

PRACTICUM REPORT

For the Partial Fulfillment of Course Requirements of the

Master of Public Health Program

Offered By

Johns Hopkins Bloomberg School of Public Health
In Cooperation with IIHMR University

By

Avleen Kaur
Cohort-4
2016-18

Under the Guidance of

Dr. Monika Chaudhary
Associate Professor
IIHMR University

Dr. G.B. Singh
Assistant Director (Immunization)
National Health Mission, Punjab

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Cost-Effectiveness Analysis of HPV vaccination Pilot Programme at Bathinda & Mansa, Punjab

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TO WHOMSOEVER MAY CONCERN

This is to certify that ***Avleen Kaur***, student of Master of Public Health Program offered by IIHMR University, Jaipur in cooperation with Johns Hopkins Bloomberg School of Public Health, Baltimore has undergone Practicum Training at **National Health Mission, Punjab** from November 1st, 2017 to December 31st, 2017.

The Candidate has successfully carried out the study designated to her/his during practicum training and her approach to the study has been sincere, scientific and analytical.

The Practicum Training is in fulfillment of the course requirements.

I wish her/him success in all his future endeavors.

Sd-

Dr. Monika Chaudhary
Practicum Advisor

CERTIFICATE BY SCHOLAR

This is to certify that the Practicum Project titled submitted by me, *Avleen Kaur* with Enrollment No. *IIHMR-U/07/2016-2018/0016* JH ID: 97E640 under the supervision of **Dr. Monika Chaudhary** for award of **Master of Public Health** carried out during the period *November 1st 2017 to April 12th 2018* embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Avleen Kaur
MPH Candidate 2016-18

Certificate from the organization

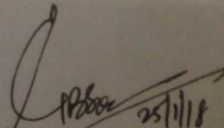
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Memo No. EPI/Pb/2018/68 Dated 25-1-18

CERTIFICATE OF COMPLETION

This is to certify that Dr. Avleen Kaur has successfully completed her practicum training at National Health Mission, Punjab from 1st November 2017 till 31st December 2017 in partial fulfillment of the requirements for the award of degree of Master of Public Health.

Her work and report would be helpful for the Department for implementation of HPV Vaccination.


Assistant Director (Immunization)
Punjab, Chandigarh

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This practicum report would not have been accomplished without the help of so many people in so many ways. It gives me immense pleasure to acknowledge the roles of these individuals for being instrumental to completion of my paper.

First, I owe an enormous debt of gratitude to my guide, Dr. Neetu Purohit and co-guide Dr. Monika Chaudhary for their constant guidance, encouragement and support. They really pushed me and helped me realize my potential to achieve that “little extra” beyond my capacity.

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ABOUT THE ORGANIZATION

The National Health Mission (NHM) encompasses its two Sub-Missions, the National Rural Health Mission (NRHM) and the National Urban Health Mission (NUHM).¹ “The National Rural Health Mission (NRHM), now under National Health Mission is an initiative undertaken by the government of India to address the health needs of under-served rural areas. Launched on 12th April 2005 by Indian Prime Minister Manmohan Singh, the NRHM was initially tasked with addressing the health needs of 18 states that had been identified as having weak public health indicators. The Union Cabinet headed by Dr. Manmohan Singh vide its decision dated 1 May 2013, has approved the launch of National Urban Health Mission (NUHM) as a Sub-mission of an overarching National Health Mission (NHM), with National Rural Health Mission (NRHM) being the other Sub-mission of National Health Mission.”² The main programmatic components include Health system strengthening in rural and urban areas, Reproductive Maternal-Neonatal-Child and Adolescent Health (RMNCH+A) and Communicable and Non-Communicable Diseases. The NHM envisages achievement of universal access to equitable, affordable & quality healthcare services that are accountable and responsive to people’s needs.¹

