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Characteristics of Pap Smear Cytology Using LBC in Gynecological Patients at Siloam West Jakarta from 2023 to 2025

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Abstract: Cervical cancer remains a major public health problem worldwide, particularly in developing countries, including Indonesia. Early detection through screening plays a crucial role in reducing morbidity and mortality. This study aimed to describe the cytological findings of Pap smears using the Liquid-Based Cytology (LBC) method based on the Bethesda system, as well as to analyze patient characteristics and HPV infection status among gynecological patients at Siloam West Jakarta Hospital from 2023 to 2025. This research employed a descriptive retrospective design using secondary data from the medical records of 823 patients. The variables analyzed included age, hormonal status, parity, clinical symptoms, cytology results, and HPV infection status. The results showed that most patients were aged 30–49 years and in the reproductive hormonal phase. The majority of cytological findings were categorized as Negative for Intraepithelial Lesion or Malignancy (NILM), with smaller proportion showing epithelial cell abnormalities, predominantly Atypical Squamous Cells of Undetermined Significance (ASC-US). HPV infection was detected in a minority of patients. The findings indicate that LBC is effective in identifying cervical cytology profiles and supporting early detection programs. Strengthening screening programs, particularly in high-risk populations, is essential to improve early diagnosis and prevention of cervical cancer.

Keywords: Cervical Cancer, Liquid-Based Cytology, Pap Smear, HPV Infection, Bethesda System.

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INTRODUCTION

Cervical cancer remains one of the leading causes of morbidity and mortality among women worldwide (Firde et al., 2025; Hussain et al., 2020). According to a 2024 World Health Organization (WHO) report, in 2022 there were more than 660,000 new cases of cervical cancer, with approximately 350,000 deaths globally. The burden of this disease is disproportionately higher in developing countries, including Indonesia, with an estimated 36,000 new cases annually and over 21,000 deaths. This situation positions cervical cancer as one of the primary public health issues affecting the female reproductive system. Etiologically, nearly 99% of cervical cancer cases are associated with Human Papillomavirus (HPV)

infection, particularly high-risk types such as HPV-16 and HPV-18 (Alrefai et al., 2024; Kiamba et al., 2025). In response to this high disease burden, the Ministry of Health of the Republic of Indonesia launched the National Cervical Cancer Elimination Plan 2023–2030, which focuses on increasing HPV vaccination coverage, strengthening early detection, and integrated management (Arrivillaga et al., 2023). One key strategy is the integration of cervical cancer screening services into the National Health Insurance (JKN) program, to improve access and screening coverage in the community.

Liquid-Based Cytology (LBC) is an advancement of the conventional Pap smear method that offers several advantages, such as more representative specimens, a background free of artifacts, and a more even cell distribution, thereby improving the accuracy of cytological interpretation (Miachieo et al., 2022). In clinical practice, the interpretation of LBC test results generally uses the Bethesda system, which has become the international reporting standard (Lyetunde et al., 2025). This system classifies cytology results into categories such as Negative for Intraepithelial Lesion or Malignancy (NILM), Atypical Squamous Cells of Undetermined Significance (ASC-US), Low-grade Squamous Intraepithelial Lesion (LSIL), Atypical Squamous Cells—cannot exclude HSIL (ASC-H), High-grade Squamous Intraepithelial Lesion (HSIL), Atypical Glandular Cells (AGC), Adenocarcinoma in situ (AIS), and malignant lesions. This classification plays a crucial role in determining risk stratification and clinical follow-up for patients (Mishra et al., 2022).

Advances in artificial intelligence technology, particularly deep learning, have demonstrated significant potential in improving the accuracy and efficiency of cervical cytology interpretation (Garg et al., 2023). A study published in *Nature Communications* in 2025 reported that the application of a deep learning model to over 28,000 LBC samples was able to increase screening sensitivity by more than 9% compared to readings by pathologists using conventional methods, while also accelerating the interpretation process. Another study showed that the use of a ResNet-50-based deep neural network model on single-cell LBC images yielded a sensitivity of 98.1% and a specificity of 97.9%, which is significantly higher than that of the conventional Pap smear method (Ekaterina et al., 2025). Furthermore, a literature review indicates that the LBC method has higher sensitivity and specificity, as well as being more cost-effective than conventional methods, particularly in resource-limited countries (Mishra et al., 2022).

