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Effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine

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Abstract: ***Aim:*** *This study aimed to evaluate the effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine.****Methods:****This study was designed as a randomized controlled trial. A simple random sample of 768 un-married Egyptian female students was recruited from 5 colleges situated within the Mansoura university campus. The sample was divided into two groups.The intervention group (n= 384) received a lecture-based education about human papillomavirus infection and vaccine; while subjects of the control group (n= 384) did not. Data on students' knowledge about and acceptance of the human papillomavirus vaccine were assessed before the lecture and after the lecture and after one month through using a 21-items self-administered questionnaire.* ***Results:****The average knowledge scores about HPV infection and its causal link with cervical cancer and knowledge scores about HPV vaccination of the intervention group showed significant increase compared to insignificant change in the control group (4.84 ±1.74 vs. 1.08 ±0.52 & 7.61 ±2.54 vs. 1.21 ±0.60 respectively; t-test=40.572, 48.053) after the lecture-based education and (3.33 ±1.38 vs. 1.06 ±0.51; t- test= 30.235& 6.93 ±2.31 vs.1.17 ±0.55 respectively, t-test= 47.534) after one month.****Conclusion:****The study hypotheses were accepted. There was a significant improvement in students' knowledge about and acceptance of HPV vaccination among the intervention group compared to the control group; indicating that lecture-based education was a useful tool for the enrichment of undergraduates' knowledge and acceptance to the Human Papillomavirus Vaccine for cervical cancer prevention.*
Key Words: *Human Papillomavirus Vaccine, cervical cancer, and lecture-based education.*

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I. INTRODUCTION

Persistent infection with high-risk human papillomavirus (HPV); a sexually transmitted infection, is a well-known reason for cervical cancer [1]. Cervical cancer-associated human papillomavirus classification describes 15 types as high-risk or carcinogenic and 12 types as low-risk viruses. The HPV-16 and HPV-18 are the most frequent high-risk types. Respectively, they are responsible for 61% and 10% of cancer cervix internationally, and 48% and 23% in Africa [2, 3].

All over the world, around 500,000 cases are diagnosed with cervical cancer annually, giving more than 270,000 deaths [4, 5]. In Egypt, 969 cervical cancer cases and 631 deaths attributable to cancer were recorded annually. Based on recent estimates of the HPV Information Centre's, cervical cancer ranks as the second most common cancer among Egyptian women and the 10^{th} most common cancer among women between 15 to 44 years [6]. Given the risk of HPV infection on cervical cancer, efforts are ongoing to arrange for primary prevention of cervical cancer by HPV vaccines.

In June 2006, two prophylactic vaccines were licensed; by the Food and Drug Administration of the United States of America, with good efficacy in preventing HPV infection and subsequent cervical cancer. The bivalent Cervarix (GlaxoSmithKline, Belgium) and quadrivalent Gardasil vaccines (Merck and Co., Inc., United States of America) [7].Rapidly, the vaccines expanded in a lot of countries and licensed in more than 150 countries. Even with the wide vaccine accessibility, only one Arab country (United Arab Emirates) introduced HPV in its national program of vaccination and few countries planned to introduce it in the near future [8].

It is noteworthy to mention that HPV vaccination is suggested before sexual debut. Despite that sexually active women still, have a chance of being vaccinated. It is not contraindicated for women with a history of HPV infection, abnormal Papanicolaou test, or genital warts. However, it is less valuable for those infected with a type of HPVs [9]. The HPV vaccines are administered in three doses. The quadrivalent vaccine is orderly at time zero, two and six months of follow-up, while the bivalent vaccine is reserved at time zero, one and six months of follow-up. Statistical data from the Organization for Economic Cooperation and Development (OECD) in 2019 demonstrated that the first dose reported higher uptake equated to other doses. In England, uptake of the first dose vaccine was 89%, while uptake of subsequent doses was 84% between 2017 and 2018 [10]. The absence of the HPV vaccine in the Egyptian national program made it difficult to identify the uptake of the HPV vaccine in Egypt.Even with the significant magnitude of HPV infection, women's awareness about this type of infection, risks, and preventive measures is inadequate [11, 12]. Thus, the present study was carried out to evaluate the effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine.

1.1 Significance of the study

High-risk HPVs are likely to be responsible for about 70% of cervical cancer cases. In North Africa; where Egypt lies, 81.2% of invasive cervical cancers are due to high-risk HPVs [13, 14]. Previous literature about the influence of the educational intervention on knowledge and acceptance of HPV vaccination; for cervical cancer prevention, showed contradictory findings. A number of studies showed an increase in woman's knowledge and uptake of cervical cancer screening after education, while others did not demonstrate a significant advantage of education [15-18]. In Egypt, few research studies addressed awareness and acceptance of HPV vaccination are available [19, 20]. Therefore, the present study was carried out to evaluate the effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine.

1.2 Operational definitions

1.2.1 *Lecture-based education*is a verbal presentation anticipated to clarify an identified subject to a group of audience[21].

1.2.2 *Human Papillomavirus* is a set of over 200 related types of viruses. Among those viruses over 40 types are spread via sexual contact; of which certain types cause genital warts and others cause various types of cancer (e.g., cervical, anal, vulvar, vaginal).*Human Papillomavirus vaccine* is a vaccine that defends against human papillomaviruses infection [11].

1.3 Aim of the study

This study aimed to evaluate the effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine.