ABOUT PILOT HPV VACCINATION PROGRAMME IN PUNJAB

The human papilloma virus (HPV) vaccination was launched in the districts of Bathinda and Mansa in Punjab by Principal Secretary Health, Mrs. Vini Mahajan on 23 November 2016, with technical support from WHO Country Office for India. Punjab is the first state in the country to include HPV vaccination in its immunization programme.³ Bathinda and Mansa districts having the higher rates of cervical cancer as compared to rest of the districts of Punjab, this dedicated campaign was launched in the two districts under two phases of anti-cervical cancer campaign. To

achieve the set target, district level teams were constituted to track the girls who were shifted to other schools.²⁸ Also, the parents of girls who were to be vaccinated under this programme were educated to ensure the security and safety of the girl children.²⁸ The vaccine for the purpose was procured by Punjab Government through UNICEF and the technical assistance was provided by the WHO.²⁸ The technical assistance to the state encompassed- assessing district/state preparedness; developing operational guidelines, including capacity-building of immunization managers and health workers; updating recording, reporting and tracking tools; and monitoring of HPV introduction during the preparatory and implementation phase.³ Under this pilot programme, the HPV vaccination was provided to school going girls studying in 6th class in all schools, both government as well private along with the second dose to the girls covered in the first phase.²⁸ In phase one, close to 10,000 girls studying in class six of government schools were covered reflecting a 95% mobilization which shows enormous commitment.³ Before launching the project, the state government had commissioned a study to the PGIMER to work out cost-effectiveness of free HPV vaccination. Following this, a group of doctors at the PGI's School of Public Health had done an economic study to evaluate the incremental cost per quality-adjusted life-years gained with the introduction of the HPV vaccine compared with a no-vaccination scenario.²⁹

MY PRACTICUM EXPERIENCE AND LEARNINGS

Having an opportunity to gain practical experience on my capstone project was dream come true. Adding to my excitement was the fact that I was going to work under the experts in this field and would have a chance to polish my knowledge and skills to a refined professional version. My practicum training took place at Parivar Kalyan Bhawan, Sector-34 A, Chandigarh under direct supervision of Dr. G.B. Singh Assistant Director (Immunization) at National Health Mission, Punjab, Chandigarh. My daily working hours were from 10am to 4pm Monday to Friday on third

floor in the organization building. On my first day, Dr. G.B. Singh briefed me about the project and what are the possible vacancies for me to gain my practicum experience. He mentioned that the cost-effectiveness study on this project has been done by Dr. Shankar Prinja with fellow doctors from P.G.I. Chandigarh, but it would be nice if I could do cost-effectiveness analysis on the same data with my understanding so that they could compare the two and see if the initiative is really cost-effective. When I was writing my capstone project on “Feasibility of introducing comprehensive program of HPV vaccination and cervical cancer screening in India” in IIHMR, I quoted Dr. Prinja’s study in my paper and never did I think that I would one day have this opportunity to meet this man. One fine day at NHM office while I was taking the data on the project from Dr. Rajesh Bhaskar, Immunization officer; a man walks into the office and Dr. Bhaskar greeted him, O! Dr. Prinja and I was numb hearing his name and to the thought that this is the same person whose work I appreciated and quoted in my project. Dr. Bhaskar introduced me to Dr. Prinja and explained to him that I was there to do my practicum training. He was so delighted to know that I am doing the cost-effectiveness analysis on the project and said that he feels there are very few professionals in India who have this skill and knowledge to do such an analysis and he is happy that I took an initiative to learn the skill. We had a brief conversation about my methodology and he was impressed about how I substituted certain parameters as the data was not available online. On November 8, 9, 10, 11 the second phase of the pilot project took place at Bathinda and Mansa where second dose of the HPV vaccination was administered to the girls who were vaccinated under the first phase last year. The campaign was commenced on 8th November 2017 by Punjab health and family welfare minister Brahm Mohindra and he was accompanied by principal secretary, Health, Anjali Bhawra. Having an opportunity to attend the event, I got to meet many healthcare officials from the region and gained a true insight of how these events are

