Cervical Cancer Screening Data from the Case-based National Electronic Registry in Bangladesh

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ABSTRACT

Introduction:

The purpose of this study is to review the cervical cancer surveillance situation of Bangladeshi women based on the data of the national cervical cancer screening, treatment, and follow-up programme which uses longitudinal data tracking through a DHIS2-based electronic registry.

Methods:

Women aged 30 to 60 were enrolled in the DHIS2 electronic registry in health facilities of all tiers and screened for cervical cancer using the VIA method. The VIA-positive women had their colposcopy in the nearest colposcopy centres. The VIA- and colposcopy-positive women were treated and followed up at certain intervals following the national standard protocol. During each encounter, required data were captured in DHIS2. Data from the DHIS2 covering January 2018 to May 2023 were extracted and analysed for this study.

Results: *In 6,895 health facilities, 1,562,963 women were enrolled. Among them, 1,557,002 (99.6%) availed VIA tests at 1,094 centres. Primary healthcare facilities performed 74.4% enrolments and 72% VIA tests. 51,913 (3.3%) women were VIA-positive, of which only 20,954 (40.4%) attended for colposcopy. Among the colposcopy-positive women, 6.3% (1,327) and 6.2% (1,302) women had CIN II/III and cervical carcinoma respectively; 81.6% (5,062) of the cervical pre-cancerous women received thermal ablation and 17.6% (1089) received Loop Electrosurgical Excision Procedure (LEEP). Distribution of histopathology reports (n=3,079) revealed 16.1% (n=495) squamous cell carcinoma, 4.0% (n=123) micro-invasive squamous cell carcinoma, 11.7% (n=36) CIN II and 8.1% (n=250) CIN III.*

Conclusions: *The sustainable national cervical cancer screening and treatment programme for women in Bangladesh using an effective DHIS2-based electronic case-based tracking system can be a valuable lesson for other countries.*

Key Words: *Cervical cancer, Cervical cancer screening, VIA, DHIS2, Bangladesh, Electronic data tracking,*

INTRODUCTION

Cervical and breast cancers are the two most prevalent cancers among Bangladeshi women. The WHO estimated about 9,640 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 [1]. The Government of Bangladesh (GOB) is committed to achieving the Sustainable Development Goals (SDGs) [2]. The country has an extensive healthcare delivery network from national to subnational levels. Taking advantage of this infrastructure, the government established a National Cervical and Breast Cancer Screening Programme (NCBCSP) for women aged 30 to 60 years, free of cost, using the VIA (Visual Inspection of Cervix with Acetic Acid) and CBE (Clinical Breast Examination) methods [3-6]. Initially, paper-based aggregated data were collected from all health facilities down to the upazila (sub-district) level. The aggregated data collection system was transformed into an electronic method in 2013 using DHIS2 (District Health Information System, version 2) [7-10]. The DHIS2 is an open-source software developed by the University of Oslo and used in over 70 low- and middle-income countries (LMICs) [11-12]. The DHIS2 gained popularity because it has been built to serve the purpose of public health data gathering, validation, analysis, and ready visualisation in the required level of aggregation and disaggregation [10,13]. The "Tracker" component of DHIS2 enables data collection, surveillance, case tracking, analysis and reporting within the national DHIS2 database.

In 2018, besides the aggregated data collection system in NCBCSP, a case-based electronic data registry (DHIS2 tracker) system was also established, and women-enrolment was rolled out down to the grassroots level towards the community clinics [9,14]. This case-based system maintains a personal electronic profile for every participating woman and updates her demographic, screening, treatment, and follow-up data. This study is based on the electronic data from the cervical cancer screening repository covering January 2018 to May 2023.

METHODS

This descriptive study used the secondary case-based data on cervical cancer screening, extracted from the DHIS2 electronic data repository of the NCBCSP of Bangladesh. The flow chart in Figure 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) [9, 15].

