Analysis of real-world free cervical cancer screening for eligible women in Beijing China, 2008-2018

Shen Jie
Capital Medical University Beijing Obstetrics and Gynecology Hospital Beijing MCH Hospital https://orcid.org/0000-0002-6763-4927

Zhang Yan
Capital Medical University Beijing Obstetrics and Gynecology Hospital Beijing MCH Hospital

Gao Lili
Capital Medical University Beijing Obstetrics and Gynecology Hospital Beijing MCH Hospital

Zhang Yue
Capital Medical University Beijing Obstetrics and Gynecology Hospital Beijing MCH Hospital

Han Lili (hanll2004@126.com)
https://orcid.org/0000-0001-5811-7904

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Abstract

Background: Cervical cancer is a very common gynecological malignancy. The incidence of cervical cancer in Beijing increased rapidly, the local government launched free cervical cancer screening in 2008 as a pilot, and then the program covered all register eligible women in 16 districts since 2009. Our study assessed the free screening program in Beijing from 2008 to 2018.

Methods: Analyzed the data of all women aged 35-64 years old who received free cervical cancer screening in Beijing from January 2008 to December 2018.

Results: Since 2008, Beijing has conducted five cycles of cervical cancer screening among 35-64 years old women. During the period, target population has adjusted and service management kept on improved. Totally 2,624,129 person times have received the services. The average detection rate of abnormal cervical cytology was 2.3%, the rate of colposcopy referral was 1.8%, and the rate of abnormal colposcopy result was 63.5%. The detection rate of CIN2+ and cervical cancer was 208.5 / 100,000, of which 5228 cases of CIN 2+ were detected, the detection rate of 199.2 / 100,000; 244 cases of cervical cancer were detected and the rate was 9.3 / 100,000.

Conclusions: Free cervical cancer screening can effectively serve the grassroots women, improve women's health awareness, and realize the early detection and early treatment of cervical cancer. The coverage of the screening population and the screening strategies need to be further explored to achieve the goal of decreasing cervical cancer incidence and mortality in the future.

Background

Cervical cancer is a very common gynecological malignancy. In 2018, an estimated 570,000 women were diagnosed with cervical cancer worldwide and approximately 311,000 women died from the disease [1]. Almost 85% of the new cases occurred in low-resource countries [2]. Cervical cancer incidence rates vary markedly across countries and regions; the estimated age-standardized (World) incidence rates have a 40-fold range worldwide. Cervical lesions are one of the diseases that seriously endanger women's health. The 2015 WHO reported that both total incidence and death of cervical cancer in China ranked the second in the world [3]. It remains one of most common cancers and the cause of cancer-related death in women across the globe. Over the next 12 years (2018 to 2030), the annual number of new cases of cervical cancer is expected to increase from 570,000 to 700,000. During that same period, the annual number of deaths will increase from 311,000 to 400,000. More than 85% of those affected are young, poor, undereducated women of color who live in the world’s poorest countries. Many are also mothers of young children whose survival is subsequently truncated by the premature death of their mothers [4].

China’s national cancer registration data from 1988 to 2012 show that the overall incidence of cervical cancer in the country has slowly decreased from 5.04 per 100,000 in 1988, but it has continued to rise since 1999, at 14.93 per 100,000 in 2012. The fifth of the incidence. A national retrospective survey of causes of death shows that the female cervical cancer mortality rate in China was stable from 2006 to 2012, ranking seventh among female cancer deaths [5]. The incidence of cervical cancer in Beijing was 3.28 / 100,000 in 2000 compared with 9.23 / 100,000 in 2009, totally increased 181.8% and annually average increased 12.1%. Cervical cancer has become the fastest growing malignant tumor in women, its incidence ranked from the 13th in 2000 to the 9th in 2009 [6–9]. So Beijing launched free cervical cancer screening in 2008 as a pilot, and then the program covered all register eligible women in 16 districts since 2009.

In this study, we assessed the free cervical cancer screening for five cycles among eligible women in Beijing to provide evidence for policy decision on further development of the program in the future.

Methods

Study population

Eligible women registered in Beijing received free cervical cancer screening once every two years. In Beijing, the program had gone through five cycles from 2008 to 2018, and served 2,624,129 person times. All women were informed consent before participating in the screening. Details are in Table 1.

