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ASSOCIATION BETWEEN ABNORMAL PAP SMEAR AND HPV RESULTS AMONG SYMPTOMATIC WOMEN ATTENDING AL-ELWIYA MATERNITY TEACHING HOSPITAL (TUMOR WOMEN CENTER)/BAGHDAD

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ABSTRACT

Background: cervical cancer is ranked the fourth common cancer among women, low- and middle-income countries account for 90% of cervical cancer mortality. It is the second largest cause of death for women in the Caribbean, three times higher than in North America and anticipated to rise 45% by 2030. This study analyzed the correlation between HPV type and Papanicolaou (Pap)-stained cervical smear cytological findings in the uterine cervix. **Method:** The study conducted at Al-Elwiya Maternity Teaching Hospital analyzed the correlation between HPV infection and Pap smear results in symptomatic women. Participants underwent HPV typing and cytological examination using the Papanicolaou method. Statistical analysis assessed associations between HPV status and cytological findings. Ethical approval and informed consent were secured, ensuring participant confidentiality. **Results:** The study population comprised mostly women aged 30-49 years, all married and primarily housewives. Pap smear results indicated 54% NILM, 30% ASCUS, and 16% LISL, with no significant difference in HPV positivity across these categories. HPV infection was detected in 20% of participants. These findings suggest the necessity for comprehensive cervical cancer screening, integrating both Pap smear and HPV testing, to effectively identify at-risk women. **Conclusion:** In the study, most symptomatic women at Al-Elwiya Maternity Teaching Hospital were 30-49 years old, married, housewives with high parity. Pap smear findings indicated 54% NILM, 30% ASCUS, and 16% LISL with no significant HPV positive difference. 20% of subjects had HPV, suggesting a low prevalence. The findings emphasise the need for comprehensive cervical cancer screening programmes that include cytological and HPV testing to identify and manage at-risk women. Similar findings show the necessity for focused screening in symptomatic patients.

KEYWORDS: Association, Abnormal, Pap smear, HPV test, Symptomatic, Women Al-Elwiya teaching hospital.

INTRODUCTION

Cervical cancer is the fourth most common cancer among women worldwide, with a significant burden in low- and middle-income countries, which account for 90% of related deaths.[1] In the Caribbean, it is the second leading cause of death among females, with a mortality rate three times higher than in North America and an expected 45% increase by 2030.[2,3] Effective screening programs are vital for early detection and management to reduce mortality rates. The two main histological types of cervical cancer are squamous cell carcinoma and adenocarcinoma, with the former being more prevalent.[4] Early cervical epithelial changes can be identified by the Papanicolaou (Pap) smear test, which has significantly reduced mortality in developed countries.[5] Screening programs can be opportunistic, where patients request tests, or comprehensive, where large groups of women are systematically encouraged to undergo testing.[6] Organized programs are more effective in reaching asymptomatic women and reducing cancer incidence and mortality. Cervical screening detects squamous and glandular cell abnormalities. Squamous cell abnormalities include low-grade squamous intraepithelial lesions (LSIL), high-grade squamous intraepithelial lesions (HSIL), atypical squamous cells of undetermined significance (ASCUS), atypical squamous cells that cannot exclude HSIL (ASC-H), and invasive squamous cell carcinoma. Glandular cell abnormalities include atypical glandular cells and adenocarcinoma.[7] Proper management of these

abnormalities is crucial to prevent progression to invasive cancer. Human papillomavirus (HPV) infection, the most common sexually transmitted infection, is a major cause of cervical cancer. Over 200 types of HPV exist, with more than 100 causing various diseases in humans.[8] High-risk HPV types are strongly associated with cervical cancer, making screening in low socio-economic regions, where HPV prevalence is higher, particularly important.[9] High-risk groups include women with comorbidities, a family history of cervical cancer, unsafe sexual practices, and symptomatic cervical lesions.[10] In Thailand, cervical cancer is the second most common cancer among women, with an estimated 8,200 new cases annually around 2012, expected to rise to 9,200 by 2020.[11] The age-standardized incidence rates across Thailand vary, with the highest in Lamphun (24.6 per 100,000 women) and the lowest in Khon Kaen (10.4 per 100,000 women).[12] Recent studies show that HPV-based screening is more effective and efficient than the Pap test for preventing invasive cervical cancer and reducing mortality.[13] Four European randomized trials revealed that the cumulative incidence of cervical cancer five years after a negative HPV test was lower than the incidence three years after a normal cytology result.[14] The objective of this study was to analyzed the correlation between human cases of papillomavirus (HPV) (positive or negative) infection of the uterine cervix, as determined by HPV typing, and the cytological results obtained from Papanicolaou (Pap)-stained cervical smears.

