BMC Global and Public Health

RESEARCH

Open Access

Cervical cancer screening data from the case-based national electronic registry in Bangladesh

Ashrafun Nessa[1*], Abul Kalam Azad[2], Shekh Md. Nizam Uddin[3], Muhammad Abdul Hannan Khan[3], Shreshtha Zaman[4] and Mohammad Abdus Salam Khan[5]

Abstract

Background The Government of Bangladesh established a visual inspection with acetic acid (VIA)-based cervical cancer screening programme at 600 primary, secondary and tertiary health facilities following a pilot programme in 2005. An aggregated data collection system was initiated using District Health Information System 2 (DHIS2) software in 2013 and a case-based electronic data registry system was developed utilising its "tracker" component since January 2018. The purpose of this study is to review the cervical cancer surveillance situation based on the data of the national cervical cancer screening, treatment and follow-up through the DHIS2-based electronic registry.

Methods Women aged 30 to 60 were enrolled in the DHIS2 electronic registry in health facilities of all tiers including the community clinics and screened for cervical cancer using the VIA method at Upazila Health Complexes and upper tiers. The VIA-positive women were referred for colposcopy in the nearest colposcopy centres. The screen-positive women were offered treatment and followed up at certain intervals following the national standard protocol. During each encounter, required data were captured in DHIS2. Anonymised data from the DHIS2 covering January 2018 to May 2023 were extracted and analysed for this study.

Results A total of 1,562,963 women were enrolled in 497 screening facilities and 6398 community clinics. Among them, 1,557,002 (99.6%) availed VIA tests, and primary health facilities performed 74.4% enrolments and 72% VIA tests. Among screened women, 51,913 (3.3%) were VIA positive, of which only 20,954 (40.4%) attended for colposcopy. Among colposcopy-positive women, 6.3% (1,327) and 6.2% (1,302) women had cervical intraepithelial neoplasia (CIN) II/III and cervical carcinoma, respectively. Among women who received treatment for cervical precancer, 81.6% (5062) had thermal ablation, and 17.6% (1089) had loop electrosurgical excision procedure. Histopathology reports ($n=3079$) revealed 16.1% ($n=495$) of women had squamous cell carcinoma, 4.0% ($n=123$) had micro-invasive squamous cell carcinoma, 11.7% ($n=36$) had CIN II, and 8.1% ($n=250$) had CIN III.

Conclusions The National Cervical Cancer Screening and Treatment Programme for women in Bangladesh using a DHIS2-based electronic case-based tracking system is effective in understanding the screening situation and can be a valuable lesson for other countries.

Keywords Cervical cancer, Cervical cancer screening, VIA, Bangladesh, Electronic data tracking, Digital health

*Correspondence:
Ashrafun Nessa
ashrafun@bsmmu.edu.bd
Full list of author information is available at the end of the article

Background

Cervical cancer is the fourth common cancer among women worldwide with approximately 660,000 new cases and 350,000 mortalities in the year 2022 [1]. Cervical and breast cancers are the two most prevalent cancers among Bangladeshi women. The WHO estimated about 9640 new cervical cancer and 12,989 new breast cancer cases in Bangladesh in the year 2022, with a mortality rate of 7.0% for cervical cancer and 7.6% for breast cancer [2]. The Ministry of Health and Family Welfare (MOHFW) introduced visual inspection of cervix with acetic acid (VIA) for cervical cancer screening and clinical breast examination (CBE) for breast cancer screening following a pilot programme in 2005 for women aged 30 to 60 years [3–5]. Both methods are simple, low cost and have the potential for immediate linkage with treatment. The screening programme, initially started in the tertiary hospitals, was gradually scaled up to the district hospitals, and by 2010, all the 64 districts were covered. In 2012, the MOHFW established a "National Centre for Cervical and Breast Cancer Screening and Training (NCCBCST)" at the Bangabandhu Sheikh Mujib Medical University (BSMMU) to facilitate rapid enhancement in the number of service providers through competency-based training and thereby rolling out the screening programme further down to the upazila (subdistrict) health facilities [3–6]. The number of screening centres was increased to 600 at the tertiary, secondary and primary care level, of which 424 centres were at the subdistrict level and all centres are providing screening services free of cost [7]. VIA-positive women are evaluated and managed in 50 colposcopy clinics spread across the country. In these facilities, colposcopy, thermal ablation (TA) and loop electrosurgical excision procedures (LEEP) are available. VIA-negative women are advised to repeat the VIA screening after 5 years. At the colposcopy clinics, "see and treat" approach is followed per the "National strategy for cervical cancer prevention and control" [6]. Through this approach, women who are suspected to have cervical precancers are given treatment during the same visit. The purpose of this article is to describe and present the data on cervical cancer screening and follow-up. In Bangladesh, case-based cervical cancer screening data was not analysed previously to survey the screening and treatment situation using this data collection system.

All the data are collected in an electronic system using a District Health Information System version 2 (DHIS2) platform. However, until 2012, paper-based and aggregated data were collected. Electronic data collection system was introduced in 2013 in aggregated form [8–11]. In 2018, besides the aggregated data collection system, a case-based electronic data registry system was also established, and enrolment was rolled out down to the grassroot level towards the community clinics [10, 12]. The DHIS2 is an open-source software developed by the University of Oslo and is used in over 70 low- and middle-income countries (LMICs) [13, 14]. The platform gained popularity due to the functionalities of data gathering, validation, analysis and ready visualisation [11, 14]. For this study, the case-based data from the cervical cancer screening repository covering January 2018 to May 2023 were used to assess the cervical cancer screening situation and the effectiveness of longitudinal case-based data tracking in national cervical and breast cancer screening programme (NCBCSP) of Bangladesh.

Methods

Bangladesh is divided into eight administrative divisions, and each administrative division is further sub-divided into 64 districts. This study used the secondary case-based data on cervical cancer screening, extracted from the DHIS2 electronic data repository of the NCBCSP. The de-identified data from the registry were accessed and analysed. The "tracker" component of DHIS2 enables data collection, case tracking, surveillance, analysis and reporting within the national DHIS2 database. In the case-based data system, a personal electronic profile for each participating woman is maintained and updated. Data profiles for each woman include their residence (division, district, home address), dates of birth and enrolment, education, profession, information on VIA, colposcopy, treatment and follow-up. The school educational system of Bangladesh is divided into primary (grade I–V), secondary (grade VI-X) and higher secondary (grade XI-XII) levels, and vocational education is skill-specific education. The flow chart in Fig. 1 describes the screening and follow-up process. Women aged 30 to 60 years are enrolled across the country either at their homes by the community health workers (CHWs) or at any health facility of different tiers, from community clinic (CC) to medical university hospital (MUH) [10, 12].