1.4 Hypotheses of the study

To attain the current study aim, two hypotheses were tested:

Hypothesis 1. Female students who attend a lecture-based education about HPV vaccination record higher knowledge scores compared to those who do not attend.

Hypothesis 2. Female students who attend a lecture-based education about HPV vaccination report higher acceptance rate to be vaccinated compared to those who do not attend.

II. SUBJECTS AND METHOD

2.1 Study design

The current study was designed as arandomized controlled trial. In this design, the study sample was randomized into intervention and control groups. Subjects of the intervention group receiveda lecture-based education about HPV infection and vaccination, while their mates of the control group did not receive any intervention.

2.2 Study setting

The existing study was carried out at Mansoura University, Egypt in 5 out of 19 colleges (i.e., Literature, Commerce, Law, Education, and Nursing). Mansoura University was established in 1972 at Mansoura city, Egypt. It is one of the largest Egyptian universities which provides education services for national and international students in different specialties. The university addedgreatly to the scientific and cultural life of Mansoura city, Egypt.

2.3 Sampling

A simple random sample of 768 students was recruited; throughout the period between October and December 2018, to share in the current research work. Students were eligible to participate in the current research work if they were: 1) Female, 2) Unmarried; since initiation of vaccination is recommended before sexual debut, 3) From ages of 18 to 25 years old, and 4) Belongs to a college situated within the university campus.

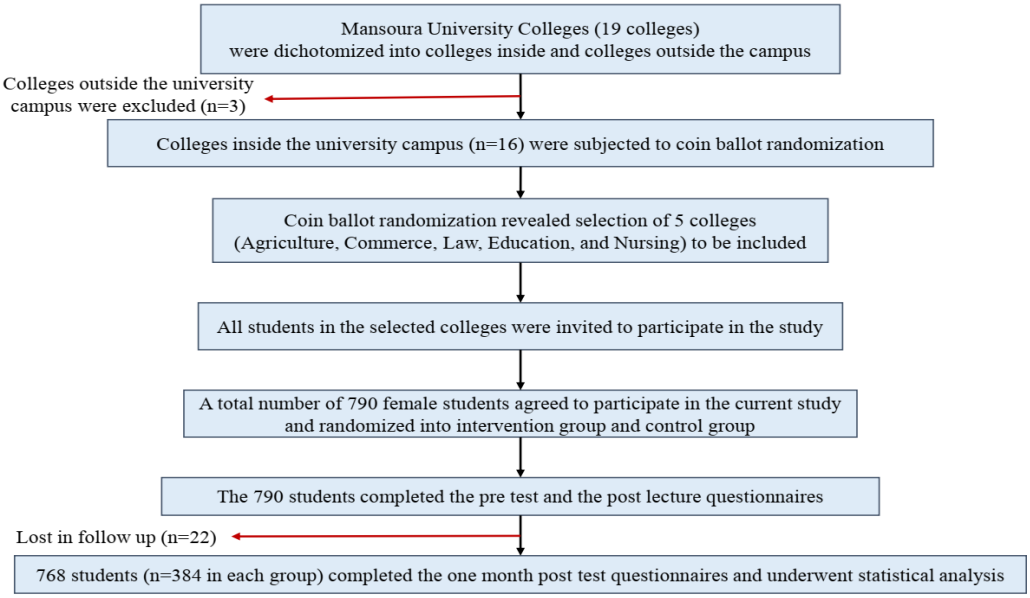
2.3.1 Sample size calculation

This randomized controlled trial proposes to evaluate the effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine. Based on data from a previous Malaysian study assessed effect of an educational intervention on knowledge of students aboutHPV vaccination[22], considering level of significance of 5%, and power of study of 80%, the sample size can be calculated using the following formula: $n = [(Z_{\alpha/2} + Z_{\beta})^2 \times \{2(SD)^2\}]/$ (mean difference between the two groups)^2, where SD = standard deviation, $Z_{\alpha/2}$: This depends on level of significance, for 5% this is 1.96, and Z_{β}: This depends on power, for 80% this is 0.84. Therefore, $n= [(1.96 + 0.84)^2 \times \{2(3.95)^2\}]/ (0.64)^2$= 383.19.Accordingly, the sample size required per group is 384.

2.3.2Colleges selection and group's assignment

A two-stage cluster sampling technique was used to recruit a simple random sample. At the 1st stage, Mansoura University colleges were grouped into two main clusters (i.e., Colleges inside and colleges outside the university campus). Three colleges situated outside the university campus (i.e., Kindergarten, Tourism, and Hotels) were excluded. At the 2nd stage, colleges situated within the university campus (n= 16) were alphabetically listed in ascending order. A simple random sample from the inside university colleges was selected. Each college had an equal chance of being involved in the study according to the findings of a coin ballot. Initially, a coin toss was done to identify which option will be included; landed heads up or landed tails up. Based on initial coin ballot finding, landed heads up option guided colleges involvement. Coin tosses were done 16 times; the number of eligible colleges. Tosses outcomes were distributed one by one on the college list; for example first toss result given to the first college in the list, etc. At the end of the coin ballot, the outcomes were revised, colleges landed heads up (i.e., Literature, Commerce, Law, Education, and Nursing colleges) were involved, while remaining colleges were excluded from the study.