Method

Descriptive retrospective study was done on 50 female cervix clinic patients at Al-Elwiya Maternity Teaching Hospital between, January to December 2023. The study aimed to analyses the correlation between human papillomavirus (HPV) infection status, as determined by HPV typing, and the cytological results obtained from Papanicolaou (Pap)-stained cervical smears among symptomatic women. **Study population:** The study included women who presented with various gynecological symptoms and attended the Women's Health Department during the specified period. Participants were selected based on their symptomatic presentation, including post-coital bleeding, vaginal/genital warts, recurrent vaginal infections, lower abdominal pain, intermenstrual bleeding, and heavy menses. Exclusion criteria included women who were asymptomatic or those with a prior diagnosis of cervical cancer. **Data collection:** Demographic and clinical data were collected through retrospective data collection and medical record reviews. The collected data included age, marital status, age at marriage, occupation, parity, smoking status, chief complaints, menstrual history, surgical history, hospital admissions, past medical history, contraceptive history, and family history of cancer. **Cytological examination:** Cervical smears were collected using the conventional Pap smear technique. The smears were then stained using the Papanicolaou method and examined by experienced cytopathologists. The results were classified into three categories: Negative for Intraepithelial Lesion or Malignancy (NILM), Atypical Squamous Cells of Undetermined Significance (ASCUS), and Low-Grade Squamous Intraepithelial Lesions (LISL).[15] **HPV Typing:** HPV typing was performed on cervical samples using polymerase chain reaction (PCR) techniques to detect the presence of high-risk HPV types. The results were categorized as HPV positive or HPV negative.[16] **Statistical analysis:** Data were analyzed using statistical software. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Chi-square tests were used to evaluate the association between categorical variables, such as HPV status and Pap smear results. T-tests and ANOVA were employed to compare means between groups. A p-value of <0.05 was considered statistically significant. **Ethical considerations:** The study protocol was approved by the institutional review board of Al-Elwiya Maternity Teaching Hospital.

RESULTS

Age Distribution: Participants are predominantly aged 30-39 years (40%), followed by those aged 40-49 years (36%). Only 14% are under 30 years, and 10% are 50 years or older. The mean age is 39.0 years with a standard deviation of 8.8 years, ranging from 23 to 59 years. Marital Status: All participants (100%) are married, with no single participants in the study. Age at Marriage: The majority married between 15-19 years (34%), followed by those who married at 20-24 years (32%). Only 12% married before 15 years, and 6% married at 30 years or older. The mean age at marriage is 20.5 years, with a standard deviation of 5.0 years, ranging from 12 to 35 years. Occupation: A vast majority are housewives (94%), while a small fraction is employed (6%). Parity: The distribution of parity shows that 28% of participants have five or more children, followed by 26% with four children. Only 14% have one child. The mean number of children is 3.6, with a standard deviation of 1.7, ranging from 1 to 8. Smoking Status: No participants are active smokers, but 18% are passive smokers, while 82% do not smoke. As shown in table 1.

Table 1: Distribution of females according to sociodemographic data.

