RESEARCH ARTICLE

**Editorial Process:** Submission:05/03/2022 Acceptance:12/19/2022

# Results of Self-Sampling Methodology Impression for Cervical Cancer Screening in Mongolia

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## Abstract

**Objective:** Mongolia is a sparsely populated country; however, almost fifty percent of the population lives in the capital city. Medical care services and exceptionally well-organized cervical cancer screening tests are limited in remote areas. To improve cervical cancer screening test coverage, we compared the interest between physicians taking samples and self-sampling among the attendees in this study. **Methods:** A total of 175 women participated in this study. The hundred twelve women visited the Gynecology ward, and the sixty-three women were provided with the cervical self-sampling test kit and filled out a questionnaire. Subsequently, the acceptability of physician taking and self-sampling were evaluated using a questionnaire. All specimens were processed using the TACAS LBC system, and the quality of samples was tested by cytology. **Results:** Regarding the acceptability of self-sampling, the selections for subsequent screening were 36% self-sampling and 64% gynecologist-sampling methods. The acceptability rates were higher in the remote areas than the urban areas. However, 64% of the participants lacked knowledge that the causative agent of cervical cancer is the human papillomavirus, and 66.9% mainly were sexually transmitted. In addition, 82.3% of the women surveyed were unaware that there was a vaccine to prevent cervical cancer, but 88.6% wanted to be vaccinated. Of most women, 44.4% chose self-sampling due to no embarrassment in the gynecological examination. The self-sampling preferences were dominant in the old age group (61.6%). The cytology satisfaction rate in physician-sampling (99.1%) was higher than in the self-sampling group (69.8%). **Conclusion:** The Implementation of the self-sampling tool may be considered a primary screening. The self-sampling test can adopt into the early screening program and may increase the coverage of the screening program and improve the quality.

**Keywords:** Cervical cancer- self-sampling- physician-sampling- screening

*Asian Pac J Cancer Prev,* **23 (12)**, 4099-4107

## Introduction

Cervical cancer is the third most common cancer globally, with more than 88% of cases occurring in developing countries Settakorn et al., (2008). Preventable and treatable cervical cancer is common among women in developing countries. Papanicolaou (Pap smears) have been used to detect women at risk for cervical cancer in developing countries and to detect precancerous lesions. As a result, Pap smears significantly reduced mortality from cervical cancer (Christopherson et al., 1976; Kim et al., 1978). Pap smear testing is a multifaceted process for the early detection of cervical cancer and its precursors. In this situation, where women often need to repeat visits to the hospital for examination, diagnosis, and treatment, the quality of the smears and their interpretation must be sufficient. However, most developing countries cannot implement comprehensive programs based on Pap smears (Fahs et al., 1996) . In addition, many social and behavioral risk factors are frequently associated with pap smear testing. Elderly, poor, uneducated, and uninsured women are less likely to have a Pap smear (Casey et al., 2001). Moreover, living in remote rural areas, the lack of primary care physicians and specialists, and the provision of medical care infrastructure and transportation may make it challenging to control cervical cancer (Yabroff et al., 2005). If a woman is examined only once in her life between the ages of 30 and 40, it reduces the risk of cervical cancer by 25-36 % (Goldie et al., 2005).

Mongolia is a landlocked country with a population of 3 million. Two-thirds of the population lives in the capital, Ulaanbaatar, while the remote areas are sparsely populated (Pezzulo et al., 2017). In Mongolia, cervical cancer is currently the fourth most common cancer in the general population and the second most common cancer among women (Ferlay et al., 2012). According to 2015 statistics, the incidence of cervical cancer was 29.8 per 100,000 women, and the mortality rate was 13.6, while 51.1% of

