

Recommendations for cervical cancer prevention and control in Ghana: public education and human papillomavirus vaccination

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SUMMARY

Globally, cervical cancer is a major public health issue causing increasing morbidity and mortality especially in low- and middle-income countries where preventive and control measures are lacking. In Ghana, it is the most common cancer among women. Approaches to reduce the incidence and mortality of the disease in Ghana have had little success due to lack of accurate data on the disease among other factors, to inform policies on prevention, early detection, diagnosis and treatment. Additionally, the lack of clear commitment, policy direction and resources has hindered the scale-up of some of the initiatives implemented to curb the cervical cancer situation in Ghana. In this paper, we make recommendations on cervical cancer education and human papillomavirus vaccination. A collaborative approach is needed involving both private and government organizations, health professionals and the general public. Public education on cervical cancer and HPV vaccination needs to be delivered through a mixture of systems including both healthcare facilities and outreach programs, involving teachers, youth groups, community members and professional bodies. The vaccination of adolescents aged 10-14 years using the nonavalent HPV vaccine will be important in reducing the incidence and mortality of cervical cancer in Ghana. The integration of public education on cervical cancer prevention, HPV vaccination and screening programs into both medical and public health services is critical in achieving high coverage of these programs.

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INTRODUCTION

Cervical cancer is a significant public health issue worldwide. It is the fourth most common cancer among women with more than 85% of new cases of the disease occurring in low- and middle-income countries (LMICs).¹ Cervical cancer is the most common cancer among women in Ghana.¹ The incidence and mortality rates have recently been estimated in some regions.^{2,3} The age standardised incidence rate (world standard population) for the Greater Accra and Ashanti regions has been estimated to be 24.5 (95% CI: 22.9-26.1) and 14.0 (95% CI: 12.9 – 15.1) per 100,000, respectively.³ In Kumasi, cervical cancer account for 29.4% of all female cancers in 2012.⁴

According to GLOBOCAN, 3,052 new cases and 1,556 deaths from cervical cancer were recorded in Ghana in 2012.¹

Human papillomavirus (HPV) infection has been shown to be a necessary initiator of cervical cancer but the infection progresses to cancer only in a fraction of women. Cofactors associated with disease progression are not well understood in many LMICs including Ghana.

We have conducted two studies to assess the incidence, mortality, survival rates and risk factors associated with cervical cancer in Ghana.

The first was a review of medical records of women diagnosed with cervical cancer from January 2010 to December 2013 at the Korle Bu Teaching Hospital (KBTH), Accra and the Komfo Anokye Teaching Hospital (KATH), Kumasi.^{2,3,5}

Structured telephone interviews were also conducted for patients and relatives to gather further information on the outcome of the disease. The second study assessed the risk factors for cervical cancer in Ghana, using a hospital-based case-control study.²

Women aged 18-95 years with newly diagnosed histologically confirmed invasive cervical cancer were eligible to be cases. They had not received treatment for the disease and had been resident in Ghana for at least 3 years. Controls were randomly selected from the same hospitals as the cases. They fulfilled all the eligibility criteria defined for the cases apart from those relating to diagnosis of cervical cancer.

A structured questionnaire was administered to the women after which a request for a cervical smear was made for the assessment of cytological abnormalities and detection of HPV DNA to establish the HPV types present. The two studies were conducted between July 2014 and May 2015. Ethical approval from the University of Otago Ethics (Health) Committee was obtained by the researchers. Additionally, the Ghana Health Service Ethical Committee and the Committee on Human Research, Publication and Ethics of the Kwame Nkrumah University of Science and Technology (KNUST) and KATH gave approval for the study.

Using the data from the review of medical records and telephone interviews, the incidence, mortality, and survival rates of women diagnosed with invasive cervical cancer were estimated. The incidence and mortality rates of cervical cancer were highest for women aged 75-79 years and decreased at older ages in our study.^{2,3} At three years from diagnosis, overall disease-specific survival was 39%.⁵ Stage at presentation (Hazard ratio (HR) for stage IV compared with stage I was 7.8; 95% CI: 4.1-14.8) and histological type (HR for other histological types compared with squamous cell carcinoma was 1.4; 95% CI: 0.4-5.9, not statistically significant) were strong predictors of cervical cancer survival. Some forms of treatment were also associated with better survival than others.

Many known established risk factors were associated with the occurrence of cervical cancer in the case-control study. These included age, an increased number of pregnancies, higher parity and oral contraceptive use.^{2, 6, 7}

In addition, use of firewood for cooking, use of home-made sanitary towels and having a polygamous husband were associated with an increased risk of cervical cancer. These associations have also been found in some other LMICs.⁸⁻¹⁰ Knowledge of HPV and cervical cancer was very low among women with and without cervical cancer in our study.²

A multi-level approach is required to address the burden of cervical cancer in Ghana. A national policy on cervical cancer tailored to the socio-economic and cultural context will need to be established if the disease is to be controlled. This approach needs to take into account the complexities of the disease, the barriers to healthcare access, the determinants of health, and the social and cultural factors that influence health. A national cervical cancer prevention and control program needs to be developed and implemented in Ghana.