		No	%
Age (years)	<30years	7	14.0
	30---39	20	40.0
	40---49	18	36.0
	≥50years	5	10.0
	Mean ± SD (Range)	39.0±8.8 (23-59)	

Marital status	Married	50	100
	Single	-	-
Age at marriage (years)	<15years	6	12.0
	15---19	17	34.0
	20---24	16	32.0
	25---29	8	16.0
	≥30years	3	6.0
	Mean ± SD (Range)	20.5±5.0 (12-35)	
Occupation	Employee	3	6.0
	Housewife	47	94.0
Parity	Para 1	7	14.0
	2	6	12.0
	3	10	20.0
	4	13	26.0
	5 & more	14	28.0
	Mean ± SD (Range)	3.6±1.7 (1-8)	
Smoking	Smoking	-	-
	Passive smoking	9	18.0
	Not	41	82.0

Table 2 show; Chief Complaints: The most common complaint is post-coital bleeding (30%), followed by vaginal/genital warts (20%) and recurrent vaginal infections (18%). Other complaints include lower abdominal pain (12%), intermenstrual bleeding (6%), and heavy menses (4%). Menstrual History: A majority have regular menstrual cycles (68%), while 28% have irregular cycles, and 4% are menopausal. Surgical History: About 36% have a history of surgery, with common procedures including cesarean section (CS) (9 cases), hysterectomy (2 cases), and others like D&C, cervical cautery, uterine polyp removal, tubal ligation, and ovarian cyst removal. Hospital Admissions and Medical History: 22% have been previously admitted to the hospital, and 12% have a past medical history including hypertension, diabetes, and rheumatoid arthritis. Contraceptive History: 40% use oral contraceptive pills (OCP), 6% use intrauterine contraceptive devices (IUCD), and 54% do not use contraception. Family History: 8% have a family history of cancer, including breast and uterine cancers. Pap Smear Results: Most participants (54%) have negative results for inter-epithelial lesions or malignancy (NILM). Atypical squamous cells of undetermined significance (ASCUS) are found in 30% of cases, and low-grade squamous intraepithelial lesions (LISL) in 16%. HPV Test Results: 20% of the participants tested positive for HPV, while 80% tested negative.

Table 2: Distribution of females according to chief complain and histories.

		No	%
Chief complaint	Intermenstrual bleeding	3	6.0
	Post-coital bleeding	15	30.0
	Heavy menses (menorrhagia)	2	4.0
	Abnormal uterine bleeding	4	8.0
	Recurrent vaginal infection	9	18.0
	Vaginal/genital warts	10	20.0
	Repeated smears	1	2.0
	Lower abdominal pain	6	12.0
Menstrual history	Regular	34	68.0
	Irregular	14	28.0
	Menopause	2	4.0
History of operation	Yes	18	36.0
	No	32	64.0
History of operation type	CS	9	
	Hysterectomy	2	
	D&C	2	
	Cervical cautery	1	
	Uterine polyp	1	
	Tubal ligation	2	
	Ovarian cyst	1	
History of blood transfusion	Yes	4	8.0

	No	46	92.0
Previous hospital admission	Yes	11	22.0
	No	39	78.0
Past medical history	Yes (4 Hypertension, 1 Diabetes & 1 Rh arthritis)	6	12.0
	No	44	88.0
Contraceptive history	OCP	20	40.0
	IUCD	3	6.0
	No	27	54.0
Family history	Yes (3 Ca breast & 1 Uterine Ca)	4	8.0
	No	46	92.0

Table 3 show that; Age: Participants with NILM (Negative for Intraepithelial Lesion or Malignancy) are predominantly aged 30 years and above (77.8%). The mean age for NILM is 36.1 years. All participants with ASCUS (Atypical Squamous Cells of Undetermined Significance) are aged 30 years and above (100%), with a mean age of 44.7 years. Participants with LISL (Low-Grade Squamous Intraepithelial Lesions) are mostly aged 30 years and above (87.5%), with a mean age of 37.6 years. There is a statistically significant difference in mean age among the groups (p = 0.006). **Age at Marriage:** The majority of participants in all groups married at 20 years or older: NILM (59.2%), ASCUS (53.3%), LISL (37.5%). The mean age at marriage is similar across groups, around 20 years, with no significant difference (p = 0.889). **Occupation:** Most participants are housewives: NILM (92.6%), ASCUS (93.3%), LISL (100%). Employment status does not show a significant difference among the groups (p = 0.734). **Parity:** Participants with NILM and ASCUS have higher parity, with most having two or more children: NILM (77.8%), ASCUS (100%), LISL (87.5%). The mean number of children is higher for ASCUS (4.7) compared to NILM (3.1) and LISL (3.5), with a significant difference (p = 0.008). **Smoking:** Passive smoking prevalence is similar across the groups: NILM (18.5%), ASCUS (13.3%), LISL (25.0%). There is no significant difference in smoking status among the groups (p = 0.782).