On enrolment, women are registered at the CCs for subsequent tracking and follow-up services. The enrolled women are screened for cervical cancer using the VIA method in health facilities at Upazila Health Complexes (UHCs) or above and in some CCs during special screening camps. Trained senior staff nurses (SSNs) or doctors perform the VIA test. VIA-positive women are referred to the nearest colposcopy centre located in the secondary or tertiary hospitals. Colposcopy-positive women are given treatment (LEEP or TA) and followed up at certain intervals using a standard protocol. Data on each woman, at each service encounter, are captured in real-time through an online DHIS2-based electronic data server. Online access to this DHIS2 server has been rolled out

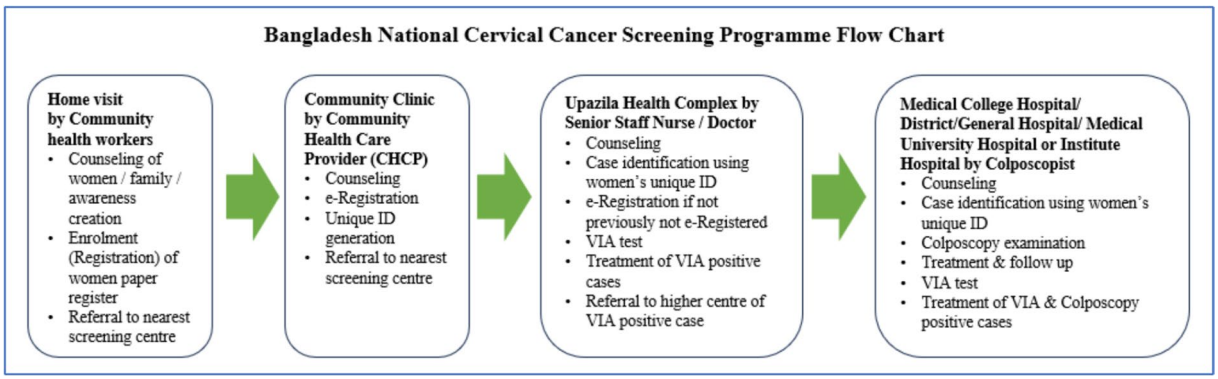

Fig. 1 Flow chart of the NCBCSP referral system

across the country. A web portal dashboard presents the real-time data summary [15, 16].

Statistical analysis

For this study, anonymised case by case data from the DHIS2 server were extracted in May 2023, which covered the period from January 2018 to May 2023, and imported into Microsoft Excel (USA). Finally, the Excel data were transferred to SPSS for analysis, summarisation and interpretation.

The number of participating health facilities was determined by simple counting of different types of health facilities. Percentages were calculated for women who had VIA tests and VIA-positive reports and women availing colposcopy-, colposcopy- and histopathology-positive reports. Frequency distribution for univariate analysis (such as distribution of enrolled women by geographic location, age group, education, occupation, year, health facility type) and cross-tabulations were used for bi- and multivariate analysis (such as VIA and colposcopy results by geographic location, year, health facility type). Confidence intervals (CI) at 95% were calculated for VIA-positivity and colposcopy-positivity rates by year and divisions.

Results

Table 1 shows distribution of different types of health facilities performing enrolment, VIA tests and colposcopy examination of the women. Enrolment was done by 6,895 health facilities. Of them, 1,094 health facilities carried out VIA tests, and 97 hospitals conducted colposcopy examinations. The number of women enrolled was 1,562,963, and among them, 1,557,002 (99.6%) had VIA tests, and 51,913 (3.30%) were VIA positive. Only 20,954 (40.4% of 51,913) VIA-positive women attended for colposcopy, and among them, 11,193 (48.6%) were colposcopy positive.

Demographic information

More than one-fourth of the enrolled women were from the Dhaka division (28.1%), majority was in the age group of 35–44 years (46.5%), 9.3% women had education grade XI and above, and almost all the women were housewives (93.5%) (Table 2).

Trend of enrolment and VIA tests by year

Figure 2 reveals a gradual increment in enrolment and VIA tests over the years. Of the total enrolment ($n=1,558,303$), only 2.10% occurred in 2018, which increased to 39.2% in 2022. Of the total VIA tests ($n=1,546,956$), only 1.90% were done in 2018, which increased to 37.2% in the year 2022. Enrolment and VIA tests covering 5 months (January to May) of 2023 were 15.7% and 15.9%, respectively.

Trend of enrolment and VIA tests by health facility types

Table 3 shows the percentage distribution of the women by enrolment as well as VIA test by health facility types. In general, most of them (over 98.0%) had their VIA tests in the same health facility where they were enrolled. The exception was the CCs, which carried out VIA tests for only 4.20% of the enrolled women, and most (88.5%) had their VIA tests in the UHCs. More than half (51.8%) of the total enrolment (1,562,963) were done in the UHCs followed by the CCs (22.6%), and of the total 1,557,863 VIA tests, about three-fourth (72.0%) were done in the UHCs.

VIA and colposcopy results

The women from Mymensingh and Dhaka divisions (Fig. 3) showed the highest VIA-positivity rate (4.00% and 3.80%, respectively). The national average VIA-positivity rate was 3.30%. The average colposcopy positivity among the VIA-positive women was 48.6%. Mymensingh division had the highest colposcopy

Table 1 The participating health facilities and women in the NCBCSP

No. of participating health facilities								
Event		**MUH**	**MCH**	**DH/GH**	**UHC**		**CC**	**Total**
Enrolment		1	22	64	410		6398	**6895**
VIA test		1	22	64	409		598	**1094**
Colposcopy examination		1	18	31	47		-	**97**
No. of participating women								
Enrolment	**VIA test**				**Colposcopy examination**			
	VIA		**VIA + ve**		**Colposcopy**		**Colposcopy + ve**	
No	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
1,562,963	1,557,002	99.6% of the enrolled women	51,913	3.3% of VIA test	20,954	40.4% of VIA + ve women	10,193	48.6% of colposcopy
95% confidence interval				3.31–3.36%	95% confidence interval			47.97–49.32%

MUH medical university hospital, *MCH* medical college hospital, *DH/GH* district hospital/general hospital

UHC Upazila Health Complex, *CC* community clinic, VIA visual inspection with acetic acid

Table 2 Division of residence, age, education, and occupation of the enrolled women