This should ideally include national policy development and program management structure, planning and preparation, implementation, monitoring, and evaluation.¹¹ This national cervical cancer policy should include prevention, early detection, diagnosis and treatment, and palliative care. The World Health Organization health system framework can be used to plan the program. Additionally, the National Cancer Control Strategy for Ghana can also be a starting point.¹²

The aim of the current paper is to make recommendations in terms of public education and HPV vaccination for the prevention of cervical cancer.

Prevention and control of cervical cancer in Ghana **Public education**

Evidence from studies^{2, 3,13-16} conducted in Ghana indicate that knowledge of HPV and other risk factors associated with the development of cervical cancer is limited. However, studies conducted in well-educated women reported relatively good knowledge of cervical cancer¹⁷ but these women are generally at lower risk of cervical cancer.² A cervical cancer educational program could be implemented as part of a national cervical cancer control program. This may be the most cost-effective approach in reducing the burden of the disease.¹¹ A mixture of systems can be used to deliver cervical cancer education program: in healthcare facilities and in the community.

There is lack of an effective curriculum, learning and teaching materials on comprehensive sexual and reproductive education in schools including cervical cancer prevention in Ghana. For this to be achieved, collaboration is needed between the Ministry of Education and Health, and the Ghana Health and Education Services.

Such collaboration will need to develop a specific, structured, targeted, age-related and culturally appropriate curriculum for adolescent sexual and reproductive health¹⁸ including cervical cancer education based on evidence from research. The development of the curriculum should ideally involve individuals with various backgrounds in research on cervical cancer and sexual health.

A review of 85 school-based sexual education programs suggested improvement in adolescent knowledge of STIs and recommended the use of curriculum-based programs in adolescent sexual and reproductive health education.¹⁹

This could be implemented in schools, communities and health facilities. The content of the curriculum needs to include all aspects of sexual and reproductive health including the causes of cervical cancer, risk factors, signs and symptoms, prevention, HPV vaccination, screening and available health services. A pilot study can be conducted to test the curriculum and make changes when necessary. Misconceptions and beliefs about cervical cancer such as a perceived lack of available treatment for the disease should be addressed if the disease is to be abated.

Systematic reviews of school-based education programs in Africa have shown that significant change in adolescents' knowledge and attitude towards HIV/AIDS and other sexually transmitted infections (STIs) can be achieved.^{20, 21} School-based sexual and reproductive health education is one way to help adolescents recognise risk and improve their sexual and reproductive health.²² A well-developed program including cervical cancer prevention can influence adolescents' attitude, knowledge and behaviour on sexual and reproductive health greatly.^{18, 23} Cervical cancer education could ideally begin at primary schools (late in primary school) as enrolment at primary school is high but decreases at the junior, senior and tertiary level (Figure 1).

Recently, the Ghana Health Service launched an adolescent health service policy and strategy to provide better direction and improve the effectiveness of adolescent health intervention in Ghana²⁴ but an action plan for its implementation will be needed. Partnerships with young people are of great importance in designing and implementing cervical cancer prevention education programs. The involvement of young people at the onset of a sexual and reproductive education program develops trust and helps to identify some of the challenges (such as lack of a youth-friendly services) that need to be improved for adolescent health programs to be effective.²⁵

This can build the capacity of young people in the area of advocacy and peer education. Partnerships with youth networks can also help provide training to volunteer peer educators to provide education to adolescents and women in the community using various media such as home visits, radio, television programs and theatre.

Youth networks in Ghana such as The Global Youth Action Network and the Ghana Youth Development Network, if suitable, may be able to train educators at the community and household level.

Many schools have some form of sexual and reproductive education program²⁶ that can be expanded to include cervical cancer prevention education. Currently, there are some forms of sexual and reproductive education programs at senior high school level. However, only a few students benefit from such education with most education programs focussing mainly or solely on human immunodeficiency virus (HIV) prevention.²⁶

Sexual and reproductive education programs at senior high schools have been incorporated into courses like Management in Living and Integrated Science at the senior high school level.²⁶ However, Management in Living is an elective course and the majority of students do not take it.²⁶ It would be important to have a comprehensive sexual and reproductive program including cervical cancer education as a stand-alone core subject for the majority of students to benefit.

This could be continued at the tertiary level with inclusion of breast and cervical screening education as part of the comprehensive sexual and reproductive education program. The establishment of clubs at schools to discuss adolescent health issues such as HPV infection and the prevention of cervical cancer will also play an important role in educating students about the disease.²⁷

It has been shown that the most effective sexual and reproductive programs are those led by teachers, health professionals, social workers and community members.²⁸ However, many require further training to deliver sexual and reproductive education to their students.²⁶ This could begin at teacher training with periodic workshops for teachers out of school. This pre-service and in-service training will be important to improve the skills of teachers in delivering adolescent sexual and reproductive education.