Table 3: Association between Pap Smear and Sociodemographic data.

		Pap smear						P value
		NILM (n=27)		ASCUS (n=15)		LISL (n=8)		
		No	%	No	%	No	%	
Age (years)	<30years	6	22.2	-	-	1	12.5	0.137
	≥30years	21	77.8	15	100	7	87.5	
	Mean ± SD	36.1±7.7		44.7±8.3		37.6±8.5		0.006^
Age at marriage (years)	<15years	4	14.8	1	6.7	1	12.5	0.670
	15---19	7	25.9	6	40.0	4	50.0	
	≥20years	19	59.2	8	53.3	3	37.5	
	Mean ± SD	20.7±5.3		20.6±4.6		19.8±5.2		0.889
Occupation	Employee	2	7.4	1	6.7	-	-	0.734
	Housewife	25	92.6	14	93.3	8	100.0	
Parity	Para 1	6	22.2	-	-	1	12.5	0.137
	Para 2 & more	21	77.8	15	100	7	87.5	
	Mean ± SD	3.1±1.6		4.7±1.6		3.5±1.5		0.008^
Smoking	Passive smoking	5	18.5	2	13.3	2	25.0	0.782
	Not	22	81.5	13	86.7	6	75.0	
*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.								
^Significant difference among more than two independent means using ANOVA-test at 0.05 level.								

Table 4 show that; Age: Participants who tested positive for HPV are more likely to be under 30 years (30%) compared to those who tested negative (10%). The mean age for HPV-positive participants is 36.1 years, and for HPV-negative participants, it is 39.7 years. There is no significant difference in age (p = 0.252). **Age at Marriage:** The distribution of age at marriage shows no significant difference between HPV-positive and HPV-negative participants. Most married at 20 years or older: HPV-positive (50%), HPV-negative (55%). The mean age at marriage is slightly higher for HPV-positive participants (22.1 years) compared to HPV-negative (20.2 years), but this difference is not significant (p = 0.274). **Occupation:** The majority of participants in both groups are housewives: HPV-positive (90%), HPV-negative (95%). Employment status does not show a significant difference between the groups (p = 0.552). **Parity:** Higher parity (two or more children) is common in both groups: HPV-positive (80%), HPV-negative (87.5%). The mean number of children is slightly lower for HPV-positive participants (3.1) compared to HPV-negative (3.8), but this difference is not significant (p =

0.462). **Smoking:** Passive smoking is slightly more prevalent in HPV-negative participants (20%) compared to HPV-positive participants (10%). There is no significant difference in smoking status between the groups.

Table 4: Association between HPV result and sociodemographic data.

		HPV result				P value
		Positive (n=10)		Negative (n=40)		
		No	%	No	%	
Age (years)	<30years	3	30.0	4	10.0	0.103
	≥30years	7	70.0	36	90.0	
	Mean ± SD	36.1±11.3		39.7±8.0		0.252
Age at marriage (years)	<15years	1	10.0	5	12.5	0.900
	15---19	4	40.0	13	32.5	
	≥20years	5	50.0	22	55.0	
	Mean ± SD	22.1±6.3		20.2±4.6		0.274
Occupation	Employee	1	10.0	2	5.0	0.552
	Housewife	9	90.0	38	95.0	
Parity	Para 1	2	20.0	5	12.5	0.541
	Para 2 & more	8	80.0	35	87.5	
	Mean ± SD	3.1±2.0		3.8±1.7		0.462
Smoking	Passive smoking	1	10.0	8	20.0	
	No	9	90.0	32	80.0	
*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.						
#Significant difference between two independent means using Students-t-test at 0.05 level.						

