2018

Early Radiation Therapy and Cervical Cancer Survival in the United States

Olufunmiso Oyetunde Asamu
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Olufunmiso O. Asamu

has been found to be complete and satisfactory in all respects,

and that any and all revisions required by

the review committee have been made.

Review Committee

Dr. Hadi Danawi, Committee Chairperson, Public Health Faculty

Dr. James Rohrer, Committee Member, Public Health Faculty

Dr. Ji Shen, University Reviewer, Public Health Faculty

Chief Academic Officer

Eric Riedel, Ph.D.

Walden University

2018

Abstract

Early Radiation Therapy and Cervical Cancer Survival in the United States

By

Olufunmiso O. Asamu

MPH Walden University, 2013

MBBS University of Ibadan, Nigeria, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Public Health

Walden University

November 2018

Abstract

A paucity of information exists on the benefits of using radiation therapy for treating women with early cervical cancer detection. The purpose of this cross-sectional study was to investigate the association between early versus late testing of Human papilloma virus (HPV), age, race, radiation therapy, and regions in United States, and survival rates among women diagnosed with early cervical cancer. The epidemiological triad of person, time, and space guided this study to explain the regional spread of cervical cancer, and the effect of early testing. Secondary data from Surveillance, Epidemiology, and End Results (SEER) were used (N= 520,153). Statistical analyses included descriptive statistics as well as binary and multiple logistic regression. According to multiple logistic regression tests early testing for HPV saved more women from cervical cancer death (Odds ratio = .917, *CI* = .896 - .939, P = .000), and women with radiation therapy had increase likelihood of dying (Odds ratio = 1.646, *CI* = 1.626 – 1.667, *P* = .000). Older Women had increased likelihood of dying when diagnosed with cervical cancer (Odds ratio = 1.043, *CI* = 1.042 – 1.044, *P* = .000).Whites had a reduced likelihood of dying when diagnosed with cervical cancer (Odds ratio = .735, *CI* = .722 - .748, *P* = .000) compared to non-Whites with increased likelihood of dying when diagnosed with cervical cancer (Odds ratio = 1.3605, *CI* = .722 - .748). Alaskans had a reduced likelihood of dying compared to women living in the Pacific Coast (Odds ratio = .714, *CI* = .598 -.853, *P* = .000). Increased awareness among women on radiation therapy for early detection of cervical cancer can improve survival and lead to positive social change.

Early Radiation Therapy and Cervical Cancer Survival in the United States

By

Olufunmiso O. Asamu

MPH Walden University, 2013

MBBS University of Ibadan, Nigeria, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Public Health

Walden University

November 2018

Table of Contents

In this study, the epidemiological triad of person, place, and time helped in educating people about disease spread and prevention. Chaney and Rojas-Guyler (2015) reported that age, race, and place influenced the decision of the people to use drugs (marijuana, tobacco, and alcohol). I found some places to be high and low risk areas for both races to develop cervical cancer, variations in the awareness for early HPV testing among women

List of Tables

List of Figures

Chapter 1: Introduction to the study

Introduction

The development of cervical cancer occurs from persistent, high-risk infection with human papilloma virus (HPV) Genotypes 16 and 18, and HPV takes 10-20 years or longer for the disease to develop into a malignant cervical cancer (Lin, Fan, & Tu, 2016). Adolescent women are at high risk of developing cervical cancer due to a lack of awareness of the causes of cervical cancer. Research on cervical cancer affecting young women remains limited. Health professionals are unable to guide adolescent women on the benefits of early screening and treatment options for HPV such, as radiation therapy for curing HPV-related cervical cancer (Lin et al., 2016).

In this chapter, I discuss the background of the problem, the problem statement, the purpose statement, and a statement of the research questions and hypotheses in the study. I also address the need to investigate the implications of early testing and radiation therapy on survival rates of women with early stages of cervical cancer, based on race and age for women living in the United States.

Background

Radiation therapy is a therapeutic component of cancer management. Baalbergen, Veenstra, and Stalpers (2013) stated that surgery or radiation therapy was the best option when treating early cervical cancer. Further, Baalbergen et al. argued that surgeons preferred surgery as the first step for treating cancer, but often requested subsequent radiation therapy for treating Stages Ia and IIa cervical cancer. Baalbergen et al. claimed that the therapeutic effects of treating cervical cancer with radiation were not apparent. There were many treatments available to women based on the stage of the disease.

Winer et al. (2015) stated that physicians treated early stage cervical cancer (Stages IA to IIA) with surgery alone and the advanced stages (Stages IIB to IVB) with chemotherapy. However, the benefits of radiation therapy for younger women remain unclear. In treating early cervical cancer with surgery alone, there was a decline in survival rates in 2015 in the United States (Winer et al., 2015). Among women diagnosed with an earlier stage of the cervical cancer, 15-61% developed metastatic disease within 2 years with 5 year survival rate less than 5% due to surgery treatment alone (Pfaendler & Tewari,

2016). Surgery alone for treating early cervical cancer did not guarantee a complete cure (Nieder et al., 2015). Research must focus on the benefits of using radiation therapy for the treatment of early cervical cancer, which was the focus of this study. Nieder et al. (2015) reported that using radiation therapy alone or in combination with other therapies for treating late-stage cervical cancer did not improve survival rates. Nieder et al. did not include the effects of radiation based on age and race for treating early stage cervical cancer; thus, there remains a gap in the literature.

Cervical cancer is a malignancy that forms in the cervix of women with the HPV pathogens; however, contracting the disease is mostly preventable through the practice of early screening tests and early vaccines (Center for Disease Prevention and Control [CDC], 2015). According to the CDC (2015), all women are at risk of contracting cervical cancer, but women who are 30 years and older have an increased danger of developing late-stage cervical cancer when there was no early testing conducted (3-year intervals). Wright et al. (2015) explained that persistent infection with high-risk Genotypes 16 and 18 lead to the development of high-grade cervical neoplasia. Wright et al. stated that the first line

screening for cervical cancer is HPV testing for Genotypes 16/18 with increased sensitivity to detect Cervical Intraepithelial Neoplasia 3 (CIN 3+).

There is a time difference between first abnormal cytology and diagnosis of cervical cancer. Zaal et al. (2015) conducted a study among women between 30 and 60 years to identify incubation period in the development of cervical cancer. In the first group, 50% of women developed cervical cancer 2 years after the first abnormal smear; and in the second group, 60% developed cervical cancer 5 years after the first smear (Zaal et al., 2015). It took approximately 3 to 5 years from the first abnormal cytology (precancerous) to the development of cervical cancer (Zaal et al., 2015). Early detection of precancerous lesion helps to prevent the development of cervical cancer.

There is a decline in the incidence and mortality related to cervical cancer; however, the incidence and mortality of this disease remain high. Pfaendler and Tewari (2016) argued that 528,000 women worldwide had cervical cancer and mortality was 266,000 annually, indicating that approximately 50% of all women diagnosed with cervical cancer die. Based on reports from the American Cancer Society, 12,900 new cases of

cervical cancer occurred in 2015 in United States and 4,100 people died, indicating a mortality rate of 32% in 2015 (Pfaendler & Tewari, 2016).

Cervical cancer cases among women increased in the United States over the last 6 decades because of improper screening for much of the period. Kim et al. (2015) found that the cervical cancer screening in the U.S. was not conducted properly, causing many women to go untreated. Kim et al. further argued that the reduction in the cervical cancer incidence began with the introduction of cytology-based screening in the 1940s, which included various screening rates based on region. In some areas, women frequently received screening; in other regions, women did not test at all. Kim et al. reported that approximately every year 12,000 women were diagnosed with cervical cancer and 4,000 women died from results of the diagnosis. Most of the diagnoses and deaths occurred in underserved communities where particular race/ethnic minorities lived (Kim et al.,2015).

There is an approximately 10-year interval between the last Pap smear test and the development of cervical cancer in women (Pfaendler & Tewari, 2016). Further, 5 % of women diagnosed with cervical cancer in North America had Stage IV cervical cancer

disease with a survival rate of less than 21% (Pfaendler & Tewari, 2016). A significant percentage of women remain unaware of the benefits of early cervical cancer screening, resulting in late-stage testing, and diagnoses of late-stage cervical cancer (Carvallo-Michelena, Rojas-Dominguez & Piscoya, 2015). Conducting the current study provided the necessary results for understanding the survival rate of early cervical cancer screening, and for closing an existing gap in the literature.

To reduce the mortality from cervical cancer among women, there must be full participation by women in cervical cancer screening. Carvallo-Michelena, Rojas-Dominguez, and Piscoya (2015) reported that the high cervical cancer death rate was due to a lack of female involvement in early detection of infections. The results indicated that early detection and stopping the development of cervical cancer is a way of reducing mortality rates among women. Hillard (2015) reported that the high incidence and mortality of cervical cancer in the United States are due to new cases of women who would not go for screening; mostly of the new cases are from Native Americans, Asian Americans, Pacific Islanders, and Alaska Natives. Women with no primary care doctors or health

insurance have the opportunity to obtain health coverage at an affordable rate for their families. Chen, Bustamante and Tom (2015) argued that uninsured migrants are offered extended eligibility under affordable care coverage for dependents' coverage under family private health insurance up to age 26 years. This policy allows migrants to have access to screening and treatment.

