TITLE PAGE

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Targeting cervical cancer campaigns on teenage high-schoolers in resource-limited economies: lessons from an intervention study of Nigerian senior secondary school girls.

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KEY MESSAGES

- Different cervical cancer education techniques are equally effective
- Engagement is key for sustainable teenage campaign successes
- Without engagement, high school campaigns may not be sustained
- Engagement can be achieved through in-built assessments and repeated teachings

ABSTRACT

Background:

Given the dearth of government-sponsored programs, preventive lifestyles and practices are the realistic hopes for millions of women in developing countries against cervical cancer. Early interventions for teenage high school girls have been advocated recently, but evidence-base for sustainable activities at this demographic is lacking. This paper reduces this gap by determining the impact of two cervical cancer education techniques.

Method:

A six-month interventional cohort study of 432 female high school students in South-eastern Nigeria.

Results:

A total of 317 (73.4%) and 301 (69.7%) valid responses were received from the pre-intervention (16.8±1.5 years) and post-intervention (17.2±1.6 years) surveys respectively. About 213 (70.8%) were fully engaged with the interventions.

Logistics regression revealed that participants who were "engaged" with the interventions, either through symposium attendance or by reading of the printed handouts, showed significant improvements across multiple cervical cancer parameters regarding knowledge on 'pap smears' (analyzed with 4 items), 'HPV vaccine' (2 items), and 'risk factors' (2 items). Improvements in Knowledge of 'early symptoms' were not improved, with "post-coital bleeding" (OR=0.95; P=0.87) and "being asymptomatic" (OR=0.69; P=0.32) remaining statistically similar between the engaged and the unengaged.

If "engagement" with either intervention was disregarded, a chi-squared analysis identified no significant improvement in knowledge on any parameter.

Conclusion:

Ensuring "engagement" with intervention campaigns is vital to achieving effective and sustainable cervical cancer knowledge. Engagement may be achieved by repeating the education activities across all the years/classes that make up high school in each developing country, along with formal examinations at each level.

Key words: Cervical cancer; high school; intervention; knowledge; secondary school; teenage women.

INTRODUCTION

Cervical cancer realities for women in developing countries are worrying. Even though it is the fourth commonest malignancy worldwide,[1] it still ranks second among women aged 15 to 44 years in developing countries.[2] Patients from these areas accounted for 445,000 (84%) of all new cases reported in 2012, as well as 85% of the 270,000 associated deaths.[1] Data reveals that the respective cervical cancer incidence rates (per 100,000 women per year) in Africa and the developed countries were 33.7 and 15.7, with mortality rates of 24.0 and 7.8 respectively.[3]

This disproportionate burden in developing countries is typified by facts from Nigeria, a quintessential developing country with 50.3 million of her women at risk.[2] About 8,240 of 14,089 Nigerian women diagnosed with the cancer annually, die,[2] and projections suggest that, by the year 2025, these deaths will rise by 63% and 50% respectively for those aged "≤65" and ">65" years.[3]

Fortunately, preventive programs in the form of screening exercises and vaccinations are of proven efficacy against cervical cancer.[3, 4] Rather disappointingly though, government sponsorship of such programs in developing countries are either poor or non-existent.[1, 5-7] The implication is that direct empowerment of women, through health campaigns, appear to be the only affordable intervention approach in these countries. Such campaigns can improve knowledge and preventive practices.[8-10] They also improve perceptions, [11, 12] screening uptakes,[11, 13-15] and the adoption of positive behaviours among those affected.[16]

A recent paper[17] suggested that health campaigns in developing countries should be targeted at young, senior secondary (high) school students, who are predominantly in their mid-to-late teens. Arguably, this suggestion is justified because, in a country like Nigeria, 15.6% of 16-year-old girls are already sexually exposed,[2] while 51.7% of university undergraduates become sexually active before they turn 20.[18] These imply that the risk of contracting HPV is rife among teenagers,[1] and, given that lack of awareness is a barrier to adopting preventive measures,[13] empowering women early becomes vital in these developing countries. In view of the foregoing suggestion, the need arises to ensure that intervention programs designed for high

schools are effective, sustainable, and would have long-lasting impacts. Unfortunately, such research on cervical cancer campaigns on high schoolers is almost non-existent. In addition to bridging this knowledge-gap, it is hoped that findings from this paper will help identify suitable intervention tools that can help reduce costs, optimize resources, and provide useful insights into for similar interventions on other non-communicable diseases (NCDs) in resource-limited economies.