Association Between HPV Results and Pap Smear (Generally): **HPV Result:** Among participants with NILM (Negative for Intraepithelial Lesion or Malignancy), 18.5% tested positive for HPV, and 81.5% tested negative. Among participants with abnormal Pap smear results (including ASCUS and LISL), 20% tested positive for HPV, and 80% tested negative. There is no significant difference in the proportion of HPV-positive results between NILM and abnormal Pap smear results (p = 0.777). The mean value for NILM participants is 31.2±27.2, while for those with abnormal results, it is 29.2±8.3, with no significant difference (p = 0.534), so there is no statistically significant difference between HPV positivity in NILM versus abnormal Pap smear results, indicating that HPV infection rates are similar regardless of Pap smear result categories in this study population.

Table 5: Association between HPV result and Pap smear (generally).

HPV result	Pap smear				P value
	NILM (n=27)		Abnormal (n=23)		
	No	%	No	%	
Positive	5	18.5	5	20.0	0.777
Negative	22	81.5	18	80.0	
Mean ± SD	31.2±27.2		29.2±8.3		0.534
*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.					
^Significant difference among two independent means using Students-t-test at 0.05 level.					

Association Between HPV Result and Pap Smear, Pap Smear and HPV Result: For participants who tested positive for HPV, the distribution is as follows: 18.5% had NILM, 20% had ASCUS, and 25% had LISL. For participants who tested negative for HPV, the distribution is: 81.5% had NILM, 80% had ASCUS, and 75% had LISL. There is no significant difference in HPV positivity among the different categories of Pap smear results (p = 0.922). This table shows that HPV positivity is relatively uniformly distributed across different categories of Pap smear results, suggesting that the presence of HPV does not significantly differ among NILM, ASCUS, and LISL categories.

Table 6: Association between HPV result and Pap smear.

Pap smear	HPV result				P value
	Positive (n=10)		Negative (n=40)		
	No	%	No	%	
Negative for inter-epithelial lesion or malignancy (NILM)	5	18.5	22	81.5	0.922
Atypical squamous cell of undetermined significance (ASCUS)	3	20.0	12	80.0	
Low grade squamous inter-epithelial lesion (LISL)	2	25.0	6	75.0	
Total	**10**	**20.0**	**40**	**80.0**	
*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.					

Figure 1: Distribution of females according to pap smear results: **Pap smear categories:** NILM (Negative for Intraepithelial Lesion or Malignancy): 54%. ASCUS (Atypical Squamous Cells of Undetermined Significance): 30%. LISL (Low-Grade Squamous Intraepithelial Lesions): 16%. This figure illustrates that the majority of participants (54%) have NILM results, indicating no evidence of intraepithelial lesions or malignancy. ASCUS is the second most common result, followed by LISL.

Figure 2: Distribution of Females According to HPV Results, **HPV Test Results:** Positive: 20%. Negative: 80%. This figure indicates that a significant majority of the study population (80%) tested negative for HPV, while only 20% tested positive. This suggests that the prevalence of HPV infection in this symptomatic population is relatively low.

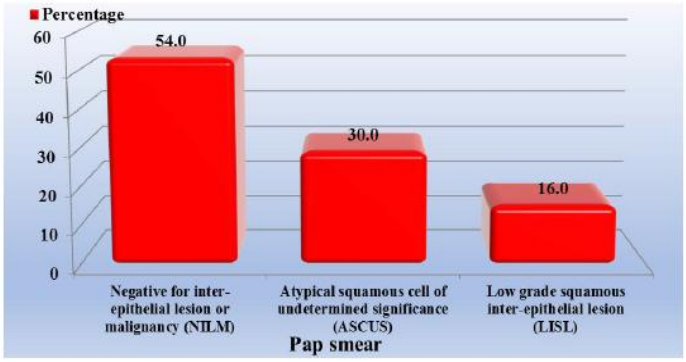

Fig. 1: Distribution of females according to Pap smear.

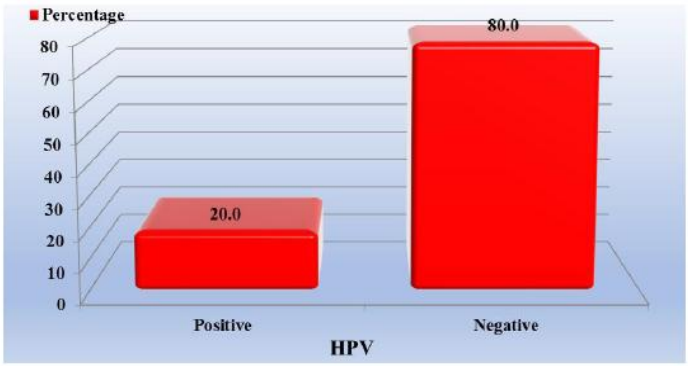

Fig. 2: Distribution of females according to HPV.