The development of the curriculum to include cervical cancer prevention should aim at providing students with the knowledge, skills, and understanding to enhance positive attitudes towards sexuality and care for their sexual health now and in the future.

Educational information could be disseminated using a variety of media including seminars, media channels such as television, radio, newspapers, posters, role-playing and drama, as well as interpersonal contact with healthcare professionals.

Public cervical cancer education can take place at schools, workplaces, churches, mosques, market places and durbars for good coverage to be achieved – our study² indicated that the majority of women preferred educational programmes at such venues. Education programs to target women in semi-urban and remote areas and those at increased risk of cervical cancer are also needed.

One of the limitations of sexual and reproductive health education in schools is the difficulty in reaching individuals out-of-school. These are the individuals who are at highest risk of developing cervical cancer.² For individuals out of school, education programs in the community can be beneficial. Community health nurses can be trained to provide organised cervical cancer education programs in the community, do home visits and give talks at community festivals.

Men usually serve as heads of families in Ghana, and drive most decision-making, including the seeking of healthcare from mainstream healthcare providers.²⁹ They will need to be involved in the educational program if it is to be effective. Women’s groups in the community also need to be involved in cervical cancer prevention program and community volunteers may be trained to provide education on cervical cancer prevention to their members and the wider community. The Ghana hairdressers and Beautician’s Association, and the National Tailors and Dressmakers Association among other professional bodies could also be involved in cervical cancer education programs incorporated into their meetings and examinations.

Healthcare professionals could be upskilled to provide education on cervical cancer when they come into contact with women during consultation, family planning, antenatal and postnatal services.

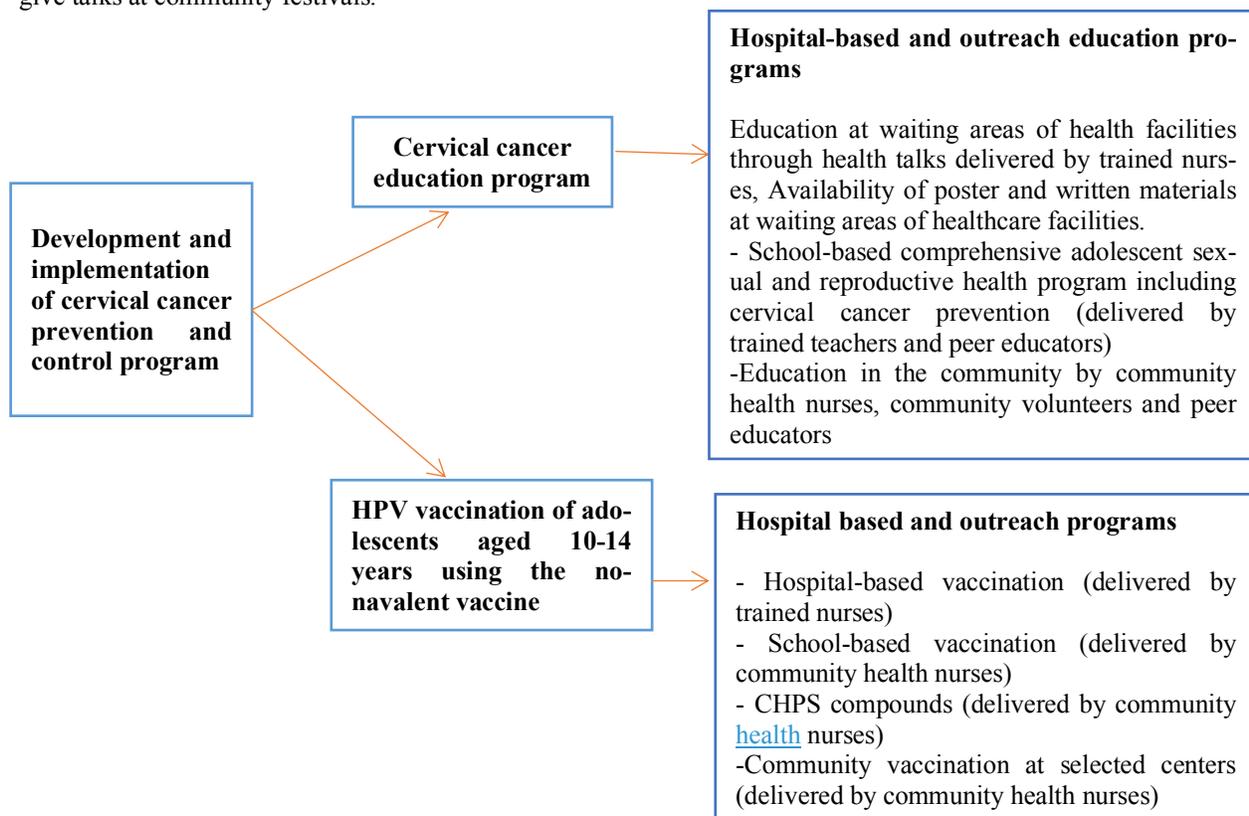


Figure 1 Recommendation for cervical cancer prevention education and HPV vaccination in Ghana.