Cervical cancer has a pre-invasive stage, known as cervical intraepithelial neoplasia (CIN) detected through early testing. Dan, Hong, Haibo and Jianrong (2015) reported that CIN occurs when the high-risk HPV virus genome gets into the host cells, leading to abnormal changes in the host cells cycle. The HPV infections cause immune evasion of the abnormal cells for many years, making them undetected and leading to the development of cervical cancer (Dan, Hong, Haibo & Jianrong, 2015). There are more than 100 HPVs, but 40 infect the genital tract, and persistent infections with Serotypes 16 and 18 could lead to cervical cancer (Foran & Brennan, 2015). The authors reported that HPV vaccines recommended for girls for ages 12 to 17 years lacked patronage due to lack of adequate

information, awareness, and education campaigns on health care services for early detection of cervical cancer (Foran & Brennan, 2015).

The U.S. policies and recommendations for screening and vaccination for the prevention of cervical cancer have not improved participation of women in early screening. Alexander et al. (2014) explained that U. S. recommendation for HPV vaccination is 21 years irrespective of age at sexual intercourse. The European recommendation for cervical cancer screening was 25-30 years, while Australia was 18 years or 2 years after first sexual intercourse (Alexander et al., 2014). Alexander et al. argued that the advent of the HPV vaccine did not change the cervical cancer screening recommendations.

The age at which women undergo screening determines their ability to get adequate treatment and survive cervical cancer. Torre et al. (2015) found that testing early in life led to early detection of the disease, and with adequate treatment, prevented late stage of cervical cancer. Torre et al. did not study the effects of early detection with the use of radiation therapy among women of different race/ethnic groups, or age by the group, thus creating a gap in the literature. When sufficient numbers of vaccinated women refused to

participate in future screening, the behavior led to increased numbers of women developing cervical cancer (Alexander et al., 2014). There is a need for increased efforts to get more women to participate in early screening, and to give better treatment for the few who have early cervical cancer. In this study, I focused on the effects of using radiation therapy for early cervical cancer among women in United States, and reported whether radiation therapy would increase survival or not.

Women who participated in the initial screening often find it difficult to complete all of the screening recommendations. In the United Kingdom, only 8% of women 20-22 years of age partially completed three doses of HPV vaccinations, and only 18% of all women received cervical cancer screening (De Angelis et al., 2014). There is a lack of adherence to screening recommendations. Normal tissue cells may have cervical cancer cells close to the tumor site, which the surgeon's knife might not remove (Kim et al., 2015). Kim et al. (2015 found that treating cervical cancer with surgery alone often did not remove all cancer cells. The procedure often led to recurrence of cervical cancer in most communities in the United States (Kim et al., 2015). Sert et al. (2016) reported that surgical

therapy in early stage cervical cancer saves lives, but recurrence is high with an odds ratio of 3.15. There is a need for additional therapy, such as radiation therapy, to remove cancer cells that may come back as invasive cervical cancer.

Murakami et al. (2015) reported that the introduction of radiation therapy into gynecological malignancies started in the recent decade; however, there was no study validating the effect of radiation therapy on gynecological malignancies. Murakami et al. stated that the tools are available to deliver adequate doses of radiation to gynecological target tissues while avoiding the nontargeted tissues. For example, the effectiveness of targeted radiation therapy occurred in prostate cancer and in the cancer of the head and neck; however, the treatment efficacy in cervical cancer was unclear (Murakami et al., 2015). Finding cervical cancer late puts women at high risk of mortality. Landoni et al. (2014) found that radiation therapy did not offer improvement for women because the disease spread to multiple organs. Landoni et al. however, did not examine the benefits of early radiation therapy for women of different race/ethnic groups who test early and show positive for cervical cancer.

Maguire, Kotronoulas, Simpson, and Paterson (2015) explained that a lack of information about the effectiveness of radiation therapy and surgery treatment existed for women of younger age groups diagnosed with cervical cancer. Maguire et al. found that the lack of information caused women to believe that surgery alone was enough to cure cervical cancer and delayed further screening, only to find that cancer returned during later testing. Maguire et al. believed that women needed more information about the short and long-term benefits of radiation therapy when diagnosed with early cervical cancer.

De Angelis et al. (2014) reported that survival of cancers associated with the breast, the rectum, non-Hodgkin lymphoma, the prostate, the ovaries, the kidney, the colon, the stomach, and the lung vary by regions in the world. Survival in Eastern Europe is low and is below the European average, while survival in Central, Northern, and Southern parts in Europe was high (De Angelis et al., 2014). The survival rates of cancers are intermediated in Ireland and United Kingdom (De Angelis et al., 2014). De Angelis et al. did not estimate the survival of cervical cancer on age and early testing using radiation therapy. Borras et al. (2015) argued that there are improvements in survival for people diagnosed with prostate,

breast, and lung cancers using radiation therapy; however, survival rates of women with cervical cancer remains unclear.

Scholars have indicated advancement in treating all forms of cancer. Although there were improvements in the treatment of women diagnosed with cervical cancer, there was a need for more studies to understand the effectiveness of using radiation therapy. The purpose of the study was to explain differences in outcomes for early diagnosis of the disease. The treatments were for women by age group and race, when using radiation therapy compared to surgery alone for treating cervical cancer.

Problem Statement

Globally, for every 530,000 diagnoses of cervical cancer, 275,000 people died, demonstrating a survival of only 48% annually (Pimenta, Galindo, Jenkins, & Taylor, 2013). Torre et al. (2015) reported that cervical cancer was the third most common type of cancer among women, after lung and breast cancers, and the fourth common cause of death globally among all cancers. Zeng et al. (2015) reported that there had been a steady

improvement in cancer survival, but the improvement in cervical cancer according to age, sex, and race remains unaccounted for in current literature.

There is a dearth of information among epidemiologists on the effects of treating early stage cervical cancer with radiation for increasing patient survival among the different age groups and races in the United States. Ellinor et al. (2015) argued that public health epidemiologist must advise women to receive early cervical cancer detection assessments. Torre et al. (2015) found that the burden of cervical cancer has increased due to U. S. women of different race/ethnic groups who had increased morbidity and mortality related to HPV infection. There remains a lack of current studies on the effects of radiation treatment on early cervical cancer among women based on race groups and age groups living in the United States.

Some women received screening early in life but do not receive subsequent screening because of a lack of mechanisms in place to receive additional screening. Ellinor et al. (2015) further argued that there are benefits for women from 23-50 years who receive screening every three years, and for women, 51-60 years old, who receive screening every

five years. The results indicated that cervical cancer developed in women due to lack of regular screening and that early screening was necessary for increasing the survival rates of women. There is an absence of existing research showing the effects of early testing and related early radiation therapy on survival rates among women. Researchers found that using radiation therapy in early breast and lung cancer treatment in the U. S. was effective for respective survival rates. However, such information is lacking with using radiation therapy for treating early cervical cancer stages among women in the U.S. compared to surgery alone (Robinson et al., 2014).

Purpose Statement

The purpose of this quantitative, cross-sectional study was to examine the association between radiation therapy (yes, no) and early detection of HPV, race (four categories), age (four groups), and five regions as the independent variables and survival rates (two classes) as the outcomes. Researchers need to understand the effects of radiation therapy on early stage cervical cancer based on women's age by group and race. Currently, there is unawareness of the survival effects of using radiation therapy for treating early

cervical cancer stages among women in the United States compared to surgery alone (Robinson et al., 2014). The intent of this study was to add to the body of knowledge and to close a gap in the literature on the effects of using radiation therapy for early cervical cancer and survival rates among women in the United States.

Research Questions and Hypotheses

The following research questions and the accompanying hypotheses were used to analyze the associations between the independent variables and the dependent variables.

RQ1*:* What is the association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

H_o1 *:* There is no association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

H_a1*:* There is an association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

RQ2*:* What is the association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer?

H_o2*:* There is no association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a2*:* There is an association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

RQ3: What is the association between race and survival rates when diagnosed with Stage I to IIa cervical cancer?

H_03: There is no association between race and survival rates when diagnosed with Stage I to IIa cervical cancer.

H_a3: There is an association between race and survival rates when diagnosed with Stage I to IIa cervical cancer.

RQ4: What is the association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer?

H_04. There is no association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a4: There is an association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

RQ5: What are the associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_05: There are no associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a5: There are associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

The two levels of HPV testing (early, late), radiation therapy (yes, no), four categories of race (Black, White, Hispanics, and Asians), four levels of age groups (20-29, 30-39, 40-49, >50), five regions (Alaska, East, Northern Plains, South West, Pacific coast) in United States constituted the independent variables. The dependent variable was two levels of survival rates (survived, not survived).

Theoretical Framework

The theory of epidemiological triad of disease model was the theoretical framework for the study. According to Cohen and Shang (2015), Clark's 1954 developed epidemiological triad to explain a spatiotemporal relationship between three areas known as the agent, the host, and the environment. Cohen and Shang found that Clark's theory was useful for breaking disease transmission by predicting the agent (procedures such as early HPV - testing), the host (age and race), and the environment or place (regions in United States). Cohen and Shang believed that a triad was a form of isolation precautions useful for the control of infectious diseases with increased morbidity and mortality outcomes.