Table 1
Overview of free cervical cancer screening program in Beijing, 2008–2018

Screening cycle	Age of target women	Screening services	Referral and diagnosis	Screening volume
2008–2009	25–65 years old	Gynecological examination, cervical cytology test (Pap smear/ LBC)	Pathological results obtained by follow-up of women with abnormal cytological examination results.	728704
2011–2012	35–59 years old	Gynecological examination, cervical cytology test(Pap smear/ LBC)	Women with abnormal gynecological or cytological result referral to colposcopy, some of them got histopathology.	349084
2013–2014	35–64 years old			456386
2015–2016				482249
2017–2018				607706

Beijing Municipal Government launched free organized cervical cancer screening program as a pilot in 2008. Targeting at 25-65-year-old women, local government in the pilot areas of Chaoyang, Xicheng and Huairou district provided screening services by the MCH service system and provided financial support. Then the program covered all register eligible women all over Beijing since 2009. A long-term screening mechanism began to establish in 2011 and continued nowadays which women could get the services at any convenient time.

Cervical cytology test, colposcopy, and histopathology is the basic procedures for screening, diagnosis and management of the screening program in Beijing. The screening procedure included recruitment by informed consent, gynecological examination, cervical cytological test and medical advices for suspicious cases detected on diagnosis and treatment [9].

Women with ASCUS and above on cervical cytological result would refer to colposcopy and some of them received pathological examination if necessary. During the period, screening programs kept on improving depending on the epidemic of the disease and the social development. In Beijing,139 community health centers and 31 hospitals undertakes the screening and referral services.

Quality Control

Gynecological examination. Check the environment, facilities and items at the screening site, observe the operation process and form filling of all gynecological screening staff, and review 5–10% of screening women on set.

Cytological test. Cervical cytology played an important role in the screening that is critical for precancerous and cervical cancer diagnosis and treatment. Professional and technical ability on cervical cytology was uneven among districts and many domestic liquid-based cytological reagents applied in clinics were lack of unified supervision and quality control. In order to ensure the quality of cervical cytology, Beijing has made many efforts on cervical cytology quality control, like formulating technical guideline, staff training and regular assessment, establishing a quality control system for cervical cytology reading,which has played vital roles in improving the quality of cervical cytology.

Pap smear or LBC were used in free cervical screening and the personnel who qualified for cervical cytology screening in this project interpreted them. Randomly sampled 5% negative and 20% positive smears for experts to review.

Colposcopy. Colposcopy, as an important examination for further evaluation of suspicious cases detected by screening, is the key step of cervical cancer screening. In Beijing, the referral medical centers provide colposcopy and pathology services. The colposcopy work guidelines in Beijing not only emphasize standard operation, but also emphasize the suspicious cases management,which means besides providing an examination, these centers must follow up the cases and carry out regular quality control.

Those with cervical cytology ASCUS and above will undergo colposcopy; experts randomly reviewed 10% normal and 5% abnormal cases for evaluating.

Pathological examination. Some women with colposcopy abnormality will received pathological examination if necessary. Data collected from the report of colposcopy biopsy, LEEP, CKC and surgery. Experts reviewed 10–20% of the sections.

Definition of indicators

Cervical cytological diagnosis. Using TBS standards in 2001/2014 for diagnosis.

Colposcopy diagnosis. Using the 2002 and 2011 IFCPC nomenclature.

Pathological diagnosis. Using the 2002 and 2011 IFCPC nomenclature.
Cytological abnormal means total number of ASCUS, AGUS, ASC-H, LSIL, HSIL, AGC, AGC-N, SCC and AC

Cytological abnormality detection rate = number of cytological abnormal/ women accepted cytological test × 100%

Colposcopy abnormality detection rate = number of colposcopy abnormal/ women accepted colposcopy examination × 100%

Number of cervical precancerous lesions detected = number of CIN2-3 + AIS

Number of cervical cancer detected = number of Cervical micro invasive carcinoma + Invasive cervical cancer

Detection rate of cervical cancer and cervical precancerous lesions = sum of cervical precancerous lesions detected and cervical cancer detected/ total screening women × 100,000/100,000

Rate of early diagnosis = sum of CIN2, CIN3, AIS and micro invasive carcinoma/sum of CIN2, CIN3, AIS, microinvasive carcinoma and Invasive cervical cancer × 100%

Number of LSIL = CIN 1 detected by colposcopy or pathology

Number of HSIL = CIN 2 & CIN 3 detected by colposcopy or pathology

Statistical analysis

All the cases collected by the MCH Information System set up by the local government. Trained staffs were responsible for data entry and review. SPSS 17.0 was used for data analyze.