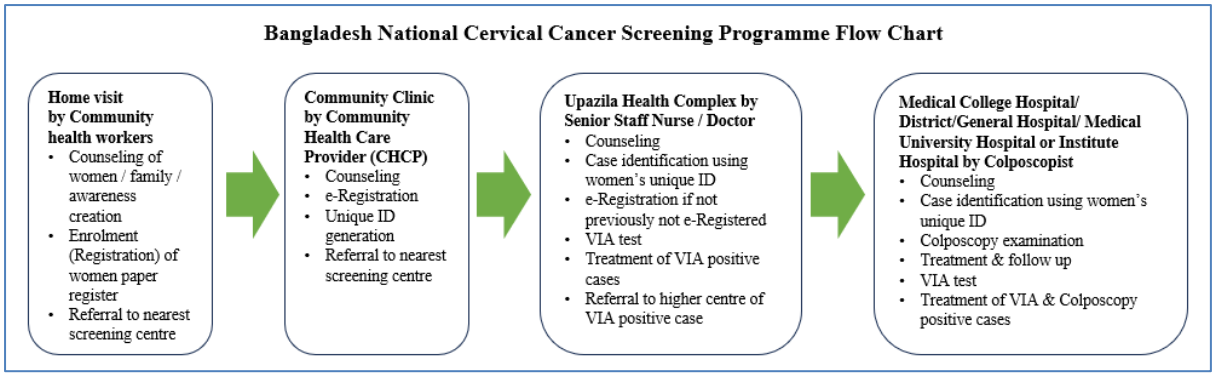

Figure-1. Flow chart of the NCBCSP referral system

On enrolment, women are e-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 Complex (UHC) or above and in some CCs during special screening camps. Trained senior staff nurses (SSNs) or doctors perform the VIA test. The VIA-positive women are referred to the nearest colposcopy centre located in the secondary or tertiary hospitals. Both VIA and colposcopy-positive women are given appropriate treatment 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 across the country. Data profiles for each woman include their residential information (division, district), dates of birth, enrolment, VIA and colposcopy reports and information on subsequent follow-up visits. A web portal dashboard presents the real-time data summary [14]. For this study, data from the DHIS2 server were extracted in May 2023, which covers the period from January 2018 to May 2023, and imported into MS Excel. The data then were checked and cleaned for inconsistencies and ambiguity. Finally, the Excel data were transferred to SPSS for analysis, summarisation, and interpretation.

RESULTS

Data source

Table 1 shows a distribution of different types of health facilities which performed the 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. Of them, 1,557,002 (99.6%) had VIA tests, and 51,913 (3.3%) were found VIA positive. All VIA-

positive women were advised for colposcopy examination, but only 20,954 (40.4% of 51,913) attended for colposcopy and among them 11,193 (48.6%) were found colposcopy positive.

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	6,398	**6,895**
VIA test	1	22	64	409	598	**1,094**
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

MCH- Medical College Hospital, DH/GH-District Hospital/General Hospital

Demographic information of the enrolled women

More than one fourth of the enrolled women were from the Dhaka division (28.1%), about two-thirds were in the age group of 35-50 years (59.3%), 36.2% had education at Grade VI to X level and almost all the women were housewives (93.5%) (Table 2).

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

Division of residence of women									
No. & %	**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)	1,547,283 7 (100.0)

Age of the women				
	30-34 years	**35-50 years**	**51-60 years**	**Total**
No. (%)	158,360 (23.5)	398,675 (59.3)	115,703 (17.2)	672,738 (100.0)

Education of the women							
No. & %	**No education**	**Grade I-V**	**Grade VI-X**	**Grade XI-XII**	**Graduate & Masters**	**Vocational**	**Total**
No. (%)	191,417 (22.1)	276,081 (31.8)	314,163 (36.2)	38,638 (4.5)	41,614 (4.8)	5,177 (0.6)	867,090 (100.0)

Occupation of the women			
No. & %	**Housewife**	**Other**	**Total**
No.	1,461,230 (93.5)	101,733 (6.5)	1,562,963 (100.0)

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 2.1% occurred in 2018, which increased to 39.2% in 2022. Of the total VIA tests (n=1,546,956), only 1.9% were done in 2018, which increased to 37.2% in 2022. Enrolment and VIA tests covering 5 months (January to May) of 2023 were 15.7% and 15.9% respectively.