Students from the selected colleges were randomly assigned either to the intervention group or the control group. Randomization was done at an equal ratio (i.e., 384 control group: 384 intervention group). The assignment was identified at the classroom gate by asking each student to select a closed opaque envelope contains letter C or I. The students who selected envelopes containing letter C was assigned to the control group, while those who selected envelopes containing letter I was assigned to the intervention group. Envelopes were opened after confirming student's eligibility and informed consent was taken. The flowchart of the study was illustrated below.



Flowchart for participation in the study

2.4 Measure of data collection

2.4.1 Self-administered questionnaire

One measure; a self-administered questionnaire, was used to collect necessary outcomes of the current study (i.e., students' knowledge about and intention to HPV vaccination). The self-administered questionnaire consists of 21 questions distributed in two parts.

Part I. Students' knowledge about the HPV vaccine

This part includes 19-items that imitate students' knowledge about the HPV vaccine. It was completed at baseline, after introducing the lecture-based education, and again after one month. This questionnaire was adapted from a previous study [23]. It consisted of two segments. The first segment described four items of the respondents' demographic characteristics (i.e., age, college, university grade, and residence). The second segment described the students' knowledge about HPV infection, its causal relation with cervical cancer, and students' knowledge about HPV vaccination. It was involved 15 Multiple Choice Questions with three options. Six questions enquired about different aspects related to HPV infection (e.g., route of transmission, technique of detection, and method of prevention), and nine questions were about different issues related to HPV vaccine (e.g., timing of initiating dosage schedule, proper age at initiating dosage schedule, available vaccines in Egypt, dosage schedule of both).

Part II. Students' intention and barriers to HPV vaccination

The second part of the questionnaire was comprised of 2 questions. Using one closed-ended question, students' intention to HPV vaccination was determined, "i.e., if the HPV vaccine is available, would you be attentive to be vaccinated?" Respondents' answers were provided to such questions before and after introducing the lecture-based education. This question carried one of two probable answers; yes or no. If the answer was no, a further open-ended question was asked: "Which barrier is impairing your intention in getting the HPV vaccine?" The barrier question was assessed if there was no intention of vaccination before the intervention.

Scoring of the responses

The correct answer was given one mark, while the wrong one was given zero. Correct responses in the 2ndsegment were added up. The total knowledge score ranges from 0 to 15 marks. A greater mark means enhanced knowledge of the respondents. Based on the total score, knowledge scores dichotomized into three levels. The poor category was given to scores less than 50%, scores of 50% to 65% were considered fair, meanwhile scores more than 65% were good.

The validity of the study measure

Before introducing the questionnaire to the students, content validity was confirmed by the Delphi method. In this method, the corresponding author communicated with a panel of three experts of Gynecology medicine and two experts in Obstetrics and Gynecology nursing. Each member of the reviewers' panel sent a copy of the developed questionnaire to revise it. After revision, a copy of the collected comments was again sent to each member giving a further opportunity for more comments. At the end of the second revision, all the questionnaires were sent to the corresponding author. Corrections were done according to the reviewers' comments (i.e., questions related to dose, route, and amount of the vaccine were deleted from the questionnaire); where these questions were viewed as more advanced details to non-specialized respondents.Furthermore,Cronbach's alpha coefficient for internal consistency of the developed tool was 0.912in this study. The value of Cronbach's alpha coefficient indicatedaccepted reliability for the developed tool.

2.5 Ethical considerations

Before conducting the current research study, ethical approval was taken from the ethics committee of the College of Nursing. Official approvals were obtained from one of the concerned authorities in each college before starting the work. The sharing in the study was voluntary. All students consented to their participation.

2.6 Research process

2.6.1 Preparation for the intervention

This phase initiated by preparing the content of the educational material. Thereafter, approvals were taken for research conduction, and then students were recruited.

The educational material content preparation

Education material was prepared by the researchers based on the available resources. It was prepared in English then translated into Arabic understandable language. It covered all important issues related to the subject of HPV infection; such as definition, mode of transmission, method of detection, high-risk groups, and the causal link between HPV infection and cervical cancer. As well as, all aspects related to HPV vaccine including vaccine types, age at vaccination, dosage schedule for both types, dose, and route of administration, etc. Before delivering the educational material, the content validity of the translated copy was confirmed by a panel of experts in medicine and nursing specialties. Modifications were made according to their comments (i.e., two items were added to the content; groups at risk for HPV infection and incidence of protection from cervical cancer after HPV vaccine).

Recruitment of the participants

At the beginning of the study, official permissions were taken from the concerned authorities in each selected college; after clarifying the aim and procedure of the study. Undergraduate students from each selected college were recruited by flyers and poster announcements in their collecting areas (i.e., lecture halls, laboratories, libraries, and digital libraries). Consents of the respondent students were taken.

2.6.2 Baseline assessment

After a full explanation by a researcher on how to complete the baseline questionnaire, all subjects of both intervention and control groups were asked to complete the questionnaire in October and November 2018. The completed questionnaires were collected immediately by a researcher and four volunteer assistant demonstrators from the Faculty of Nursing, Mansoura University. Distribution and collection of the questionnaires consumed about 15 minutes. After collecting the baseline questionnaires, subjects of the control group were instructed to leave the lecture hall and return after 90 minutes to fill in the posttest questionnaire.