Division of residence of women										
No. and %	**Barishal**	**Chittagong**	**Dhaka**	**Khulna**	**Mymensingh**	**Rajshahi**	**Rangpur**	**Sylhet**		**Total**
No. (%)	82,545 (5.3)	283,897 (18.3)	434,971 (28.1)	196,906 (12.7)	78,962 (5.1)	231,331 (15.0)	181,273 (11.7)	57,398 (3.7)		1,547,2837 (100.0)
Age of women										
	30–34 years	**35–44 years**	**45–49 years**		**50–54 years**	**55–59 years**	**60 years**		**Total**	
No. (%)	159,461 (23.5)	315,689 (46.5)	86,732 (12.8)		68,931 (10.2)	37,596 (5.5)	10,225 (1.5)		678,634 (100.0)	
Education of women										
	No education	**Grades I–V**	**Grades VI–X**		**Grades XI–XII**	**Graduate and masters**	**Vocational**		**Total**	
No. (%)	191,417 (22.1)	276,081 (31.8)	314,163 (36.2)		38,638 (4.5)	41,614 (4.8)	5177 (0.6)		867,090 (100.0)	
Occupation of women										
	Housewife			**Other**			**Total**			
No. (%)	1,461,230 (93.5)			101,733 (6.5)			1,562,963 (100.0)			

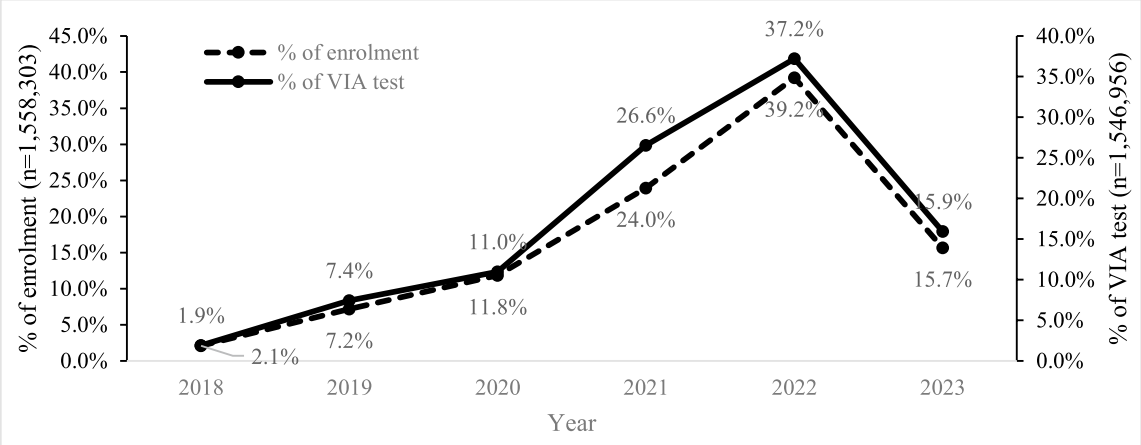

Fig. 2 Trend of enrolment and VIA tests by year

positivity (62.4%). Table 4 shows the 95% confidence interval for the VIA-positivity rate and colposcopy-positivity rate at different divisions.

The VIA-positivity rate declined gradually over the years (7.10% in 2018 to 2.70% in 2023). In contrast, the year-wise colposcopy-positivity rate (%) showed a rising trend from 2018 (38.4%) to 2021 (55.8%), and then a declining trend from 2022 (44.5%) to 2023 (32.5%) was observed (Fig. 4). Table 5 shows the 95% confidence interval for the VIA-positivity rate and colposcopy-positivity rate in different years.

The VIA positivity had a declining trend from tertiary level to primary level healthcare facilities (Fig. 5). The colposcopy-positivity rate among the VIA-positive women was the lowest at the MUH (42.9%). The 95% confidence interval for the national VIA-positivity rate was 3.31%—3.36% and national colposcopy-positivity rate was 47.97%—49.32%.

Type of colposcopy findings

Figure 6 shows the distribution of the colposcopy findings among 20,954 VIA-positive women. More women had colposcopy diagnosed CIN I (36.1%) compared to CIN II/III (6.30%) and cervical carcinoma (6.20%).

Among the 8889 women with colposcopy diagnosed cervical precancer, 6205 received treatment (Table 6). Most of them (81.6%) received thermal ablation, followed by LEEP (17.6%).

Among the 6205 treated women, 3079 histopathology reports were available (Fig. 7). Of them, 16.1% ($n=495$) had squamous cell carcinoma, 4.00% ($n=123$) had micro-invasive squamous cell carcinoma, 1.90% ($n=60$) had adenocarcinoma, and 8.10% ($n=250$) had CIN III.

Discussion

This study used the secondary source of electronic case-based cervical cancer screening data extracted from the DHIS2 server of the NCBCSP in Bangladesh. In over 5 years, from January 2018 to May 2023, more than 1.56 million ($n=1,562,963$) women aged 30 to 60 years were enrolled in 6895 government health facilities (national, subnational and community clinics). There was an increasing trend of enrolment over the years (Table 1). However, it could cover only 5.3% of the country's 29.43 million target women for screening (estimated from the Bangladesh Population Census 2022) [17]. From January 2005 to December 2019, 2.4 million (aggregated data) VIA tests were performed with VIA positivity of 4.5% tested women with a rising trend of the number of women screened per year [18]. The aggregated cervical cancer screening data of last 10 years (2014 to 2024) also revealed an inadequate coverage of 17.9% (5.3 million) [16]. The target population living in the hard-to-reach areas, such as coastal areas (approximately 3.17 million) and hilly districts (approximately 0.52 million) [17], have difficult access to the screening centres at the district or subdistrict hospitals.

The implementation of case-based DHIS2 data tracking was in development and trial phase in the years 2018 and 2019 which might be related to lower number of cases recorded in the case-based data system in the initial years. Unavailability of screening services near their residence, lack of transport support, shyness of women in the conservative society, misconceptions, fear and lack of awareness of the screening benefits may also attribute to the low coverage. More awareness-raising interventions at the community level and rapid scale-up of the programme along with an electronic monitoring system are recommended. Reports show varying cervical cancer

Table 3 The proportion of women enrolment and VIA tests by health facility type

Enrolment Health facility type	Percent distribution of VIA tests between enrolment and other health facility type					
	MUH	**MCH**	**DH/GH**	**UHC**	**CC**	**Total**
MUH (*n* = 49,700; 3.2%)	98.4%	0.1%	0.1%	1.4%	0.0%	100.0%
MCH (*n* = 116,891; 7.5%)	0.1%	99.4%	0.0%	0.4%	0.0%	100.0%
DH/GH (*n* = 233,160; 14.9%)	0.1%	0.1%	99.4%	0.3%	0.0%	100.0%
UHC (*n* = 809,912; 51.8%)	0.1%	0.1%	0.0%	99.8%	0.0%	100.0%
CC (*n* = 353,300; 22.6%)	0.2%	0.7%	6.5%	88.5%	4.2%	100.0%
Total (*n* = 1,562,963; 100.0%)	**3.1%** (*n* = 48,989)	**7.5%** (*n* = 117,594)	**16.3%** (*n* = 254,348)	**72.0%** (*n* = 1,122,087)	**1.0%** (*n* = 14,845)	**100.0%** (*n* = 1,557,863)