DISCUSSION

This study aimed to investigate the correlation between human papillomavirus (HPV) infection status and cytological findings from Papanicolaou (Pap)-stained cervical smears among symptomatic women attending Al-Elwiya Teaching Hospital. The results indicate significant associations and align with findings from other similar studies. The demographic data showed that the majority of participants were aged 30-49 years (76%), with a mean age of 39 years. All participants were married, with most marrying between the ages of 15-19 years (34%). The majority were housewives (94%), and parity was high, with an average of 3.6 children per woman. These findings are consistent with other studies that highlight the prevalence of cervical cancer in women of reproductive age and in those with multiple childbirths, a known risk factor for cervical cancer.[17,18] In terms of chief complaints, post-coital bleeding (30%) and vaginal/genital warts (20%) were the most common. This is indicative of the symptomatic

nature of the study population, which aligns with the known clinical presentations of HPV-related cervical pathology.[19] Most women had regular menstrual cycles (68%), but a significant portion (36%) had a history of surgical procedures, predominantly cesarean sections. This high rate of surgical history underscores the need for targeted cervical cancer screening in women with extensive gynecological histories.[20] The Pap smear results revealed that 54% of participants had negative results for intraepithelial lesions or malignancy (NILM), 30% had atypical squamous cells of undetermined significance (ASCUS), and 16% had low-grade squamous intraepithelial lesions (LISL). This distribution is comparable to findings in other studies where NILM results are most common, followed by ASCUS and LISL.[21,22] The association between Pap smear results and sociodemographic data showed significant differences in mean age, with ASCUS cases being older on average ($p = 0.006$), and higher parity in ASCUS cases ($p = 0.008$). These associations reflect known risk factors where older age and higher parity correlate with increased risk of cervical abnormalities.[23,24] HPV testing revealed that 20% of the participants were HPV positive. When examining the association between HPV results and Pap smear findings, there was no significant difference in HPV positivity across different Pap smear categories ($p = 0.922$). This finding suggests that while HPV infection is present, its detection does not significantly vary between NILM, ASCUS, and LISL results. This aligns with studies indicating that HPV infection can be present across a spectrum of cytological findings.[25,26] Comparatively, studies from various regions, including Turkey and Thailand, have reported similar HPV prevalence rates and cytological distributions. For instance, Ozalp et al. reported a comparable distribution of Pap smear results and HPV positivity in their study population, highlighting the ubiquitous nature of HPV and its impact on cervical cytology.[27] Similarly, Sachan et al. found a significant correlation between HPV infection and cytological abnormalities, reinforcing the need for integrated screening approaches that utilize both Pap smear and HPV testing.[28] Figure 1 demonstrated that a majority (54%) of the study population had NILM results, indicating no evidence of intraepithelial lesions or malignancy, while ASCUS and LISL accounted for 30% and 16%, respectively. Figure 2 showed that 80% of the participants tested negative for HPV, which suggests a relatively low prevalence of HPV infection in this symptomatic population. This contrasts with studies in higher prevalence areas, underscoring regional differences in HPV epidemiology.[29]

CONCLUSION

The study revealed that the majority of symptomatic women attending Al-Elwiya Teaching Hospital were aged 30-49 years, married, and predominantly housewives with high parity. Pap smear results showed 54% NILM, 30% ASCUS, and 16% LISL, with no significant difference in HPV positivity among these categories. HPV infection was present in 20% of the participants, indicating a relatively low prevalence. The findings highlight the importance of comprehensive cervical cancer screening programs integrating both cytological and HPV testing to effectively identify and manage at-risk women. These results are consistent with similar studies, emphasizing the need for targeted screening efforts in symptomatic populations.