Results

Briefs of cervical cancer screening in Beijing from 2008 to 2018

During 2008–2018, totally 2,624,123 eligible women were screened in Beijing. During the past ten years, the screening programs and procedures updated and improved continuously. Coverage rate remain steadily during 10 years in Beijing, the mean was 17.9% (16.6%-19.4%). The composition of participation in screening are relatively higher among women of 45–59 years of age, education level below junior high school, and those in rural, as shown in Table 2.

Table 2
Participation of cervical cancer screening in the five cycles in Beijing n (%)

		2008–2009	2011–2012	2013–2014	2015–2016	2017–2018
Age group	25–29	26504(3.4)	-	-	-	
	30–34	42375(5.5)	-	-	-	
	35–39	79304(10.2)	44790(12.9)	39258(8.6)	43315(8.8)	57404(9.4)
	40–44	120536(15.5)	70474(20.2)	73750(16.1)	64779(13.2)	64886(10.7)
	45–49	163308(21.1)	93895(26.9)	93625(20.4)	97631(20.0)	116236(19.1)
	50–54	159170(20.5)	77351(22.2)	106408(23.2)	118922(24.3)	139189(22.9)
	55–59	124505(16.1)	62596(17.9)	88994(19.4)	94064(19.2)	131251(21.6)
	60–64	59451(7.7)	-	56700(12.4)	70258(14.4)	98740(16.3)
Education Level	Below junior high school	482885(66.3)	243351(69.7)	306228(68.3)	314406(66.1)	391274(64.4)
	Senior high school	164705(22.6)	80108(22.9)	98714(22.0)	103329(21.7)	137988(22.7)
	College and above	81114(11.1)	25647(7.3)	43187(9.6)	57811(12.2)	78444(12.9)
Living areas	Urban		80671(23.2)	177542(38.7)	176582(36.1)	196073(32.3)
	Rural		268435(76.8)	281193(61.3)	312387(63.9)	411633(67.7)
Total		728704(100.0)	349106(100.0)	458735(100.0)	488969(100.0)	607706(100.0)

Cervical cytology test

From 2008 to 2018, totally 2,624,123 women in Beijing accepted cervical cytology test, with an average abnormal detection rate of 2.3%(60814/2624123).Among those abnormalities, the detection rate of ASC was 1.8%（47347/2624123）, LSIL was 0.5%（13022/2624123）, HSIL and above was 0.1%（3511/2624123）,AGC was 0.04%（1058/2624123）. ASC-H accounted for 6.9% (3292/47347)of ASC, ASC: SIL = 2.87:1.

Table 3
Cervical cytology results in five screening cycles in Beijing, 2008–2018

		Number of women inspected	NILM	ASC-US	ASC-H	LSIL	HSIL	SCC	AGC-NOS	AGC-N	AIS	ADCA	Abnormalities[a]
2008–2009	N	728698	712111	11676	1144	2213	1031	27	433	21	15	27	12413
	%		97.7	1.6	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.3
2011–2012	N	349084	338715	4675	526	1271	481	16	69	28	0	0	7066
	%		97.0	1.3	0.2	0.4	0.1	0.0	0.0	0.0	-	-	2.0
2013–2014	N	456386	442476	8103	609	2757	666	20	236	22	0	0	12413
	%		97.0	1.8	0.1	0.6	0.1	0.0	0.1	0.0	-	-	2.7
2015–2016	N	482249	470485	7497	516	2543	620	12	82	16	3	1	11290
	%		97.6	1.6	0.1	0.5	0.1	0.0	0.0	0.0	0.0	0.0	2.3
2017–2018	N	607706	590074	12104	497	4238	631	7	133	18	3	1	17632
	%		97.1	2.0	0.1	0.7	0.1	0	0	0	0	0	2.9

[a] Cervical cytology result of ASC-US and above defined as abnormalities.

Women with cervical cytology of ASCUS and above will refer to colposcopy that accounted for 1.8% in the four cycles. In addition, women with suspicious symptoms will undergo colposcopy to avoid missed diagnosis as much as possible. From 2011 to 2018, totally 47,118 women in Beijing received colposcopy referrals. The detection rate of colposcopy abnormalities was 63.5% (29911/47118). Among them, 12,207 cases of LSIL, 2,993 cases of HSIL were detected, 199 suspected cancers. The composition ratio was 25.9% (12207/47118), 6.4% (2993/47118) and 0.4% (199/47118) respectively.