actually arranged and conducted. Since the day I joined the organization, there were meetings, job allocations to the staff and planning on how to conduct this and how much and what kind of professionals are to be allocated where. The banners were printed out with messages and information of cervical cancer and HPV vaccinations which were sent to be put up in Bathinda and Mansa. Medical officers were trained and allocated at the vaccination campaign sites and to make this campaign a success the district administration had tied up with the education, health and transport departments so that all kinds of help could be extended to the health department so that no Class VI girl students were left out during the vaccination schedule. In crux, it was a hands-on experience for me to learn about how really such endeavors are planned, conducted and accomplished and I am thankful to Dr. G.B. Singh for letting me gain this experience and be a part of this project in any way possible.

PRACTICUM PROJECT TRAINING

As for my capstone paper, I did cost-effectiveness analysis of introducing HPV vaccination in National Immunization Programme in India, I was inclined towards doing the same kind of study on a project practically being carried out in the country. Knowing my intentions regarding the same, Dr. G.B. Singh, Assistant Director (Immunization) at National Health Mission, Punjab, Chandigarh who was also my practicum supervisor at the workplace gave me an opportunity to write a report on cost-effectiveness analysis of HPV vaccination Pilot Programme at Bathinda & Mansa, Punjab.

OBJECTIVE

To assess the cost-effectiveness of HPV vaccination Pilot Programme at Bathinda & Mansa, Punjab and compare it to the cost-effectiveness of comprehensive cervical cancer prevention and control program which could be facilitated by including HPV vaccination in National immunization program alongside already existing screening programme.

EXECUTIVE SUMMARY

India bears a quarter of cervical cancer burden of the world with 1,23,000 new cases diagnosed and 67,500 deaths reported due to the disease every year.⁴ Cervical cancer is the second most common cancer in Indian women accounting for 22.86% of all cancer cases among them.⁴ It ranks as the second leading cause of cancer deaths in women aged 15 to 44 years in India⁵ with one woman dying of cervical cancer every 8 minutes in the country.⁴ By 2025, the number of new cervical cancer cases in India is projected to increase to 226,084 provided if the incidence continues to rise in the same fashion.⁶ Sexually transmitted human papillomavirus (HPV) infection is the most important risk factor for cervical cancer and 83.2% of cervical cancer in India is attributed to HPV – 16, 18.⁷ HPV infection is so common that it happens to infect almost all sexually active men and women at some point in life.⁸

Cervical cancer is one of the few highly preventable cancers with a significantly high cure rate if detected early. The two recommended modes of prevention are - primary prevention through vaccination best administered at an early age of 9-13 years before sexual debut and secondary prevention through screening women preferably 30 years and above to detect the disease at precancerous stage and prevent its further progression. With HPV vaccine combating 83.2% of cervical cancer incidence, the need for cervical cancer screening remains though the required frequency decreases substantially.^{9,10} WHO recommends a comprehensive approach of vaccination as well as screening for prevention and control of cervical cancer.⁸ Though India has launched its very first National screening program for cervical cancer, it is still reluctant to introduce the vaccine in its National immunization program due to multiple reasons.

This paper attempts to estimate the cost-effectiveness of HPV vaccination pilot programme held in Bathinda and Mansa, Punjab and compare it to the cost-effectiveness of comprehensive cervical

cancer prevention and control program which could be facilitated by including HPV vaccination in National immunization program alongside screening if found feasible in terms of cost-effectiveness, financial sustainability and socio-cultural and ethical acceptability. The cost-effectiveness of three policy alternatives i.e. vaccination, screening and a comprehensive program was calculated. The vaccination and comprehensive program interventions were found to be more cost-effective options over screening, providing larger health benefits for the price invested. However, as the impact of screening can be observed instantly, it would take decades to realize the impact of vaccination until once the vaccinated cohort reaches certain age. As India already has National screening program in place, the cost-effectiveness of introducing a comprehensive program over a screening program was also assessed in terms of costs and health benefits. As per WHO cost-effectiveness threshold, the comprehensive program of HPV vaccination and screening of women above 30 years till age 65 was found to be highly cost-effective over an exclusive screening program; averting 1.08 times more cases, 1.81 times more deaths and 1.76 times more DALYs than a screening program at an extra cost of 27.1%.