(Parentheses show the number of VIA tests done in the same health facility type). *MUH* medical university hospital, *MCH* medical college hospital, *DH/GH* district hospital/general hospital. *UHC* Upazila Health Complex, *CC* community clinic

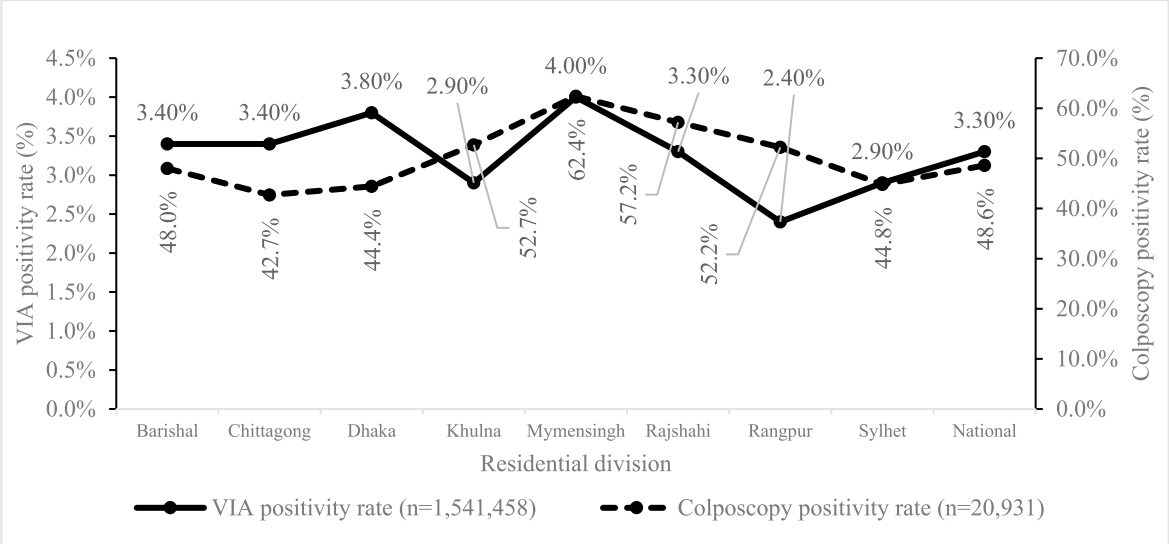

Fig. 3 VIA and colposcopy -positivity rate (%) by division

Table 4 95% confidence interval for the VIA-positivity rate and colposcopy-positivity rate at different divisions

	Barishal	**Chittagong**	**Dhaka**	**Khulna**	**Mymensingh**	**Rajshahi**	**Rangpur**	**Sylhet**	**National**
VIA positivity	3.30–3.55%	3.33–3.47%	3.74–3.85%	2.88–3.03%	3.89–4.17%	3.21–3.35%	2.30–2.44%	2.80–3.10%	3.31–3.36%
Colposcopy positivity	47.63–53.64%	42.35–45.38%	45.24–47.54%	55.88–59.59%	61.35–67.57%	57.40–60.51%	75.52–80.15%	46.50–54.04%	47.97–49.32%

screening coverage in different countries, such as 53.9% in Thailand, 78.0% in England, 3.0% in Ghana, 4.8% in Uganda and 7.1% in India [19–23]. However, these countries do not have electronic enrolment and tracking systems like Bangladesh. Only a few countries, for example Burkina Faso, Cote d'Ivoire, Guatemala and Philippines, reported using the DHIS2 tracker to strengthen their cervical cancer screening programme [24, 25]. Although in this study the case-based screening coverage is low (5.3%), it is commendable that electronic data tracking is introduced for screening and monitoring purposes in a low-resource country like Bangladesh.

The consistent increase in year-wise enrolment and VIA tests, and availing the tests in the same year by most women (Fig. 2), indicated their acceptance and interest in the screening program. Three-fourths (74.4%, *n* = 1.1

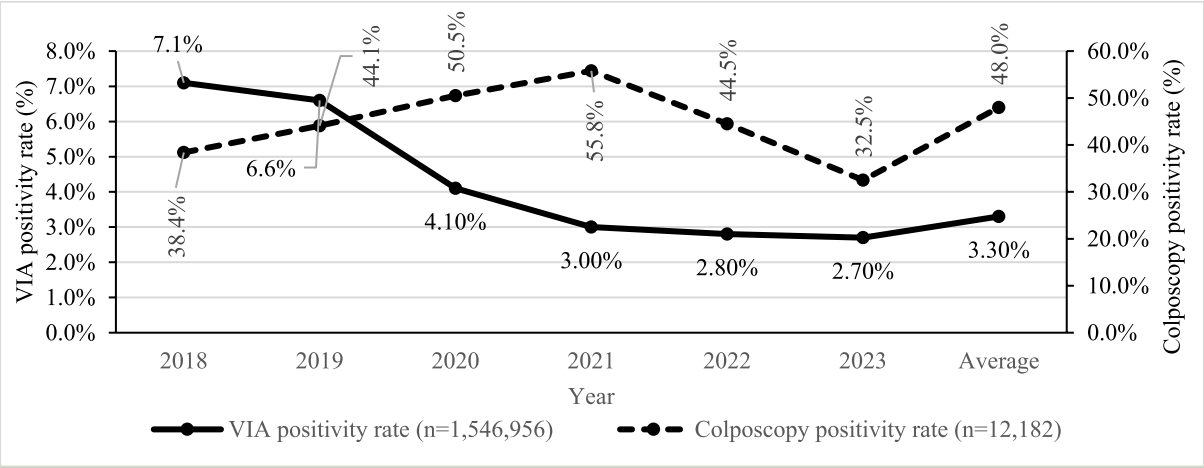

Fig. 4 Positivity rate (%) for VIA tests and colposcopy by year

Table 5 95% confidence interval for the VIA-positivity rate and colposcopy-positivity rate in different years

Year	2018	2019	2020	2021	2022	2023	Average
VIA positivity	6.77–7.35%	6.32–6.60%	3.99–4.17%	2.90–3.01%	2.90–3.01%	2.65–2.78%	3.31–3.36%
Colposcopy positivity	34.65–42.26%	42.30–46.08%	55.87–59.76%	59.49–62.46%	45.57–49.04%	29.69–38.93%	47.97–49.32%