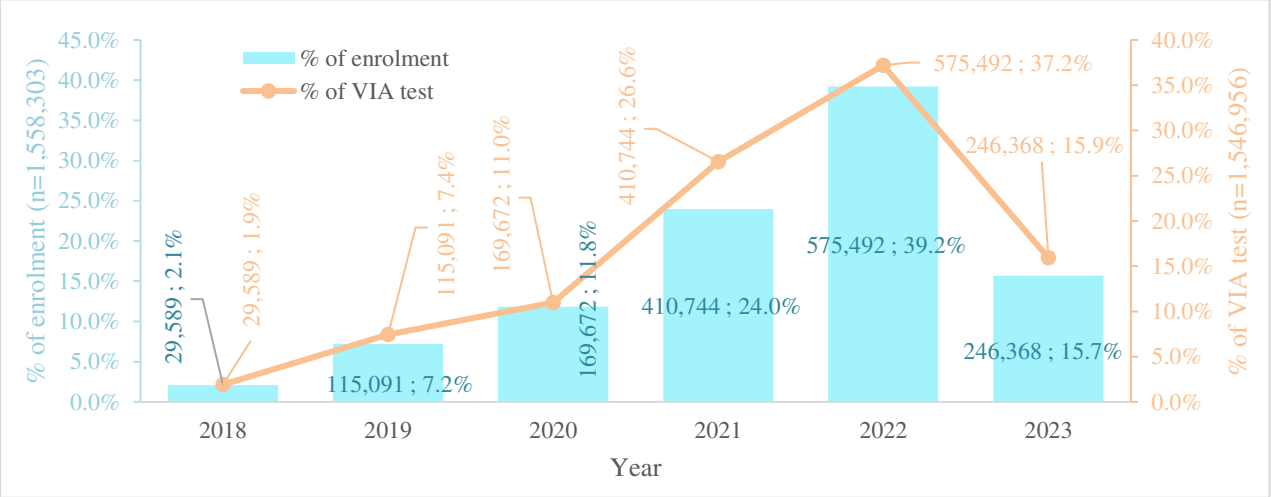

Figure-2. *Trend of enrolment and VIA tests by year*

Figure 3 shows that most enrolled women had their VIA tests in the enrolment year varying between 81.2% (in 2020) and 98.6% (in 2018). The remaining women performed their tests in the subsequent years.

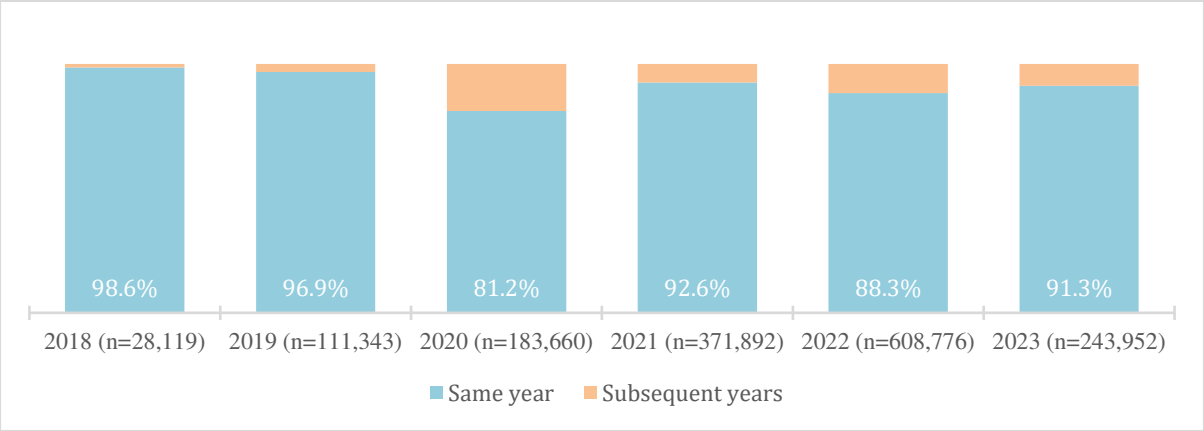

Figure-3. The proportion of enrolled women having VIA tests in the same or subsequent years

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 4.2% of the enrolled women, and most (88.5%) had their VIA tests in the UHCs. Of the total enrolment (1,562,963), more than half (51.8%) were done in the UHCs followed by the CCs (22.6%) and of the total 1,557,863 VIA tests, 72.0% were done in the UHCs.

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)

VIA and colposcopy results

Figure 4 shows the VIA and colposcopy positivity rate of the women by their residential division. The women from Mymensingh and Dhaka divisions showed the highest VIA-positivity rate (4.0% and 3.8% respectively). The national average VIA-positivity rate was 3.3%. The VIA-positive women from the Mymensingh division had the highest colposcopy-positivity (62.4%). The average colposcopy-positivity among the VIA-positive women was 48.6%.