Using two common education delivery techniques, which are the traditional, face-to-face lectures (with or without video and electronic teaching aids) and the use of printed handouts, our work aims to primarily determine the six-month post-intervention impact of cervical cancer education campaign among high school females. A secondary aim is to explore the potential impact of being "engaged" with one or both of the intervention techniques, relative to "not being engaged".

METHODS

Setting, Participants, Inclusion Criteria and Recruitment

The participants included female, final-year, senior secondary school students in all the government-owned schools within the Otuocha Post Primary Schools Service Commission (PPSSC) Educational Zone of Anambra State, Nigeria. Twenty-four schools with 432 participants were eligible.

Anambra is one of Nigeria's 36 states, with a projected 2016 population of 5,527,800.[19]The Otuocha PPSSC is one of the six educational zones in the State,[20] and covers three of its 21 Local Government Areas (LGAs).[19] Each school is headed by a principal, and all the principals in a particular zone report to a Zonal Director.

The participants were recruited through a written letter to the participating school principals, the students and their parents. The delivery was through the relevant state agencies and the responsible Zonal Director.

Study design and Intervention

This is a six-month longitudinal cohort study, involving pre and post-intervention surveys. A pre-intervention randomization divided the participants into the two groups of: "attend symposium" and "not attend

symposium". The randomization was achieved through a balloting process, which allowed students to randomly pick a paper from a pool containing “yes” or “no” options. Each school had a total number of ballot papers equal to the number of their eligible students. Half of the ballot papers for each school were marked “yes”, and the other half, “no”. Students who picked “yes”, attended the symposium, while the others did not.

The intervention symposium was a 2-hour event which included a 45-minute PowerPoint-assisted lecture, followed by a 21-minute video on breast self-examination (BSE). To ensure uniformity, the handouts (Supplementary Data 1 or SD-1) contained essentially the same information as those delivered during the lecture, and were distributed to all 432 eligible students from the first working day after the symposium.

The Questionnaire: design, despatch, and return

The Pre-intervention Questionnaire (Supplementary Data 2 or SD-2) was adapted from previous studies,[21-24] and then piloted with 20 students in the same class as the targeted participants who attend schools in a different educational zone. The post-intervention questionnaire survey (Supplementary Data 3 or SD-3), was similar to SD-2, with only a few modifications included to reflect its post-intervention status.

Each of the questionnaires had four 4 parts. Part 1 contained the Introduction, Participant Information, and Consent, while Part 2 collected the basic respondent demographics and/or their modes of engagement with the Intervention. Part 3 focused on Breast Cancers (not covered in this paper), while Part 4 covered Cervical Cancers. To reduce speculative responses, some questions in Parts 3 and 4 were worded negatively, while others were positive. However, only the positively-worded ones were analysed because an earlier but related paper[17] showed that these were representative of the participants’ views.

The pre-study questionnaires were dispatched on September 18^{th,} 2017, and returned within one week (ahead of the intervention symposium on September 29th, 2017). The post-study questionnaires were dispatched on the 26th of March 2018, six months post-intervention. All dispatches and returns were through the Zonal Director and the various school principals. Where return was not possible within one week, the

questionnaires were rejected, so as to avoid influencing the responses after the symposium (pre-intervention survey), or to keep within the six-month time frame (post-intervention survey).

Data Analysis

All analysis was with the IBM® SPSS version 25.0. Where necessary, the Paired Samples T-test was used to compare the Means. To answer the primary research question, a Chi-squared (χ^2) analysis was used, with the Null Hypothesis bring that, "six months after a cervical cancer intervention symposium, there would be no improvement in the knowledge among participants who attended, compared to those who did not". This hypothesis was to be rejected if the significance level was ≤0.05. This part of the analysis adopted the "intention to treat" principle[25], which allowed each group to be analyzed based on the original intention at randomization (i.e., "attend symposium" and "not attend symposium").

The study's secondary aim was explored using logistics regression. "Engagement" with one or both of the intervention techniques (either as "attendees" to the symposium or by "reading the handouts") was analyzed against "not being engaged". For the regression analysis, all questions with options of "Yes/Agree", "Not Sure/Unsure" and "No/Disagree" were dichotomized into "correct" for the right ones, or "incorrect" for the "wrong and not sure/unsure" responses. The two independent (predictor) variables required for the analysis were "attendance to the symposium" and the "reading of handouts", while the dependent (outcome) variables included the responses ("Correct" versus "Incorrect") to the Knowledge on Pap Smears, HPV vaccines, the Risk Factors, and the Early Symptoms of cervical cancer.