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these patients were diagnosed at a late stage and had a 5-year survival rate of 44.2 % (Cancer, 2015). In 2011, the Ministry of Health of Mongolia approved clinical guidelines for implementing cervical cancer prevention programs. Since 2012, women between 30 and 60 have been required to have a Pap smear every three years to be screened for cervical cancer. According to a 2018 study, HPV-16 is the most common type in Mongolian women, followed by HPV-52, 58, and 33 (Tsedenbal et al., 2018). Self-sampling is now used for the early detection of cervical cancer. The purpose of this study was to combine the results of the self-sampling device and liquid-based cell analysis with the results of analytical questionnaires to calculate the results of self-sampling tests. Identifiers include regional differences, occupations, medical history, knowledge of cervical cancer, and demographic information about a screening program that accepts self-sampling methods. OBJECTIVE: Introduce a self-sampling method for early detection of cervical cancer in Mongolia and assess the patient's knowledge, skills, and preferences.

## Materials and Methods

*Study design*

The study was conducted in a cross-section design and included women volunteers who wished to be screened for cervical cancer from May to August 2020. Participants were divided into two groups: self-sampling and physician-sampling. Pregnant women, women who have undergone radiation, chemotherapy, and hysterectomy, or women unable to make their own decisions are excluded from the study. A consent form was signed and explained to all participants, explaining the purpose of the study.

*Questionnaire and cytological methodology*

In a total of 4 groups, 44 questionnaire items were filled up, and a self-sampling kit was collected from the self-sampling group. Self-sampling kit (shown in Figure 1). These included a health education poster, a self-sampling explanatory sheet, a self-sampling brush Viba-Brush® Combi (Rovers Medical Devices B.V., Netherlands), and a cell preservative solution. The participants collected the samples from themselves at home or in the bathroom as instructed, and the sampled brush head was removed and placed in a non-preservative buffer solution and delivered to the research team. The physician collected cervical smears after filling out three groups and 44 items questionnaire. The cervical brush head was removed, placed in a cell-storage buffer solution, and delivered to the research team. All samples submitted to the laboratory were processed manually according to the TACAS liquid-based cytology protocol. A group of cytopathologists evaluated the quality of the Pap-stained slides using the 2014 Bethesda system (Nayar and Wilbur, 2015).

*Statistics*

Statistical analysis was performed using SPSS 23.0 software (IBM Corporation, Armonk, NY, USA) and defined by statistical tools, p-values, and ratios. All experiments were considered statistically significant at $p < 0.05$.

## Results

A total of 175 women volunteered for early detection of cervical cancer from May to August 2020. The mean age ± standard deviation of the study participants was 44 ± 10 (Table 1). According to the participants' education level, the majority of the women are in high level 95 (54.2%), followed by middle 53 (30.3%), low 22 (12.6%), and other 5(2.9%). Therefore, among unmarried participants, 97 (54.2%) were dominant in our study, followed by 59 (33.7%), Divorced or widowed 13 (7.4%), partners 6 (3.4%). Therefore, most of the women do not smoke

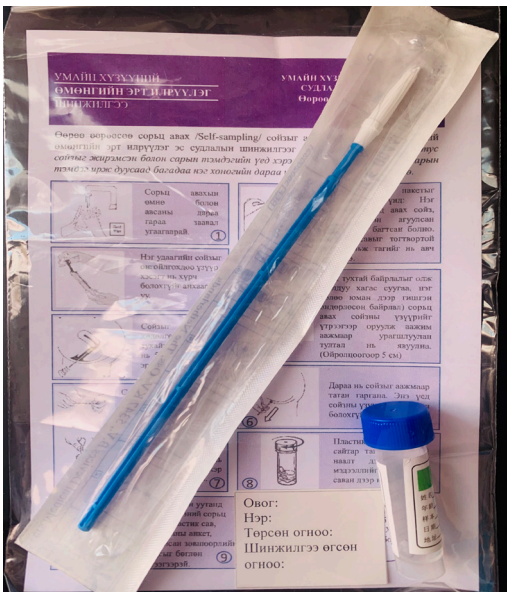


Figure 1. Self-Sampling Cytology Kit. (Instructions in Mongolian, with brush and preservative solution)