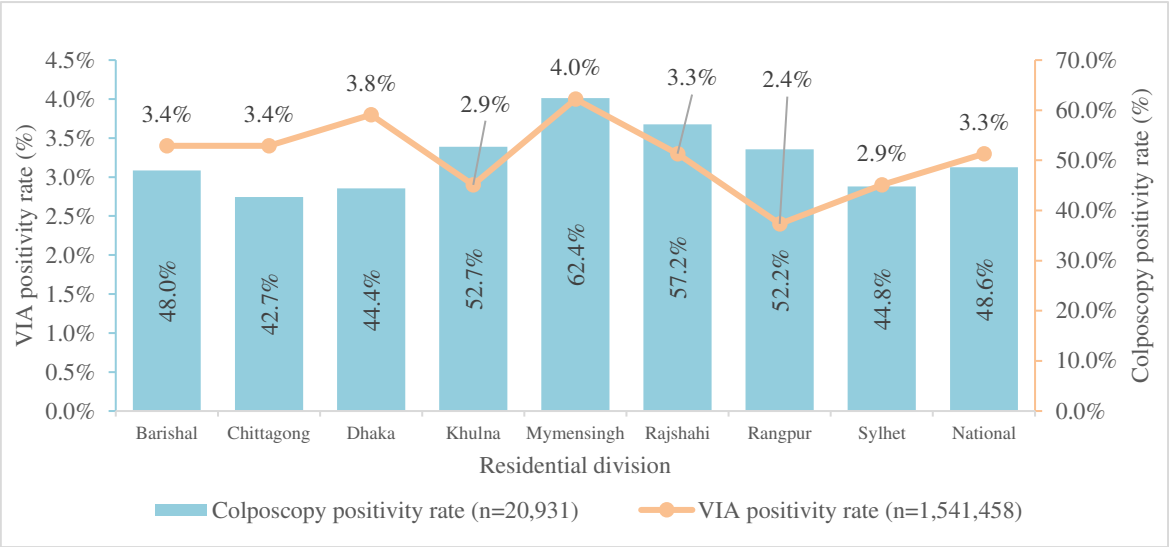

Figure 4. VIA and colposcopy positivity rate (%) among the women by division

The VIA-positivity rate declined gradually over the years (7.1% in 2018 to 2.7% 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 (Figure 5).

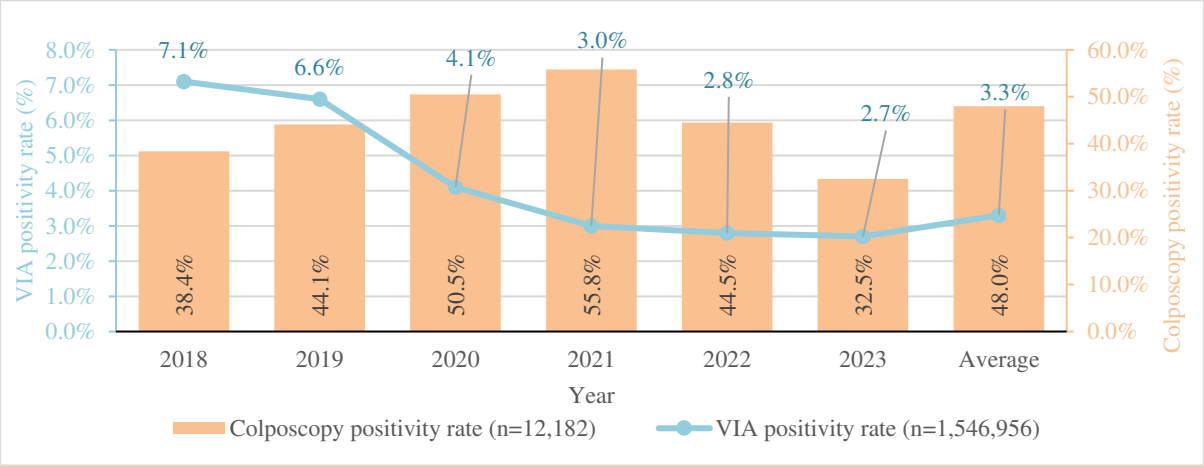

Figure 5. Positivity rate (%) for VIA tests and colposcopy among the women by year

Figure 6 shows the distribution of VIA and colposcopy positivity rates of women by health facility types where they had the tests. The VIA-positivity had a declining trend from higher to lower levels of the health facilities. The colposcopy-positivity rate among the VIA-positive women was the lowest at the MUH (42.9%).

