural South Africa: a health economic modelling analysis. *Lancet HIV*. 2015;2(4):e159-e168.
8. World Health Organization. *Comprehensive cervical cancer control: a guide to essential practice*. 2nd ed. Geneva, Switzerland: WHO; 2014.
9. Franco EL, Duarte-Franco E, Ferenczy A. Cervical cancer: epidemiology, prevention and the role of human papillomavirus infection. *CMAJ [Internet]*. 2001;164(7):1017-1025.
10. Msyamboza KP, Phiri T, Sichali W, Kwenda W, Kachale F. Cervical cancer screening uptake and challenges in Malawi from 2011 to 2015: retrospective cohort study. *BMC Public Health*. 2016;16:806.
11. Chidyaonga-Maseko F, Chirwa ML, Muula AS. Underutilization of cervical cancer prevention services in low and middle income countries: a review of contributing factors. *Pan Afr Med J*. 2015;21:231.
12. Maseko FC, Chirwa ML, Muula AS. Client satisfaction with cervical cancer screening in Malawi. *BMC Health Serv Res*. 2014;14(1):1-8.
13. Arbyn M, Sankaranarayanan R, Muwonge R, et al. Pooled analysis of the accuracy of five cervical cancer screening tests assessed in eleven studies in Africa and India. *Int J Cancer*. 2008;123(1):153-160.
14. Mustafa RA, Santesso N, Khatib R, et al. Systematic reviews and meta-analyses of the accuracy of HPV tests, visual inspection with acetic acid, cytology, and colposcopy. *Int J Gynecol Obstet*. 2016;132(3):259-265.
15. Malata A, Chirwa E, Chimwaza A, Maluwa A, Kazembe A, Chadza E. Factors that contribute to delay in seeking cervical cancer diagnosis and treatment among women in Malawi. *Health (Irvine Calif)*. 2012;04(11):1015-1022.
16. Maseko FC, Chirwa ML, Muula AS. Health systems challenges in cervical cancer prevention program in Malawi. *Glob Health Action*. 2015;8:26282.
17. Parry-Smith W, Underwood M, De Bellis-Ayres S, Bangs L, CWE R, Panikkar J. Success rate of cold coagulation for the treatment of cervical intraepithelial neoplasia. *J Low Genit Tract Dis*. 2015;19(1):17-21.
18. Dolman L, Sauvaget C, Muwonge R, Sankaranarayanan R. Meta-analysis of the efficacy of cold coagulation as a treatment method for cervical intraepithelial neoplasia: a systematic review. *BJOG*. 2014;121:929-942.
19. Wyse A, Seah WA, O'Neill J, Byrne P. The use of cold coagulation for the treatment of cervical intraepithelial neoplasia. *Irish Med J*. 2017;110(5):565. http://imj.ie/the-use-of-cold-coagulation-for-the-treatment-of-cervical-intraepithelial-neoplasia-2/. Accessed October 1, 2019.
20. Campbell C, Kafwafwa S, Brown H, et al. Use of thermo-coagulation as an alternative treatment modality in a 'screen-and-treat' programme of cervical screening in rural Malawi. *Int J Cancer*. 2016;139(4):908-915.
21. Sankaranarayanan R, Wealey R. *A Practical Manual on Visual Screening for Cervical Neoplasia*. In: IARC Technical Publication No 41. Lyon, France: International Agency for Research on Cancer; 2003.
22. Kapambwe S, Mwanahamuntu M, Pinder LF, Chisele S, Chirwa SC, Parham GP. Partnering with traditional chiefs to expand access to cervical cancer prevention services in rural Zambia. *Int J Gynaecol Obstet*. 2019;144(3):297-301.
23. Alliance for Cervical Cancer Prevention. *Improving Screening Coverage Rates of Cervical Cancer Prevention Programs: A Focus on Communities*. Seattle: ACCP; 2004 Cervical Cancer Prevention Issues in Depth, No. 4.
24. Wong LP, Wong YL, Low WY, Khoo EM, Shuib R. Cervical cancer screening attitudes and beliefs of Malaysian women who have never had a pap smear: a qualitative study. *Int J Behav Med*. 2008;15(4):289-292.
25. Markovic M, Kesic V, Topic L, Matejic B. Barriers to cervical cancer screening: a qualitative study with women in Serbia. *Soc Sci Med*. 2005;61(12):2528-2535.
26. Adsul P, Manjunath N, Srinivas V, Arun A, Madhivanan P. Implementing community-based cervical cancer screening programs using visual inspection with acetic acid in India: a systematic review. *Cancer Epidemiol*. 2017;49:161-174.
27. Munthali AC, Ngwira BM, Taulo F. Exploring barriers to the delivery of cervical cancer screening and early treatment services in Malawi: some views from service providers. *Patient Prefer Adherence*. 2015 Mar 24;9:501-508.
28. Deksissa ZM, Tesfamichael FA, Ferede HA. Prevalence and factors associated with VIA positive result among clients screened at family

guidance Association of Ethiopia, south west area office, Jimma model clinic, Jimma, Ethiopia 2013: a cross-sectional study. *BMC Res Notes [Internet]*. 2015;8(1):618.

29. Holowaty P, Miller AB, TT RT. Natural history of dysplasia of the uterine cervix. *J Natl Cancer Inst*. 1999;91:252-258.
30. Cremer ML, Conzuelo-Rodriguez G, Cherniak W, Randall T. Ablative therapies for cervical intraepithelial neoplasia in low-resource settings: findings and key questions. *J Glob Oncol*. 2018; 4:1-10.
31. Viviano M, Kenfack B, Catarino R, et al. Feasibility of thermocoagulation in a screen-and-treat approach for the treatment of cervical precancerous lesions in sub-Saharan Africa. *BMC Womens Health*. 2017;17(1):2.
32. Mungo C, Osongo CO, Ambaka J, et al. Safety and acceptability of thermal ablation for treatment of human papillomavirus among women living with HIV in Western Kenya. *JCO Glob Oncol*. 2020;6: 1024-1033.
33. Sauvaget C, Muwonge R, Sankaranarayanan R. Meta-analysis of the effectiveness of cryotherapy in the treatment of cervical intraepithelial neoplasia. *Int J Gynecol Obstet*. 2013;120(3):218-223.
34. World Health Organization (WHO). Cervical-Cancer-Elimination-Strategy-Updated-11-May-2020. 2020; (April):1–35. https://www.who.int/docs/default-source/cervical-cancer/cervical-cancer-elimination-strategy-updated-11-may-2020.pdf?sfvrsn=b8690d1a_4

How to cite this article: Chinula L, Topazian HM, Mapanje C, et al. Uptake and safety of community-based "screen-and-treat" with thermal ablation preventive therapy for cervical cancer prevention in rural Lilongwe, Malawi. *Int. J. Cancer*. 2021;149:371–377. https://doi.org/10.1002/ijc.33549