Table 4
Result of referral to colposcopy in Beijing cervical cancer screening, 2011-2018[a]

Screening cycle	Women accepted colposcopy (N)	Abnormalities(N)				Detection rate of abnormality(%)
		Total[b]	LSIL	HISL	Suspected Cancer	
2011–2012	5131	3079	1038	373	38	60.0
2013–2014	12267	7296	3097	807	40	59.5
2015–2016	13103	7863	3285	801	88	60.0
2017–2018	16617	11673	4787	1012	33	70.2

[a] Free colposcopy did not provide in 2008–2009.

[b] Abnormalities include low-grade cervical lesions, high-grade lesions, suspected cervical cancer, or other abnormalities detected by colposcopy within the screening procedure.

During 2008–2018, the rate of cervical cancer and precancerous lesions detected by free screening among eligible women in Beijing was 208.5 / 100,000 (5472/2624123). Among them, 5228 cases were detected as cervical precancerous lesions and 244 cases were cervical cancer, with a detection rate of 199.2 / 100,000 (5228/2624123) and 9.3 / 100,000 (244/2624123) respectively. 97.9% of them received treatment. Details were in Table 5.

Table 5
Pathological examination results among the screening program in Beijing, 2008–2018

Screening cycle	Women accepted cervical cancer screening	precancerous lesions (N) [a]	Cervical cancer(N)[b]	Detection rate of precancerous lesions & cervical cancer (/100,000)	Detection rate of precancerous lesions (/100,000)	Detection rate of cervical cancer (/100,000)	Rate of early diagnosis (%)
2008-2009[c]	728698	513	89	82.6	70.4	12.2	91.9
2011–2012	349084	668	30	199.9	191.3	8.6	97.3
2013–2014	456386	1261	53	286.4	274.9	11.6	97.5
2015–2016	482249	1213	41	256.0	247.7	8.4	97.6
2017–2018	607706	1575	31	264.3	259.2	5.1	98.4

[a] Sum of CIN2, CIN3, and adenocarcinoma in situ

[b] Sum of minimally invasive and invasive cancer

[c] 2008–2009 pathological results was self-reported by follow-up.

Discussion

WHO emphasis that effective screening and treatment of pre-cancer for women aged 30 years and above can prevent women from developing cervical cancer [5]. Different countries and regions will choose their own screening strategy adapt to the variable local conditions and economic conditions.

In Beijing,data showed that the highest disability weight per thousand people of cervical cancer were among 35–65 years old, the morbidity and mortality in the 25–35 age group were not high, which means less than 35 years old screening in Beijing was not cost-effectiveness. Therefore, the local government kept on improving the screening program to adapt to the socio-economic development. In recent guidelines, WHO recommended that the minimum age limit for cervical cancer screening in developing countries should not be less than 30 years old as well [10–11] .

Among those participated in the screening program, women below junior high school accounted for more than 60%, women living in rural accounted for more than 60%, and women older than 45 years old accounted for more than 70%. The majority was middle-aged and older women, unemployed, and agricultural population. Our study showed that more women in rural would receive the screening services than those in urban because most women living in urban received regular gynecological examinations organized by the working places. The program benefit women of low income especially [12], who could hardly covered by the regular physical examination supported by the working places. Therefore, they are very active in this screening. From 2008 to 2018, totally 2,624,129 person times received the screening services, accounted for about 15–20% of all eligible women, which was almost the same as the township screening participate rates in China [13]. Not only the program improved the health outcomes but also increased the equity.

The China Women's Development Program (2011–2020) proposes that the regular screening rate for women's common diseases should reach more than 80%, try to improve the rate of early diagnosis and treatment of cervical cancer and breast cancer, reduce mortality [14]. The coverage rate of the screening in Beijing is only less than 20% especially in urban compared with the size of eligible women in Beijing, which was far lower than that of developed countries. As WHO reported, only 22 countries, mainly with high income, reported screening programs achieving 70% coverage or above. The majority of countries report participation rates below 50%, some as low as less than 10%, due to lack of organized programs, ineffective population outreach, fragmented service delivery, unavailable infrastructure and limited financial resources. According to the household registration survey, for cervical cancer, the main reason of refusal to participate in screening is variable in different countries [15–16]. Barriers to increased coverage relate to both supply and demand, with the latter including cultural, social and financial barriers. Further, many countries face challenges relating to poor-quality screening and follow-up of positive cases [17]. In our investigation, lack of time and long distance was the barriers for women received the screening services. In addition, data of women's health check-ups are not included because they were not supported by government funds. A modelling study in China suggest that population coverage of screening is more important than the frequency of screening, and the once in a lifetime screening at age 45 years might be the best available strategy, given the insufficient budget. The optimal age at which to screen is driven from the distinctive age-specific prevalence of CIN2 + and high-risk HPV in Chinese women [18]. We also notice that eligible women accepted screening had lower composition ratio in Beijing, yet the ratio should be more than 70%, which has mentioned by WHO in order to expect eliminating cervical cancer worldwide [19].