However, cytology results cannot be interpreted in isolation from the patient's clinical characteristics. Factors such as age, hormonal status, parity, and clinical symptoms can influence the cytological appearance of the cervix (Campaner & Fernandes, 2024). Therefore, a comprehensive evaluation that integrates cytology results, clinical characteristics, and HPV infection status is essential for more accurately understanding the distribution of precancerous lesions and cervical cancer within a population. Siloam Hospital West Jakarta, as a tertiary healthcare facility, has provided cervical cancer screening services using the LBC method. However, to date, there have been no publications specifically describing the distribution of cervical cytology results based on the Bethesda classification among patients at this facility. This information is crucial as a basis for evaluating the effectiveness of screening programs and as a reference for clinical and public health policy decisions. Based on this background, this study aims to describe the distribution of cervical cytology results using the LBC method based on the Bethesda system, as well as to analyze the clinical characteristics and HPV infection status of gynecological patients at Siloam Hospital West Jakarta during the period from 2023 to 2025.

METHOD

This study is a descriptive study with a retrospective approach using secondary data in the form of patient medical records without direct intervention on the study subjects. The study

was conducted at the Department of Anatomical Pathology at Siloam Hospital West Jakarta, with data collection taking place from October to December 2025, covering gynecological patients who underwent Pap smear examinations using the LBC method from January 2023 to December 2025. The target population in this study was all women residing in Jakarta, while the accessible population consisted of female patients who underwent LBC testing at Siloam Hospital West Jakarta. The study sample was selected using total sampling based on inclusion and exclusion criteria. Inclusion criteria included gynecological patients undergoing LBC with complete clinical data (age, hormonal status, parity, and clinical complaints) as well as data accessible through medical records, while exclusion criteria included incomplete, illegible data, or data lacking the necessary clinical information. Variables observed in this study included cervical cytology results based on the Bethesda system (NILM, ASC-US, LSIL, ASC-H, HSIL, AGC, AIS, and malignant), patient age, hormonal status (reproductive, perimenopausal, postmenopausal), parity, clinical complaints, and HPV infection status. Data were collected using a data collection form developed by the researchers based on medical records and anatomical pathology laboratory reports. All obtained data were then analyzed descriptively using SPSS version 31 software by calculating frequency distributions and percentages for each variable, which were subsequently presented in the form of tables or diagrams to facilitate the interpretation of the study results. This study has obtained ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, Tarumanagara University, as per decision letter number 629/KEPK/FK UNTAR/IX/2025.

Table 1. Operational Definitions of Variables

No	Variable	Operational Definition	Measurement Method	Measurement Tools	Measurement Results
1	Cervical cytology results (Bethesda)	Cervical cytology results based on the Bethesda classification system as recorded in the medical record	Review of medical record data	Medical records	NILM, ASC-US, LSIL, ASC-H, HSIL, AGC, AIS, Malignant
2	Age	The patient's age at the time of the Pap smear, calculated from the date of birth to the date of the examination	Medical record observations	Medical records	Year (number)
3	Hormonal status	The patient's hormonal status at the time of examination	Medical record observations	Medical records	Reproductive, Perimenopausal, Postmenopausal
4	Parity	Number of children the patient has given birth to	Medical record observations	Medical records	Number of children (n)
5	Clinical complaints	Symptoms reported by the patient during the examination	Medical record observations	Medical records	Present (vaginal discharge, cervicitis, erythroplakia, postcoital bleeding, postmenopausal bleeding), Absent
6	HPV infection status	Human Papillomavirus infection status recorded in the medical record	Medical record observations	Medical records	Positive (high-risk, low-risk), Negative

RESULTS AND DISCUSSION

This study collected 823 samples from gynecological patients who underwent LBC Pap smear testing at Siloam Hospital West Jakarta between 2023 and 2025. Based on the age variable, the largest group was in the 30–49-year-old category, comprising 437 patients

(53.1%), followed by 235 patients (28.6%) aged ≥50 years and 151 patients (18.4%) aged <30 years. Based on hormonal status, the majority of patients were in the reproductive category, totaling 548 patients (66.6%), followed by postmenopausal patients (186 patients, 22.6%) and perimenopausal patients (89 patients, 10.8%). Based on the parity variable, the largest group consisted of multiparous patients (>2 parities) totaling 446 patients (54.2%), nulliparous patients (0 parities) totaling 212 patients (25.8%), primiparous (1 parity) 156 patients (19.0%), and grandmultiparous (≥5 parities) 9 patients (1.1%). Based on the clinical complaint variable, the "no abnormalities" category included 400 patients (48.6%), vaginal discharge in 388 patients (47.1%), cervicitis in 24 patients (2.9%), erythroplakia in 6 patients (0.7%), postmenopausal bleeding in 3 patients (0.4%), and postcoital bleeding in 2 patients (0.2%)