RESULTS

BASIC SUMMARY (Table 1)

A total of 317 (73.4%) and 301 (69.7%) valid responses were received from the pre-intervention and post-intervention surveys respectively. A Paired Samples T-test showed a significant difference in the mean ages for the Pre-intervention (16.8±1.5) and Post-intervention (17.2±1.6) groups; t (296) = 2.835, p=0.01.

Of the 301 post-intervention respondents, 133 (44.2%) attended the symposium, while a total of 189 (62.8%) read the handouts (including some who did not attend the symposium). The total number of participants who were engaged with one or the other of the interventions (i.e., either by attending the symposium or through reading the handout) was 213 (70.8%). The remaining 88 (29.2%) were not engaged at all.

IMPACT OF THE INTERVENTIONS

A. Knowledge of Pap smears and HPV (Table 2)

As shown in Table 2A, no aspect of the participants' post-intervention knowledge regarding Pap Smears was significantly increased. These include Knowledge that it "can detect cervical cancer" (p=0.19), that it is "for sexually active girls aged ≥18 years" (p=0.53), and that it should be commenced "after 2 years of sexual debut" (p= 0.67) and repeated "two-yearly" (p= 0.46). Changes in Knowledge on HPV Vaccines (Table 2B) followed similar trends as for pap smears.

B. **Knowledge of Cervical Cancer Risk Factors and Early Symptoms (Tables 3)**

Mixed findings were observed for knowledge on both the Risk Factors and Early Symptoms. Table 3A shows that knowledge that "early onset of unprotected sexual activity" is a risk factor, increased by 15.1% (p<0.001), but the +4.9% increase for "multiple sexual partners" lacked significance (p=0.23).

Similarly, as shown in Table 3B, the knowledge that "bleeding after sexual encounter" can be an early symptom increased by 8.1% (p= 0.02), while the fact that "there may be no symptoms" remained virtually unchanged (+0.2%; p= 0.93);

COMPARISON OF "ENGAGED" AND "UNENGAGED" PARTICIPANTS

These are all shown in Table 4. Apart from "Knowledge of Early Symptoms", being engaged with the interventions was significantly associated with increased knowledge on Pap Smears, HPV Vaccine, and Risk Factors. Knowing that Pap Smears "can help detect cervical cervix" (OR = 3.46; p<0.001), that it "can be repeated every two years" (OR = 3.66; p<0.001), and that it is "for women aged ≥18 years" (OR = 2.73; p=0.002) or "for women after 2 years of sexual debut" (OR = 8.98; p=0.003), were all significantly raised.

With HPV vaccines, the attendees were also more likely to know that "vaccines can be preventive" (OR = 3.35; p<0.001) and that "it is best administered before sexual debut" (OR = 2.53; p=0.003). Knowledge of Risk

Factors followed a similar trend, with attendees being twice more likely to remember that "early age of sexual debut" (OR = 2.05; p=0.01) and "multiple sexual partners" (OR = 1.74; p=0.05) were risk factors.

No statistical differences were observed regarding Knowledge of the Early Symptoms, as evidenced by findings on "bleeding post intercourse" (OR = 0.95; P=0.87) and "having no symptoms" (OR = 0.69; P=0.32).

DISCUSSION

The statistically significant difference in the means of ages between the pre-intervention (16.8±1.5 years) and post-intervention (17.2+/-1.6 years) groups confirms the age increase expected from a survey of the same individuals taken half a year apart. This is expected from a longitudinal study such as ours, and lend some credence to the authenticity of our data.

A comparison of the post-intervention group to the pre-intervention group (Table 2) reveal that, six months after the intervention, knowledge regarding Pap Smears (assessed through four different items) and HPV (two items) were statistically unchanged. These would appear to imply that any impact from the intervention was not sustained six months after they were carried out. This observation was partly replicated with respect to the Knowledge on the Risk Factors and Early Symptoms, where only one of the two items assessed remained significantly improved after six months (Table 3). Unfortunately, this study did not conduct an immediate post-intervention survey, which would have helped ascertain if any knowledge gained in the immediate aftermath of the intervention, wore off after six months.