Swedish practice has proved that cervical cytology smear test helps to detect precancerous lesions earlier, greatly reducing the risk of cervical cancer. [20] Abnormal detection rate of cervical cytology in Beijing was 2–3%. In the 5th cycle, the rate was almost 3% that was the same as Chinese women in rural accepted screening services, but lower than the developed coastal areas in China [21–22], even far lower than 5.7% of liquid-based cytology and 4.5% of Pap-smear in Asia [23]. The detection rate of abnormal cervical cytology was not high enough to detect precancerous lesion or cervical cancers as much as possible. The screening program has carried out in Beijing for a decade; the technical of cervical cytology is still uneven. The rate was much lower than that of the screening program in US, Japan and Turkey [24–26]. Meanwhile, we must soberly recognize that the rate is far from the Chinese experts' speculation that abnormal detection rate of cervical cytology among the eligible women should be 5–7% [27]. Moreover, it had affected the colposcopy referral rate for ASCUS result. The highest colposcopy referral rate for ASCUS result was 2.7% in the fifth cycle, much lower than that in Canada and European countries [28].

In our study, cases of ASC-US accounted for 1.8% of all cytological tests. The ratio of ASC-US to squamous intraepithelial lesions was 2.87, suggesting the proportion of TBS diagnosis was acceptable. There was no over diagnosis of ASC-US [29].

Screening program in China started late. Empowerment of cytopathologists and cytology technicians is a long-term effort. In Beijing, grassroots personnel mainly undertook cervical cytology sampling and film readings. Our quality control showed although the capabilities improved apparently from the beginning of the screening program, while sampling, film production and dyeing, varieties

of personnel diagnosis on film reading remain the affecting factors of the cytological test quality in Beijing yet. We should exert to further empower the staffs and improve the quality control system especially on the detail of cervical cytology production, staining and reading [30].

In the five screening cycles, the detection rate of cervical cancer and precancerous lesions has continued to increase that was much higher than the national level of 124.9 / 100,000. The effectiveness of screening is not limited to early detection and treatment of a small number of cancer patients, but more importantly, to find a large number of patients with precancerous lesions, to release them from expensive cervical cancer treatment costs, and to achieve good social and economic benefits. In our study, the detection rate of precancerous lesions has continued to increase, from 70.4/100,000 to 259.4/100,000; while the detection rate of cervical cancer has been declining, till the fifth cycle it was 5.1/100,000. The detection rate of cervical cancer in Beijing was almost the same as cervical cancer incidence in Beijing. The early diagnosis rate was above 90% that remained in high level from the very beginning of the program. It kept on increasing and peaked in the fifth cycle, which was higher than that of the rural women-screening program in China.

The incidence and mortality of cervical cancer have continued to decline in many countries and regions due to organized screening for decades. In US, the incidence of cervical cancer has decreased by more than 50% in the past 30 years, and the mortality rate reduced from 5.55/100,000 to 2.3 /100,000 [31]. As Beijing Institute for Cancer Research and Beijing Center for Disease Prevention and Control reported, cervical cancer incidence and mortality kept on increasing in Beijing within 10 years; incidence (ASR world) was 5.21/100,000 in 2008 and 6.01/100,000 in 2017. Organized screening carried out in Beijing is only 10 years,with the improvement of MCH system and the advancement of cervical cancer screening and diagnosis and treatment technology, the incidence fell from sixth in the 1980s to tenth in 2017mortality dropped from first in 1985 to eighth in 2010 and APC of incidence (ASR world) in Beijing kept on decreasing within 10 years, 3.96% in 2005–2013 and − 0.61% after 2013 [32].