Table 1. Social Status of the Survey Participants

| Specifications | n (%) |
|---|---|
| Age average ± standard deviation | 44±10 |
| Education level | |
| Low | 22 (12.6) |
| Middle | 53 (30.3) |
| High | 95 (54.2) |
| Other | 5 (2.9) |
| Marital status | |
| Married | 59 (33.7) |
| Unmarried | 97 (55.4) |
| Partner | 6 (3.4) |
| Divorced/Widowed | 13 (7.4) |
| Smoking | |
| Yes | 9 (5.1) |
| No | 155 (88.6) |
| Used to | 11 (6.3) |
| Secondhand smoking | |
| Yes | 100 (57.1) |
| No | 75 (42.9) |

Table 2. Univariate Logistic Regression Analysis Investigating Predictors of Participant's Preferences for Physician-Sampling (N=112) versus Self-Sampling (N=63)

| Specifications | Physician-sampling group n (%) | Self-sampling group n (%) | OR (95% CI) | p-value |
|---|---|---|---|---|
| Residency | | | | |
| Urban area | 69 (69.0) | 31(31.0) | 3.40 (1.02-11.3) | 0.112 |
| Remote area | 43 (57.3) | 32 (42.7) | - | |
| Regular sexual partner | | | | |
| Yes | 17 (26.2) | 48 (73.8) | 0.28 (0.08-0.98) | 0.0001 |
| No | 95 (86.4) | 15 (13.6) | - | |
| Contraceptive use | | | | |
| Often | 41 (52.6) | 37 (47.4) | 6.57 (1.72-25.1) | 0.011 |
| Rarely | 9 (26.5) | 25 (73.5) | - | |
| Number of sex partner | | | | |
| 1 | 55 (67.9) | 26 (32.1) | 0.28 (0.08-0.98) | 0.31 |
| 2 and above | 57 (60.6) | 37 (39.4) | - | |
| Induced abortion | | | | |
| Yes | 38 (51.4) | 36 (48.6) | 2.47 (0.76-8.01) | 0.003 |
| No | 74 (73.3) | 27 (26.7) | - | |

155 (88.6%); however, the remaining women revealed that they smoked 9 (5.1%) and used to smoke 11 (6.3%) before. Regarding family members smoking history, 57.1% are affected by secondhand smoking, but 42.9% have no history of constant secondhand smoking.

Of the 175 women surveyed, 63 (36%) preferred a self-sampling kit compared to 112 (64%) who reported a preference for physician-sampling. Risk behavioral parameters were generally similar between the women in the self-sampling and the physician-sampling groups. Forty-eight (73.8%) of women with a regular sexual partner preferred to have a cytology test on their own compared to those who do not have regular sexual partners. Univariate logistic regression analyses of predictors of preference for self-sampling found that rarely usage of contraceptives in women was significantly high (OR=6.57 95% CI: 1.72-25.1). Therefore, women with the induced abortion were commonly chose self-sampling compared to the physician sampling group (OR=2.47 95% CI: 0.76-8.01). On the contrary, women without induced abortion had more tendency to choose physician sampling (Table 2).

64% of the total participants did not know the causative agent of cervical cancer was the human papillomavirus, and 66.9% lacked knowledge that it is usually sexually transmitted. Moreover, 53.7% of respondents had a history of early detection of cervical cancer, but 82.3% of the participants did not receive regular cytology testing. In addition, 82.3% of the women surveyed were unaware that a cervical cancer vaccine was available, but 88.6% of the participants were willing to be vaccinated (Figure 2).