Findings from the comparison between "engaged" and "unengaged" participants (Table 4) were very revealing. Those who were "engaged" either as attendees or handout-readers showed significant improvements in Knowledge across all parameters (Pap Smears, HPV vaccines, and Risk Factors) except on "early symptoms". These findings seem to suggest that being "engaged" with a cervical cancer intervention technique was necessary to ensure significantly sustained knowledge after six months. It is not clear though,

why knowledge on the early symptoms was not improved accordingly, but a future study may be needed to further evaluate this.

Put together, the foregoing findings imply that ensuring that participants are engaged with health promotion activities is the main way to retain the lessons of such interventions in the medium (six months) term at least. As such, we recommend that, for high school students, any intervention program introduced into their curriculum should have a built-in assessment (examination and quizzes) system in place, so as to ensure this engagement. Repeating the teachings may also be another way to ensure long term sustenance of the learned knowledge, given that repeated education is known to help transform learned behaviours into habits.[26, 27]

Comparisons to existing studies were not entirely feasible, as no previous study we identified has ever adopted our approach, which allowed for comparisons between “engaged” and “non-engaged” high school participants. However, multiple studies [11-13, 16, 28-30] have variously reported that anti-cervical cancer campaigns were effective in increasing knowledge. While these reports broadly agreed with our secondary analysis that evaluated the engaged-only post-intervention participants, they were not consistent with the findings of our primary analysis, which compared the pre-intervention participants to all the post-intervention participants (irrespective of whether they were engaged or not). It should be noted, though, that none of the cited studies was among high school students. Ours appears to be the first to do this.

The younger age of our participants (mean ages in the mid-teens) compared to those in all the other studies might also be responsible for the non-increase in knowledge in our undifferentiated analysis, given that our cohort may still be relatively immature, have limited exposure, and are yet to fully comprehend the realities of cervical cancer. This might have affected the level of seriousness with which they approached the cancer education. Arguably, the older participants in the cited studies (with mean ages of approximately 48[11], 33[12], 34,[28] and 37[30] years) have more exposures, given that most have either postgraduate education or are mothers already. They are therefore more likely to fully comprehend the need for such education, leading to sustained retention of their acquired knowledge. While this line of argument makes a case for

health campaigners to wait till the women are older, such a delay means that things might already be too late for most of the girls, as over half of them are likely to have been sexually exposed before the aged of 20 years.[2]

Study strength and limitation

This paper's ability to analyse "engagement" by exploring participants in the post-intervention group alone, is considered a major strength, as it allowed key characteristics to be identified. However, its inability to collect data immediately after the intervention, posed a limitation which did not allow the study to assess how the immediate impact of the intervention might have changed over time.

Conclusions and Recommendations

Knowledge gained from cervical cancer awareness campaigns can be effective and sustainable among high school girls only if their engagement with the activities is ensured. If such engagement is not guaranteed, such activities among them may be futile.

To ensure engagement and long-term sustenance, we recommend that any cervical cancer intervention program introduced into their curriculum of senior secondary (high) schools should have an in-built formal assessment system, with the teachings preferably repeated across multiple classes for each cohort.

Ethics: Ethical clearance was obtained from the Griffith University Human Research Ethics Committee *(GU Ref No: 2017/458).* The Participant Information Sheet (Pages one of SD-2 and SD-3) made clear that participation was voluntary, and that Consent was implied with procession to questionnaire-completion. As explained in the methods, permissions were also obtained during the recruitment of the participants.

Funding: No external source of funding was received.

Conflicts of interest: Both authors of this work were the respective founders two different charity foundations involved in delivering the health education on cervical cancer to female secondary students in the Otuocha Educational Zone of Anambra State, Nigeria, who were the participants in this study.