Additionally, efforts to improve the level of knowledge of HPV, risk factors, HPV vaccination and cervical screening requires increased involvement of the media and women who have survived the disease. Individuals are often strongly influenced by messages from someone living with or who has survived the disease. Additionally, the involvement of people with disability and head porter (kayayee) will potentially result in increased coverage among the at-risk groups.

Implementation by District Health Management Teams in structured manner would ensure country-wide coverage, similar to immunization programs implemented in a similar fashion. Community Health Nurses have been trained to do childhood immunization and educate mothers at child welfare clinics countrywide. A similar approach would ensure good penetration and coverage.

HPV vaccination

The implementation of a national HPV vaccination programme to vaccinate adolescent girls aged 10-14 years will need to be an integral component of the control and prevention of cervical cancer in Ghana. Results from some studies^{2,30-33} support licensing of the nonavalent HPV vaccine in Ghana. The vaccine provides immunity to the high-risk oncogenic HPV types that have been found to account for the majority of cervical cancer in Ghana.^{2, 30-33} The nonavalent HPV vaccine prevents infection against nine HPV types (6, 11, 16, 18, 31, 33, 45, 52 and 58). The vaccine has been shown to be efficacious, with an overall estimated rate of prevention of 80% for precancerous lesions, and 90% and cervical cancer.³⁴ Both pre-licensure and post-licensure studies have shown the vaccine to be safe.³⁵⁻³⁹

The three doses required may be an obstacle in the implementation of HPV vaccination program in Ghana, however, two doses provide similar antibody levels as the three-dose schedule.^{40, 41} A two-dose regimen will increase HPV vaccine affordability and make for easier implementation. Because HPV vaccines are effective when given before sexual debut, the target age group should be young adolescents aged 10-14 years. Economic modelling will be important in assessing the cost-effectiveness of vaccinating girls aged 10-14 years.⁴²

A system to keep track of adolescents vaccinated and those who are yet to complete their doses is essential for the programme to be monitored and reduce the risk of the same person being vaccinated on several occasions. There are also other issues which need to be considered such as maintaining the cold chain, vaccine stock, vaccine safety and the monitoring of adverse effects. Experience from childhood immunization can be relied upon.

Cost has prevented the introduction of the HPV vaccine in many LMICs. However, funding of the HPV vaccine by Global Alliance for Vaccines and immunization (GAVI) reduces the price of the vaccine (less than 5USD per dose).⁴³ Donations from GAVI have also led to demonstration projects in some LMICs. With the current reduction of the price of HPV vaccines by GAVI, the Government of Ghana might take the opportunity to make the vaccine available to young adolescents. GAVI has supported governments in various countries including Ghana with demonstration projects in order to build capacity and infrastructure to deliver a HPV vaccination program.

A HPV vaccine pilot program was launched in the Greater Accra, Central and Northern regions of Ghana in 2013. It has been estimated that over 33,000 primary school girls aged 10-14 were vaccinated with the quadrivalent HPV vaccine in Ghana.⁴⁴ The results of this demonstration program will inform policy on HPV vaccination. The GAVI supported demonstration project is for a five-year period. However, efforts are being made by the government to extend it to ten years.⁴⁴

Due to low school attendance during later adolescence, particular for girls, vaccination programs in the community will be needed. The use of established immunization network such as those that deliver vaccination program to infants and a network of sexual and reproductive services such as family planning may be able to be used to deliver HPV vaccine to adolescents.⁴² Thus, a mixture of services might be employed in Ghana involving both HPV vaccine delivery at health facilities and outreach programs.

The HPV vaccination program could initially be rolled out in selected communities, preferably populations with characteristics associated with the highest incidence rates, and gradually increased to cover the whole country. The target age group might receive HPV vaccination at a fixed healthcare facility in the selected communities. A central location for HPV vaccination might be established for girls out of school to be immunised. Thus, both school and community based vaccination programs is essential to improve coverage of at risk groups.

Most sexual and reproductive health services are involved in providing family planning and cervical screening services to women. It will be important for HPV vaccination programs to be integrated into these services. Although the primary target group for HPV vaccination is younger than users of current sexual and reproductive health services, these services provide contact for the education for HPV vaccination when moth-

ers attend health services.⁴² Vaccination of infants in Ghana is possible as the Expanded Program on Immunization (EPI) has maintained in place an infrastructure and logistics system. However, the safety and effectiveness of HPV vaccines in infants are unknown.⁴² Nevertheless, HPV vaccination might be integrated into the EPI, not to vaccinate infants, but rather adolescents aged 10-14 years. This could be followed by educating women about other vaccines that can be given at various stages of their children lives.