Lastly, given that India bears the highest share of global burden of cervical cancer, it is recommended that the policy makers in India should consider the complementary roles of vaccination and screening and initiate measures to implement both through a comprehensive program to reduce the burden of a preventable cancer.

COST-EFFECTIVENESS ANALYSIS

Policy alternatives assessed

The first scenario was HPV vaccination for 11-year-old girls as a target population. This was compared to two other policy alternatives; the second alternative was what India has currently; the screening program for women aged 30 years and above till 65 years of age with VIA as a method of screening through ‘screen and treat’ approach of precancerous lesions. The third alternative was a WHO recommended comprehensive program of vaccination of a cohort between 9-13-year-old girls and screening for women above 30 years old till age 65.

Approach

Two widely used models were employed. First model used was the PRIME “Papillomavirus Rapid Interface for Modelling and Economics” model, created by scientists at the London School of Hygiene and Tropical Medicine in London and Université Laval in Quebec in conjunction with the World Health Organization, Geneva.⁷ This helped in calculating cost-effectiveness of HPV vaccination program against no other intervention available. The second model used was the CERVIVAC model, the excel based model developed by the PAHO’s ProVac Initiative to enable health decision makers to conduct cost-effectiveness analysis of cervical cancer prevention.¹¹ This model was used as a guide to calculate cost-effectiveness of second policy alternative i.e. screening program intervention. And eventually, using both these models as a guide, the cost-effectiveness of WHO recommended comprehensive program was calculated.

Data

All the estimates used in this study have been considered with an intent to help make this analysis favorable from the perspective of health decision makers in India. For example, to calculate the years lost due to disability (YLD) saved, the average duration of the case until remission or death (years) has been taken as a minimum value of 5 years; to seek minimal average benefit that could be earned by an intervention. Furthermore, every cost-effectiveness study for HPV vaccination reviewed for this paper had considered the overall cervical cancer mortality to calculate the deaths prevented by vaccinating a cohort. While in this paper an estimated percentage of cervical cancer mortality due to HPV 16, 18 was considered to calculate the deaths averted through vaccination which gives a more precise estimate of health benefits earned.

Table 1. Sources of data used in cost-effectiveness analysis

Parameter	Source
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Female cohort size by single age for India	Census India (2011) ¹²
Vaccine operational cost	As provided by NHM ¹³
Cervical cancer incidence and mortality data on India	Excel based PRIME tool which contains country specific data on cervical cancer and reliability of this data was checked from PRIME modelling study ⁷ which identifies GLOBOCON 2012 as the source of this data.
Percentage of cervical cancer incidence due to HPV 16, 18 in India	PRIME modelling study ⁷ and country specific report by HPV information centre ⁵
Percentage of cervical cancer mortality due to HPV 16, 18	Estimated using different literatures ¹⁴
Cost of cervical cancer treatment in India	Excel based PRIME tool ¹⁵ provided cervical cancer treatment cost (2013) which was converted into present (2017) value using online price inflators.
Screening cost (VIA, colposcopy/biopsy, cryotherapy)	Study on Comprehensive Global Cervical Cancer Prevention by Harvard School of Public Health using CERVIVAC model. ¹¹
Life expectancy at various ages	Sample Registration System (SRS) based Life table (2011-2015) census of India. ¹⁶
Disability weights	“Global Burden of Disease Study 2015 (GBD 2015) by Institute for Health Metrics and Evaluation (IHME)” ¹⁷
Sensitivity and specificity of VIA	“The Alliance for Cervical Cancer Prevention (ACCP), International Agency for Research on Cancer (IARC)” ¹⁸