2.6.3 The education intervention

The educational material was presented only to subjects of the intervention group through PowerPoint slides within 60 minutes; then 20 minutes were given to students to express their concerns and ask questions. Thereafter, subjects of the control group were allowed to reenter the lecture hall again to answer the posttest questionnaire with their mates of the intervention group. An additional 15 minutes were given to allow students of both groups to answer the post-test questionnaires to avoid being influenced by others. The completed questionnaires were collected by the responsible personnel. At this moment all subjects of both groups were informed about the time of the next follow-up questionnaire completion (i.e., after one month).

2.6.4 Follow-up evaluation

During November and December 2018, subjects of the intervention and control groups were collected and arranged in a lecture hall to complete the one-month follow-up questionnaire.Both the pre and post-test questionnaires were the same. The completed questionnaires were collected by the responsible personnel. The post-test scores were compared with the pretest scores to assess the effect of education on the students' knowledge about and acceptance of the HPV vaccine.

2.7 Statistical analysis

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean ±standard deviation (SD). Categorical data were expressed in number and percentage. The comparisons were determined using Student's t-test for two variables or a one-way ANOVA test for comparison among than two variables with continuous data. A Chi-square test was used for comparison of variables with categorical data. Statistical significance was set at $p<0.05$.

III. RESULTS

3.1 Demographic characteristics of the intervention and control groups

Table 1 demonstrates and compares the demographic and educational characteristics of the students in the intervention group and the control group. As shown in Table 1, the two groups were matched regarding the age, college, educational grade as well as the residence.

3.2 Participants' Knowledge about items related to HPV infection and its causal link with cervical cancer in the intervention and control groups pre and post the lecture-based education

Table 2 shows the frequency of the corrected answers about items related to HPV infection and its causal link with cervical cancer in the intervention and control groups at baseline, after the lecture-based education and after one month. It is clear from this table that at baseline evaluation, there was no significant difference between both groups regarding all items. After the lecture and after one-month evaluations, the frequency of the corrected answers was significantly higher in the intervention group compared to the control group in all evaluated items. The highest frequency of the corrected answers was observed for the item" Is it possible to be protected against cervical cancer by the vaccine?" it was 79.2% and 78.1% compared to 23.2% and 23.2% respectively in the control group ($p< 0.001$, $X2 = 163.377$ & 231.92).

Table 3 shows the frequency of the corrected answers about items related to HPV vaccination in the intervention and control groups at baseline, after the lecture-based education and after one month. Table 3 clarified that at baseline evaluation, there was no significant difference between both groups regarding all items. After the lecture, the frequency of the corrected answers was significantly higher in the intervention group compared to the control group in all of the evaluated items. The highest frequency was observed for the item "What is the dosage schedule of getting HPV bivalent vaccine?" (88.8% vs. 8.6 % in the control group; $p < 0.001$, $X2 = 494.419$). Likewise, afterthe one-month evaluation showed that the frequency of the corrected answers was significantly higher in the intervention group compared to the control group. The highest frequency was 78.7% in the intervention group compared to 19.3% in the control group ($p < 0.001$, $X2 = 270.868$) for the item "How many vaccine doses requested for complete protection against cervical cancer?"

Table 4 displays the frequency of the corrected answers about items related to the efficacy of the HPV vaccination in the intervention and control groups at baseline, after the lecture-based education and after one month. This table exposes that at baseline evaluation, there was no significant difference between both groups in all items. The assessment after the lecture-based education revealed that most of the intervention group (91.4%) compared to 17.2 % only in the control groupprovided correct answers about "How much cervical cancer protection provided by HPV vaccine?"; X^2 =426.194. However, after one month the highest correct answer frequency was given by the intervention group subjects (80.5% vs. 10.9 % in the control group; $p< 0.001$, X^2 = 374.059 for the item "Does HPV vaccine protect when given to a female already having HPV infection?"

Table 5 demonstrates that there was no significant difference between the average knowledge scores about HPV infection and its causal link with cervical cancer and knowledge scores about HPV vaccination among the intervention and control groups at baseline evaluation ($p= 0.183$, $p= 0.503$ respectively). However, the average knowledge scores about HPV infection and its causal link with cervical cancer and knowledge scores about HPV vaccination of the intervention group showed significant increase compared to insignificant change in the control group (4.84 ±1.74 vs. 1.08 ±0.52& 7.61 ±2.54 vs. 1.21 ±0.60respectively; $p< 0.001$) after the lecture-based education and (3.33 ±1.38 vs. 1.06 ±0.51& 6.93 ±2.31 vs.1.17 ±0.55respectively, $p<0.001$) in the intervention compared to control group after one month. **Figure 1** illustrates that difference in frequency of good knowledge among both groups was not significant at baseline evaluation, while after the lecture-based education and after one month the good knowledge scoressignificantly increased among the intervention group compared to the control group (75.5% and 75% vs. 15.6 and 15.9 % respectively; $p < 0.001$).