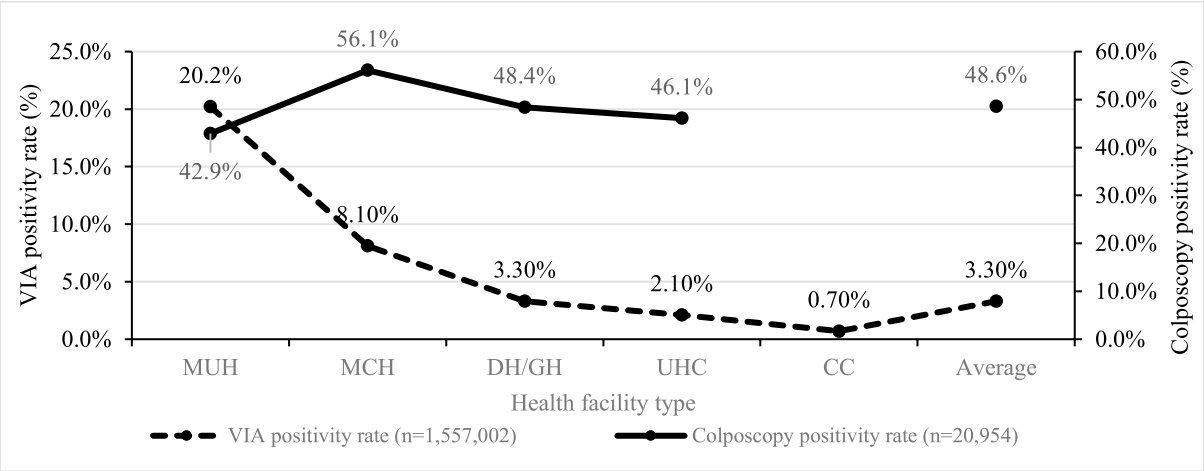

Fig. 5 Positivity rate (%) for VIA and colposcopy tests by health facility type. (Parentheses show the 95% confidence interval and total N).Ca Cx VAIN, cervical cancer and vaginal intraepithelial neoplasia

million) of the total enrolment was collectively done by the primary level health facilities (410 UHCs and 6398 CCs) reflecting the benefits of the availability of the enrolment near their home. Women frequently visit CCs for essential primary health-care services including follow-up for themselves and their children [26–28], and inclusion of all 14,000 CCs under the network of the national screening programme might lead to more coverage of the target women. A limited number of VIA tests were done in some CCs only during special camps operated by the visiting trained SSNs from UHCs, and such special camps could be organised in CCs time to time. Low-risk women attending the CCs might have attributed to the low VIA-positivity rate.

Only 20,954 (40.4%) women had the colposcopic evaluation, meaning 59.6% of the VIA-positive women did not attend colposcopy clinics. Colposcopy services are presently available at the secondary and tertiary hospitals at

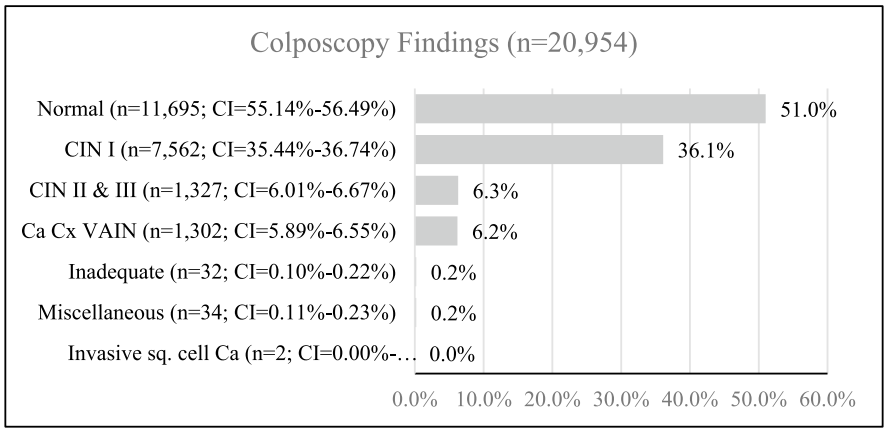

Fig. 6 Distribution of the colposcopy findings among the VIA-positive women (parentheses shows the 95% Confidence Interval and total N). Ca Cx VAIN: Cervical Cancer and Vaginal Intraepithelial Neoplasia

Table 6 Treatment of the women with cervical precancer

Treatment type	No	%
Cryotherapy	46	0.7
Thermal ablation	5062	81.6
Cone	8	0.1
LEEP	1089	17.6
Total	**6205**	**100.0**

the district level where immediate colposcopy is offered to the VIA-positive women. However, VIA-positive women from the primary healthcare level (UHC) needed to visit a colposcopy centre at the district level. Considerable number of those VIA-positive women missed the colposcopy test. The reasons for low attendance might be long distance from home to colposcopy clinics, women might not feel encouraged to travel due to transport costs, guardians not being available to accompany them and engagement with familial responsibilities, and these could be avoided by decentralisation of the colposcopy centres. Cytology/human papillomavirus (HPV) testing setup and infrastructure are not feasible yet at the district or subdistrict level for triaging VIA-positive women. However, HPV testing can be considered for triaging, and HPV samples from all VIA-positive women can be sent

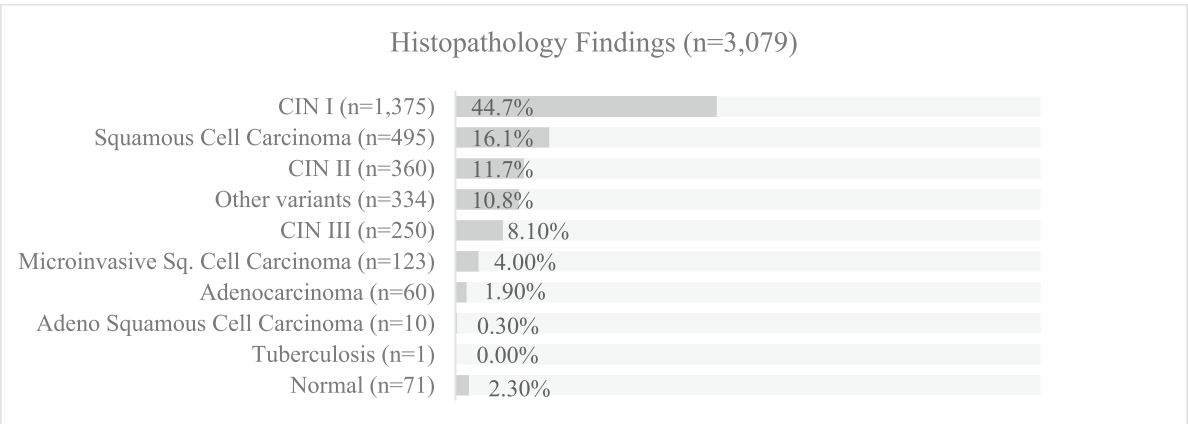

Fig. 7 Histopathology findings of the biopsy samples collected during colposcopy examination

by ordinary courier service to a central lab. Colposcopy referral could be planned thereafter. All these recommendations can be considered in the government strategy.