Assumptions

The analysis was conducted from a payer perspective. In all three scenarios, the program intervened in a particular age cohort and cost-effectiveness of all three interventions was calculated for executing the program as per the guidelines in one particular cohort. For example, for the 2 dose HPV vaccination program, 11-year-old cohort was taken as the target population, with an intent to intervene before sexual debut and avoid the sex stigma associated with the vaccine (HPV being an STD) which could potentially stir up while vaccinating a teen aged candidate. While for screening, 30-year-old cohort was followed over 5 years interval till 65 years of age to calculate the cost-effectiveness of screening program in a single cohort over lifetime. In the comprehensive program scenario including vaccination and screening, 11-year-old cohort was taken as the target population for vaccination which was followed for screening at the age of 30 till 60 years to fulfill the criteria of screening a woman as per the current screening guidelines. Taking PRIME modelling study as a reference, the prevalence of HPV 16, 18 in women with cervical cancer in India i.e. 83.2% was considered as the percentage of cervical cancer incidence attributed to HPV 16, 18⁷ and the percentage of cervical cancer mortality attributed to HPV 16 and 18 has been estimated as 70%. After aggressive literature review, the efficacy of HPV vaccination against HPV 16,18 was taken as 100%¹⁹ and for screening, the sensitivity and specificity of VIA method of screening was taken as 81% and 83% respectively.¹⁸

In screening scenarios, it was assumed that all cases were diagnosed at precancerous stages and treated through screen and treat approach (inclusive of screening the target population through VIA, colposcopy/biopsy as a confirmatory diagnostic test for positively screened patients and cryotherapy as a treatment for precancerous lesions); saving the cancer treatment cost of advanced stages. But even when diagnosed at precancerous stages, the survival rate of cervical cancer is almost 90-95%^{20,21}; hence, it was assumed that out of the cases detected through screening 90%

were saved and 10% lead to advanced stages and consequently death. The cancer treatment cost was considered to be exclusive of VIA, colposcopy/biopsy and cryotherapy treatment costs. The average duration of cervical cancer in a patient in India was assumed as 5 years and for standard life expectancy at age of death (used to calculate years of life lost; YLL), the average life expectancy was considered using Sample Registration System (SRS) based life tables by census India. To calculate the years lost due to disability (YLD) for vaccination program, two extreme case scenarios were considered, assuming 70% cases were screened at advanced stages and 30% were screened at initial stages,^{22,23} and hence disability weights were used accordingly for both using GLOBOCON disability weights 2015.

In comprehensive program scenario, the 80% cohort taken up for screening at age 30, 40, 50 and 60 was assumed to be the same cohort which has been vaccinated at the age of 11. Hence, the incidence of cervical cancer prevented by screening was considered as the incidence caused by reasons other than HPV- 16, 18 as the incidence due to HPV- 16, 18 was assumed to be taken care by HPV vaccination. This analysis did not consider the herd immunity and protection by HPV vaccination for genital warts or other HPV related cancers, consequently underestimating the overall cost-effectiveness of the vaccination program.

Results

Table 2. Results of cost-effective analysis

PARAMETERS	VACCINATION PROGRAM	SCREENING PROGRAM	COMPREHENSIVE PROGRAM
<u>COSTS</u>			
• Program cost	\$ 102,274	\$ 380,627	\$ 483,593
• Cancer treatment cost saved	\$ 91,682	\$ 103,782	\$ 215,713
• Net Program cost	\$10,592	\$ 276,845	\$ 267,880
<u>HEALTH OUTCOMES</u>			
• Cases prevented	176	200	415
• Deaths prevented	81	100	281
• DALYS averted	3373	4411	12,190
<u>COST-EFFECTIVENESS</u>			
• ICER per case prevented	\$ 60	\$ 1,387	\$ 646
• ICER per death prevented	\$ 131	\$2,760	\$ 952
• ICER per DALY averted	\$ 3	\$ 63	\$24