3.3 Participants' intention to receive the HPV vaccine pre and post the lecture-based education and main barriers impairing intervention and control groups to receive the vaccine

As shown in **Figures 2 a, b** theintention to receive HPV vaccination in the intervention group subjects and control group at baseline(43.0% vs. 44% respectively). However, a significant increase was noticed after lecture-based education in the intervention group compared to the control group (92.2% vs. 43.8%; $p<0.001$).On enquiring the respondent students of the intervention group about the main barriers impairing their intention on receiving the vaccine before education, low knowledge about the HPV vaccine was the highest barrier (50.3%). Depend on little self-risk for acquiring cervical cancer impaired vaccination of 30.5%, while 13.5% of students declared the cost of the vaccine as the main barrier against vaccination and minimal respondents (5.7%) reported that uncertainty about vaccine effectiveness weakened their intention to vaccinate. On the other hand, control group subjects indicated that little self-risk for acquiring cervical cancer was the highest barrier against vaccination (39%), followed by low knowledge about the HPV vaccine in 37% of the respondents, while uncertainty about effectiveness of the vaccine and its high cost was the least barriers (12.1% and 11.9% respectively). Differences between the two groups regarding barriers impairing their intention to vaccination were highly significant (X^2 =22.03 & $p < 0.001$).

Table 1. Demographic and educational characteristics of the intervention and control groups **(n= 768)**

Characteristics	Intervention group (n=384)		Control group (n=384)		Chi square test	
	n	%	n	%	X^2 or t-test	p
Age						
18 years	37	9.6	47	12.2	3.885	0.421
19 years	126	32.8	107	27.9		
20 years	114	29.8	108	28.1		
21 years	49	12.8	56	14.6		
22 years	58	15.1	66	17.2		
Mean ± SD	**19.9 ±1.2**		**20.0 ±1.4**		1.063*	0.288
Colleges						
Education	89	23.1	94	24.5	1.216	0.875
Nursing	85	22.1	83	21.6		
Commerce	80	20.8	69	18.0		
Law	72	18.7	77	20.1		
Literature	58	15.3	61	15.9		
Educational Grades						
First	59	15.4	64	16.7	1.529	0.676
Second	130	33.9	142	37.0		
Third	140	36.5	129	33.6		
Fourth	55	14.2	49	12.8		
Residence						
Rural	136	35.5	124	32.3	0.837	0.360
Urban	248	64.5	260	67.7		

** Student's t-test*

Table 2. Comparison of frequency of the corrected answers about items related to HPV infection and its causal link with cervical cancer in intervention and control groups at baseline and after the lecture-based education **(n= 768)**

Questions	Intervention group (n=384)		Control group (n=384)		Chi square test	
	n	%	n	%	X^2	p
What is the HPV infection?						
Prethe lecture	68	17.7	78	20.3	0.846	0.358
After the lecture	227	59.1	74	19.3	127.897	<0.001
After one month	157	40.9	72	18.8	43.504	<0.001
Chi square in each group, p value	138.728	[<0.001]	0.310	[0.856]		
What is the route of HPV infection transmission?						
Prethe lecture	58	15.1	70	18.2	1.350	0.245
After the lecture	243	63.3	69	18.0	193.829	<0.001
After one month	201	52.3	66	17.2	128.807	<0.001
Chi square in each group, p value	279.529	[<0.001]	0.154	[0.926]		
Which technique is helping in HPV infection detection?						
Prethe lecture	56	14.6	67	17.4	1.171	0.279
After the lecture	298	77.6	53	13.8	314.956	<0.001
After one month	213	55.5	49	12.8	190.552	<0.001
Chi square in each group, p value	314.098	[<0.001]	3.717	[0.156]		
What do you think is causing cervical cancer?						
Prethe lecture	49	12.8	61	15.9	1.528	0.216
After the lecture	287	74.7	59	15.4	273.428	<0.001
After one month	201	52.3	53	13.8	155.994	<0.001
Chi square in each group, p value	303.977	[<0.001]	0.754	[0.686]		
Having one type of HPV means one can't acquire new type?						
Prethe lecture	65	16.9	76	19.8	1.051	0.305
After the lecture	199	51.8	71	18.5	93.581	<0.001
After one month	206	53.7	70	18.2	104.608	<0.001
Chi square in each group, p value	136.16	[<0.001]	0.352	[0.839]		
Is it possible to be protected against cervical cancer by vaccine?						
Prethe lecture	98	25.5	91	23.7	0.344	0.558
After the lecture	304	79.2	89	23.2	163.377	<0.001
After one month	300	78.1	89	23.2	231.92	<0.001
Chi square in each group, p value	303.612	[<0.001]	0.039	[0.981]		

Table 3. Comparison of the frequency of the corrected answers about items related to HPV vaccination in the intervention and control groups at baseline and after education**(n= 768)**

Questions	Intervention group (n=384)		Control group (n=384)		Chi square test	
	n	%	n	%	X^2	p
Are you aware about the correct timing of receiving HPV vaccine?						
Prethe lecture	66	17.2	70	18.2	0.143	0.705
After the lecture	301	78.4	68	17.7	283.187	<0.001
After one month	268	69.8	64	16.7	220.799	<0.001
Chi square in each group, p value	340.791	[<0.001]	0.336	[0.845]		
What is the proper age for getting the HPV vaccine?						
Prethe lecture	49	12.8	38	9.9	1.568	0.201
After the lecture	312	81.3	38	9.9	394.111	<0.001
After one month	297	77.3	33	8.6	370.323	<0.001
Chi square in each group, p value	463.909	[<0.001]	0.507	0.776		
How many vaccine doses requested for complete protection against cervical cancer?						
Prethe lecture	67	17.5	78	20.3	1.029	0.310
After the lecture	327	85.2	76	19.8	328.936	<0.001
After one month	302	78.7	74	19.3	270.868	<0.001
Chi square in each group, p value	448.094	[<0.001]	0.131	[0.937]		
Which HPV vaccine is available in Egypt?						
Prethe lecture	33	8.6	36	9.4	0.143	0.705
After the lecture	333	86.7	36	9.4	460.124	<0.001
After one month	300	78.1	34	8.9	374.877	<0.001
Chi square in each group, p value	577.922	[<0.001]	0.083	[0.959]		
What is the dosage schedule of getting HPV bivalent vaccine?						
Prethe lecture	29	7.6	34	8.9	1.061	0.303
After the lecture	341	88.8	33	8.6	494.419	<0.001
After one month	299	77.9	30	7.8	384.774	<0.001
Chi square in each group, p value	613.236	[<0.001]	0.293	[0.864]		
What is the dosage schedule of getting HPV quadrivalent vaccine?						
Prethe lecture	31	8.1	32	8.3	0.017	0.896
After the lecture	337	87.8	32	8.3	485.246	<0.001
After one month	301	78.4	29	7.6	393.107	<0.001
Chi square in each group, p value	598.348	[<0.001]	0.211	[0.899]		