The theory is useful when testing multiple interventions based on pathogens in a cross-sectional study. Rohrer, Grover and Moats (2013) applied the epidemiological triad to medical care studies and argued that researchers should use variations of the theory to person, place, and time associated with the theoretical model. Chaney and Rojas-Guyler (2015) argued that a triad is a tool that explains health promotion, educational research, and

practice; thereby, it is useful when analyzing health disparities across age, geographical regions, and access to health care.

The epidemiological triad provides utility when explaining the health outcome surveillance and risk analysis for women who receive early HPV testing. A diagram of the theoretical model is in Figure 1. The diagram demonstrates a spatiotemporal relationship and shows the mode of transmission of infective agents within women (person or host). The diagram also shows the possible ways of stopping the disease transmission (early detection, radiation therapy, drugs, surgery) in a region (United States). Using the triad as the theoretical framework for the study provided understanding of early HPV testing as related to reducing mortality and increasing their quality of life. A summary of constructs about the study variables is in Table 1.

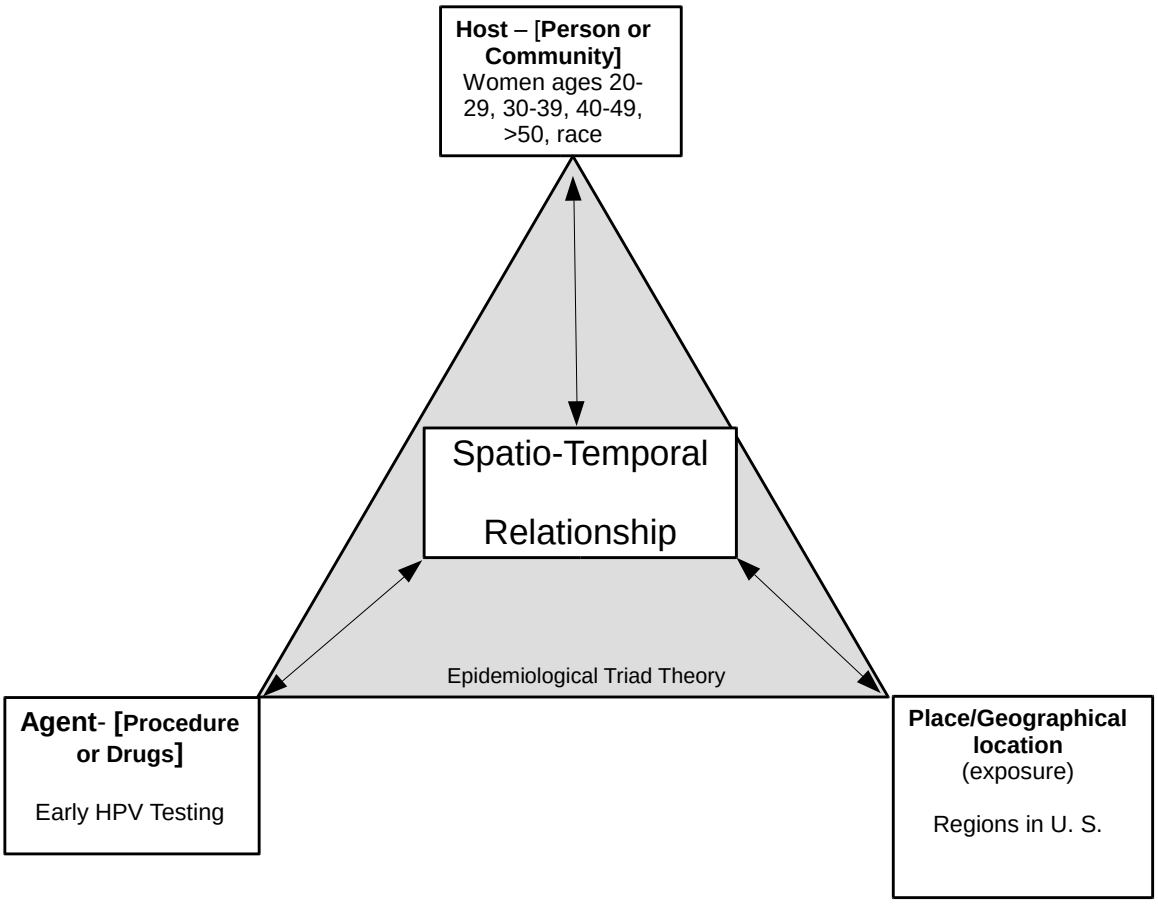

Figure 1. A model is showing a connection between spatiotemporal relationship and epidemiological triad. Adapted from "Spatial analysis methods for health promotion and

education" by R. A. Chaney and L. Rojas-Guyler, 2015, Health Promotion Practice, 16, p. 5.

Table 1

Theory of Epidemiological Triad

Constructs	Variable	Treatment	Survival
Agent or Time (Procedure or Drug) Early HPV Testing (Year)	Early HPV testing	Radiation therapy	Unknown
	Late HPV testing (Year)	No radiation therapy	Unknown
		Radiation and surgery	Unknown
Host (person, community) Age Race	Age (20- 29, 30-39, 40-49, >50) Race (Black, non-Hispanic White, Hispanic, and Asians)	Radiation therapy	Unknown
		No radiation therapy	Unknown
		Radiation and surgery	Unknown
Place/Geographical location (Exposure)	Regions in U. S. (Alaska, East, Nothern Plains, South West, Pacific coast)	Radiation therapy	Unknown
		No radiation therapy	Unknown
		Radiation and surgery	Unknown

Nature of Study

I used a quantitative cross-sectional study to determine if there was a difference in the survival of cervical cancer among women of different race after radiation therapy. I chose the quantitative methodology for this study. The quantitative method includes post positivist knowledge that provides part of the truth by observing numerical data from a large sample size, and making inferences from the samples (Isaza-Restrepo, Carvajal, & Montoya, 2016).

The study was a cross-sectional study of secondary data obtained from Surveillance, Epidemiology, and End Results (SEER) dataset from 1973 to 2012. The analysis required using modes that included descriptive statistics, and a logistic regression analysis. I did not employ survival analysis. Survival analysis involves assumptions and extrapolations in the calculation to predict time to an event when researchers know that time is not sufficient to follow every participant to the end of life, and the cause of death could differ from the study events or predictors (Gassama, Bénichou, Dartois, & Thiébaut,

2017; Williams, Lewsey, Mackay, & Briggs, 2016). I employed a logistic regression analysis, which is the best method to describe the relationship between the dependent variable and the independent variables (Pourghasemi, Moradi, & Aghda, 2013) because the hypotheses do not address time to the event.

These data from SEER were appropriate for use in the study because the SEER is a reliable source of information when conducting national studies based on delay adjusted, long term, and population-based incidence and mortality data (Siegel, Miller, & Jemal, 2015). The SEER includes proper documentation of women with or without radiation and outcomes from follow up. The independent variables were the effect of early cervical cancer screening using radiation therapy among Non-Hispanic Blacks, Non-Hispanic Whites, Asians, and Hispanics, broken down by age and race groups.

Definition of Terms

The independent variables were the effect of early cervical cancer screening using radiation therapy among non-Hispanic Blacks, non-Hispanic Whites, Hispanics, and Asians, and the effect of early cervical cancer screening using radiation therapy among age

groups. The dependent variable was the survival rates among races. These are the definitions of these variable terms:

Cervical cancer: The malignancy of the cervical epithelium, which is the result of infection by HPV on the cervix (Maguire et al., 2015).

Cervical intraepithelial neoplasia (CIN): CIN is the premalignant lesion with three histological stages: CIN1, CIN2, and CIN3 (Santesso et al., 2015).

Cervical cancer survival: Is the prognostic value in cervical cancer. However, this value remains unclear (Pan et al., 2015).

Cytology-based screening: The use of Papanicolaou (Pap) smear to examine the changes in the cervical epithelial cells for infections due to HPV (Subramanian et al., 2016). The results of Pap tests are either low-grade Squamous intraepithelial lesion (LSIL), atypical squamous cells, or high-grade squamous intraepithelial lesion (Chengquan et al. (2015; Thrall, Janssen, & Mody, 2015).

Human papilloma virus (HPV) Genotype 16, 18): The cause of cervical cancer, detected by Papanicolaou (Pap). The test shows either high-grade squamous intraepithelial

lesion (HSIL) or low-grade squamous intraepithelial lesion (LSIL; Barron, Austin, Li, & Zhao, 2015; Skinner et al., 2015).

Race: The occurrence of names of people in the U. S. Census data more than 100 times, and the address geocoded based on the longitude and, latitude from U. S. 2000 Census book (Grundmeier et al., 2015; Rio & Alonso-Villar, 2015).

Radiation: The transmission and emission of charged particles for the killing of a cervical cancer cell with minimal or no damage to the normal cervical epithelial cells (Kaur, Avasthi, Pujari, & Sarma, 2013).

Radiation therapy: The delivery of doses in required amount for 5 to 6 weeks to maximize damage to the malignant cervical cancer cells and cause no damage to the surrounding normal cells (Ghose et al., 2015).