Table 3. Cost-effectiveness of introducing comprehensive program over screening program in India

PARAMETERS	SCREENING PROGRAM	COMPREHENSIVE PROGRAM	DIFFERENCE
Program cost	\$ 380627	\$ 483593	102966 27.1% more than screening
Cases prevented	200	415	215 1.08 times more than screening
Deaths prevented	100	281	181 1.81 times more than screening
DALYs prevented	4411	12190	7779 1.76 times more than screening

“According to WHO, an intervention that costs less than three times the national annual GDP per capita, per disability-adjusted life-year (DALY) avoided, is considered cost-effective, whereas one that costs less than once the national annual GDP per capita is considered highly cost-effective.”²⁴ Taking this approach into account, the comprehensive program turned out be highly cost-effective over screening; providing larger health benefits by spending minimal extra cost. The comprehensive program was estimated to avert 1.08 times more cases, 1.81 times more deaths and 1.76 times more DALYs than a screening program at an extra cost of 27.1%. If we consider net

program cost, the comprehensive program turns out to be a much cost-effective option over a screening program; preventing more cases, deaths and DALYs for the amount spent as the net program cost for comprehensive program turns out to be less than the screening cost. Also, as screening once to thrice in a lifetime is also considered highly cost-effective for a comprehensive program in LMICs, India can facilitate a comprehensive program with lesser frequent screenings over a lifetime, at a price equal to or less than the current screening program and gain comparatively extensive health benefits.

CONCLUSION

Prevention is any day better than cure and one of the most applauding triumphs of public health has been the ability to prevent communicable diseases with a corresponding impact on population health through immunization. Cervical cancer is one of the few preventable cancers as it is almost always caused by sexually transmitted HPV infection which can now be prevented through vaccination. While HPV vaccine has been considered as an “extraordinary invention” and a “wonder jab” in the west, India is still reluctant to introduce it at a national scale. With cervical cancer being asymptomatic till advanced stages, lack of awareness about HPV and cervical cancer and poor health seeking behavior amongst population, majority of women (almost two-third) are diagnosed at later stages when cure rates are generally below 10%. In such a scenario, vaccination at an early age could prove to be an effective tool in combating cervical cancer incidence in India, given that 83.2% of cervical cancer in India is being caused by HPV-16, 18⁷ and vaccine has been proven to have high efficacy against these two strains. However, in India, where almost 22% of population is living on less than \$1.90 a day²⁵ and out of pocket health expenditures are so high that it can push a family into poverty, the high cost of vaccine would keep it from reaching majority

of the population, benefiting only few who can afford. Hence, it calls for the public health sector to realize these gaps and facilitate a provision for vaccination to reach population at large.

Cervical cancer has a cure rate of almost 90%^{20,21} if detected early and the long latent period of the disease provides enough time frame to catch it at precancerous stages. Hence, cervical cancer screening on a regular basis is the best prevention option for women population who have already had a sexual debut and are not eligible for vaccination. Also, as vaccination combats only 83.2% of risk associated with the disease, the need for screening remains though the required frequency decreases substantially.^{26,27} However, screening would intervene late and only help reduce the mortality rates but, vaccination would help reduce both incidence as well as mortality due to cervical cancer. Also, while the health benefits gained through screening would be observed instantly, it would take decades to realize the health benefits achieved through vaccination program. But once the vaccinated cohorts would reach the age where difference in cervical cancer incidence before and after the intervention could be acknowledged, the vaccination program is assumed to avert more deaths and cases than screening.