Table 4. Comparison of the frequency of the corrected answers about items related to the efficacy of the HPV vaccination in the intervention and control groups at baseline and after the lecture-based education**(n= 768)**

Questions	Intervention group (n=384)		Control group (n=384)		Chi square test	
	n	%	n	%	X^2	p
How much cervical cancer protection provided by the HPV vaccine?						
Prethe lecture	78	20.3	68	17.7	0.846	0.358
After the lecture	351	91.4	66	17.2	426.194	<0.001
After one month	307	80.0	65	16.9	305.319	<0.001
Chi square in each group, p value	482.848	[p<0.001]	0.085	[0.958]		
Does the HPV vaccine protect when given to a female already having HPV infection?						
Prethe lecture	57	14.8	44	11.5	1.927	0.165
After the lecture	321	83.6	44	11.5	400.611	<0.001
After one month	309	80.5	42	10.9	374.059	<0.001
Chi square in each group, p value	480.857	[p<0.001]	0.042	[0.979]		
Is screening necessary for HPV after receiving the vaccine?						
Prethe lecture	66	17.2	71	18.5	0.222	0.638
After the lecture	298	77.6	69	18.0	273.667	<0.001
After one month	278	72.4	63	16.4	243.812	<0.001
Chi square in each group, p value	348.914	[<0.001]	0.622	[0.733]		

Table 5. Knowledge scores about HPV infection, its causal link with cervical cancer and knowledge scores about HPV vaccination **(n= 768)**

Scores	Intervention group (n=384)	Control group (n=384)	Student's t test	
	Mean ±SD	Mean ±SD	t	p
Knowledge score about HPV infection and causal link with cervical cancer				
Prethe lecture	1.11 ±0.53	1.09 ±0.51	0.533	0.594
After the lecture	4.84 ±1.74	1.08 ±0.52	40.572	<0.001
After one month	3.33 ±1.38	1.06 ±0.51	30.235	<0.001
Repeated measure ANOVA: F, [p]	777.937 [<0.001]	0.340 [0.712]		
Knowledge score about HPV vaccination				
Pre the lecture	1.24 ±0.61	1.23 ±0.61	0.227	0.820
After the lecture	7.61 ±2.54	1.21 ±0.60	48.053	<0.001
After one month	6.93 ±2.31	1.17 ±0.55	47.534	<0.001
Repeated measure ANOVA: F, [p]	1159.210 [<0.001]	1.373 [0.254]		

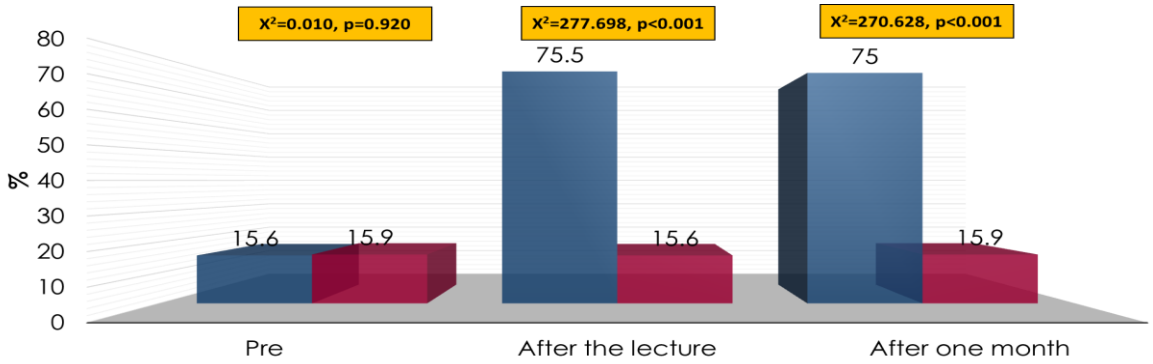


Figure 1. Comparison of the frequency of the good knowledge scores between the intervention and control group at baseline, after the lecture-based education, and after one month (Good score refers to scores > 65%)