REFERENCES

1. World Health Organization. *Human papillomavirus (HPV) and cervical cancer*. WHO 2016 2016-06-03 [cited 2018 January 6th]; Available from: http://www.who.int/mediacentre/factsheets/fs380/en/.
2. World Health Organization/HPV Information Centre. *Nigeria: Human Papillomavirus and Related Cancers, Fact Sheet 2017* 2017 July 2017 [cited 2018 January 7th]; Available from: http://www.hpvcentre.net/statistics/reports/NGA_FS.pdf.
3. Ukpo, T.M.O., *Nigerian Women's Knowledge and Awareness of Cervical Cancer*. 2013, ProQuest Dissertations Publishing, Walden University, Minneapolis: Walden University, Minneapolis.
4. Rashid, S., S. Labani, and B.C. Das, *Knowledge, Awareness and Attitude on HPV, HPV Vaccine and Cervical Cancer among the College Students in India.* PLOS ONE, 2016. **11**(11): p. e0166713.
5. Ombech, E.A., A. Muigai, and P. Wanzala, *Awareness of cervical cancer risk factors and practice of Pap smear testing among female primary school teachers in Kasarani division, Nairobi Kenya.* African Journal of Health Sciences, 2012. **21**(2): p. 121-132.
6. Isara, A. and C. Ojedokun, *Knowledge of breast cancer and practice of breast self examination among female senior secondary school students in Abuja, Nigeria.* Journal of preventive medicine and hygiene, 2011. **52**(4).
7. Oluwatosin, O.A., *Assessment of women's risk factors for breast cancer and predictors of the practice of breast examination in two rural areas near Ibadan, Nigeria.* Cancer epidemiology, 2010. **34**(4): p. 425-428.
8. Anyanwu, S., *Breast cancer in eastern Nigeria: a ten year review.* West African journal of medicine, 1999. **19**(2): p. 120-125.
9. Newman, L.A. and A.E. Alfonso, *Age-related differences in breast cancer stage at diagnosis between black and white patients in an urban community hospital.* Annals of surgical oncology, 1997. **4**(8): p. 655-662.
10. Suh, M.A.B., et al., *Breast self-examination and breast cancer awareness in women in developing countries: a survey of women in Buea, Cameroon.* BMC research notes, 2012. **5**(1): p. 627.
11. Mbachu, C., C. Dim, and U. Ezeoke, *Effects of peer health education on perception and practice of screening for cervical cancer among urban residential women in south-east Nigeria: a before and after study.* BMC WOMENS HEALTH, 2017. **17**: p. 41.
12. Rosser, J.I., B. Njoroge, and M.J. Huchko, *Changing knowledge, attitudes, and behaviors regarding cervical cancer screening: The effects of an educational intervention in rural Kenya.* Patient education and counseling, 2015. **98**(7): p. 884-889.
13. Abiodun, O.A., et al., *Impact of health education intervention on knowledge and perception of cervical cancer and cervical screening uptake among adult women in rural communities in Nigeria.* BMC public health, 2014. **14**(1): p. 814.
14. Shakya, S., et al., *Community-Based Health Education has Positive Influence on the Attitude to Cervical Cancer Screening among Women in Rural Nepal.* Journal of Cancer Education, 2016. **31**(3): p. 547-553.
15. Chigbu, C.O., et al., *The impact of community health educators on uptake of cervical and breast cancer prevention services in Nigeria.* International Journal of Gynecology & Obstetrics, 2017. **137**(3): p. 319-324.
16. Coronado Interis, E., et al., *Increasing cervical cancer awareness and screening in Jamaica: Effectiveness of a theory-based educational intervention.* International journal of environmental research and public health, 2015. **13**(1): p. 53.
17. Ifediora, C. and E. Azuike, *Knowledge and attitudes about cervical cancer and its prevention among female secondary school students in Nigeria.* Tropical Medicine & International Health, 2018.
18. Ayinde, O., A. Omigbodun, and A. Ilesanmi, *Awareness of cervical cancer, Papanicolaou's smear and its utilisation among female undergraduates in Ibadan.* African Journal of Reproductive Health, 2004: p. 68-80.