REFERENCES

1. Ozalp SS, Us T, Arslan E, Oge T, Kaşifoğlu N. HPV DNA and Pap smear test results in cases with and without cervical pathology. J Turk Ger Gynecol Assoc, 2012; 1, 13(1): 8-14. doi: 10.5152/jtgga.2011.69. PMID: 24627668; PMCID: PMC3940231.
2. Sachan PL, Singh M, Patel ML, Sachan R. A Study on Cervical Cancer Screening Using Pap Smear Test and Clinical Correlation. Asia Pac J Oncol Nurs, 2018; 5(3): 337-341. doi: 10.4103/apjon.apjon_15_18. PMID: 29963597; PMCID: PMC5996593.
3. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray F. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer, 2015; 1, 136(5): E359-86. doi: 10.1002/ijc.29210. Epub 2014 Oct 9. PMID: 25220842.
4. Virani S, Bilheem S, Chansaard W, Chitapanarux I, Daoprasert K, Khuanchana S, Leklob A, Pongnikorn D, Rozek LS, Siriarechakul S, Suwanrungruang K, Tassanasunthornwong S, Vatanasapt P, Sriplung H. National and Subnational Population-Based Incidence of Cancer in Thailand: Assessing Cancers with the Highest Burdens. Cancers (Basel), 2017; 17, 9(8): 108. doi: 10.3390/cancers9080108. PMID: 28817104; PMCID: PMC5575611.
5. Llanos AAM, Warner WA, Luciani S, Lee TY, Bajracharya S, Slovacek S, Roach V, Lamont-Greene M. Gynecologic cancer mortality in Trinidad and Tobago and comparisons of mortality-to-incidence rate ratios across global regions. Cancer Causes Control, 2017; 28(11): 1251-1263. doi: 10.1007/s10552-017-0961-4. Epub 2017 Sep 15. PMID: 28917021; PMCID: PMC5909810.
6. Arbyn M, Ronco G, Anttila A, Meijer CJ, Poljak M, Ogilvie G, Koliopoulos G, Naucler P, Sankaranarayanan R, Peto J. Evidence regarding human papillomavirus testing in secondary prevention of cervical cancer. Vaccine, 2012; 20, 30, 5: F88-99. doi: 10.1016/j.vaccine.2012.06.095. Erratum in: Vaccine. 2013 Dec 16;31(52):6266. PMID: 23199969.
7. Ronco G, Dillner J, Elfström KM, Tunesi S, Snijders PJ, Arbyn M, Kitchener H, Segnan N, Gilham C, Giorgi-Rossi P, Berkhof J, Peto J, Meijer CJ; International HPV screening working group. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European