Screening: A process of investigating a disease causation organism in an asymptomatic individual (Bulliard et al., 2014). Screening could opportunistic or organized; organized screening occurs when participants from a given population undergo a form of investigation to detect the presence of a disease-causing agent, or opportunistic

occurs when an individual undergoes screening outside an organized screening method (Bulliard et al., 2014).

Staging: The use of surgical specimen obtained from a tissue such as a cervix to classify the patient as high, an intermediate or low risk for cervical cancer (Juan et al., 2015; Matsuo et al., 2015). Early cervical cancer is Stage 1-11A (cancer is localized or regional), the late Stage is 11B-1VB (cancer metastasized), A is the absence of lymph nodes metastasis, and B is the presence of lymph nodes metastasis (Min Sun et al., 2015; Winer et al. (2015).

Survival rate: Survival rate is x years for individuals with cancer who are alive for x years divided by the number of individuals diagnosed with same cancer for an x period of years within the study population (Wegwarth, Gaissmaier, & Gigerenzer, 2011).

Testing: The detection of disease-causing agents before the symptoms become apparent, and early detection programs use public health instruments to detect individuals with cancer before the disease becomes advanced; subsequent treatment fails to achieve the desired outcomes (Bill-Axelson et al., 2014; Rajaraman et al., 2015). Saraiya et al. (2014)

stated that early testing is a preventive service supported by Affordable Care Act (ACA) for women with high risks of contracting HPV.

Assumptions

I assumed that the secondary data collected from SEER were reliable and could generalize the cervical cancer statistical data obtained if collected by any other agencies.

Scope and Delimitations

I examined the secondary data from the SEER database for women who used or did not use radiation for early cervical cancer. The delimitation of the study was to participants living in United States; the result may not be generalizable to countries beyond United States.

Limitations

This study does not apply to women who developed early cervical cancer from in-utero exposure to diethylstilbestrol; organ transplant; or the use of chemotherapy, such as chronic use of corticosteroid. I did not identify which HPV types were in the secondary data. The secondary data collected from SEER could not assume a causal role because the

data were not primary data, and they could only measure associations between independent and dependent variables.

Significance

Professionals who examine and treat women with early cervical cancer in the United States can use the result of this study. The results of the study would contribute to the prognostic factors of survival for women of different races and age groups. The findings may motivate women to seek screening and treatment for early cervical cancer cases. This study may be a source of health education for non-Hispanic Blacks, White non-Hispanics, Hispanics, and Asians to correct any misperception about early screening for cervical cancer, radiation therapy, and similar survival rates.

The results of the study will add to the body of knowledge in epidemiology for understanding the effects of radiation for treating early stage cervical cancer for non-Hispanic Black, White non-Hispanics, Hispanics, and Asians living in the United States. The outcomes of the study will contribute to social change by providing evidence for women for getting regular Papanicolaou test (Pap smear) and cervical cytology tests early

in life. The results of the study could contribute to positive social change if early detection of cervical cancer proves to reduce mortality among women who otherwise succumb to the disease. The results may help to keep families together and provide a better quality of life for women who receive early testing and radiation therapy.

Summary

Pimenta et al., (2013) stated that survival rates among women with cervical cancer is below average. Cervical cancer is the third most common cancer after lung and breast cancers in United States, despite the availability of tools for testing and making a diagnosis (Pimenta et al., 2013). Improvement in cervical cancer treatment due to age and the race is not clear, and no scholars demonstrated the association between radiation therapies, early testing, age, race, and survival rate (Zeng et al., 2015). Ellinor et al. (2015) argued that epidemiologists and physicians have the responsibility to pass correct information about the benefits of treatment to women to encourage them to participate in cervical cancer screening and treatment. Robinson et al. (2015) believed that survival of women with

cervical cancer depends on their awareness and participation in screening as well as treatment options.

This chapter included the background, problem statement, purpose of the study, research questions, and hypothesis. The chapter also included discussion on the theoretical for the study, the significance of this study, and the implications for positive social change. In chapter 2, I explained the review of the literature on cervical cancer and the spatiotemporal relationship associated with the epidemiological triad.

Chapter 2: Literature review

Introduction

Participation by women in early screening for cervical cancer is poor, and survival rate of women from cervical cancer treatment due to age, sex, and race is not clear (Torre et al., 2015). The purpose of this study is to examine the effects of radiation therapy on early cervical cancer detection based on age by group and race for women living in the United States. There are benefits to women understanding the advantages of getting early cervical cancer screening (Huh et al., 2015). One advantage of early screening is the opportunity to use the most effective treatment options to increase cancer remission. Radiation therapy kills malignant cervical cells while sparing the healthy cervical cells. There are no studies on the effects of radiation treatment for curing cervical cancer in an early stage status among different races or age by groups living in the United States (Östensson et al., 2015).

In this chapter, I discuss the current literature findings related to my study. My discussion on the strategy to find current literature for the study includes a review of the epidemiological triad that is the theoretical framework I used for this research. Also, I

discuss research findings on cervical cancer survival based on various treatment options about the epidemiological triad.

Literature Review Strategy

I conducted an online search of relevant articles and journals using multiple databases such as Medline, Thoreau, Google Scholar, PsycINFO, ProQuest Central, Academic search Premier, ProQuest Health, EBSCO, Science and Ovid journals. Also, I searched the dissertations and theses database available through ProQuest to find empirical studies related to the treatment of cervical cancer. Other health science collections such as Medical Complete, Social science Journals, and Cochrane database of systematic review provided findings related to the epidemiological triad that was foundational for the study.

I conducted searches using keywords, subject terms, and Boolean phrases. Some key search terms centered on *cervical cancer, cancer, cervical, age, race, early detection, HPV testing, Papanicolaou (Pap) test, epidemiological triad, epidemiological triangle, and epidemiological model.* The primary research period was within the last 5 years of publication for a majority of studies; however, researching beyond a 5-year period was

necessary to understand the background of the study phenomenon and a history of treatment used in cervical cancer treatment.

Epidemiological Triad Theory

Introduction

The epidemiological triad was the theoretical framework for the study. Clark created the epidemiological triad in 1954 (Cohen & Shang 2015). The purpose of the triad was to study the relationship between an agent such as a procedure drug (early HPV testing), a host such as a person or community (women), and an environment such as the exposure to disease (risk of cervical cancer and radiation therapy) in disease transmission (Chaney & Rojas-Guyler, 2015). Hagan (2011) found that agent is efficient in disease transmission into the host, and is stable in the environment. Hagan demonstrated that the epidemiological triad was effective for understanding the interaction between the cycle of transmission of other diseases such as early HPV testing of women exposed to cervical cancer, and the rate of survival.

Bunnik et al. (2014) argued that when controlling infectious agents, scholars must focus on the time between the distant exposure, the infection event, and the delay in the onset of transmission. Further, Bunnik et al. argued that infectivity depends on the distance between the host and the pathogen decay (virulence) rate; therefore, control is necessary because of the interplay of the infectious agent and infectivity in the environment. Rohrer et al., (2013) explained that the epidemiological triad provided a guide to quality assessment. When the research involved an epidemiological study that required testing associations between variables, researchers located variations on the environment (place), host (person), and time (procedure). I present a detailed description of the inter-relationships in the epidemiological triad in the next section.

Agent, Host, and Environment

Agent (procedure). The agent part of the triad includes chemical contaminants and mechanical forces that form an interaction between the host and an environment, resulting in the metamorphosis of a disease (CDC, 2012). Rohrer et al. (2013) applied an agent to time as in a pre and post intervention period or early and late testing period. Morabia

(2014) examined the concept of time in the epidemiological triad and argued that individual or groups of individuals enter and leave a population over time, and individuals develop varying health outcomes over time. Chaney and Rojas-Guyler (2015) referred to the agent as a procedure or drug such as HPV testing procedure. For this study, the time represented the difference between early period and late period testing using the HPV procedure among women. Blennow et al. (2015) explained that early testing is preferable to late testing for making a diagnosis of Alzheimer's disease (AD) because early testing allowed for easy monitoring and prevention of a severe form of the disease.

Early testing for biomarkers in the cerebrospinal fluid of people with mild cognitive impairment revealed peptide, amyloid-β, phosphorylated tau, and total tau prevented progression to AD and offered early treatment strategies (Blennow, 2015). Early testing for the Human Epidermal Growth Factor Receptor 2 gene or ERBB2 offered better care and prevented progression to full-blown breast cancer Stage IV (Wolff et al., 2014). Wolff et al. (2014) argued that the HER 2 gene expressed more than 15% to 20% in primary breast

cancers, and detection from early rather than late testing led to better management and increased the quality of care.

Time related to early testing of a disease influences outcomes. Early testing provides increased success in disease detection and management that result in the cure and eradication of many diseases. The time element of the triad provides a necessary basis for comparing the effectiveness of early testing of cervical cancer compared to late testing among women when using radiation therapy for increasing the survival rates of women.

Host (person). The host is a link in the chain of disease transmission between the agent and the manifestation of the disease. Hosts are humans, animals, or organisms harboring diseases leading to sicknesses (CDC, 2012). Females with HPV infect males during unprotected sex, causing males to contract the HPV; these infected males, in turn, infect other females during unprotected sex, causing the disease to spread (Liu et al., 2015). The disease originates in either males or females (Liu et al., 2015). According to the CDC (2012) report, a host was not always aware of harboring a disease such as men who carry the HPV.