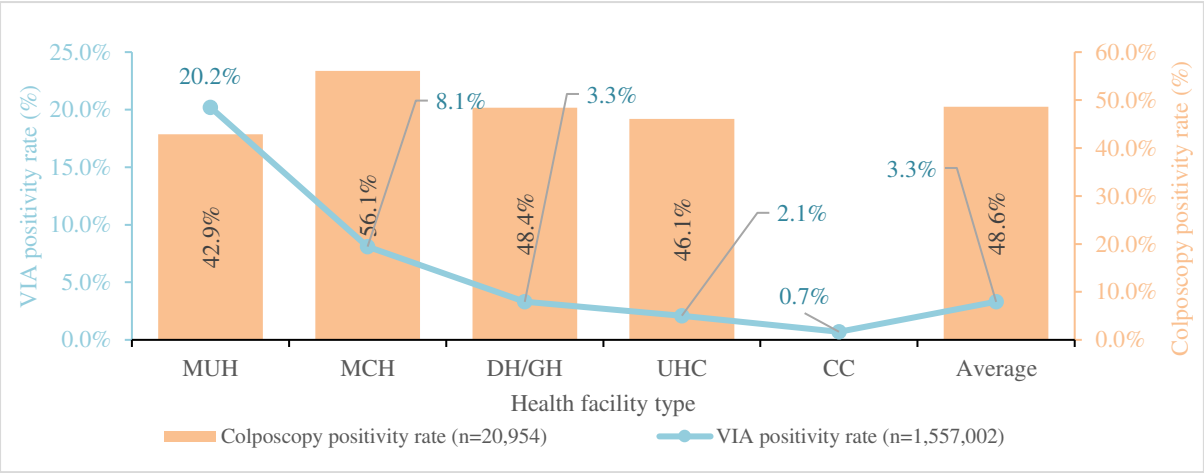

Figure-6. Positivity rate (%) for VIA and colposcopy tests among women by health facility type

Type of colposcopy findings

Figure 7 shows the distribution of the colposcopy findings among 20,954 VIA-positive women who undertook the colposcopy examination. More women had colposcopy diagnosed CIN I (36.1%) compared to CIN II and III (6.3%) and cervical carcinoma was suspected in 6.2% of the cases.

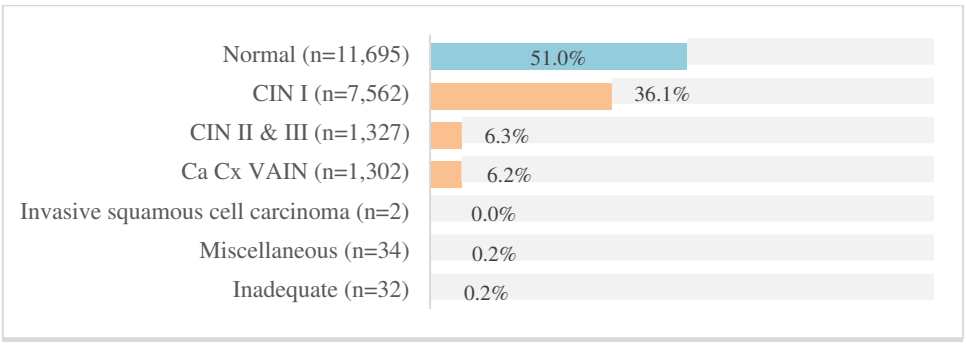

Figure-7. Distribution of the colposcopy findings among the VIA-positive women (n=20,954)

Among the 8889 women with colposcopy diagnosed cervical precancer, 6,205 received treatment (Table 4). Most of them (81.6%) received thermal ablation, followed by LEEP (17.6%).

Table-4. Treatment of the women with cervical precancer

Treatment type	**No.**	**%**
Cryotherapy	46	0.7
Thermal ablation	5,062	81.6
Cone	8	0.1
LEEP	1,089	17.6

Total	**6,205**	**100.0**

Among the 6,205 treated women, 3,079 histopathology reports were available (Figure 8). Of them, 16.1% (n=495) had squamous cell carcinoma, 4.0% (n=123) had micro-invasive squamous cell carcinoma, 1.9% (n=60) had adenocarcinoma and 8.1% (n=250) had CIN III.