Table 3 compares perceptions of cervical screening tests and satisfaction rates using different age groups' self-sampling kits. 58.5% of women answered that the

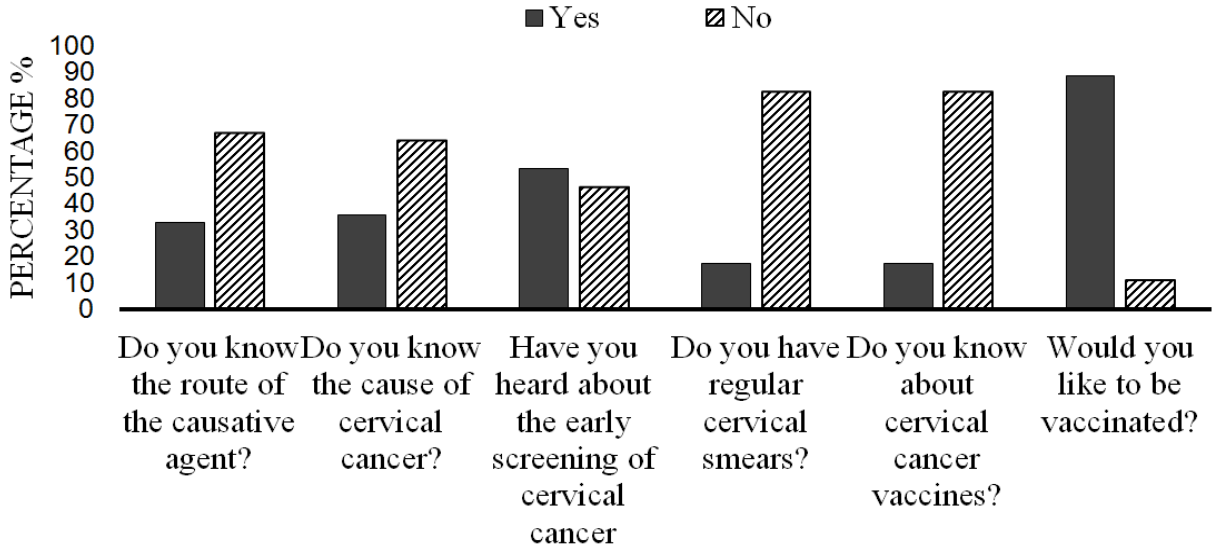


Figure 2. Knowledge and Attitudes about the Cause of Cervical Cancer, Cytological Test, Screening, and Vaccines

Table 3. Evaluation of Self-Sampling (N = 63)

| | Age group | | | | | | P-value |
|---|---|---|---|---|---|---|---|
| | ≤29 | | 20-49 | | 50≤ | | |
| | n=9 | % | n=41 | % | n=13 | % | |
| Was the explanation of the self-sampling methodology clear? | | | | | | | |
| Very easy | 4 | 44 | 12 | 29.2 | 5 | 38.4 | 0.76 |
| Easy | 5 | 56 | 24 | 58.5 | 8 | 61.6 | |
| Difficult | - | - | 2 | 4.8 | - | - | |
| Very difficult | - | - | 3 | 7.3 | - | - | |
| Was the self-sampling kit easy to use? | | | | | | | |
| Very easy | 1 | 11.1 | 7 | 17 | 2 | 15 | 0.75 |
| Easy | 7 | 77.8 | 29 | 70.7 | 11 | 85 | |
| Difficult | 1 | 11.1 | 2 | 4.9 | - | - | |
| Very difficult | - | - | 3 | 7.4 | - | - | |
| Whether Was there pain or discomfort in the self-sampling? | | | | | | | |
| Painful | 2 | 22.2 | 9 | 22.1 | 3 | 23 | 0.82 |
| Painless | 3 | 33.4 | 19 | 46.2 | 4 | 30.7 | |
| Comfortable | 4 | 44.4 | 13 | 31.7 | 6 | 46.3 | |
| Why did you choose self-sampling? | | | | | | | |
| Painless | - | - | 3 | 7.4 | 4 | 30.7 | 0.06 |
| No embarrassment | 4 | 44.4 | 7 | 17 | 3 | 23 | |
| Easy to use | 4 | 44.4 | 16 | 39 | 6 | 46.3 | |
| It can be used at home | 1 | 11.1 | 9 | 22.1 | - | - | |
| Do not prefer | - | - | 6 | 14.6 | - | - | |
| Which do you prefer to have self-sampling or physician-sampling? | | | | | | | |
| Self-sampling | 2 | 22.2 | 16 | 39 | 8 | 61.6 | 0.57 |
| Physician-sampling | 2 | 22.2 | 4 | 9.8 | 1 | 7.7 | |
| Either | 5 | | 20 | 48.8 | 4 | 30.7 | |
| Neither | - | - | 1 | 2.4 | - | - | |
| Was there anything you did not like about self-sampling? | | | | | | | |
| Absent | 6 | 66.6 | 24 | 58.6 | 10 | 77 | 0.77 |
| Difficult | - | - | 1 | 2.4 | - | - | |
| The sample was taken correctly | 3 | 33.4 | 16 | 39 | 3 | 23 | |
| Will you choose a self-sampling kit next time? | | | | | | | |
| Yes | 8 | 88.9 | 35 | 85.3 | 13 | 100 | 0.85 |
| No | - | - | 1 | 2.4 | - | - | |
| Doubt | 1 | 11.1 | 5 | 12.3 | - | - | |