WHO recommends a comprehensive program with both vaccination and screening to enable an effective intervention for prevention and control of cervical cancer especially in countries with high burden of the disease.⁸ The cost-effectiveness analysis in this paper shows comprehensive program to be a highly cost-effective option for India as compared to exclusive vaccination and screening interventions. However, there is a profound need to create awareness and sensitize the population about the disease so that the unfelt need can be converted into a felt need. Given that India bears the highest share of global burden of cervical cancer, the policy makers in India need to acknowledge the complementary roles of vaccination and screening interventions and initiate

measures to implement both through a comprehensive program to reduce the burden of a preventable cancer.

REFERENCES

1. MOHFW. (n.d.). *National Health Mission*. Retrieved from <https://mohfw.gov.in/sites/default/files/56987532145632566578.pdf>.
2. Wikipedia (n.d.). National Health Mission. Retrieved April 2, 2018, from https://en.wikipedia.org/wiki/National_Health_Mission
3. WHO (n.d.). Punjab launches HPV vaccine with WHO support. Retrieved April 2, 2018, from http://www.searo.who.int/india/mediacentre/events/2016/Punjab_HPV_vaccine/en/
4. Statistics [Internet]. [cited 2017 Sep 30]. Available from: <http://cancerindia.org.in/index.php/know-about-cancer/statistics#cervical-cancer>
5. Human Papillomavirus and Related Diseases Report INDIA. [cited 2017 Sep 30]; Available from: <http://www.hpvcentre.net/statistics/reports/IND.pdf>
6. Satija A. CERVICAL CANCER IN INDIA. Available from: docshare.tips/cervical-cancer_57642dd4b6d87f3e878b4bcb.html?utm_source=docshare&utm_medium=sidebar&utm_campaign=58717299b6d87f86098b48b4
7. Mark Jit, PhD, Marc Brisson, PhD†, Allison Portnoy, MSPH†, Dr Raymond Hutubessy, PhD (2014, July). Cost-effectiveness of female human papillomavirus vaccination in 179 countries: a PRIME modelling study. Retrieved September 30, 2017, from [http://www.thelancet.com/journals/langlo/article/PIIS2214-109X\(14\)70237-2/fulltext](http://www.thelancet.com/journals/langlo/article/PIIS2214-109X(14)70237-2/fulltext)
8. WHO | Human papillomavirus (HPV) and cervical cancer. WHO [Internet]. 2016 [cited 2017 Sep 30]; Available from: <http://www.who.int/mediacentre/factsheets/fs380/en/>
9. PATH. (n.d.). About cervical cancer. Retrieved September 30, 2017, from <http://www.rho.org/about-cervical-cancer.htm>
10. PaoloGiorgi Rossi, FrancescaCarozzi et al (2016, November 20). Cervical cancer screening in women vaccinated against human papillomavirus infection: Recommendations from a consensus conference. Retrieved September 30, 2017, from <http://www.sciencedirect.com/science/article/pii/S0091743516303759>
11. Campos NG, Sharma M, Kyu AC, Lee E, Geng F, Kim JJ, et al. Comprehensive Global Cervical Cancer Prevention Costs and Benefits of Scaling up within a Decade. 2016 [cited 2017 Sep 30]; Available from: <https://www.cancer.org/content/dam/cancer-org/cancer-control/en/reports/the-cost-of-cervical-cancer-prevention.pdf>