The mechanism of action of the HPV that cause cervical cancer in the host remains unclear. Natarajase, Enthumathi, Shanmughap, Sumathi, and Das (2015) stated that infection of the cervix by HPV abolished the innate immune response by reducing the Toll-like receptors-2 and TLR 4 expressions (pathogen recognition receptors) in cervical squamous cells. This reaction is the first carcinogenic event in cervical cancer development.

The host demonstrates strong resistance to HPV infection. Paaso et al. (2015) reported that persistent HPV infection reduces cell-mediated immunity, and the women's ability to survive the cervical cancer development depends on the level of CD4+ and CD8+ HPV-specific T-cell response that promote innate immunity against HPV 16 E2 protein and help apoptosis (programmed cell death). Researchers have reported that men could serve as a host to HPV. Pask and Rawlins (2016) reported that HPV could infect men from women leading to the development of genital warts, anal cancer and oropharyngeal cancers (throat cancer).

Other disease processes involve host to produce diseases. Abdizadeh, Maraghi, Ghadiri, Tavalla and Shojaee (2015) reported that toxoplasmosis is an infection caused by *Toxoplasma Gondi* in nonimmune human beings and non-immune pregnant women as host, causing abortion and stillbirth. Early detection would be of advantage to prevent the harmful effects of the disease on the host (women and the pregnancy; Abdizadeh et al., 2015). However, in the late stage of the disease, there would be parasites in the tissues, which makes it difficult to treat with drugs; patients (host) are less likely to tolerate the drugs. The development of HIV and Hepatitis C virus infection in human beings are examples of other ways hosts play roles in the transmission of diseases (Miao, Li, Zheng, Cohen & Liu, 2016).

Environment (exposure). The environment is the place, geographical location, or exposure to the agent (Rohrer et al., 2013). Table 2 shows that there must be an environment for sexual intercourse, and the agents are unprotected sex among the females of all races and ages (the host). The outcome of this interaction is an exposure of the host to cervical cancer. Unprotected sex, oral sex, frequent change of partners without the use of a

condom, and development of sexually transmitted infection expose females to HPV (Knight, Needham, Ward & Roberts, 2016). Mullins, Widdice, Rosenthal, Zimet and Kahn (2015) argued that females tend to contract cervical cancer due to inconsistent knowledge about their safety following HPV vaccination, HPV and their perception of the risks of Sexually transmitted infections. Mullins et al. argued that inability of mothers to provide necessary HPV information to their daughters, and lack of information from providers for females during hospital visits encourages unprotected sex and late HPV testing.

Table 2

HPV Virus Infection as it affects Agent, Host, and the Environment.

	Environment	Agent	Host	Outcome
Contracting HPV	Sexual intercourse	Unprotected sex	Females and Males All ages All races	Known (Exposure to cervical cancer among females)
Treatment (Cervical Cancer)	Early detection (within three	Radiation therapy	Females All ages All races	Unknown Unknown Unknown

	years of first sexual unprotected intercourse or by age 21 unless there is sexual abstinence)	Surgery with Radiation Therapy	Females All ages All races	Unknown Unknown Unknown
		Surgery without radiation therapy	Females All ages All races	Unknown Unknown Unknown
Treatment (Cervical Cancer)	Late detection (Anytime)	Radiation therapy	Females All ages All races	Low Survival Low Survival Low Survival
		Surgery with Radiation Therapy	Females All ages All races	Low Survival Low Survival Low Survival
		Surgery without radiation therapy	Females All ages All races	Low Survival Low Survival Low Survival

Torre et al. (2015) argued that the HPV vaccination does not protect against established HPV infections and HPV genotypes that cause cervical cancer. Researchers do not know the outcome when females of all races and ages opt for early detection of cervical

cancer and receive radiation therapy, surgery with radiation therapy or surgery without radiation therapy (Östensson et al., 2015). When females of all races and ages with cervical cancer opt for late detection of the disease, the disease metastasizes to a different part of the body, the treatment modalities are not effective and the outcomes are a low survival from the disease. Jolly, Bessler, Ncube, Bey and Knight (2015) argued that some factors are responsible for the late detection of cervical cancer by females of all ages and races. These include inadequate knowledge of cervical cancer, low socioeconomic (SES) factors, lack of access to testing facilities, pain from tests such as colposcopy, and fear and embarrassment of having a positive cervical cancer diagnosis (Jolly et al., 2015).

Spatiotemporal Relationship and Spread of Diseases

Time, place, and person are constructs that explain the spatiotemporal relationship in cervical cancer spread from early to late spread. Hautala and Jauhiainen (2014) reported that spatiotemporal relationship is a process of building ideas from what other people have known based on time, place, and person, and this relates to the disease creation in spatial and temporal dimensions. Hautala and Jauhiainen believed that knowledge creation is an

interactive process that comes from people, agent and their environment as they process the thoughts and actions of another individual, and relate them to time (the past, present, future), and space. Hautala and Jauhiainen explained that time is linear and connected to space on a geographical surface, and space is surrounding the place.

The model of spatiotemporal relationship explains the process of the spread of the cervical cancer. Lai et al. (2015) reported that past researchers had explained the spread of diseases based on the characteristics and activities of agents, host, and environment causing the disease; however, it is preferable to express the spread of diseases using spatiotemporal means within the epidemiological triad. This model uses a temporal and spatial approach to identify the flow of diseases (Lai et al., 2015). The triad uses time (the time the disease is detected), the person (the host such as women, race, and their ages), and place (where exposure takes place such as exposure to cervical cancer, and exposure to radiation therapy; Lai et al., 2015). There is a lack of information on the benefits of receiving radiation therapy early to prevent precancerous cervical lesions from becoming invasive lesions (Östensson et al., 2015).

A spatiotemporal understanding of disease spread led to an understanding of how to stop the spread of diseases. Lai et al. (2015) argued that a spatiotemporal approach examines the effect of continuous testing to prevent disease progression, and it offers early warning sign in disease surveillance. Also, the spatiotemporal model is useful for health care policy makers to formulate policies that may allocate more resources to areas of the communities to minimize the spread of a particular disease (Lai et al., 2015).

Cervical Cancer

HPV

The rate of exposure to HPV remains high. In the United States, over 80 million females alone host the HPV, while 14 million new infections occurred annually (Kenya et al., 2015). Wright et al. (2015) found that the HPV had different strains (6, 11, 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 66). The strains that were most effective for mutating into cervical cancer were the Genotypes 16 and 18 (Wright et al., 2015). Although contracting HPV Genotypes 16 and 18 lead to squamous intraepithelial lesions (dysplasia), a small percentage of the dysplasia produces cervical cancer cells in women (Trimble et al.,

2015). Kenya et al. (2015) argued that other HPV genotypes did not result in the cervical cancer disease among women.

Risk Factors for Contracting HPV

There are factors that increase the spread of the HPV virus among women. Men are the original carriers of HPV, and unprotected sex with HPV-infected men is a risk factor for women to contract HPV (Vermandere, Naanyu, Degomme & Michielsen, 2015). Factors that spread the HPV infection include men with many sexual partners having unprotected sex, and women with many sexual partners having unprotected sex with HPV-infected men. This pattern continues with HPV-infected women infecting other men, who in turn infect other women (Bezabih, Tessema, Sengi, & Deribew, 2015; Nayak, 2015). A single exposure to HPV among women who have unprotected sex with HPV-infected men to result in HPV infection, but the single exposure does not necessarily lead to the development of cervical cancer (Cooper & Gordon, 2015).

Behaviors Associated with Cervical Cancer after HPV Exposure

There are behaviors that increase the risk of the HPV (16 and 18 genotypes) infection mutating into cervical cancer. Nayak (2015) stated that prolonged use of contraceptives, HIV infection, multiparity, and promiscuity were factors associated with HPV mutating into cervical cancer. Chung (2015) explained that long-term use of contraceptives increased the risk of developing cervical cancer in HPV-infected women by stimulating estrogen and progesterone receptors that trigger cervical cancer development. Chung indicated that the inverse is also true, which is that a reduction in contraceptives had a positive relationship with the risk of developing cervical cancer. Parham et al. (2015) stated that women infected with HIV were at increased risk of the HPV infection mutating into cervical cancer.

An HIV diagnosis increased the risk of contracting HPV infection by reducing the host's immunity and the ability to fight against the development of HPV. Smoking also increased the risk of the HPV virus developing into cervical cancer (Wieland et al., 2015). Smoking increases the HPV load in the cervical epithelium. The HPV-positive women who

smoked had an increased level of HPV 16 and 18 DNA loads (Wieland et al., 2015). The increased HPV loads damaged the epithelium, causing CIN that developed into cervical cancer (Wieland et al., 2015).

Early HPV Screening

Testing women for HPV are easy to do and cost effective; however, O'Connor et al. (2014) found that testing led to psychological and emotional anxiety and stress among women. O'Connor et al. argued that some women believed the HPV infection was a sexually transmitted disease, and therefore a positive result would cause other people to believe the women lived a life of promiscuity, this perception would result in social shaming.