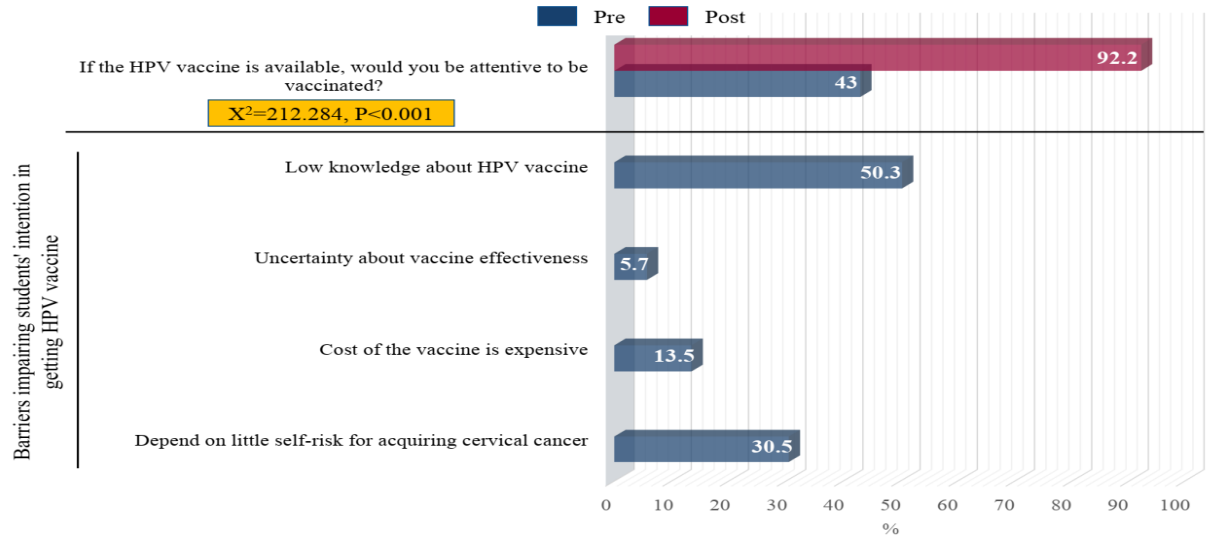


Figure 2a. The intention of the intervention group subjects to vaccination and the barriers impairing their intention to get the vaccine prior education

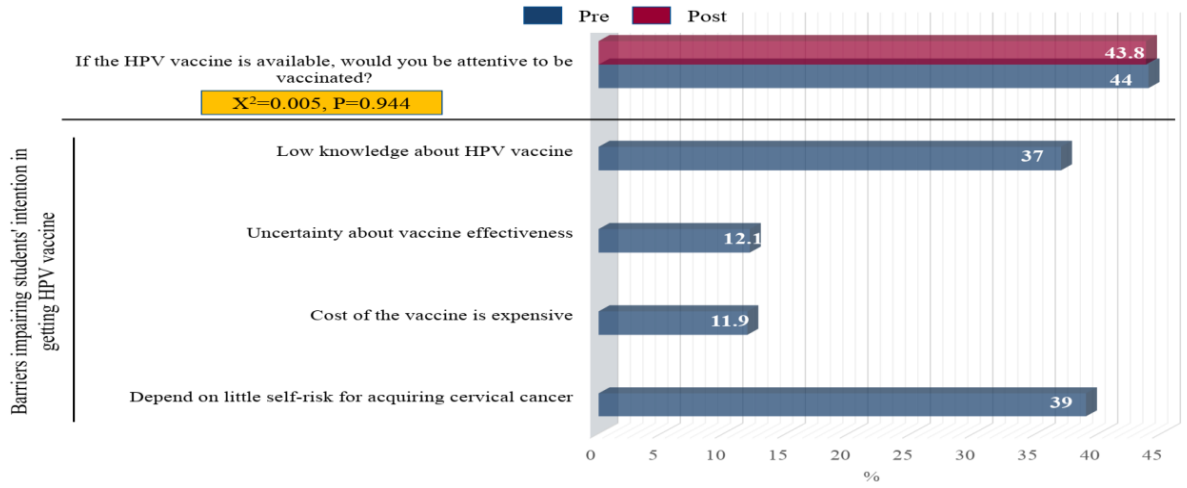


Figure 2b. The intention of the control group subjects to vaccination and the barriers impairing their intention to get the vaccine prior education

IV. DISCUSSION

This study aimed to evaluate the effect of a lecture-based education on female undergraduates' knowledge and acceptance of the human papillomavirus vaccine. From the present study results, this aim seems to be realized. Results showed a significant increase in students' knowledge scores about the HPV infection and vaccination among the intervention group subjects compared to those in the control group. Hence, the 1st study hypothesis "Female students who attend a lecture-based education about HPV vaccination record higher knowledge scores compared to those who do not attend" was accepted.

Female undergraduates of thepresent study recorded lowknowledge scores about HPV infection and HPV vaccine at baseline assessment. This finding supportsevidence of amulticenterobservational study involved443 **Egyptian** women ≥ 18 years of age, whichdemonstrated that only 33.2% of the studied sample had information related to the HPV infection [20].In consonance, arecent systematic reviewinvolved eighteen research studies from nine Arab states of the **Middle East** and **North Africa** region foundlow to moderate HPV infection knowledge and HPV vaccine awarenessin nine studies[24]. Sucha systematic review found HPV infection knowledge was 20.0% in adolescents and varied between 31.0% and 65.0% in adult women [24].