The integration of HPV vaccination into the Community-based Health planning and services (CHPS) program is also important. Community health nurses in CHPS compounds that provide maternal and childcare to women and adolescents could be trained to provide education on cervical cancer and also HPV vaccination. The private sector is important in the health delivery system in Ghana. It is therefore important for both private for profit and not for profit health providers to be included in cervical cancer education and HPV vaccination programs.

Because the target population for HPV vaccination is different from that of current national vaccination programs, a school-based vaccination program is likely to be the most effective strategy.⁴² Vaccination can be done in schools similar to the pilot project and the community to reach a high number of adolescents (aged 10-14 years). School-based HPV vaccination programs may provide new incentives for the expansion and improvement of adolescent health services.¹¹ However, having an immunization team present at a school for several days may be resource intensive, thus, the establishment of a school health programs with a provider would be helpful.¹¹

The school health provider can be trained to provide HPV vaccination to the target age group. Additionally, the use of schools as HPV vaccination sites and encouraging school children to bring those aged 10-14 years who have left school to the vaccination sites could be evaluated in demonstration projects.⁴² There are socio-cultural issues which need to be considered for HPV vaccination program. Because HPV vaccines are for STIs their acceptance and marketing may be problematic.

Additionally, the stigmatisation of young women with respect to a women-only vaccination program also needs to be avoided.⁴² The introduction of HPV vaccination among adolescents may, therefore, be misinterpreted as an attempt to reduce fertility rates.^{42,45} There has been concern that vaccination may enhance adolescent promiscuity by encouraging more at-risk sex.⁴⁶⁻⁴⁸

However, this conjecture has not been supported by studies that have reported no statistically significant increase in sexual behaviour and STIs in adolescents after HPV vaccination.^{49,50} Although the acceptance of the HPV vaccine has been shown to be generally high in many countries⁵¹⁻⁵⁵, these social concerns need to be considered if high coverage is to be achieved in Ghana.

The education of adolescents and parents is critical in reducing misconceptions about HPV vaccination. Studies are needed to assess the acceptability of the vaccine and any misconceptions among the Ghanaian population. Multiple stakeholders need to be involved at the appropriate stages of advocacy and social communication. Any attempt to implement a national HPV vaccination programme should involve clinicians, parents, teachers and other relevant stakeholders to obtain widespread support.

Training of individuals to coordinate and head the program will be required with government sponsorship. The Ghana Ministry of Health (MOH) needs to be the lead agent in coordinating the prevention and control of cervical cancer in Ghana. The establishment of a multidisciplinary team and stakeholder's advisory groups with representatives from various groups and service providers will be necessary.¹¹ Working groups can be established to oversee the various aspect of the program.

The Department of Disease Control and Prevention, Ghana Health Service, could be a base for cervical cancer prevention and control program in Ghana. Collaboration with the Family Health division will ensure high impact and efficiency. Continued evaluation of cervical cancer education and the HPV vaccination program is likely to be necessary to enhance its effectiveness and ensure that the program achieves its objectives and reaches the target population.

Funding is a major challenge for cervical cancer prevention and control in Ghana and many other countries in Africa. Some government funds and technical support would need to be allocated for the cervical cancer prevention and control program.¹¹ Partnership with private companies is a way of improving funding for cervical cancer control; similar to that achieved for cardiovascular disease through the establishment of the National Cardiothoracic Centre. Additionally, support from individuals, private companies, and multinational companies might be sought to complement government funding in the provision of infrastructure, logistics and human resources.⁵⁶

Incentives, such as awards and tax reductions, may be introduced for the involvement of individuals, private and multinational companies for cervical cancer prevention and control.⁵⁶

Volunteering is also a way for students and individuals to make a positive difference for others and society, and also gain valuable experience and skills for their various careers. Volunteers could also reduce costs and improve access to preventive services for the majority of Ghanaians. Volunteers have been used in New Zealand, United Kingdom, United States of America, and other countries to improve health services.⁵⁷ This can be incorporated into cervical prevention and control programs in Ghana.

Cervical cancer prevention and control needs focussed infrastructure including human resources, vaccine storage facilities, laboratories, and treatment centres which are scarce in Ghana. Training of health care workers to reduce the shortage of health professionals in Ghana is also an urgent priority for a national cervical cancer control policy to be effective.⁵⁶ This might be achieved by training some health professionals such as community health nurses which is less expensive.