19. National Population Commission of Nigeria. *Anambra (State, Nigeria) - Population Statistics, Charts, Map and Location*. 2017 [cited 2017 30th Novemner]; Available from: http://www.citypopulation.info/php/nigeria-admin.php?adm1id=NGA004.
20. Government of Anambra State, N. *PPSSC OTUOCHA ZONE | ADMIN PAGE*. 2017 2012 [cited 2017 30th November]; Available from: http://ppsscotuochazone.com/other_zones.php.
21. Segni, M., et al., *Breast self-examination: knowledge, attitude, and practice among female health science students at Adama Science and Technology University, Ethiopia.* Gynecol Obstet (Sunnyvale), 2016. **6**(368).
22. Omoyeni, O.M., et al., *Assessment of the Knowledge and Practice of Breast Self Examination among Female Cleaners in Obafemi Awolowo University Ile Ife, Nigeria.* International Journal of Caring Sciences, 2014. **7**(1): p. 239.
23. Irurhe, N., et al., *Knowledge and awareness of breast cancer among female secondary school students in Nigeria.* Academic Journal of Cancer Research, 2012. **5**(1): p. 01-05.
24. Doshi, D., et al., *Breast self-examination: knowledge, attitude, and practice among female dental students in Hyderabad City, India.* Indian journal of palliative care, 2012. **18**(1): p. 68.
25. Gupta, S.K., *Intention-to-treat concept: a review.* Perspectives in clinical research, 2011. **2**(3): p. 109.
26. Lally, P., et al., *How are habits formed: Modelling habit formation in the real world.* European journal of social psychology, 2010. **40**(6): p. 998-1009.
27. Lally, P. and B. Gardner, *Promoting habit formation.* Health Psychology Review, 2013. **7**(sup1): p. S137-S158.
28. Wright, K.O., Y. Kuyinu, and F. Faduyile, *Community education on cervical cancer amongst market women in an urban area of Lagos, Nigeria.* Asian Pac J Cancer Prev, 2010. **11**(1): p. 137-140.
29. Sossauer, G., et al., *Impact of an educational intervention on women's knowledge and acceptability of human papillomavirus self-sampling: a randomized controlled trial in Cameroon.* PloS one, 2014. **9**(10): p. e109788.
30. Rezaei, M.B., S. Seydi, and S.M. Alizadeh, *Effects of 2 educational methods on the knowledge, attitude, and practice of women high school teachers in prevention of cervical cancer.* Cancer nursing, 2004. **27**(5): p. 364-369.

Table 1: Demographics and characteristics of female high school students in Otuocha Educational Zone of Anambra State, Nigeria

A. Summary of Pre-Intervention and Post-Intervention Groups			
S/N	**Respondent Variable**	**Pre-Intervention (n=317)**	**Post-Intervention (n=301)**
1	Age Groups (Years) <15 15-19 ≥20	 9 (2.8%) 298 (94.0%) 10 (3.2%)	 9 (3.0%) 279 (91.5%) 13 (4.3%)
2	Age Means (Years)	16.8 ± 1.5	17.2 ± 1.6 ***Paired Samples T-Test*** 2.835 (df = 296) (-0.639 to -0.115) *p-value = 0.005**
3	Mode	17	17
4	Median	17.00	17.00
5	Standard Deviation	1.457	1.596
6	Range Years	12 (13-25)	13 (12-25)
B. Engagement with Intervention: Post-Intervention Group only (n=301)			
1	Total number engaged with the interventions (i.e., either attended the symposium or read the handout)	213 (70.8%)	
2	Number not engaged at all with any of the interventions	88 (29.2%)	
3	Number which attended health symposium (some might have also read the handout)	133 (44.2%)	
4	Number which read handout at all (some might have also attended symposium)	189 (62.8%)	
C. **Other exclusive participant data**			
1	Number which attended symposium exclusively, but did not read Handout	21	
2	Number which exclusively read handout without attending symposium	80	

Table 2: Chi-squared analysis of Knowledge on aspects of cervical cancer following awareness intervention among female high school students in South-eastern Nigeria

S/N	Questions	Pre-intervention Responses (Part 3 of Questionnaire, SD-1)			Post-intervention Responses (Part 3 of Questionnaire, SD-2)			Change after Intervention	Chi-squared statistic (df)	p-value
		Correct [A] (%)	Incorrect or Unsure (%)	Total (%)	Correct [B] (%)	Incorrect or Unsure (%)	Total (%)	[B] – [A]		
A	**Knowledge on Pap Smears** *(Part 4: Question 6 in both Supplementary Data, SD, 1 and 2)*									
	Pap smears can detect cervical cancer	*134 (43.1)*	*177 (56.9)*	*311 (100.0)*	*146 (48.3)*	*156 (51.7)*	*302 (100.0)*	*+5.2%*	1.707 *(1)*	0.19
	Pap smear is advisable for girls aged ≥18 years who are sexually active	*90 (29.3)*	*217 (70.7)*	*307 (100.0)*	*95 (31.7)*	*205 (68.3)*	*300 (100.0)*	*+2.4%*	0.396 *(1)*	*0.53*
	Pap smear is advised for all women >2 years after onset of intercourse	*44 (14.4)*	*262 (85.6)*	*306 (100.0)*	*39 (13.2)*	*257 (86.8)*	*296 (100.0)*	*-1.2%*	0.183 (1)	0.67
	Eligible women should have Pap smears at least every 2 years	*80 (26.4)*	*223 (73.6)*	*303 (100.0)*	*87 (29.1)*	*212 (70.9)*	*299 (100.0)*	*+2.7%*	0.545 (1)	0.46
B	**Knowledge on Human Papilloma Vaccine, HPV** *(Part 4: Question 6 in both Supplementary Data, SD, 1 and 2)*									
	HPV Vaccine can prevent cervical cancer	109 (35.9)	195 (64.1)	304 (100.0)	115 (38.3)	185 (61.7)	300 (100.0)	+2.4%	0.397 (1)	0.53
	HPV Vaccine should be given before the onset of sexual activity	102 (33.6)	202 (66.4)	304 (100.0)	96 (32.0)	204 (68.0)	300 (100.0)	-1.6%	0.165 (1)	0.68