Women often worry about the outcome of screening. Smith (2014) explained that early screening using Pap and HPV screening, though, prevent the pre-cancer stage from developing into invasive cancer following treatment of the positive cases, but women with high-risk HPV positive or abnormal Pap test usually develop psychological problems because of the fear of developing cervical cancer. Smith explained that abnormal Pap test

or HPV DNA positive test could lead to more screening using Colposcopy or biopsy, which may increase fears of these additional tests. Health caregivers must explain the benefit of early testing to patients, that both tests are important when carried out early to reduce the advancement of persistent infections with HPV virus (Smith, 2014).

The United States is not an exception in the global persistence of cervical cancer. Wang et al. (2014) reported that the incidence of cervical cancer was on the rise among younger women in the United States with poor clinical outcomes, despite the knowledge, prevention, and treatment modalities for the causative organism. Fleming, Schluterman, Tracy, and Temkin (2014) argued that there was unequal treatment after early detection of cervical cancer. Some women received radiation; others received surgery, and there was no data on the control variables such as a race on radiation therapy.

Researchers have shown that age is important in the management of cervical cancer. Smith et al. (2015) reported that age was important in the development of the disease, and the screening procedures were Pap smear test and HPV DNA tests for women from ages 21 to 65 years. Saslow et al. (2012) argued that screening must start at age 21 and those

women at ages 21-29 years must receive screening every three years using a Pap test. Women that were 30-65 years must screen for HPV using the Pap smear and HPV DNA tests every five years. Some women must screen every three years using the Pap smear test alone (Park et al., 2015). Screening should continue for 20 years after the treatment for CIN2, CIN3, and adenocarcinoma in situ (Saslow et al., 2012).

Some exceptions to cervical cancer screening occur. Exceptions include women with two consecutive negative Pap and HPV tests within the last ten years or women who had a hysterectomy (Saslow et al., 2012). Also, Smith et al. stated that the criteria for an exception were for women older than 65 years of age and women with three consecutive negative Pap smear tests. These women did not need screening for the HPV and cervical cancer. Researchers had argued that SES is an important factor in determining when some women were likely to engage cervical cancer screening (Tervonen et al., 2016).

Early Screening vs. Late Screening

Researchers demonstrated that early testing for cervical cancer could speed up the treatment of cervical cancer, and late HPV testing worsened the diagnosis.

Sankaranarayanan (2014) stated that HPV testing offered early detection of precancerous lesions of the cervix, and cancerous lesions if women present late. Benard et al. (2014) reported that early HPV and Pap tests are useful to determine the health status of a woman before or during HPV infection and the development of cervical cancer and are the sources of education for women concerning the disease. Benard et al. stated that the HPV and Pap tests provide evidence-based screening practices for cervical cancer, and help to prevent the precancerous lesions from progressing to invasive cervical cancer.

Persistent infections of the HPV virus led to the development of cervical cancer. Hariri, et al. (2015) explained that researchers developed emerging infections program (EIP) for Cervical Intraepithelial Neoplasia (CIN 1, 2, 3) to screen women from age 28years for persistent infections of HPV. Hariri et al. reported that researchers should focus on the environment or the place of the high risk of HPV infection as catchment areas for screening HPV genotypes 16 and 18, the most virulent of HPV for cervical cancer.

Early testing detects precancerous lesions. Perkins and Stier (2014) explained that HPV testing has increased sensitivity than Pap test and that HPV test detects 95% of HPV

while Pap test detects about 40-70% of HPV, when the physicians asked for the two tests, the detection rate increased above 95%. Perkins and Stier stated that early HPV and Pap tests detect precancerous lesions before progression to invasive lesions detected by late HPV testing, and early HPV and Pap tests reduce the incidence by 50%. The risk of developing cervical cancer or cervical dysplasia after three years of negative Pap test is .78%, after three years of negative HPV test is .34% and after three years for both Pap and HPV tests is .30% (Perkins & Stier, 2014). Women with late testing and women missing their testing dates will progress to cancerous lesions if there are preexisting precancerous lesions (Perkins & Stier, 2014).

Cervical Cancer Screening and SES

The association between cervical survival and SES is inconsistent and inconclusive despite reports that SES contributes to health disparities (Lin, Shootman & Zhan, 2014). Williams, Moneyham, Kempf, Chamot and Scarinci (2015) argued that cervical cancer rates were higher in resource-constraint regions due to the inability of women to adhere to screening recommendations. Tay et al. (2015) argued that women with low employment

status belong to the low socioeconomic class, and were less likely to undergo cervical cancer screening or complete the recommended number of screenings. Tervonen et al. (2016) argued further that there is an association between lower SES and advanced stage of cancer in the United States. Tervonen et al. explained that the strength of association depends on the health care system because researchers observed differences in countries with high levels of health equity such as Finland. The United States study revealed that socioeconomic disadvantages led to increased risk of late stage cancers such as colorectal, prostate, and breast cancers (Tervonen et al., 2016).

Diagnosis of Cervical Cancer

The reports of HPV and cervical cancer continue to grow globally. Kjær, Munk, Junge, and Iftner (2014) explained that 500,000 women were diagnosed with cervical cancer every year, while 270,000 (54%) of women died from the disease. Kjær et al. (2014) argued that the HPV virus was responsible for the development of high-grade cervical lesions (HSIL) in women and was further responsible for cancer development in men. Kjær et al. argued that HSILs caused cancers in the anus, vagina, penis, oropharynx, and vulva

respectively among males and females. The HPV infection was associated with 5 percent of all cancers diagnosed globally (Kjær et al., 2014).

Identifying the histology of cervical cancer cells types is useful when detecting the growth and spread of cancer cells in women. Lazzari et al. (2014) described cervical cancer as having three histological types that are Adenocarcinoma, Squamous cell carcinoma, and Adenosquamous. Clinicians use examinations and image techniques such as magnetic resonance imaging (MRI), and Computed Tomography (CT) when diagnosing cervical cancer. Lazzari et al. argued that the MRI was the best imaging technique for identifying the location, size, and metastasis of cervical cancer, with 88% to 97% sensitivity, and 93% specificity. Driscoll, Halpenny, Johnston, Sheehy, and Keogan (2015) explained that there were four stages of cervical cancer and three methods of diagnosing each stage; the three methods for diagnosing each stage of cancer involve surgical, clinical, or radiological methods. Table 3 explains the four stages of cervical cancer spread in women detected in Stages Ia to IIa and the possibility of getting surgery and radiation.

Table 3

Stages in Cervical Cancer Diagnosis

Stage at diagnosis	Interpretation of stages	Treatment	Outcome/risk	Unknown
I	Tumor limited to the cervix			
Ia	Lesion less than 5 cm	Surgery only, Radiation, Surgery + Radiation	Removal of tumor with surgery, radiation kills cervical cancer cells	Whether all cancer cells are removed with surgery, the benefits of radiation therapy
Ib	Lesion greater than 5 cm	Surgery only, Radiation, Surgery + Radiation	Removal of tumor with surgery, radiation kills cervical cancer cells	Whether all cancer cells are removed with surgery, the benefits of radiation therapy

II	Tumor extends past the cervix to lower part of the uterus			
IIa	No lymph nodes involvement	Surgery only, Radiation, Surgery + Radiation	Removal of tumor with surgery, radiation kills cervical cancer cells	Whether all cancer cells are removed with surgery, the benefits of radiation therapy
IIb	lymph nodes involvement	Surgery and chemotherapy	The beginning of metastasis, surgery, radiation not effective. Chemotherapy might be effective. Out of the scope of this	We do not know the extent of spread of cervical cancer cells. Out of the scope of this proposed study.

			proposed study	
III	Tumor invades abdominal tissues, not beyond the diaphragm			
IIIa	Tumor restricted to one site e.g. uterus and ovary	Chemotherapy	Surgery, radiation not effective. Chemotherapy might be effective. Out of the scope of this proposed study	We do not know the extent of spread of cervical cancer cells. Out of the scope of this proposed study.
IIIb	Tumor restricted to multiple sites	Chemotherapy	Surgery, radiation not effective. Chemotherapy might be	We do not know the extent of spread of cervical cancer cells. Out of the scope of

			effective. Out of the scope of this proposed study	this proposed study.
IV	Metastasis to pelvic regions, beyond diaphragm, and para-aortic lymph nodes			
Iva	Tumor cells found in the rectum and bladder	Chemotherapy	Surgery, radiation not effective. Chemotherapy might be effective. Out of the scope of this proposed study	We do not know the extent of spread of cervical cancer cells. Out of the scope of this proposed study.
IVb	Tumor with	Chemotherapy	Surgery, radiation	We do not know the

distant metastasis	not effective. Chemotherapy might be effective. Out of the scope of this proposed study	extent of spread of cervical cancer cells. Out of the scope of this proposed study.

These methods aid in determining whether cancer metastasized from one stage to the next, with stage one being the first stage and stage four the last stage of cervical cancer, reflecting the occurrence of ultimate metastasis (Prat & Mbani, 2015). Failure to diagnose cervical cancer early usually resulted in metastasis to different parts of the body including the lymph nodes (pelvic and Para-aortic), which in turn results in early mortality (Prat & Mbani, 2015). The following discussions are on the treatments used in cervical cancer patients.