Our study has many strengths. First, the program was one of the services providing in primary health care system in Beijing that was practical and suitable in Chinese primary health services. By taking on screening, grassroots service capabilities have been empowered; by participating in screening, women's health awareness strengthened; by implementing screening, cancer and precancerous lesions have been detected as early as possible to reduced morbidity and mortality. Second, it is the comprehensive description and data analysis of free cervical cancer screening of all eligible women in Beijing from the very beginning. The sample size was large covering 16 districts all over Beijing that can provide evidence for the national screening program improvement.

In 2019, Beijing updated the program on cervical screening [33]. On one hand, the government integrated health check-ups and data targeted at the eligible women; applied co-testing in cervical cancer screening. These updating aims at improving screening strategy. On the other, social mobilize to improve the women’s awareness and participation. We hope that an optimal screening model suitable for the epidemiological status of cervical cancer and the socio-economic development in Beijing will maximize the detection of cervical lesion, achieve the goal of early found, early diagnosis and early treatment.

Conclusions

Free cervical cancer program in Beijing has seen progresses in the decade with the increasing detection rate on precancerous lesion and cancers and the early diagnosis rate that benefitted the eligible women especially those with low income. We cannot overemphasize social mobilization to increase screening coverage. More emphasis should be put on the first step of the screening to find the abnormalities as much as possible. More efforts need to explore a suitable screening strategy in Beijing to implement cervical cancer elimination in the coming days.

Declarations

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Author’s contributions

JS and LH designed the study. JS, Yan Z, YZ and LG conducted the study and communicated with the community health centers and the hospitals. JS, Yan Z and LH made the plan of data analysis. Yan Z cleaned and analyzed the data. JS wrote the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The study was approved by the Research Ethical Board of Beijing Obstetrics and Gynecology Hospital, Capital Medical University (KY-2013-266). In addition, the consent of every participant were all received.

Consent for publication

No individuals' details were reported in this study.

Competing interests

The authors declare that they have no competing interests.

Author details

Department of Women's Health Care, Beijing Obstetrics and Gynecology Hospital, Capital Medical University, Beijing Maternal and Child Health Care Hospital, Beijing 100026,China

Abbreviations

WHO: World Health Organization; MCH: Maternal and Child Health Care; LBC: liquid-based cytology; NILM: Negative for intraepithelial lesion or malignancy; ASCUS: Atypical squamous cells of undetermined significance; ASCUS+/≥ASCUS: Atypical squamous cells of undetermined significance or worse; ASC-H: Atypical squamous cells -cannot exclude high-grade squamous intraepithelial lesion; LSIL: Low-grade intraepithelial lesion; HSIL: High-grade squamous intraepithelial lesion; AGC: Atypical glandular cell; AGCUS: atypical glandular ceall of undetermined significance; AGC-N: Atypical glandular cell-favor neoplastic; SCC: Squamous cell carcinoma; AC□ Adenocarcinoma□AIS: Adenocarcinoma in situ; CIN: Cervical intraepithelial neoplasia; CIN 1: Cervical intraepithelial neoplasia grade 1; CIN2+: Cervical intraepithelial neoplasia grade 2 or worse; CIN3+: Cervical intraepithelial neoplasia grade 3 or worse; LEEP: Loop electrosurgical excision procedure; CKC: Cold knife conization; TBS: the Bethesda system; IFCPC: International Cervical Pathology and Colposcopy Alliance; ASR: Age standardized rate; APC: Annual percentage change

References

1. Globocan 2012:Estimated cancer incidence□mortality and prevalence worldwide in 2012[R].[2015-02-02].http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx?cancer=cervix.
2. Wei M, Zhou W, Bi Y, Wang H, Liu Y, Zhang ZJ. Rising mortality rate of cervical cancer in younger women in Urban China. J Gen Intern Med 2019;34(2):281–4,http://dx.doi.org/10.1007/s11606-018-4732-z.
3. Global Burden of Disease Cancer Collaboration. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2017: A Systematic Analysis for the Global Burden of Disease Study. JAMA Oncol. 2019; doi: 10.1001/jamaoncol.2019.2996
4. Mailhot et al. Estimating child mortality associated with maternal mortality from breast and cervical cancer. Cancer. 2019 Jan 1;125(1):109-117. doi: 10.1002/cncr.31780. Epub 2018 Nov
5. Women's Health Branch of Chinese Medical Association. Guideline for comprehensive prevention and control of cervical cancer. People's Medical Publishing House. 2017. ISBN 978-7-117-24716-0/R.24717