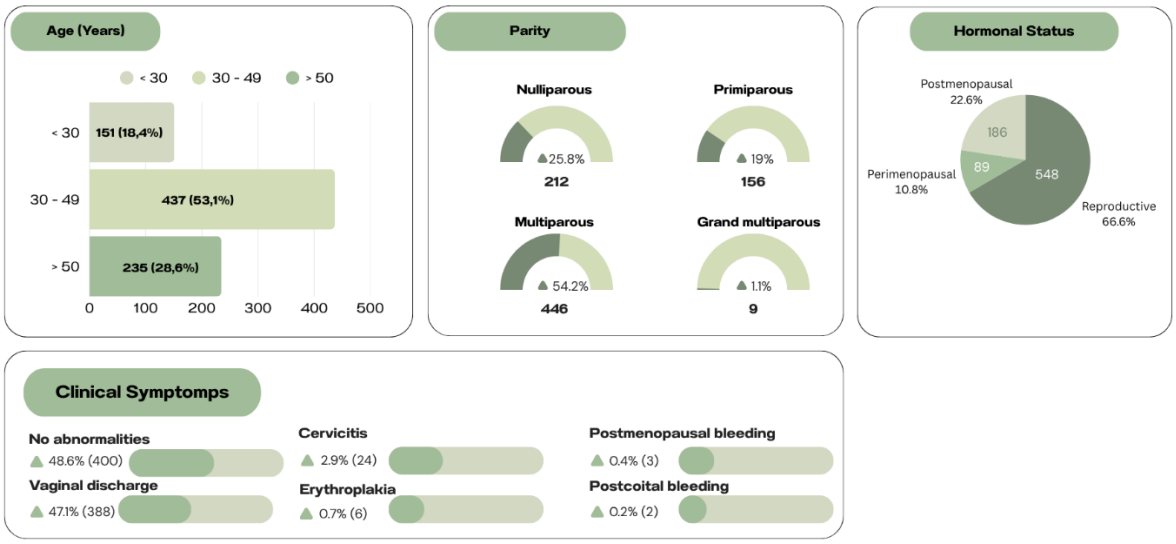

Figure 1. Characteristics of Gynecological Patients (n = 823)

The distribution of Pap smear cytology results using the LBC method showed that the majority of patients fell into the NILM category, totaling 697 patients (84.7%). The most common epithelial cell abnormality was ASC-US in 117 patients (14.2%), followed by Low-grade LSIL in 7 patients (0.9%), while ASC-H and HSIL were found in very small numbers, with 1 patient each (0.1%). No patients with AGC, AIS, or malignancy were identified in this study. Based on the HPV infection status variable, 132 patients (16%) tested positive for HPV, consisting of high-risk 94 patients (11,4%), low-risk 38 patients (4,6%), while 691 patients (84%) tested negative for HPV.

Table 2. Pap Smear Cytology Results Using the LBC Method and HPV Status (n = 823)

Variable	Category	Number (n)	Percentage
LBC Results	NILM	697	84.7
	ASC-US	117	14.2
	LSIL	7	0.9
	ASC-H	1	0.1
	HSIL	1	0.1
	AGC	0	0
	AIS	0	0
	Malignant	0	0
Infection Status	HPV Positive	132	16
	High-risk	94	11,4
	Low-risk	38	4,6
	HPV Negative	691	84

Based on the analysis of patient characteristics, the NILM category was the most common cytological finding across all variables, particularly among patients aged 30–49 years (379 patients), and was most prevalent among patients with reproductive hormonal status (452 patients), multiparous status (392 patients), and patients without clinical complaints (344 patients). ASC-US findings were also most frequently observed in the 30–49 age group (56 patients), reproductive status (88 patients), multiparous parity (53 patients), and patients with vaginal discharge complaints (59 patients). LSIL were relatively rare and were more commonly found in patients under 30 years of age (6 patients), those with reproductive status (7 patients), nulliparous women (6 patients), and patients presenting with vaginal discharge (4 patients). Meanwhile, high-grade lesions were very minimal, with ASC-H was found in one case in the 30–49 age group, among women with reproductive hormonal status, primiparous women, and patients with vaginal discharge; and HSIL in one case each in those aged ≥50 years, perimenopausal women, multiparous women, and asymptomatic patients. Regarding clinical symptoms, the majority of results were dominated by NILM in both asymptomatic patients and those with vaginal discharge, while other categories such as cervicitis, erythroplakia, and bleeding showed very small numbers. No cases of AGC, AIS, or malignancy were found across all studied variables.