Treatment of cervical cancer

In recent years, patients who experienced early cervical cancer detection benefitted from using radiotherapy with chemotherapy or radiotherapy without chemotherapy, which was the primary treatment option for increasing survival rates among women (Lazzari et al., 2014). Treatment modalities and the availability of equipment for diagnosis were of great importance when managing cervical cancer.

Participation in screening for cervical cancer among women in developed countries was not as high as possible. Researchers believed that 42% of women in the United States do not engage in early screening (Cohen et al., 2016). Cohen et al. argued that the screening rates among women varied by region in the United States and by age. The researchers indicated that 44% to 81% of women between ages 45 years to 64 years engaged early screening. Approximately 67% of the women did not engage the U.S. screening recommendations, indicating a high level of non-adherence among U.S. women, even though there was awareness among screening centers on a nationwide level (Cohen et al., 2016).

Despite the available knowledge of causative organisms of cervical cancer and effective treatment modalities, there remains inadequacy of awareness of the effectiveness of using radiation therapy among women of all races and ages that undergo early screening in the United States (Chen, Kessler, Mori, & Chauhan, 2012). Researchers have argued that there is a benefit from increasing the number of women that undergo early (under age 40) cervical cancer screening because these researchers have observed an increase in nulliparous women diagnosed with early cervical cancer (Choi et al., 2015). The following are discussions on treatment options such as surgery, radiation, and treatment combinations for removing or curing cervical cancer for women with early stage diagnoses and late stage diagnoses.

Treatment of early cervical cancer

The treatment modalities for early cervical cancer are surgery and radiation. Treatment for cervical cancer is effective and lead to cure when detected early, and the prognosis of cervical cancer depends on the staging (Lau et al., 2015). Radiation therapy alone or in combination with another therapy has proofed increase survival in many

diseases such as lung, breast, and colorectal cancers (Landry et al., 2015). Researchers have noted the disparities in the outcomes of the use of radiation therapy for breast cancer among different age groups and races (Powers et al., 2015). There is a lack of information on the benefit of using radiation therapy in cervical cancer in early age groups and races and needs to be further studied (Fang et al., 2015).

Surgery Treatment

Early stage diagnosis. Surgery is one of the recommended treatment modalities for addressing early stage cervical cancer in women. Shazly, Murad, Dowdy, Gostout and Famuyide (2015) stated that the treatment for early cervical cancer is surgery such as radical vaginal hysterectomy (open, vaginal, abdominal, laparoscopic, or robotic), but there is a lack of evidence to support the effectiveness of surgery for early cervical cancer. Pareja et al. (2015) argued that surgeons used radical trachelectomy or cervicectomy (removal of cervix only to preserve fertility in young women that deserve to bear children). Pareja et al. stated that surgeon-recommended trachelectomy often leads to high recurrence rate. There

are no effective and conclusive policy recommendations for surgery in early stage cervical cancer (Pareja et al., 2015).

Late stage diagnosis. Vizza et al. (2015) stated that surgeons used radical surgery for the tumors that are visible, but due to metastasis, most tumors are not visible; surgeons followed the surgeries with chemo-radiotherapy as treatment modalities for advanced cervical cancer. Surgery reduced the tumor size in late stage, but could not remove the obscured cervical cancer cells; however, the outcome of treating late cervical cancer with surgery remains uncertain (Vizza et al., 2015). Ramondetta et al. (2015) supported the idea that treating late stage cervical cancer with surgery, chemotherapy, and radiation therapy offered little or no significant outcomes.

Radiation Therapy Treatment

Early stage diagnosis. Treatment of early stage cervical cancer involves radiation therapy. Heijkoop et al. (2015) reported that Intensity Modulated Radiotherapy (IMRT) is the recommended treatment for early stage cervical cancer. The IMRT is better than the conventional 3-dimensional radiotherapy for effective sparing of the healthy tissues while

killing the cancer cells (Heijkoop et al., 2015). Fu et al. (2015) argued further that using radiation therapy before surgery shrinks the tumors and makes tumor removal by radical surgery easier to do. Fu et al. stated that currently, radiation therapy is a standard therapeutic approach for treating early cervical cancer.

Late stage diagnosis. Radiation treatment for late stage offered no improvement in prognosis. Wakatsuki et al. (2015) reported that metastases occur at higher frequencies in late-stage cervical cancer, and when surgeons offered radiation therapy as the necessary treatment, the result is a poor outcome. Lutgens et al. (2016) argued that radiation therapy with cisplatin-based chemotherapy (RT-CT) is the standard therapeutic approach to advanced stage cervical cancer. Lutgens et al. argued further that the advantages of radiology in advanced stages were less obvious than in early stages.

Surgery and Radiation Therapy Treatment

Early stage diagnosis. Surgeons use surgery and radiation for better management of cervical cancer in the early stage of the disease. Sert et al. (2016) reported that surgery had intra-operative complications, which required postoperative radiation therapy. Winer et

al. (2015) stated that a combination of surgery and radiation therapy would increase survival in early stage of cervical cancer. However, the ratio of women that received radiotherapy to women who did not received radiotherapy was 1:2 (182 women received surgery, 98 women received radiotherapy) (Alexandre et al., 2017).

Late stage diagnosis. Surgeons tend to treat the late stage of cervical cancer with combinations of surgery, radiation. Fournel et al. (2016) explained that advanced stage cervical cancer are unresectable, and surgeon often tried a combination of radiotherapy and surgery, however, the outcomes have never been proven successful. Abou-Taleb et al. (2016) argued that the physicians treated the late stage cervical cancer with a combination of surgery and radiation therapy to reduce the toxic effect of the disease. Abou-Taleb et al. did not specify the advantages and disadvantages of the treatments.

Other Treatment Modalities

Some women were using treatment methods for experiencing less stress that was free or cost little when compared to radiation and surgery treatments (Tang et al., 2015). There are other methods of treating cancers such as cancer immunotherapy (Regan, Guth,

Coy, & Dow, 2016). Coley's treatment is a type of immunotherapy treatment used for treating patients with a late stage cervical cancer diagnosis (Eskander & Tewari, 2015). The treatment is a process of inducing fever from artificial viral infection leading to the development of leukocyte proliferation resulting in the body producing enzymes, hormones or chemicals that destroyed cancer cells (Dhama et al., 2015). Coley's treatment has led to the development of Bacillus Calmette–Guerin vaccine (BCG) in the treatment of superficial bladder cancer and demonstrated cancer-protective effect when treating early stage disease (Bross et al., 2015). This mode of therapy needs further investigation.

Some women would have embraced homeopathic treatment. Homeopathy is a science that embraces the belief that some preparations could facilitate self-cure by stimulating the body to eliminate waste and correct equilibrium (Dossett, Davis, Kaptchuk & Yeh, 2016). Mathie et al. (2016) searched for evidence of validity in using homeopathic treatment in disease management, and the conclusion was that none of the evidence was free of potential bias, and the result was either uncertain or inadequate. Available studies did not show support for homeopathic forms of treatment, indicating no scientific support

because of lacking information on effectiveness (Stub, Musial, Kristoffersen, Alræk, & Liu, 2016). In summary, conducting this proposed study, the treatment group consists of women with cervical cancer who received radiation therapy alone, or radiation with surgery, and the control group that consists of women with cervical cancer who received other treatments without radiation therapy.

Cancer Survival Rates

Cervical cancer survival rates vary within racial groups. DeSantis, Ma, Bryan, and Jemal (2014) reported that survival rate in breast cancer was lowest in African-American with 78.9% compared to 88.6 in non-Hispanic Whites, 91.1% in Asian American/Pacific Islanders, and 87.0% in Hispanic/Latina. Yu et al. (2015) stated that survival rate in lung cancer following surgery in early detection when there is no metastasis is better, application of radiation in early and advanced lung cancer is not clear, and more research is needed to examine the benefits of using radiation therapy in lung cancer. Jansen, Hoffmeister, Arndt, Chang-Claude, and Brenner (2014) stated that overall survival rate in colorectal cancer (CRC) in stages I to III was 18 months after diagnosis. However, the

CRC-specific survival following the use of B-blockers such as ß$_2$-adrenergic (propranolol) was 17 months longer than overall survival.

Cervical cancer morbidity and mortality

Women with late testing incurred advanced stage of cervical cancer from CIN. Nygard et al. (2014) reported that about 30 % of CIN 3 lesions would lead to cervical cancer if left untreated for 30 years. In women of childbearing age, the existence of CIN 3 could lead to premature delivery, and it could affect the health of the newborn child. Miller, Hanson, Johnson, Royalty, and Richardson (2014) explained burden of the disease among women in the U. S., despite the preventive and treatment options that are available. The authors argued that despite the improvement in prevention and treatment, the burden of cervical cancer shows disparities based on race and SES.