explanation of the self-sampling was very clear, but 12.1% of the women aged between 20-49 expressed difficulty in understanding. Therefore, most women expressed that the self-sampling kit is easy to use among all age groups; however, ages are difficult under 49. Reason for the choosing self-sampling was no embarrassment 44.4% in women aged under 29, easy to use was the common reason of women 39%, 46.3% aged between 20-49 and over 50 years old respectively. When comparing the preference of the sampling, the majority of young and middle-aged women preferred to use both self-sampling and physician sampling. However, self-sampling preferences were dominant in the old age group (61.6%). The majority of the participants expressed there were no concerns about self-sampling, but minor participants doubted the sample had been taken correctly or not. However, 88.9% of the self-sampling group women were also ready to use the self-sampling kit the next time. All those findings were not statistically significant for different age groups.

The evaluation of the sampling smear quality in both self-sampling and physician-sampling groups was compared (Figure 3). The satisfactory rate in cervical smears of physician-sampling groups (99.1%) was higher than the self-sampling group (69.8%). On the other hand, unsatisfactory evaluation of self-sampling smears (30.2%) was commonly associated with no columnar cells, according to the Bethesda system 2014.

Cytological evaluation by Bethesda system were evaluated among the total satisfactory smears in both study groups (Table 4). According to the cytological

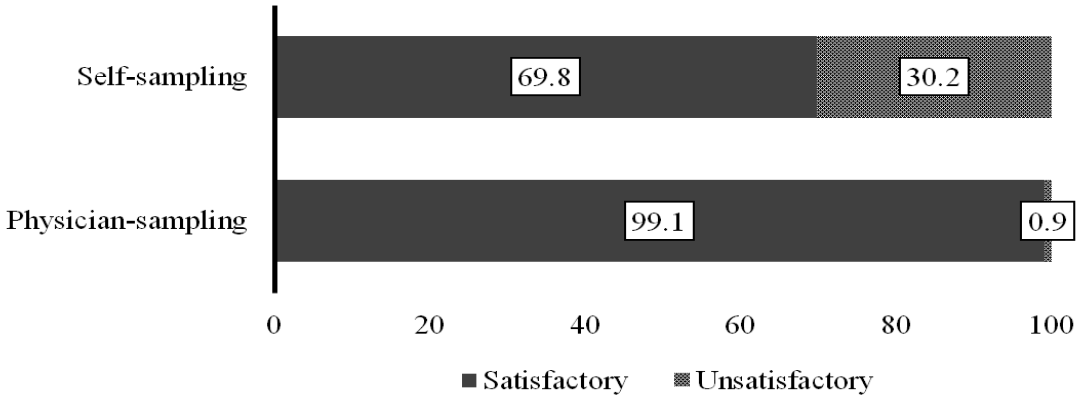


Figure 3. Cervical Cytology Adequacy Evaluation by Bethesda System 2014 in Self-Sampling versus Physician-Sampling Smears