6. Government B. Hygiene and population health report of Beijing in 2010. People's Medical Publishing House; 2011.
7. Accelerating cervical cancer elimination Report by the Director-General. EXECUTIVE BOARD 144th session Provisional agenda item 6.5 EB144/28 30 November 2018
8. Wang Tong□Wu Minghui□Wu Yumei et al. Analysis of incidence change of cervical cancer in Beijing during past 17 years[J]. Beijing Medical Journal□2017□39□6□□599-602
9. Liu Fengyun□Cervical cancer screening report in Beijing[J]□Beijing Medical Journal□1996□18□30□
10. Su Jiantin Gao Yanlin Wei Zaihual et al. Burden of cervical cancer in Bering□ Chin J Epidemiol□September2014□35(9):1078-1079World Health Organization.
11. WHO Guidance Note. Comprehensive cervical cancer prevention and control: a healthier future for girls and women. Geneva, Switzerland: WHO, 2013
12. Han Lili, Qi Qingqing, Dong Cuiying et al. Analysis of cervical cancer screening results for women in pilot areas in Beijing. Chin J Prev Med. January 2011,Vol. 45,No.1 DOI□3760□cma.j.issn.0253-9624.201l-01.020)
13. Government B. Hygiene and population health report of Beijing in 2016. People's Medical Publishing House; 2017.
14. The China Women's Development Program (2011-2020). http://www.china.com.cn/policy/txt/2011-08/08/content_23160230.htm
15. Su Jianting GaoYanlin Wei Zaihua et al. Analysis of cervical cancer disease burden of permanent residents in Beijing in 2010. Chin J Epidemiol□September2014,35(9):1078-1079
16. Niu Shuyuan Gao Wanping Zhou Xi. Retrospective analysis of death of malignant tumors of female reproductive system in Beijing. Beijing Medical Journal. 1989. 11□5□:266-269 DOI: 10. 15932 /j. 0253 -9713. 1989. 05. 006
17. Accelerating cervical cancer elimination Report by the Director-General. EXECUTIVE BOARD 144th session Provisional agenda item 6.5 EB144/28 30 November 2018
18. Changfa Xia, Shangying Hu, Xiaoqian Xu et al. Projections up to 2100 and a budget optimization strategy towards cervical cancer elimination in China: a modelling study. Lancet Public Health 2019;4: e462–72
19. Draft: Global strategy towards eliminating cervical cancer as a public health problem. DRAFT: 16 December 2019
20. Arbyn M, Weiderpass E, Capocaccia R Effect of screeningon deaths from cervical cancer in Sweden [J]. BMJ, 2012, 344 (mar1): e804
21. SONG Bo□WU Jiu Ling□SONG Li et al. Analysis on the status of cervical cancer Screening for rural women in 2012. Chinese Journal of Women and Children Health□January 2015□Vol□ 6□No□ DOI:10.19757/j.cnki.issn1674-7763.2015.01.001
22. Yang Li, Li Weidong, Zou Xingwen et al. A analysis of the cervical cancer screening programme among women in rural areas of Guanzhou. CHIN J Cancer Prev Treat, September 2018,(25)17. DOI:10.16073/j.cnki.cjcpt.2018.17.001
23. Cheung AN,Szeto EF,leung BS,et Liquid-based cytology and conventional cervical smears□a comparison study in Asian screening population. Cancer, 2003, 99:331-335.
24. Onyema Greg Chido-Amajuoyi, Sanjay Shete. Prevalence of abnormal cervical cancer screening outcomes among screening-compliant women in the United States. American Journal of Obstetrics & Gynecology,2017,7:75-77
25. Kiyoshi Ito, Ryusei Kimura, Hiroshi Konishi et al. A comparison of liquid-based and conventional cytology using data for cervical cancer screening from the Japan Cancer Society. Japanese Journal of Clinical Oncology, 2019, 1–8 doi: 10.1093/jjco/hyz161
26. Zühal ÖCAN1 , Elife KIMILOĞLU , Ayşenur AKYILDIZ İĞDEM et al. Comparison of the Diagnostic Utility of Manual Screening and the ThinPrep Imaging System in Liquid-Based Cervical Cytology. Turkish Journal of Pathology. doi: 10.5146/tjpath.2019.01473
27. Expert consensus on cervical cancer screening and abnormal management issues in China. Chin J Clin Obstet Gynecol March 2017□Vol.18□No.2:190-192
28. Anjali Kulkarni, MSc, MD Michelle Policarpio, MSc Samara Strub, MPA et al. Performance Indicators for Colposcopy in Ontario. J Obstet Gynaecol Can 2020;42(2):144–149
29. Cibas ES□Zou KH□Crum CP□et a1□Using the rate of positive high risk HPV test results for ASCUS together with the ASC□US□SIL ratio in evaluating the performance of cytopathologists□Am J Clin Patho1□2008□129(1)□97□101□
30. Shen Jie□Zhang Yue□Gao Lili et al. Quality control analysis on cervical cytology of free cervical cancer screening for 35-64-year-old women in Beijing in 2013.Chin J Obstet Gynecol Pediatr(Electron Ed),2015,11(5):574-578
31. ACOG Practice Bulletin No. 157□ Obstet Gynecol. 2016;127:185-7.