Table 3. Cross-tabulation of LBC Pap Smear Results by Patient Characteristics (n = 823)

Variable	Category	NILM	ASC-US	LSIL	ASC-H	HSIL	AGC	AIS	Malignant
Age	<30	108 (71.5%)	37 (24.5%)	6 (4.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	30–49	379 (86.7%)	56 (12.8%)	1 (0.2%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	≥50	210 (89.4%)	24 (10.2%)	0 (0.0%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Hormonal Status	Reproductive	452 (82.5%)	88 (16.1%)	7 (1.3%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Perimenopause	80 (89.9%)	8 (9.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Postmenopausal	165 (88.7%)	21 (11.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Parity	Nulliparous	163 (76.9%)	43 (20.3%)	6 (2.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Primiparous	134 (85.9%)	20 (12.8%)	1 (0.6%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Multiparous	392 (87.9%)	53 (11.9%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Grandmultipara	8 (88.9%)	1 (11.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Clinical Complaints	No abnormalities	344 (86.0%)	52 (13.0%)	3 (0.8%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Vaginal discharge	324 (83.5%)	59 (15.2%)	4 (1.0%)	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Servicitis	21 (87.5%)	3 (12.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Erythroplakia	4 (66.7%)	2 (33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Menopausal Bleeding	2 (66.7%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Postcoital bleeding	2 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

The distribution of HPV infection status shows that the highest number of HPV-positive patients was found in the 30–49 age group (57 patients), followed by those under 30 years of

age (55 patients) and those 50 years of age and older (20 patients), while HPV-negative cases were also predominantly found in the 30–49 age group (380 patients), followed by those aged ≥50 years (215 patients) and <30 years (96 patients). Based on hormonal status, HPV-positive cases were most common in the reproductive age group (107 patients), followed by the perimenopausal group (14 patients) and the postmenopausal group (11 patients), while HPV-negative cases were also dominated by the reproductive age group (441 patients), followed by the postmenopausal group (175 patients) and the perimenopausal group (75 patients). Regarding parity, HPV-positive cases were most frequently found in nulliparous women (60 patients), followed by multiparous women (45 patients), primiparous women (26 patients), and grandmultiparous women (1 patient), while HPV-negative cases were most common among multiparous women (401 patients), followed by nulliparous women (152 patients), primiparous women (130 patients), and grandmultiparous women (8 patients). Based on clinical complaints, HPV-positive results were most common in patients with vaginal discharge (69 patients), followed by those without complaints (55 patients), cervicitis (7 patients), and erythroplakia (1 patient), and were not found in patients with menopausal bleeding or postcoital bleeding. Meanwhile, HPV-negative results were most common in patients without symptoms (345 patients), followed by vaginal discharge (319 patients), cervicitis (17 patients), erythroplakia (5 patients), menopausal bleeding (3 patients), and postcoital bleeding (2 patients).

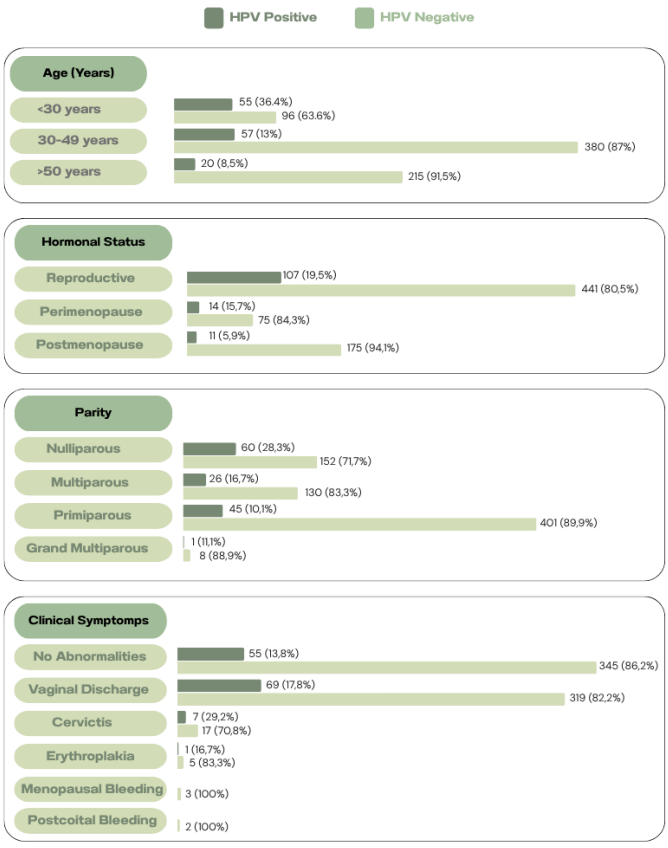

Figure 2. Cross-Tabulation of HPV Infection Status by Patient Characteristics (n = 823)