Table 4. Cytological Evaluation for Physician-Sampling Group versus Self-Sampling Group

| Cytological diagnosis | Physician-sampling N=110 | | Self-sampling N=44 | |
|---|---|---|---|---|
| | Number (n) | Percentage (%) | Number (n) | Percentage (%) |
| NILM | 92 | 83.6 | 39 | 88.6 |
| ASCUS | 12 | 10.9 | 4 | 9.1 |
| LSIL | 5 | 4.5 | 1 | 2.2 |
| ASC-H | 1 | 0.9 | - | - |
| HSIL | - | - | - | - |
| SCC | - | - | - | - |

NILM, negative for intraepithelial lesion or malignancy; ASC-US, atypical squamous cells of undetermined significance; LSIL, low-grade squamous intraepithelial lesion; ASC-H, atypical squamous cells cannot rule out HSIL; HSIL, high-grade squamous intraepithelial lesion; SCC, squamous cell carcinoma.

evaluation, majority of the smears in physician sampling vs self-sampling groups were reported as NILM, negative for intraepithelial lesion or malignancy 83.6% vs 88.6%; followed by ASC-US, atypical squamous cells of undetermined significance 10.9% vs 9.1%; LSIL, low-grade squamous intraepithelial lesion 4.5%vs 2.2%; However, ASC-H, atypical squamous cell cannot rule out HSIL were detected in physician sampling group 0.9%. Other categories including HSIL, high-grade squamous intraepithelial lesion; SCC, squamous cell carcinoma were not evaluated in this study.

## Discussion

Although cervical cancer is preventable, it is still the most common cause of cancer-related deaths among women in developing countries. The Pap smear test has been introduced as accessible and cost-effective in most countries, and the screening is the only one of the processes that lead to early detection of cervical cancer and its precursors. To be effective, women must have regular smear tests, and suitable screening attendance and cervical smear quality and interpretation must be adequate. However, in most developing countries, high-quality cytological services are a challenge, and efforts are underway to improve the quality of pap smears and screening methods. In Mongolia, cancer is the second leading cause of death in the population, and cervical cancer is the leading cause of death in women aged 15-44 years (Dondog et al., 2008; Tsedenbal et al., 2018). This study aimed to introduce a self-sampling method for the early detection of cervical cancer in Mongolia and assess the patient's knowledge and preference.

In a study of 175 women who volunteered for early detection of cervical cancer, most respondents preferred to see a doctor rather than collect the samples themselves. However, 58.7% of the women agreed that self-sampling was easy to use and easy to follow. A recent meta-analysis of 24 countries showed a significant agreement on self-sampling and a preference for self-sampling over physician-sampling (Nelson et al., 2017). Participants who collected samples on their own expressed doubts about the correctness of the samples and the reliability of the test results. However, some women in the United States and Europe have expressed a preference for self-sampling rather than seeking medical attention (Dzuba et al., 2002; Racey et al., 2013; Rosenbaum et al., 2014). Several European and North American studies have shown that women who are not routinely screened for cervical cancer are more likely to use a self-sampling kit than a pap smear test (Racey et al., 2013).

The majority of the countries offer cervical cancer screening programs to women aged 21 years and older where women are invited to have physician obtained Pap smear testing (Gakidou et al., 2008). In contrast, Mongolia offers a cervical cancer screening program to women over 30 years old (Chimeddamba et al., 2015). On the other hand, researchers in Cameroon found that women were

more comfortable with self-sampling at home and less worried about embarrassment but preferred the safety of samples and the quality of tests to see a gynecologist (Berner et al., 2013). In our study, 34.9% of participants reported there is a doubt about the reliability of the results in self-collected samples compared to those collected by physicians. Although free of charge cervical cancer screening is available for Mongolian women aged 30–60, not all women respond to these invitations. Screening program attendance is especially low among the group with socioeconomic difficulty, low-income (Levinson et al., 2016; Watson et al., 2017). These disparities are likely to promote the high distribution of cervical cancer incidence and mortality rates (Benard et al., 2014; Musselwhite et al., 2016).