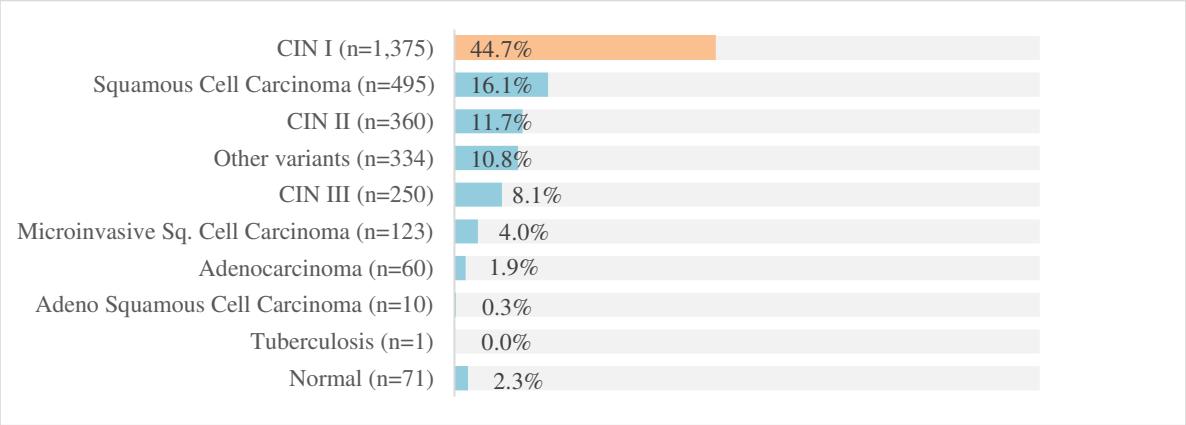

Figure-8. Histopathology findings of the biopsy samples collected during colposcopy examination (n=3,079)

DISCUSSIONS

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 6,895 government health facilities (national, subnational and community clinics). In just over 5 years, the enrolment of 1.56 million eligible women in DHIS2 is remarkable (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) [16]. The aggregated cervical cancer screening data of the national screening program of 8 years (2014 to 2022) also revealed an inadequate coverage of 11.42% (3.36 million) [15]. This coverage was the result of considerable efforts, given in recent years. Also, the adaptation of case-based DHIS2 electronic data tracking was in development and trial stage in the years 2018 and 2019 which might be another reason of low performance in the initial years. Several factors may be attributed to the low coverage, such as unavailability of screening services near their doorsteps, lack of transport support, shyness of women in a conservative society, misconceptions, fear, and lack of awareness of the screening benefits and availability. Also, the low coverage of screening in Bangladesh calls for rapid scaling of the programme along with an electronic monitoring system. More awareness-raising interventions at the community

level are recommended. Reports show varying cervical cancer 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 [17-21]. 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 the Philippines, are reported to be using the DHIS2 tracker to strengthen their cervical cancer screening programme [22,23]. Although the screening coverage is low (5.3%), it's commendable that electronic data tracking is introduced in the programme for screening and monitoring purposes in a low-resource country like Bangladesh.

There was a consistent increase in year-wise enrolment and VIA tests, and most women availed the tests in the same year they were enrolled (Figures 2 and 3). These indicate the acceptance and interest of the women in the screening program.

Three-fourths (74.4%, n=1.1 million) of the total enrolment was collectively done by the primary level health facilities (410 UHCs and 6398 CCs) which reflected the effects of the availability of the services at the doorsteps of women. The contribution of the CCs in enrolment could have been more if all 14,000 CCs could be engaged in the national screening programme since the CCs are in rural areas, near their home. The women frequently visit CCs for essential primary health-care services including follow-up for themselves and their children [24-26]. Therefore, it is recommended to onboard all the remaining CCs under the network of the national screening programme. Women's preference for enrolment in the CCs and performing their VIA tests in the nearby UHCs (88.5%) (Table 3) also suggests that decentralisation of the VIA tests may 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.