**Statistically significant; DF = Degree of Freedom*

***NB**: Only positively worded questions in the two sets of Questionnaires (Part 3 of Supplementary Data or SD 1 and 2) were included in the analysis.*

Table 3: Chi-squared analysis of Knowledge on risk factors and early symptoms of cervical cancer following awareness intervention among female high school students in South-eastern Nigeria

S/N	Questions	Pre-intervention Responses (Part 3 of Questionnaire, SD-1)			Post-intervention Responses (Part 3 of Questionnaire, SD-2)			Change after Intervention	Chi-squared statistic (df)	p-value
		Correct [A] (%)	Incorrect or Unsure (%)	Total (%)	Correct [B] (%)	Incorrect or Unsure (%)	Total (%)	[B] – [A]		
A	**Knowledge on Cervical Cancer Risk Factors** *(Part 4: Question 7 in both Supplementary Data, SD, 1 and 2)*									
	Early onset of unprotected sexual activities	*94 (30.6)*	*213 (69.4)*	*307 (100.0)*	*138 (45.7)*	*164 (54.3)*	*302 (100.0)*	*+15.1%*	14.673 *(1)*	0.000*
	Having multiple sexual partners	*107 (35.2)*	*197 (64.8)*	*304 (100.0)*	*118 (40.0)*	*177 (60.0)*	*295 (100.0)*	*+4.9%*	1.472 *(1)*	0.23
B	**Knowledge on Cervical Cancer Early Symptoms** *(Part 4: Question 8 in both Supplementary Data, SD, 1 and 2)*									
	Bleeding after sexual encounter	66 (20.9)	250 (79.1)	316 (100.0)	88 (29.0)	215 (71.0)	303 (100.0)	+8.1%	5.507 (1)	0.02*
	There may be no symptoms	50 (16.1)	261 (83.9)	311 (100.0)	48 (16.3)	246 (83.7)	294 (100.0)	+0.2%	0.007 (1)	0.93

**Statistically significant; DF = Degree of Freedom*

***NB**: Only positively worded questions in the two sets of Questionnaires (Part 3 of Supplementary Data or SD 1 and 2) were included in the analysis.*

Table 4: Logistics Regression evaluating the knowledge levels of "engaged" and "unengaged" participants to the cervical cancer interventions for female high school students in South-eastern Nigeria

Outcome (Dependent) Variables	Odds Ratio (OR)	Confidence Interval	Probability (p) value
A. Knowledge on Pap Smears			
• Pap smear can help detect CA cervix	3.46	2.00 - 5.96	0.000*
• Pap smear is for those aged 18 years and more, or those sexually active	2.73	1.46 - 5.11	0.002*
• Pap smear should be commenced 2 years after starting intercourse	8.98	2.11 - 38.16	0.003*
• Pap smear should be done 2 yearly	3.66	1.83 - 7.34	0.000*
B. Knowledge of Human Papilloma Virus (HPV)			
• HPV vaccine can be preventive	3.35	1.84 - 46.09	0.000*
• HPV vaccines should be given before the onset of sexual intercourse	2.53	1.37 - 4.67	0.003*
C. Knowledge of Risk Factors			
• Early onset of sexual intercourse	2.05	1.21 - 3.45	0.007*
• Having multiple partners	1.74	1.01 - 2.98	0.045*
D. Knowledge of Early Symptoms			
• Bleeding post intercourse	0.95	0.55 - 1.66	0.866
• No symptoms	1.47	0.69 - 3.11	0.321

**Statistically significant;*

***NB**: Only positively worded questions in the two sets of Questionnaires (Part 3 of Supplementary Data or SD 1 and 2) were included in the analysis.*