The provision of incentives as well as mentorship opportunities might help reduce the migration overseas of health professionals. Career opportunities for advancement and specialisation will be important. Further reward may be given to health professionals who accept posting to rural areas to address the staff shortages. All these initiatives would support a cervical cancer education and HPV vaccination program to reduce the burden of the disease in Ghana.

CONCLUSION

Cervical cancer is a very important public health issue in Ghana. There are opportunities to reduce the burden of the disease through education, HPV vaccination, screening and treatment of the disease. Achieving this requires a coordinated systematic approach from the government, private agencies, health professionals and the general population. We recommend a whole-of-government approach involving all the relevant governmental agencies and other key stakeholders to develop an integrated approach for cervical cancer control and prevention in Ghana.

REFERENCES

1. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C et al. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 [Internet]. 2013.
2. Nartey Y. The epidemiology of cervical cancer in Ghana. Dunedin: University of Otago; 2017.
3. Nartey Y, Hill CP, Amo-Antwi K, Nyarko MK, Yarney J, Cox B. Cervical cancer in the Greater Accra and Ashanti regions of Ghana. *J Glob Oncol* 2016: JGO005744.
4. Laryea DO, Awuah B, Amoako YA, et al. Cancer incidence in Ghana, 2012: evidence from a population-based cancer registry. *BMC Cancer*. 2014; 14:362
5. Nartey Y, Hill PC, Amo-Antwi K, Nyarko KM, Yarney J, Cox B. Factors Contributing to the Low Survival Among Women With a Diagnosis of Invasive Cervical Cancer in Ghana. *Int J Gynecol Cancer*, 27(9) 1926-1934.
6. Smith JS, Green J, Berrington de Gonzalez A, Appleby P, Peto J, Plummer M, et al. Cervical cancer and use of hormonal contraceptives: a systematic review. *Lancet*. 2003; 361(9364):1159-67.
7. Munoz N, Franceschi S, Bosetti C, Moreno V, Herrero R, Smith JS, et al. Role of parity and human papillomavirus in cervical cancer: the IARC multi-centric case-control study. *Lancet*. 2002; 359(9312):1093-101.
8. Velema JP, Ferrera A, Figueroa M, Bulnes R, Toro LA, de Barahona O, et al. Burning wood in the kitchen increases the risk of cervical neoplasia in HPV-infected women in Honduras. *Int J Cancer*. 2002; 97(4):536-41.
9. Chaouki N, Bosch FX, Munoz N, Meijer CJ, El Gueddari B, El Ghazi A, et al. The viral origin of cervical cancer in Rabat, Morocco. *Int J Cancer*. 1998; 75(4):546-54.
10. Bayo S, Bosch FX, de Sanjose S, Munoz N, Combita AL, Coursaget P, et al. Risk factors of invasive cervical cancer in Mali. *Int J Epidemiol*. 2002; 31(1):202-9.
11. World Health Organization. Comprehensive cervical cancer control: A guide to essential practices. Geneva: World Health Organization, 2006.
12. Ministry of Health. National strategy for cancer control in Ghana. Accra: Ministry of Health, 2011.
13. Williams MS, Amoateng P. Knowledge and beliefs about cervical cancer screening among men in Kumasi, Ghana. *Ghana Med J*. 2012; 46(3):147-51.
14. Coleman MA, Levison J, Sangi-Haghpeykar H. HPV vaccine acceptability in Ghana, West Africa. *Vaccine*. 2011; 29(23):3945-50.
15. Abotchie PN, Shokar NK. Cervical cancer screening among college students in Ghana: knowledge and health beliefs. *Int J Gynecol Cancer*. 2009; 19(3):412-6.
16. Ebu NI, Mupepi SC, Siakwa MP, Sampselle CM. Knowledge, practice, and barriers toward cervical