32. Han Lili Zhao Tongxiang Deng Xiaohong. Comparative Study on Evaluation Indexes of Cervical Cancer Screening. Chin J Obstet Gynecol Pedediatr (Electron ED).2014. 10(6):757-762
33. Government of Beijing. Optimizing and integrating cervical and breast cancer screenings in Beijing: government notification. 2018. http://www.beijing.gov.cn/zhengce/zhengcefagui/201905/t20190522_61459.html

Figures

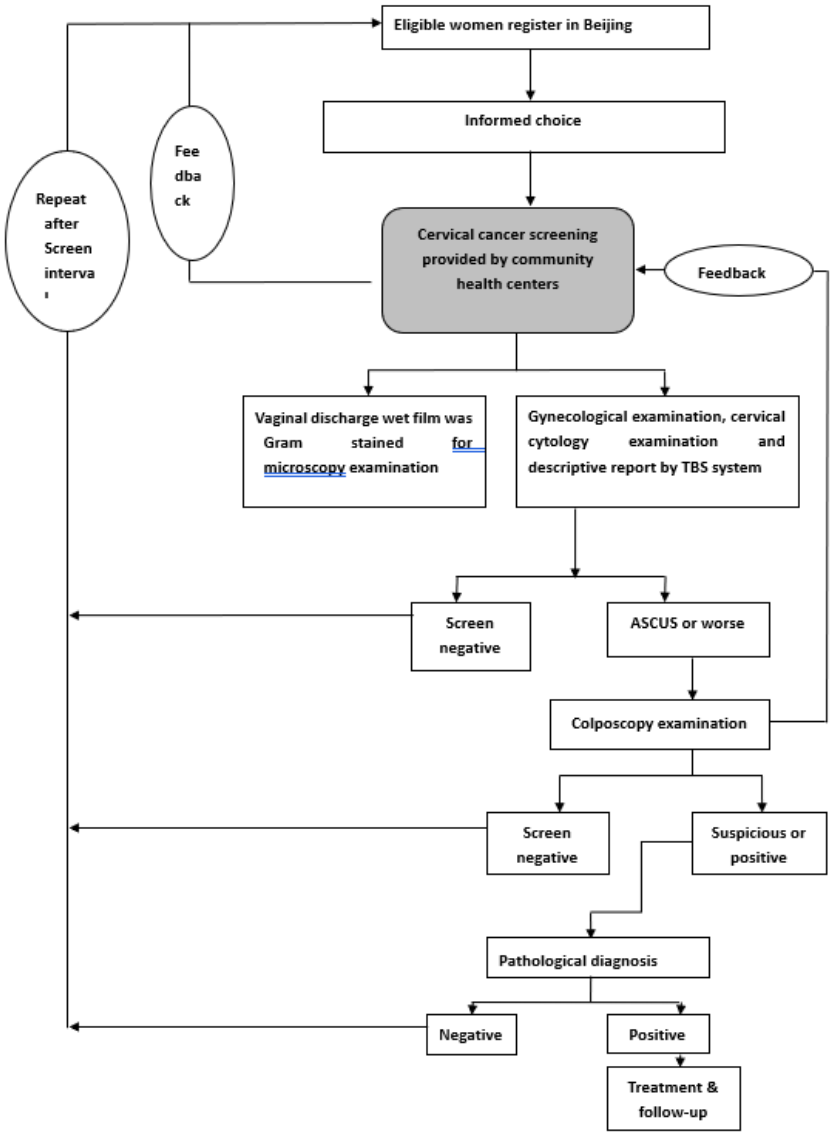

Figure 1

Flowchart of screening.