A nationwide lockdown due to Covid-19 was declared by the government from 23 March to 30 May 2020, and during this period, both screening and diagnostic services were suspended [29, 30]. Overall, the number of patients undergoing colposcopy (first visit after a positive screening test) dropped by 27% in 2020 compared to the previous year [30]. However, more women with symptoms attended for colposcopy following lockdown, both in the year 2020 and 2021 which might be related to peak in colposcopy positivity during 2020/2021.

To improve coverage, every colposcopy centre should check compliance regularly and contact and counsel noncompliant women over telephone. To avoid low attendance, the DHIS2 system could send individualised messages and reminders to the registered phone numbers of screened positive women. Other studies assessed the usefulness of interventions such as mobile phones or text messaging [31–33]. Involving CHWs to get insight of the misunderstandings among the women has also proven benefit [34].

The study shows regional variation for VIA and colposcopy-positivity rates among the women with the highest positivity in Mymensingh (Fig. 3). Regional variation was also found in the VIA positivity rate in India, 14.0% in Maharashtra, 12.7% in Andhra Pradesh and 9.7% in North India [35–37]. Regional variation was also reported for colposcopy-positivity rate in a study in Italy [38].

The declining trend in the year-wise VIA positivity rate (7.1% in 2018 to 2.7% in 2023) might be attributed to several factors. In the initial years, VIA tests were mostly done in the DHs/GHs or higher-level health facilities, a lower number of VIA tests were performed and women with a higher risk of cervical precancer and cancer participated. During the later years, the emergence of the UHCs at the subdistrict level as the major contributors to the VIA tests with rising awareness led more participation, irrespective of the risk of cervical precancer and cancer. Additionally, the health personnel received multiple hands-on trainings and thus gained better skills and experience. The above factors are potential reasons for lower VIA positivity during the later years. The National Cervical Cancer Screening Programme is trying to provide organised screening services; thus, many asymptomatic women are encouraged to participate and avail screening services. This may also explain the reason of present low VIA-positive rate. The present study showed a consistent VIA-positive rate of 2.4 to 4.0% at different divisions making a national average of 3.3%. A similar picture was revealed in Kenya, where the VIA-positivity rate became less than 5% for most years, especially after 2016, when the screening numbers increased [39]. The increasing trend in the colposcopy-positivity rate among VIA-positive women for the first few years and then a declining trend in the subsequent years (Fig. 5) could not be explained, and exploration of this fact is needed. The lowest colposcopy-positivity rate among the VIA-positive women in the MUH compared to other health facility types might be due to the presence of highly experienced and knowledgeable colposcopists in the university hospital.

Among the women availing colposcopy examination, 7562 (36.1%) of the women had CIN I, and 1327 (6.3%) had CIN II/III, and they were treated either by LEEP (17.6%, 1089) or TA (81.6%, 5062). TA is an accepted and well-adopted method of treatment for cervical precancer [40, 41]. Despite having a computerised system in place, out of 6205 treated women, only 3079 histopathology reports were available. Among the treated women, many women with low-grade disease did not have colposcopy-directed cervical biopsy, especially in health facilities where histopathology services were not available. Moreover, among women having biopsy sample collection, many did not come back with their histopathology report. Among the available histopathology reports ($n=3079$), 22.3% had cervical cancer, and among them, a low number of microinvasive carcinomas ($n=123$, 4.0%) was detected. Several factors may attribute, viz., not well-organised pathology services; unavailability of all histopathology reports for data updating, etc. Though less than half of the VIA-positive women had colposcopy and many histopathology reports were unavailable, diagnosis of considerable number of cervical precancer and cancer cases indicates the effectiveness of the screening programme and necessity of meticulous tracking of positive women.

This is the first data analysis through the electronic data system providing the opportunity of assessment of the screening situation in Bangladesh. The LMICs using DHIS2 for aggregated data collection from health facilities can also implement case-based data collection and tracking. The case-based longitudinal data of each enrolled woman enables tracking of non-attendees for subsequent examinations and follow-up and to bring them back at regular intervals for further screening. The experience of the viable and effective DHIS2-based electronic tracking of case-based cervical cancer data of women in Bangladesh can be a valuable lesson for other countries.

Conclusions

The study presents a comprehensive analysis of the outcomes of implementation of an electronic tracking system for national cervical cancer screening and treatment in Bangladesh. The findings indicate the acceptability of the screening programme, as evidenced by the gradual increase in enrolment and VIA tests over the years. The DHIS2 system helped in data surveillance and efficiently helped in monitoring, evaluation and management of screen-positive women. The creation of a live dashboard is a powerful tool for health managers and policymakers by providing real-time data and analysis for monitoring purposes. Decentralising colposcopy services, utilising mobile technology for reminders and improving community engagement should improve the screening coverage.

Abbreviations

DHIS2	District Health Information System version 2
VIA	Visual inspection of cervix with acetic acid
CIN	Cervical intraepithelial neoplasia
LEEP	Loop electrosurgical excision procedure
MOHFW	Ministry of Health and Family Welfare
CBE	Clinical breast examination
NCCBCST	National Centre for Cervical and Breast Cancer Screening and Training
BSMMU	Bangabandhu Sheikh Mujib Medical University
TA	Thermal ablation
LMICs	Low- and middle-income countries
NCBCSP	National Cervical and Breast Cancer Screening Programme
CHWs	Community health workers
CCs	Community clinics
MUH	Medical university hospital
UHCs	Upazila Health Complexes
SSNs	Senior staff nurses
MCHs	Medical college hospitals
DHs/GHs	District hospitals/General hospitals
HPV	Human papillomavirus
DGHS	Directorate General of Health Services

Acknowledgements

The DHIS2 software configuration is the result of an extensive and repeated input from international agencies (WHO, UNICEF, GIZ, etc). Authors would also like to acknowledge the key involvement of government organizations (Directorate General of Health Services and MOHFW) of Bangladesh for their support in the configuration of DHIS2 and its' maintenance. We are grateful to the health managers, healthcare providers, data and field staff at all tiers of healthcare facilities across the country for their participation and contribution.