According to this study, 53.7% of respondents had a history of early detection of cervical cancer, but 82.3% of the participants did not receive regular cytology testing (Figure 2). Numerous barriers preventing participation in cervical cancer screening programs have been identified. First, an individual's embarrassment and shame can decrease participation rates in cervical cancer screening (Marlow et al., 2015; Chorley et al., 2017). Second, a lack of knowledge about the importance of cervical cancer screening or the risk of disease can also delay the patient's submission. Recent study results in women aged 25–45 showed that screening rates were highest among women who were aware of the cervical cancer screening interval (Hansen et al., 2011), and similar results were found in China (Jia et al., 2013), UK (Marlow et al., 2015) and the Ethiopia (Kifle et al., 2020). In addition, cancer awareness activities or face-to-face meetings—can increase the participation of women in screening programs (Everett et al., 2011; Simo et al., 2021). Third, socioeconomic barriers may also hinder patient test submission with recommended screening guidelines. For example, in a 2014 study, most women answered that they had forgotten to make a doctor appointment; other practical reasons were being pregnant, breastfeeding, or other (Bosgraaf et al., 2014). Therefore, in our study, 82.3% of the women surveyed were unaware that a cervical cancer vaccine was available, but 88.6% of the participants were willing to be vaccinated. The vaccine is the primary prevention of cervical cancer worldwide (Bosgraaf et al., 2014). However, vaccination is not available in most developing countries due to the practical and social reasons for false stories among young girls (Zehbe et al., 2017). All participants lacked knowledge of the causative agent and route of cervical cancer transmission. In addition, only 17.7% of the participants were heard about cervical cytology were screened. According to Sawyer's research, differences in availability of primary health care providers may affect a patient's education about risk factors of cervical cancer (Sawyer et al., 1990). However, the lack of knowledge about cervical cancer among women in our study and the lack of regular cytological examinations indicates there is a need to change women's knowledge and attitudes in the future.

The experience of discomfort or pain at a past clinical visit can discourage women from revisiting a health professional (Jia et al., 2013; Chorley et al., 2017). Offering women the option of cervical samples at home has been proposed as a means to increase participation in cervical cancer screening programs

The studies among Swedish women who had missed two previous screening rounds found the response rate to be two to three times higher if self-testing was offered than a standard screening invitation (Darlin et al., 2013; Broberg et al., 2014). Women participating in self-sampling trials for cervical cancer screening reported a positive impression in our study (Table 3). A survey in Hong Kong on self-sampling could increase participation rates in cervical cancer screening by 6.5% (Wong et al., 2016). In follow-up interviews with the First Nations, study participants described that self-sampling reduced stress about hospital visits and physical or emotional discomfort from a Pap test (Zehbe et al., 2017). A group of 746 Australian women who self-collected a vaginal sample and returned a questionnaire reported that the home-based test was less embarrassing, less uncomfortable, and more convenient than a clinician-performed Pap test (Sultana et al., 2015). Similarly, In our study, 58.5% of women answered that the explanation of the self-sampling was very clear, but 12.1% of the women aged between 20-49 expressed difficulty understanding. Therefore, most women expressed that the self-sampling kit is easy to use among all age groups; however, ages are difficult under 49 (Table 3).

Similar results were found in German women aged 20–30 years who participated in a study on self-sampling and rated the user-friendliness of the self-sampling method as easy (Deleré et al., 2011). When comparing the preference of the sampling, the majority of young and middle-aged women preferred to use both self-sampling and physician sampling. However, self-sampling preferences were dominant in the old age group (61.6%). The majority of the participants expressed there were no concerns about self-sampling, but minor participants doubted the sample had been taken correctly or not. This was similar to the study of University of Washington clinics for routine cervical cancer screening; about 40% of participants were concerned that self-sampling might be inferior to physician-sampling (Mao et al., 2017). However, most women in the self-sampling group were also ready to use the self-sampling kit the next time in our study, which could lead to improved patient compliance.