This study shows that of the total 823 patients, the majority were in the 30–49 age group (n = 437), followed by those aged ≥50 years (n = 235) and those under 30 years (n = 151). These findings indicate that the reproductive-age group through perimenopause constitutes the largest population undergoing screening. This aligns with the WHO recommendation that cervical cancer screening is most effective for women aged 30–49 years, as the risk of precancerous lesions progressing to invasive cancer is higher in this age group. In younger

women, HPV infection is generally transient and can be naturally cleared by the immune system, so the resulting lesions tend to regress, and screening rates are relatively lower (Kiamba et al., 2025; Sethy et al., 2023).

Based on hormonal status, the majority of patients were in the reproductive category (n = 548), followed by postmenopausal (n = 186) and perimenopausal (n = 89). These findings align with the study by Sethy et al. (2023), which showed that the majority of screening patients were in the reproductive phase. Biologically, hormonal status influences cervical epithelial maturation and the quality of cytology specimens (Kuzucular et al., 2024; Mishra et al., 2022). In postmenopausal women, decreased estrogen levels can lead to cervical epithelial atrophy, which may complicate the interpretation of cytology results (Andola et al., 2024; Campaner & Fernandes, 2024).

Based on parity, the majority of patients were multiparous (n = 446), followed by nulliparous (n = 212), primiparous (n = 156), and grandmultiparous (n = 9). These findings are consistent with the study by Seftianti et al. (2026), which reported that the majority of patients undergoing examination were women with high parity. High parity is known as one of the risk factors for cervical cancer, associated with hormonal changes and recurrent cervical trauma (Shiga et al., 2023). However, in this study, the grandmultipara group was relatively small, likely influenced by the trend of declining fertility rates; thus, although they are at high risk, their contribution to the population remains low. Based on clinical complaint variables, the majority of patients had no complaints (48.6%), followed by vaginal discharge (47.1%), while other complaints such as cervicitis, erythroplakia, and bleeding were relatively rare. These findings align with the study by Gujjar et al.(2024), which reported that the majority of patients undergoing Pap smear screening did not exhibit clinical symptoms. Additionally, by Nene et al.(2025) found that vaginal discharge was the most commonly reported complaint, although the majority of patients still showed normal cytology results.

Based on cytology results, the majority of patients showed NILM (n = 697), followed by ASC-US (n = 117), LSIL (n = 7), and 1 case each of ASC-H and HSIL, with no AGC, AIS, or malignancy detected. These findings align with those reported by Gujjar et al. (2024), which showed that normal cytological results predominate in LBC examinations with a low prevalence of precancerous lesions, indicating that most patients are in a normal cytological state or exhibit only mild cellular changes. Based on HPV infection status, 132 patients tested HPV-positive and 691 tested negative. This proportion aligns with the study by Han & Deng (2025), which showed that an HPV prevalence of approximately 16% remains within the range reported in various population studies, thus reflecting consistency with global epidemiological patterns.

Cross-tabulation analysis indicates that NILM cytology results remained predominant across all variables, including age, hormonal status, parity, and clinical complaints. Cytological abnormalities such as ASC-US and LSIL were more frequently found in the 30–49 age group, among women with a reproductive hormonal status, and in nulliparous women. Meanwhile, high-grade lesions such as ASC-H and HSIL were very rarely found. Regarding HPV infection status, the highest number of positive cases was found in the 30–49 age group, among women with a reproductive hormonal status, nulliparous women, and patients with vaginal discharge, indicating a tendency for HPV infection distribution in groups with active reproductive activity and higher exposure to risk factors (Kumiega & Madrigal, 2023; Tahboub et al., 2024).

CONCLUSION

Based on the overall findings of this study, it can be concluded that the Pap smear using the LBC method plays a crucial role as an effective screening tool for the early detection of cervical cytological abnormalities in the gynecological patient population. This is particularly important among women of reproductive age, who are the primary target group of screening

programs. The implications of this study highlight the need to strengthen cervical cancer early detection programs by increasing the coverage of LBC-based screening integrated with HPV testing, as well as public education regarding the importance of routine screening even in the absence of clinical symptoms. Additionally, healthcare facilities are encouraged to utilize local data as a basis for evaluating and planning more targeted prevention strategies. It is also recommended to conduct further research using an analytical design to explore the relationship between risk factors and the incidence of precancerous lesions, as well as the development of technology-based screening systems, such as artificial intelligence, to improve the accuracy and efficiency of cytological interpretation in the future.

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