- cancer screening in Elmina, Southern Ghana. *Int J Womens Health*. 2015; 7:31-9.
17. Adanu RM. Cervical cancer knowledge and screening in Accra, Ghana. *J Womens Health Gend Based Med*. 2002; 11(6):487-8.
 18. Picot J, Shepherd J, Kavanagh J, Cooper K, Harden A, Barnett-Page E, Jones J, Clegg A, Hartwell D, Frampton GK. Behavioural interventions for the prevention of sexually transmitted infections in young people aged 13-19 years: a systematic review. *Health Educ Res*. 2012; 27(3):495-512.
 19. Bearinger LH, Sieving RE, Ferguson J, Sharma V. Global perspectives on the sexual and reproductive health of adolescents: patterns, prevention, and potential. *Lancet*. 2007; 369(9568):1220-31.
 20. Paul-Ebhohimhen VA, Poobalan A, van Teijlingen ER. A systematic review of school-based sexual health interventions to prevent STI/HIV in sub-Saharan Africa. *BMC Public Health*. 2008; 8:4.
 21. Sani AS, Abraham C, Denford S, Ball S. School-based sexual health education interventions to prevent STI/HIV in sub-Saharan Africa: a systematic review and meta-analysis. *BMC Public Health*. 2016; 16(1):1069.
 22. Wellings K, Collumbien M, Slaymaker E, Singh S, Hodges Z, Patel D, Bajos N. Sexual behaviour in context: a global perspective. *Lancet*. 2006; 368(9548):1706-28.
 23. Michielsen K, Chersich MF, Luchters S, De Koker P, Van Rossem R, Temmerman M. Effectiveness of HIV prevention for youth in sub-Saharan Africa: systematic review and meta-analysis of randomized and nonrandomized trials. *Aids*. 2010; 24(8):1193-202.
 24. Graphic online. GHS adopts new policy on adolescent health development service, 2017 [access 04/07/2017]. Available from: <https://www.graphic.com.gh/news/general-news/ghs-adopts-new-policy-on-adolescent-health-development-service.html>.
 25. Allen L. 'Say everything': Exploring young people's suggestions for improving sexuality education. *Sex Education*. 2005; 5(4):389-404.
 26. Awusabo-Asare Kofi, Ann Biddlecom, Akwasi Kumi-Kyereme, Patterson K. Adolescent Sexual and Reproductive Health in Ghana: Results from the 2004 National Survey of Adolescents. New York: Guttmacher Institute. 2006.
 27. Geidne S, Quennerstedt M, Eriksson C. The youth sports club as a health-promoting setting: an integrative review of research. *Scand J Public Health*. 2013; 41(3):269-83.
 28. Kirby D, Obasi A, Laris BA. The effectiveness of sex education and HIV education interventions in schools in developing countries. *World Health Organ Tech Rep Ser*. 2006; 938:103-50; discussion 317-41.
 29. Ganle JK, Dery I. 'What men don't know can hurt women's health': a qualitative study of the barriers to and opportunities for men's involvement in maternal healthcare in Ghana. *Reprod Health*. 2015; 12:93.
 30. Awua AK, Sackey ST, Osei YD, Asmah RH, Wiredu EK. Prevalence of human papillomavirus genotypes among women with cervical cancer in Ghana. *Infect Agent Cancer*. 2016; 11:4.
 31. Denny L, Adewole I, Anorlu R, Dreyer G, Moodley M, Smith T, Snyman L, Wiredu E, Molijn A, Quint W, Ramakrishnan G, Schmidt J. Human papillomavirus prevalence and type distribution in invasive cervical cancer in sub-Saharan Africa. *Int J Cancer*. 2013; 134(6):1389-98.
 32. Attoh S, Asmah R, Wiredu EK, Gyasi R, Tettey Y. Human papilloma virus genotypes in Ghanaian women with cervical carcinoma. *East Afr Med J*. 2010; 87(8):345-9.
 33. Domfeh A, Wiredu E, Adjei A, Ayeh-Kumi P, Adiku T, Tettey Y, Gyasi R, Armah H. Cervical human papillomavirus infection in accra, ghana. *Ghana Med J*. 2008; 42(2):71-8.
 34. Joura EA, Giuliano AR, Iversen OE, Bouchard C, Mao C, Mehlsen J, et al. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *N Engl J Med*. 2015; 372(8):711-23.
 35. Macartney KK, Chiu C, Georgousakis M, Brotherton JM. Safety of human papillomavirus vaccines: a review. *Drug Saf*. 2013; 36(6):393-412.
 36. Block SL, Brown DR, Chatterjee A, Gold MA, Sings HL, Meibohm A, Dana A, Haupt RM, Barr E, Tamms GM, Zhou H, Reisinger KS. Clinical trial and post-licensure safety profile of a prophylactic human papillomavirus (types 6, 11, 16, and 18) 11 virus-like particle vaccine. *Pediatr Infect Dis J*. 2010; 29(2):95-101.
 37. Angelo MG, David MP, Zima J, Baril L, Dubin G, Arellano F, Struyf F. Pooled analysis of large and long-term safety data from the human papillomavirus-16/18-AS04-adjuvanted vaccine clinical trial programme. *Pharmacoepidemiol Drug Saf*. 2014; 23(5):466-79.
 38. Slade BA, Leidel L, Vellozzi C, Woo EJ, Hua W, Sutherland A, Izurieta HS, Ball R, Miller N, Braun MM, Markowitz LE, Iskander J. Postlicensure safety surveillance for quadrivalent human papillomavirus recombinant vaccine. *JAMA*. 2009; 302(7):750-7.
 39. Gee J, Naleway A, Shui I, Baggs J, Yin R, Li R, Kulldorff M, Lewis E, Fireman B, Daley MF, Klein NP, Weintraub ES. Monitoring the safety of quadrivalent human papillomavirus vaccine: findings