The comparison between the self-sampling and physician-sampling adequacy was different in our study (Figure 3). The cervical smear satisfactory rate was high in physician-sampling groups. However, self-sampling and physician sampling had a high concordance rate in some studies (van Baars et al., 2012; Ketelaars et al., 2017; Tranberg et al., 2018). Therefore, previous study showed that the choice of the self-sampling device had the most significant impact on the DNA and high-risk papillomavirus (hrHPV) detection (Virtanen et al., 2017). Moreover, it can be used as a primary screening method in routine screening. This may indicate that self-sampling is more sensitive for HPV virus detection rather than regular cytology smear. In our study unsatisfactory rate of self-sampling was commonly associated with no columnar cells. In cytology testing, both ectocervical

and endocervical cells are collected in physician-sampling, whereas self-sampling generally characterizes a mixture of vaginal and cervical cells (Schmeink et al., 2011). The low sensitivity of self-sampling is because typical vaginal cells and few cervical cells are collected (Brink et al., 2006). Therefore, blood obscuring cells is a common unsatisfactory characteristic in cytology specimens (Delany et al., 2008). However, there was no blood covering effect in our study because we have used a liquid-based cytology technique in this study (Yoshida et al., 2013).

The Pap smear is not perfect and cytological screening is not available in many developing countries; promising alternatives to cytological screening need to be seriously evaluated. In our study, self-sampling for cytology evaluation was mostly normal at 88.6%. However, detection for cell abnormality were ASCUS 9.1%, LSIL 2.2% compared to physician sampling ASCUS 10.9%, LSIL 4.5%, HSIL 0.9%. A previous study (Sellors et al., 2000) suggested that self-sampling was sensitive for most cases of HSIL, but it was predicted by HPV detection and self-sampling specimen. Further research in Mongolia is needed on the sensitivity and specificity of self-sampling via HPV testing, which could form the basis of cervical cancer prevention programs in developing countries.

Our study has several strengths. First, no study evaluated self-sampling preference among Mongolian women. Therefore, this study offers additional testing techniques to prevent cervical cancer in our country, which has a high proportion of women of childbearing age. In addition, our study was conducted on volunteer participants who mainly had trouble accessing regular health care services, especially those from rural areas. However, the limitation of our study was that a small number of women were offered self-sampling methods. Equal access to health care services is crucial for our country, where 60.9% of the population lives in the capital city, Ulaanbaatar, and the rest of the population lives in remote areas. Therefore, most of the survey participants are from the capital city rather than from remote areas may not fully reflect the need and effectiveness of self-sampling methods. Finally, the absence of a virus detection test in our study may affect the presentation of self-sampling advantages.

In conclusion, the present pilot study indicates a positive experience with self-sampling in Mongolia. Self-sampling could be the alternative option for the non-attendees or rural areas in cervical cancer screening programs. The self-sampling test can adopt into the early screening program and may increase the coverage of the screening program and improve the quality of the screening program in Mongolia. More clinical and large population study is needed for the future strategy.

## Author Contribution Statement

Batchimeg Tsedenbal, developed the concept and designed the manuscript, and wrote the paper, Gerelmaa Enebish, collected the data, contributed specimen processing, Bayasgalan Tserensodnom, contributed data analyzing and English editing, Masanao Saio, provided key intellectual support.

## Acknowledgments

The research team would like to thank the professional and methodological advice of the department of histopathology and cytopathology, Graduate School of Health Sciences, Gunma University. We would also like to thank the National Center for Pathology, Mongolia for the generous support.

*Funding Statement*

This study is supported by the post-doctoral grant of the Division for Science and Technology at the Mongolian National University of Medical Sciences.

*Ethical Approval*

This study was approved by the Research Ethics Review Committee of the Mongolian National University of Medical Sciences (2020/3-02).

*Data Availability*

All the required data has been included in the manuscript.

*Conflict of Interest*

The authors declare that they have no competing interests.

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