randomised controlled trials. Lancet, 2014; 8, 383(9916): 524-32. doi: 10.1016/S0140-6736(13) 62218-7. Epub 2013 Nov 3. Erratum in: Lancet, 2015; 10, 386(10002): 1446. PMID: 24192252.
8. World Health Organization. Cervical Cancer. Available online: https://www.who.int/cancer/prevention/diagnosis-screening/cervical-cancer/en/ (accessed on 11 July 2019).
9. Chan, C.K.; Aimagambetova, G.; Ukybassova, T.; Kongrtay, K.; Azizan, A. Human Papillomavirus Infection and Cervical Cancer: Epidemiology, Screening, and Vaccination—Review of Current Perspectives. J. Oncol, 2019; 2019: 3257939.
10. 8-Cofie, L.E.; Hirth, J.M.; Wong, R. Chronic comorbidities and cervical cancer screening and adherence among US-born and foreign-born women. Cancer Causes Control, 2018; 29: 1105–1113.
11. American Health Organization. Cervical Cancer. Available online: https://www.paho.org/en/topics/cervical-cancer (accessed on 11 July 2019).
12. Lynch-George, G.; Maharaj, R. Cervical Smears at Public Health Centres in Eastern Trinidad: Coverage and Follow-up, 2009–2010. West Indian Med. J, 2014; 63: 575–581.
13. Umakanthan S, Bukelo MM, Ghany S, Gay D, Gilkes T, Freeman J, Francis A, Francis K, Gajadhar G, Fraser J. The Correlation of Papanicolaou Smears and Clinical Features to Identify the Common Risk Factors for Cervical Cancer: A Retrospective and Descriptive Study from a Tertiary Care Hospital in Trinidad. Vaccines (Basel), 2023; 18, 11(3): 697. doi: 10.3390/vaccines11030697. PMID: 36992281; PMCID: PMC10052654.
14. World Health Organization. Comprehensive Cervical Cancer Control: A Guide to Essential Practice. 2nd ed. World Health Organization; Geneva, Switzerland: 2014. [(accessed on 16 June 2022)]. Cancer and pre-cancer classification systems. Annex 4. Available online: https://www.ncbi.nlm.nih.gov/books/NBK269605/
15. Umezawa T, Umemori M, Horiguchi A, Nomura K, Takahashi H, Yamada K, Ochiai K, Okamoto A, Ikegami M, Sawabe M. Cytological variations and typical diagnostic features of endocervical adenocarcinoma in situ: A retrospective study of 74 cases. Cytojournal, 2015; 29, 12: 8. doi: 10.4103/1742-6413.156081. PMID: 25972909; PMCID: PMC4421916.
16. Jalal Kiani S, Shatizadeh Malekshahi S, Yousefi Ghalejoogh Z, Ghavvami N, Shafiei Jandaghi NZ, Shahsiah R, Jahanzad I, Yavarian J. Detection and Typing of Human Papilloma Viruses by Nested Multiplex Polymerase Chain Reaction Assay in Cervical Cancer. Jundishapur J Microbiol, 2015; 26, 8(12): e26441. doi: 10.5812/jjm.26441. PMID: 26865940; PMCID: PMC4745380.
17. World Health Organization. Cervical Cancer. Available online: https://www.who.int/cancer/prevention/diagnosis-screening/cervical-cancer/en/ (accessed on 11 July 2019).
18. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer, 2015; 136(5).
19. Llanos AAM, Warner WA, Luciani S, et al. Gynecologic cancer mortality in Trinidad and Tobago and comparisons of mortality-to-incidence rate ratios across global regions. Cancer Causes Control, 2017; 28(11): 1251-1263.
20. Chan CK, Aimagambetova G, Ukybassova T, et al. Human Papillomavirus Infection and Cervical Cancer: Epidemiology, Screening, and Vaccination—Review of Current Perspectives. J Oncol, 2019; 2019: 3257939.
21. Umakanthan S, Bukelo MM, Ghany S, et al. The Correlation of Papanicolaou Smears and Clinical Features to Identify the Common Risk Factors for Cervical Cancer: A Retrospective and Descriptive Study from a Tertiary Care Hospital in Trinidad. Vaccines (Basel), 2023; 11(3): 697.
22. Lynch-George G, Maharaj R. Cervical Smears at Public Health Centres in Eastern Trinidad: Coverage and Follow-up 2009–2010. West Indian Med J, 2014; 63: 575–581.
23. Cofie LE, Hirth JM, Wong R. Chronic comorbidities and cervical cancer screening and adherence among US-born and foreign-born women. Cancer Causes Control, 2018; 29: 1105-1113.
24. American Health Organization. Cervical Cancer. Available online: https://www.paho.org/en/topics/cervical-cancer (accessed on 11 July 2019).
25. Arbyn M, Ronco G, Anttila A, et al. Evidence regarding human papillomavirus testing in secondary prevention of cervical cancer. Vaccine, 2012; 30: 5.
26. Ronco G, Dillner J, Elfström KM, et al. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European randomized controlled trials. Lancet, 2014; 383(9916): 524-32.
27. Ozalp SS, Us T, Arslan E, et al. HPV DNA and Pap smear test results in cases with and without cervical pathology. J Turk Ger Gynecol Assoc, 2012; 13(1): 8-14.
28. Sachan PL, Singh M, Patel ML, et al. A Study on Cervical Cancer Screening Using Pap Smear Test and Clinical Correlation. Asia Pac J Oncol Nurs, 2018; 5(3): 337-341.
29. Virani S, Bilheem S, Chansaard W, et al. National and Subnational Population-Based Incidence of Cancer in Thailand: Assessing Cancers with the Highest Burdens. Cancers (Basel), 2017; 9(8): 108.