- from the Vaccine Safety Datalink. *Vaccine*. 2011; 29(46):8279-84.
40. Hernandez-Avila M, Torres L, Stanley M, Salmeron J, Cruz-Valdez A, Munoz N, Herrero R, Villaseñor-Ruiz IF, Lazcano-Ponce E. Evaluation of the immunogenicity of the quadrivalent HPV vaccine using two versus three doses at month 21: An epidemiological surveillance mechanism for alternate vaccination schemes. *Hum Vaccin Immunother*. 2016; 12(1):30-8.
 41. Romanowski B, Schwarz TF, Ferguson L, Peters K, Dionne M, Behre U, Schulze K, Hillemanns P, Suryakiran P, Thomas F, Struyf F. Sustained Immunogenicity of the HPV-16/18 AS04-Adjuvanted Vaccine Administered as a Two-Dose Schedule in Adolescent Girls: Five-Year Clinical Data and Modelling Predictions from a randomized study. *Hum Vaccin Immunother*. 2011; 12(1):20-9.
 42. Kane MA, Sherris J, Coursaget P, Aguado T, Cutts F. Chapter 15: HPV vaccine use in the developing world. *Vaccine*. 2006; 24 Suppl 3:S3/132-9.
 43. GAVI. Human papillomavirus vaccine support: Record low price agreed for HPV vaccines 2015 [access 14/09/2015]. Available from: <http://www.gavi.org/support/nvs/human-papillomavirus-vaccine-support/>.
 44. Graphic online. 33,000 girls vaccinated against cervical cancer Accra: Ghana: Graphic online; 2014 [access 02/07/2016]. Available from: <http://www.graphic.com.gh/news/general-news/33-000-girls-vaccinated-against-cervical-cancer.html>.
 45. Bingham A, Drake JK, LaMontagne DS. Sociocultural issues in the introduction of human papillomavirus vaccine in low-resource settings. *Arch Pediatr Adolesc Med*. 2009; 163(5):455-61.
 46. Holman DM, Benard V, Roland KB, Watson M, Liddon N, Stokley S. Barriers to human papillomavirus vaccination among US adolescents: a systematic review of the literature. *JAMA Pediatr*. 2014; 168(1):76-82.
 47. Brabin L, Roberts SA, Farzaneh F, Kitchener HC. Future acceptance of adolescent human papillomavirus vaccination: a survey of parental attitudes. *Vaccine*. 2006; 24(16):3087-94.
 48. Forster A, Wardle J, Stephenson J, Waller J. Passport to promiscuity or lifesaver: press coverage of HPV vaccination and risky sexual behavior. *J Health Commun*. 2010; 15(2):205-17.
 49. Smith LM, Kaufman JS, Strumpf EC, Levesque LE. Effect of human papillomavirus (HPV) vaccination on clinical indicators of sexual behaviour among adolescent girls: the Ontario Grade 8 HPV Vaccine Cohort Study. *Cmaj*. 2015; 187(2):E74-81.
 50. Bednarczyk RA, Davis R, Ault K, Orenstein W, Omer SB. Sexual activity-related outcomes after human papillomavirus vaccination of 11- to 12-year-olds. *Pediatrics*. 2012; 130(5):798-805.
 51. La Vincente SF, Mielnik D, Jenkins K, Bingwor F, Volavola L, Marshall H, Druavesi P, Russell FM, Lokuge K, Mulholland EK. Implementation of a national school-based Human Papillomavirus (HPV) vaccine campaign in Fiji: knowledge, vaccine acceptability and information needs of parents. *BMC Public Health*. 2015; 15:1257.
 52. Lee Mortensen G, Adam M, Idtaleb L. Parental attitudes towards male human papillomavirus vaccination: a pan-European cross-sectional survey. *BMC Public Health*. 2015; 15:624.
 53. Dempsey AF, Brewer SE, Pyrzanowski J, Sevic C, O'Leary S T. Acceptability of human papillomavirus vaccines among women older than 26 years. *Vaccine*. 2015; 33(13):1556-61.
 54. Constantine NA, Jerman P. Acceptance of human papillomavirus vaccination among Californian parents of daughters: a representative statewide analysis. *J Adolesc Health*. 2007; 40(2):108-15.
 55. Lenselink CH, Gerrits MM, Melchers WJ, Massuger LF, van Hamont D, Bekkers RL. Parental acceptance of Human Papillomavirus vaccines. *Eur J Obstet Gynecol Reprod Biol*. 2008; 137(1):103-7.
 56. Morhason-Bello IO, Odedina F, Rebbeck TR, Harford J, Dangou JM, Denny L, Adewole IF. Challenges and opportunities in cancer control in Africa: a perspective from the African Organisation for Research and Training in Cancer. *Lancet Oncol*. 2013; 14(4):e142-51.
 57. Hotchkiss RB, Fottler MD, Unruh L. Valuing volunteers: the impact of volunteerism on hospital performance. *Health Care Manage Rev*. 2009; 34(2):119-28