Providing girls with adequate knowledge about causal risk factors for cervical cancer and HPV infection before sexual debut can help in protection from HPV infection and other types of sexually transmitted infections. After introducing a lecture-based education, awareness about the HPV infection was significantly raised among subjects of the intervention group compared to their mates in the control group. Meanwhile, among intervention group subjects, theslight reduction was observed at aone-month follow-up evaluation compared to post lecture evaluation but still higher than baseline evaluation. Likewise,**Malaysian** intervention study; involved 580 students of 18-25 years age-old, noted an increase in the incidence of students with good knowledge from 8.8% to 25.5% after introduction of information about HPV infection and its prevention and a reduction in the incidence of students with poor knowledge about HPV infection and vaccination from 48.3% to 29.3% among the education group compared to non-significant difference among the control group[22]. Moreover, the same **Malaysian**study noted a significant improvement inthe incidence of education group students knowaboutthe causal association between HPV infection and cervical cancer from 57.9% at baseline to 82.8% post-educationcompared to their mates in the control group [22].

Parallel, a significant increase was noted in mean knowledge score; from 12.94 prior education to 53.74 post-education, in a **Nigerian** study evaluated the effect of education on female adolescent students' knowledge about HPV infection and protection from cervical cancer [25]. In that study, a group of students was educated about cervical cancer and HPV infection, then delivered the received messages using fliers containing key information to their school mates. Before education, most of the respondent students were not aware that HPV could cause cervical cancer, had lower knowledge about the contributing risk factors for acquisition of HPV and cervical cancer and depreciate susceptibility of all sexually active females. However, most of the misconceptions and lack of knowledge were corrected after education [25].

The resemblance between the current study and previous studies findings for improvement of respondents' knowledge after education compared to pre-education, may be explained by similarities in educational material, selecting similar age groups, selecting sample interested with the studied topic. However, the slight reduction at one month compared to post lecture may be related to that the students forget the received information. Such evidence may spotlight the importance of integrating such topics in the sexual health curriculum. Contrariwise, Lee and coauthors [26] noted that 95.9% of young girls were aware of the presence of cervical cancer and its related issues in a previous noninterventionstudy in **Hong Kong**. The difference between Lee's result and that of the current study could be explained by the difference in cultures and the availability of the primary health care facilities to each population.

Researchers of the current study evaluated the students' acceptance or attitude towards receiving the HPV vaccine pre and post the lecture-based education among subjects of both intervention and control groups. Pre-education findings revealed that more than half of the respondent undergraduatesof both groups reported unwillingness to receive the HPV vaccine. On enquiring about barriers to vaccination, respondents stated that lacking knowledge about the HPV vaccine, doubt about its efficacy, and high cost of the vaccine were the main barriers to vaccination among both groups. In concordance, a **Canadian** cross-sectional web-based survey assessed views of 401 university students about HPV vaccination and highlighted some barriers led to delay in HPV vaccine receiving [27]. Such barriers revolved around knowledge deficiency, possible side effects, and higher cost of the vaccine. Despite that 48.3% of the same sample stated their intent to receive the HPV vaccine someday in the future.

The post-test reports indicated that lecture-based education raised the positive attitude of the interventiongroup subjects to HPV vaccination; from 43% at pre-intervention to 92.2 % at post-intervention evaluation, compared to the non-significant difference in control group subjects. Thus, the 2nd study hypothesis "Female students who attend a lecture-based education about HPV vaccination report higher acceptance rate to be vaccinated compared to those who do not attend" was accepted. A similar finding was given in an earlier multi-center study included 557 undergraduate students recruited from six **Chinese** universities; where students showed a significant increase in vaccine acceptability from 72.7% to 81.9% post informative group lecture [28]. This finding is of a particular significance since a study in **Japan** highlighted that increased vaccine acceptability could be achieved by emphasizing on vaccine safety and cost through education methods [29]. Such enhancement of the students' willingness to vaccination may be attributed to that the lecture-based education closed the knowledge gap about the importance of HPV vaccination, highlighted the causal relationship between HPV infection and cancer cervix, as well it put emphasize to vaccine effectiveness and safety. Therefore, it raised acceptance and willingness to vaccination. Since the HPV vaccine had been evident as primary prevention against cervical cancer, this finding highlights that the Ministry of Health needs to keenly integrate the HPV vaccine within the national vaccination program and recommend its provision routinely at 11-12 years old.

Strengths and limitations of this study

Proper selection of the target group, undergraduate students aged 18 years or above, was counted as a strength of this study. Because this is the age preceding the marriage event and starting sexual activity, a high-risk factor for HPV infection. However, adopting a lecture-based education style may be a limitation in this study. Introducing the lecture during schedule free times may limit other students' enthusiasm or keen to take part in the study. So, using a web-based model of education may be useful in a future study. Since educational content isavailable for a longer time and the students may found an opportunity to get it in a suitable time.

V. CONCLUSION AND RECOMENDATIONS

Depending on current study findings, tested hypotheses were accepted. There was a significant improvement in students' knowledge about and acceptance of HPV vaccination among the intervention group compared to the control group. Hence, the following can be recommended:

1. As a nursing implication, it is important to publicize important HPV- related issued; the causal association between HPV infection and cancer cervix, the proper time for vaccine initiation, and highlight the importance of vaccination to susceptible groups. As well, it is imperious to correct misbeliefs around the HPV vaccine; like women need to be vaccinated are only those with multiple sexual partners. Thus, increase knowledge about vaccine and increase vaccine interest.
2. A follow-up study can be suggested to determine vaccination uptake incidence; to conclude whether the provided knowledge translates into higher rates of vaccination.

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