12. World Population Prospects - Population Division - United Nations [Internet]. [cited 2017 Sep 30]. Available from: <https://esa.un.org/unpd/wpp/Download/Standard/Interpolated/>
13. World Health Organisation. (2016, December). Guide to introducing HPV vaccine into National Immunization Programs. Retrieved September 30, 2017, from <http://apps.who.int/iris/bitstream/10665/253123/1/9789241549769-eng.pdf?ua=1>
14. Kegel, D. (n.d.). Deaths due to HPV. Retrieved September 30, 2017, from <http://www.kegel.com/hpv/deaths/>
15. World Health Organisation. (n.d.). PRIME Tool A World Health Organization resource. Retrieved September 30, 2017, from <http://primetool.org/>
16. Ministry of Home Affairs, Government of India. (n.d.). SRS Based Life Table. Retrieved September 30, 2017, from http://www.censusindia.gov.in/vital_statistics/Appendix_SRS_Based_Life_Table.html
17. Institute for Health Metrics and Evaluation (IHME) (n.d.). Global Burden of Disease Study 2015 (GBD 2015) Disability Weights. Retrieved September 30, 2017, from <http://ghdx.healthdata.org/record/global-burden-disease-study-2015-gbd-2015-disability-weights>
18. Alliance for Cervical Cancer Prevention (ACCP) (2003). Visual inspection with Visual inspection with acetic acid (VIA): acetic acid (VIA): Evidence to date. Retrieved September 30, 2017, from http://screening.iarc.fr/doc/RH_via_evidence.pdf
19. WHO | Human papillomavirus and HPV vaccines: a review. WHO [Internet]. 2011 [cited 2017 Sep 30]; Available from: <http://www.who.int/bulletin/volumes/85/9/06-038414/en/>
20. Ministry of Health, Belize (2016). CERVICAL CANCER CLINICAL GUIDELINES. Retrieved September 30, 2017, from <http://www.clearcyte.com/research/Belize-Cervical-Screening-Guidelines.pdf>
21. Bhagwan Mahaveer Cancer Hospital and Research Center (BMCHRC). (n.d.). Cancer Information. Retrieved September 30, 2017, from http://www.bmchrc.org/content.php?page_id=129
22. Senapati R, Nayak B, Kar SK, Dwibedi B. Why cervical cancer cases are being lately diagnosed in Eastern India? An analysis of the associated factors. Indian J Obstet Gynecol Res [Internet]. 2016 [cited 2017 Sep 30];3(4):418–21. Available from: [https://www.innovativepublication.com/admin/uploaded_files/IJOGR_3\(4\)_418-421.pdf](https://www.innovativepublication.com/admin/uploaded_files/IJOGR_3(4)_418-421.pdf)

23. Samrat Dutta, Nandita Biswas, and Goutam Mukherjee (2013, September). Evaluation of Socio-demographic Factors for Non-compliance to Treatment in Locally Advanced Cases of Cancer Cervix in a Rural Medical College Hospital in India. Retrieved September 30, 2017, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3853394/>
24. WHO | Thresholds for the cost-effectiveness of interventions: alternative approaches. WHO [Internet]. 2015 [cited 2017 Sep 30]; Available from: <http://www.who.int/bulletin/volumes/93/2/14-138206/en/>
25. The World Bank. (n.d.). Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population). Retrieved September 30, 2017, from <https://data.worldbank.org/indicator/SI.POV.DDAY?locations=IN>
26. PATH. (n.d.). About cervical cancer. Retrieved September 30, 2017, from <http://www.rho.org/about-cervical-cancer.htm>
27. Paolo Giorgi Rossi, Francesca Carozzi et al (2016, November 20). Cervical cancer screening in women vaccinated against human papillomavirus infection: Recommendations from a consensus conference. Retrieved September 30, 2017, from <http://www.sciencedirect.com/science/article/pii/S0091743516303759>
28. Punjab Government. (n.d.). key-initiative. Retrieved April 29, 2018, from http://punjab.gov.in/key-initiative?p_p_id=pressrelaese_WAR_PressReleaseAdminportlet&p_p_lifecycle=2&p_p_state=normal&p_p_mode=view&p_p_cacheability=cacheLevelPage&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=2&_pressrelaese_WAR_PressReleaseAdminportlet_param=24572
29. Bharti, V. (2017, December 14). 'Erroneous' study basis of state's cervical cancer vaccine. The Punjabi Tribune, Retrieved from <http://www.tribuneindia.com/news/punjab/-erroneous-study-basis-of-state-s-cervical-cancer-vaccine/512929.html>.