Although 51,913 (3.3%) were found VIA-positive and all were expected to carry out colposcopy, only 20,954 (40.4%) had colposcopy, meaning 59.6% of the VIA-positive women did not attend colposcopy. The reasons for such low attendance might be fewer colposcopy clinics at the district level (places distant from home), where the women might not feel encouraged to travel due to transport costs, guardians not being available to accompany them, engagement with familial responsibilities and these could be avoided by decentralisation of the colposcopy centres. Also, during the lockdown period of the COVID-19 pandemic, colposcopy clinics remained closed [27-28]. Moreover, to improve coverage every colposcopy centre should check compliance regularly and, contact and counsel non-compliant women. To avoid low attendance, the DHIS2 system could add a new feature, which would generate and send

individualised messages and reminders to the registered phone numbers of the screened positive women. Several other measures may be recommended, such as (a) coordinated activities at various levels of the health system for improving data reporting, data quality, monitoring and supervision; (b) identification of potential barriers and facilitators and mitigating them; (c) assessing the usefulness of interventions such as mobile phones or text messaging [29-31]; (d) engaging the community health workers to get insight of the misunderstandings among the women [32]; (e) meetings/workshops involving the community stakeholders for improving service uptake.

The study shows regional variation for VIA and colposcopy positivity rates among the women with the highest positivity in Mymensingh (Figure 4). 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 [33-35]. Regional variation was also reported for colposcopy positivity rate in a study in Italy [36].

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 pre-cancer and cancer participated. During the later years, the emergence of the UHCs at the sub-district level as the major contributors to the VIA tests with rising awareness led more participation, irrespective of the risk of cervical pre-cancer and cancer. Additionally, the health personnel received multiple hands-on trainings and thus gained better skills and experience. The above factors are reasons for lower VIA-positivity during the later years. 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 [37]. 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 (Figure 5), could not be explained and exploration of this fact is needed.

The declining trend in the VIA positivity rate from the tertiary and secondary level to the primary level of health facilities (Figure 6) might be related to the referral of more high-risk and complicated patients to the higher-level facilities. The health facilities at the primary level enrol and perform tests for many women irrespective of low, medium, or high risk of cervical pre-cancer or cancer. 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 thermal ablation (81.6%, 5062). Thermal ablation is an accepted and well-adopted method of treatment for cervical pre-cancer [38-40]. The colposcopy clinics of Bangladesh use thermal ablation liberally in the management of cervical precancer [41] which is reflected in this data.

Among the available histopathology reports (n=3,079), the distribution of CIN I, CIN II, and CIN III represented 44.7%, 11.7%, and 8.1% respectively and 22.3% of women had cervical cancer (micro-invasive squamous cell carcinoma, squamous cell carcinoma adenocarcinoma, adenosquamous cell carcinoma). Though less than half of the VIA-positive women had colposcopy and many histopathology reports were unavailable, diagnosis of considerable cases of cervical precancer and cancer indicating the effectiveness of the screening programme. This is the 1st 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 initiate case-based data collection and tracking. The DHIS2 implementation for Bangladesh's cervical cancer screening programme tracks case-based longitudinal data of each enrolled woman, enabling defaulters to bring back to service and assess women's health conditions over time. Instant visualization of data summary in a live dashboard helps the health managers, policymakers, and health planners to undertake the situation analysis at any time and make evidence-based decisions and responses. This 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.

CONCLUSION

The study presents a comprehensive analysis of the implementation and outcomes 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. Decentralizing colposcopy services, utilizing mobile technology for reminders, and improving community

engagement should improve the screening coverage. The successful implementation of the case-based data tracking system in Bangladesh offers valuable insights to other countries for improving data surveillance of their cervical cancer screening programme.

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Abbreviations

VIA	Visual Inspection of cervix with Acetic Acid
CBE	Clinical Breast Examination
DHIS2	District Health Information System version 2
DGHS	Directorate General of Health Services
MOHFW	Ministry of Health and Family Welfare
UHCs	Upazila Health Complexes
DHs/GHs	District Hospitals/ General Hospitals
MCHs	Medical College Hospitals
MUH	Medical University Hospital
CCs	Community Clinics
CHWs	Community Health Workers
SSNs	Senior Staff Nurses
LEEP	Loop Electrosurgical Excision Procedure
GOB	Government of Bangladesh
NCBCSP	National Cervical and Breast Cancer Screening Programme
LMICs	Low and Middle-Income Countries
SDGs	Sustainable Development Goals

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