Authors' contributions

AN, MASK and AKA conceptualized and designed the study. Data curation was performed by SMNU, MAHK. Data Validation was performed by AKA, SMNU, SZ. All authors participated in drafting and revising the manuscript for important intellectual content and approved the final version before submission. All authors read and approved the final manuscript.

Funding

Not applicable.

Data availability

The cervical cancer screening data repository of the Case-based National Electronic Registry in Bangladesh is not publicly accessible. However, there is an interactive dashboard at https://nccbcst.bsmmu.ac.bd/dashboard that allows users to view the updated and de-identified data summary. The data we used for the study were not drawn from the dashboard. Rather we extracted anonymized case by case records from the repository.

Declarations

Ethics approval and consent to participate

The cervical cancer screening data repository of the case-based national electronic registry in Bangladesh is owned and maintained by the National Cervical and Breast Cancer Screening and Training Centre of the Ministry of Health and Family Welfare of the Government of Bangladesh. The corresponding author is the director of the centre and, hence, the legal authority of the data with permission to access and use the data. Ethical approval was therefore not required. The screening, follow-up and patient management data in the repository are gathered, as a routine procedure, from all government health facilities across the country, where the participating women provide informed consent for data collection, follow up and research during each procedure. Finally, all research procedures conformed to the principles of the Helsinki Declaration.

Consent for publication

Consent for publication of de-identified registry data was obtained from all participants.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Gynaecological Oncology, Bangabandhu Sheikh Mujib Medical University, Dhaka 1000, Bangladesh. [2]Directorate General Health Services, Dhaka, Bangladesh. [3]HiSP Bangladesh, Dhaka, Bangladesh. [4]National Centre for Cervical and Breast Cancer Screening and Training, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. [5]Medical Education & Family Welfare Division, Ministry of Health and Family Welfare, Dhaka, Bangladesh.

Received: 2 July 2024 Accepted: 10 March 2025
Published online: 09 April 2025

References

1. WHO. Cervical Cancer. China: World Health Organization; 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/cervical-cancer. [Accessed on 23.1.2025].
2. WHO GLOBOCAN 2022. International Agency for Research on Cancer. Global Cancer Observatory. URL:https://gco.iarc.who.int/media/globocan/factsheets/populations/50-bangladesh-fact-sheet.pdf. [Accessed on 22.1.2025].
3. Ahmed T, Nessa A, Rahman J. Development of a visual inspection programme for cervical cancer prevention in Bangladesh. Elsevier Reprod Health Matters. 2008;16(32):78-85. 4.
4. Basu P, Nessa A, Majid M, Rahman JN, Ahmed T. Evaluation of the National Cervical Cancer Screening Programme of Bangladesh and the formulation of quality assurance guidelines. BMJ Sex Reproductive Health. 2010;36(3):131–4. 5.
5. Nessa A, Hussain MA, Rahman JN, Rashid MH, Muwonge R, Sankaranarayanan R. Screening for cervical neoplasia in Bangladesh using visual inspection with acetic acid. Int J Gynecol Obstet. 2010;111(2):115–8.
6. Government of People's Republic of Bangladesh. National strategy for cervical cancer prevention and control Bangladesh (2017–2022); 2017. Retrieved from: https://www.iccp-portal.org/system/files/plans/BGD_B5_s21_National%20Strategy%20cervical%20ca%20prevention%20and%20control%20Bd%202017-%202022.pdf
7. Health Bulletin 2023. Management Information System. Directorate General of Health Services. Ministry of Health and Family Welfare, Government of People's Republic of Bangladesh. 2023. Retrieved from: https://dghs.portal.gov.bd/sites/default/files/files/dghs.portal.gov.bd/page/8983ee81_3668_4bc3_887e_c99645bbfce4/2024-10-30-15-17-04fcbbc3747cbf6cc6983a34770666d1.pdf

8. Ministry of Health and Family Welfare, Government of Bangladesh. National Health Information System (DHIS2). Available from: https://centraldhis.mohfw.gov.bd [Accessed 27 Mar 2024].
9. National Cervical and Breast Cancer Surveillance System. (2021). Available from: https://cxbrcancersurveillance.mohfw.gov.bd. [Accessed 27 Mar 2024].
10. Nessa A, Uddin SM, Azad AK. Initiation of population-based cervical and breast cancer screening in Bangladesh. Indian J Gynecologic Oncol. 2021;19:1–8.
11. Khan MAH, Azad AK, de Oliveira CV. Bangladesh's digital health journey: reflections on a decade of quiet revolution. WHO South-East Asia J Public Health. 2019;8(2):71–6.
12. Nessa A, Hossain MS, Uddin SM, Islam MR, Khan MA, Azad AK. Electronic aggregated data collection on cervical cancer screening in Bangladesh since 2014: what the data tells us? BMC Public Health. 2024;24(1):1–9.
13. Dehnavieh R, Haghdoost A, Khosravi A, Hoseinabadi F, Rahimi H, Poursheikhali A, Khajehpour N, Khajeh Z, Mirshekari N, Hasani M, Radmerikhi S. The District Health Information System (DHIS2): a literature review and meta-synthesis of its strengths and operational challenges based on the experiences of 11 countries. Health Inform Manage J. 2019;48(2):62–75.
14. Kiwanuka A, Kimaro HC, Senyoni W. Analysis of the acceptance process of District Health Information Systems (DHIS) for vertical health programmes: a case study of TB, HIV/aids and malaria programmes in Tanzania. Electron J Inform Syst Developing Ctries. 2015;70(1):1–4.
15. In Action [Internet]. DHIS2. Available from: https://dhis2.org/in-action/. [Accessed on 23.01.2025]
16. In Action [Internet]. National Centre for Cervical and Breast Cancer Screening and Training. Available from: https://nccbcst.bsmmu.ac.bd/nccbcst/. [Accessed on 23.01.2025]
17. Bangladesh Bureau of Statistics. (2022). Population and Housing Census 2022. https://sid.portal.gov.bd/sites/default/files/files/sid.portal.gov.bd/publications/01ad1ffe_cfef_4811_af97_594b6c64d7c3/PHC_Preliminary_Report_(English)_August_2022.pdf.
18. Bhatla N, Nessa A, Oswal K, Vashist S, Sebastian P, Basu P. Program organization rather than choice of test determines success of cervical cancer screening: case studies from Bangladesh and India. Int J Gynecol Obstet. 2021;152(1):40–7.
19. Ploysawang P, Rojanamatin J, Prapakorn S, Jamsri P, Pangmuang P, Seeda K, Sangrajrang S. National cervical cancer screening in Thailand. Asian Pac J Cancer Prev. 2021;22(1):25.
20. Health and Social Care Information Centre. Cervical Screening Programme, England, 2012-13. 24. 2013. ISBN 978-1-84-636971-1.
21. Ampofo AG, Adumatta AD, Owusu E, Awuviry-Newton K. A cross-sectional study of barriers to cervical cancer screening uptake in Ghana: an application of the health belief model. PLoS ONE. 2020;15(4): e0231459.
22. Ndejjo R, Mukama T, Musabyimana A, Musoke D. Uptake of cervical cancer screening and associated factors among women in rural Uganda: a cross sectional study. PLoS ONE. 2016;11(2):e0149696.
23. Reichheld A, Mukherjee PK, Rahman SM, David KV, Pricilla RA. Prevalence of cervical cancer screening and awareness among women in an urban community in South India- a cross-sectional study. Ann Glob Health. 2020;86(1):30. https://doi.org/10.5334/aogh.2735. PMID:32211300;PMCID: PMC7082824.
24. Kabue M, Gauvreau CL, Daceney N, Bertram MM, Shissler T, Reis V, Dodo M, Garces A, Llave C, Dao B, Mohan D, Huang L. Understanding integrated HPV testing and treatment of pre-cancerous cervical cancer in Burkina Faso, Cote d'Ivoire, Guatemala and Philippines: study protocol. Reprod Health. 2023;20(1):167.
25. Huang L, Shissler T, Graham K, Archambault M. The SUCCESS Project: Supporting the elimination of cervical cancer through an integrated approach to secondary prevention [Internet]. Cancer Control. 2022 [cited 2025 Mar 18]:39-42. Available from: http://cancercontrol.info/wp-content/uploads/2022/11/39-43-Hunag.pdf.
26. Karim RM, Abdullah MS, Rahman AM, Alam AM. Identifying role of perceived quality and satisfaction on the utilization status of the community clinic services. Bangladesh context BMC Health Serv Res. 2016;16:204.
27. Muyeed A, Siddiqi MN. Influential determinants of patient satisfaction with primary health care services from community clinics: a micro survey in Bangladesh. J Clin Basic Res. 2020;4:1–7.
28. Yaya S, Bishwajit G, Ekholuenetale M, Shah V. Awareness and utilization of community clinic services among women in rural areas in Bangladesh: a cross-sectional study. PLoS ONE. 2017;12:e0187303.
29. Basu P, Lucas E, Zhang L, Muwonge R, Murillo R, Nessa A. Leveraging vertical COVID-19 investments to improve monitoring of cancer screening programme–a case study from Bangladesh. Prev Med. 2021;151:106624.
30. Lucas E, Murillo R, Arrossi S, Bárcena M, Chami Y, Nessa A, Perera S, Silva P, Sangrajrang S, Muwonge R, Basu P. Quantification of impact of COVID-19 pandemic on cancer screening programmes–a case study from Argentina, Bangladesh, Colombia, Morocco, Sri Lanka, and Thailand. Elife. 2023;16(12):e86527.
31. Holme F, Kapambwe S, Nessa A, et al. Scaling up proven innovative cervical cancer screening strategies: challenges and opportunities in implementation at the population level in low-and lower-middle- income countries. Int J Gynaecol Obstet. 2017;138(Suppl 1):63–8.
32. Lee HY, Koopmeiners JS, Rhee TG, Raveis VH, Ahluwalia JS. Mobile phone text messaging intervention for cervical cancer screening: changes in knowledge and behavior pre-post intervention. J Med Internet Res. 2014;16(8):e196.
33. Firmino-Machado J, Varela S, Mendes R, Moreira A, Lunet N, Carmo A, Cancela A, Firmino A, Ramos A, Teixeira A, Vieira A. Stepwise strategy to improve cervical cancer screening adherence (SCAN-Cervical Cancer)–automated text messages, phone calls and reminders: population based randomized controlled trial. Prev Med. 2018;1(114):123–33.
34. Drummond JL, Were MC, Arrossi S, Wools-Kaloustian K. Cervical cancer data and data systems in limited-resource settings: challenges and opportunities. Int J Gynecol Obstet. 2017;138:33–40. https://doi.org/10.1002/ijgo.12192.
35. Sankaranarayanan R, Nene BM, Dinshaw KA, Mahe C, Jayant K, Shastri SS, Malvi SG, Chinoy R, Kelkar R, Budukh AM, Keskar V. A cluster randomized controlled trial of visual, cytology and human papillomavirus screening for cancer of the cervix in rural India. Int J Cancer. 2005;116(4):617–23.
36. Gravitt PE, Paul P, Katki HA, Vendantham H, Ramakrishna G, Sudula M, Kalpana B, Ronnett BM, Vijayaraghavan K, Shah KV, CATCH Study Team. Effectiveness of VIA, Pap, and HPV DNA testing in a cervical cancer screening program in a peri-urban community in Andhra Pradesh, India. PloS one. 2010;5(10):e13711.
37. Satyanarayana L, Asthana S, Bhambani S, Sodhani P, Gupta S. A comparative study of cervical cancer screening methods in a rural community setting of North India. Indian J Cancer. 2014;51(2):124–8.
38. Garutti P, Cristiani P, Fantin GP, Sopracordevole F, Costa FS, Schincaglia P, Ravaioli A, Bianchi PSD, Naldoni C, Ferretti S, Bucchi L. Interpretation of colposcopy in population-based cervical screening services in north-eastern Italy: an online interregional agreement study. Eur J Obstet Gynecol Reprod Biol. 2016;206:64–9 ISSN 0301-2115.
39. Mwenda V, Mburu W, Bor JP, Nyangasi M, Arbyn M, Weyers S, Tummers P, Temmerman M. Cervical cancer programme, Kenya, 2011–2020: lessons to guide elimination as a public health problem. Ecancermedicalscience. 2022;16:1442.
40. Randall TC, Sauvaget C, Muwonge R, Trimble EL, Jeronimo J. Worthy of further consideration: an updated meta-analysis to address the feasibility, acceptability, safety and efficacy of thermal ablation in the treatment of cervical cancer precursor lesions. Prev Med. 2019;1(118):81–91.
41. WHO. WHO guidelines for the use of thermal ablation for cervical WHO guidelines for the use of thermal ablation for cervical pre-cancer lesions pre-cancer lesions. 2019. Available at: https://iris.who.int/bitstream/handle/10665/329299/9789241550598-eng.pdf.

Publisher's Note