Methodological Critique of Epidemiological Studies

A summary of epidemiological studies in Table 4 provide examples of models used when analyzing cross-sectional quantitative studies. Henderson and Elsass (2015) stated that researchers used the cross-sectional study to explore psychological, demographical, and social predictors in research activities. Warwick, Falaschetti, Rockwood, Mitnitski, Thijs, Beckett, and Peters (2015) stated that cross-sectional study could be used to investigate survival following treatments, by demonstrating the effectiveness of hypertensive medications on hypertensive patients. The survivor causal effect (SCE) is the effect of treatments on the outcomes of the population that survived when given necessary treatment

The sample size is important for effective use of statistical methods in the epidemiological study. Yanagihara, Wakaki and Fujikoshi (2015) reported that sample size (N) was important in planning a research study that involved statistical significance level, power, effect size, null and alternate hypothesis. A cross-sectional study has its defect in the choice of research design. Dall'Ora, Griffiths, Ball, Simon, and Aiken (2015) reported that cross-sectional study is limited in its ability to infer causality, but has a strong ability to infer associations between predictor variables and the outcome variable.

Table 4

Methodological critique of epidemiological study

References	Research Design	Measures	Stat Model	Sample size (N)	Findings
Proposed Study	Quantitative methodology, Cross-sectional study	Age by year, Race by ethnicity. Time to event, HPV	Logistic regression, Chi-Square test of association	206	There is a lack of information on the benefit of radiotherapy for women with early cervical cancer based on age and race. Study between1973 -2012,

		Testing period (Early or late) Treatment by level (radiation, surgery with radiation, no radiation)			U.S. To be determined
Diels et al., (2015)	Cross-sectional study	Age, health-related quality of life (HRQoL), treatment of prostate cancer (radiation, androgen, surgery, chemotherapy), cost	Goodness of fit, median regression model	602	Prostate cancer is the most common cancer among men in Europe. The researchers conducted the study to examine the effect of treatments on prostate cancer. The research revealed that chemotherapy was the best treatment for prostate cancer.

Liang et al., (2016)	Cross-sectional study	Age, Education, Income, Religion, Marital Status, Living status, Cancer stage, Time since diagnosis, Metastasis, Surgery Status	Pearson correlation, Linear regression	201	Researchers noted that women with breast cancers experienced distress at diagnosis. The study was to establish the distress in women with breast cancer and the scope of management. The researchers found that symptoms management self-efficacy acted as mediator between symptoms distress and quality of life (QoL)
Guertin et al., (2015)	Cross-sectional study	Age, Gender, Race, Education, Smoking, Pack-years, Age at smoking initiation, Prior lung cancer diagnosis	Logistic regression analysis	6,108	Researchers stated that time to first cigarette (TTFC) after waking and nicotine dependence are associated. The study investigated the association between TTFC and chronic obstructive pulmonary disease (COPD). The study detected that shorter TTFC leads to

					increased risk of COPD.
Bregendahl, Emmertsen, Lindegaard and Laurberg (2015)	Cross-sectional study	Major LARS, Symptoms of sexual dysfunction, symptoms of urinary dysfunction	Multiple logistic regression	516	Information concerning urinary and sexual dysfunction after rectal cancer treatment in women is limited. This study investigated the relationships between using radiotherapy, and surgery to the development of bowel dysfunction.
Pazaitou-Panayiotou, Panagiotou, Polyzos and Mantzoros (2015)	Cross-sectional study	Age, Sex, Tumor size, Histology, Stage, prechemotherapy serum albumin,	Logistic regression model, t-test, Mann-Whitney U test, Kaplan-Meier	89	Treatment for curative esophagogastric cancer was chemotherapy, before surgery with narrow therapeutic index. The researchers investigated whether treatment with narrow therapeutic index affects

	pre-chemotherapy Neutrophil lymphocyte ratio, (Basal Metabolic Rate (BMI)	test, Log-rank test	survival status. The researcher found out that adjuvant toxicity affected the long- term survival of patients with oesophagogastric cancer

Summary and Transition

Cervical cancer on early testing in the United States could result in increased survival rates if surgeons consider radiation therapy as number one therapy or in combination with surgery. This chapter provides a review of the literature on surviving cervical cancer, contracting the disease, and the behaviors that increase a woman's risk to contract cervical cancer. Torre et al. (2015) emphasized the importance of knowing survival rates of women with cervical cancer; however, Torre et al. also stated that there remains a deficiency of awareness on the survival rates due to age, race, and sex among women in the United States. This study uses epidemiological triad model. Bhopal (2012)

argued that epidemiological studies should make use of epidemiological models of time, place, and person molded from the agent, host, and environment models. This knowledge informed the use of an epidemiological triad of time, place, and person for the proposed study of early testing, radiation therapy, and survival rate in women with cervical cancer in the United States.

In this chapter, I reviewed the constructs of an epidemiological triad with respect to time, place, and person. The knowledge of the spatiotemporal relationship of the constructs can assist in understanding how to interrupt the spread of the disease. In this chapter, I also presented information on early and late HPV screening by women in the United States, the criteria for making diagnoses based on the four stages of cervical cancer, and the treatment modalities for the four stages. The information regarding radiation therapy benefits in early stage cervical cancer is not clear and this lack of clarity might be responsible for the low participation of women in early cervical cancer screening programs (Östensson et al., 2015). In this proposed study, I intend to focus on the benefits of early radiation therapy among women based on age groups and races.

In Chapter 3, I present the research design and the research questions for this proposed study. I justify the choice of design and methodology and discuss the statistics that I plan to use to address the research questions. Finally, I consider the potential internal and external validity of my results based on my research design.

Chapter 3: Results

The purpose of this quantitative study was to analyze secondary data from the SEER between 1973, and 2012. Cervical cancer is preventable with early detection, but it is not preventable when the diagnosis progresses from early stage to late stage. Subramanian et al. (2016) stated that cervical cancer is preventable, and 70-80 % of women are screened for cervical cancer annually in United States. The unscreened 20-30% women remain significant, and researchers must encourage evidence-based cervical cancer screening to lower the incidence of the disease in United States. (Subramanian et al., 2016).

Some women have experienced a recurrence of cervical cancer following surgery for removal of pre-cancerous lesions to prevent cervical cancer, but a few years later, the women experience an advanced stage of the disease due to recurrence. Abe et al. (2015) argued that recurrence due to surgical removal of cervical cancer has led to the introduction of radiation therapy in early cervical cancer. Legge et al. (2015) argued that despite advances in diagnosis and treatment, women with early-stage cervical cancer treated with

surgery only have 30-50% recurrence, and such women may die from the disease. The 5-year prognosis from such recurrence is 3-13% (Legge et al., 2015). More cervical cancer cells remain in the normal tissues of the cervix that the surgeon could not remove during the surgery and they later develop into advanced stage cancer.

In radiation therapy, radiation is applied at a dose that individual women can tolerate into both the cervical cancer cells and the surrounding normal tissues with the hope that the radiation will kill cancer cells and spare the normal tissues (Chang, Bezjak, Mornex, & IASLC Advanced Radiation Technology Committee, 2015). In pre-Obama care, some women could not afford health insurance, with Obama care, insurance gives women access to health care (Test & Block, 2013). Women's lack of participation in early screening is due to psychological reason, as some women do not want to go screening, and women of some races are reluctant to go for screening (Vinekar et al., 2015).

Lack of participation in screening varies among groups of women. Women of older ages tend to go for screening than women of younger ages (Alford et al., 2015). There is a lack of information on the benefits of radiation therapy for females based on ages and races

in the United States. The purpose of this study was to explain the effects of early radiation therapy among women with cervical cancer in United States. I used the SPSS software for statistical tests to perform descriptive statistics and logistic regression analysis.

In this chapter, I discuss the research question for this study, research design, rationale, and how the design will contribute positively to the body of knowledge in the field of epidemiology. I used the setting and sample section to summarize and justify the sampling procedures, sample size, and the study population. This section includes the data analysis, the screening procedures, and the analytic methods. The last two sections address threats to internal and external validity; finally, I discuss the ethical procedures in accessing the secondary data from SEER, the summary, and transition to Chapter 4.

Research Questions and Hypothesis

In conducting this study, I gained an understanding of the association between radiation therapy and early cervical cancer detection among women in the United States based on age and race. There was a systematic analysis of secondary data collected from

different parts of United States by SEER made available to researchers for future studies. I used the following research questions:

RQ1*:* What is the association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

H_o1*:* There is no association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

H_a1*:* There is an association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

RQ2*:* What is the association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer?

H_o2*:* There is no association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a2*:* There is an association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

RQ3: What is the association between race and survival rates when diagnosed with Stage I to IIa cervical cancer?

$H_0$3: There is no association between race and survival rates when diagnosed with Stage I to IIa cervical cancer.

H_a3: There is an association between race and survival rates when diagnosed with Stage I to IIa cervical cancer.

RQ4: What is the association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer?

$H_0$4: There is no association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a4: There is an association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

RQ5: What are the associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

$H_0$5: There are no associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a5: There are associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

This study was a quantitative, cross-sectional study using secondary data obtained from SEER, and I used the study participants to answer research questions as presented in Table 5.

Table 5

Research Questions, Independent Variables, and Participants

Research question	**Independent variable**	**Participants**
RQ 1	Early/Late HPV testing	Women diagnosed with cervical cancer
RQ 2	Age (20-29, 30-39, 40-49, >50	Women diagnosed with cervical cancer

RQ 3	Race	Women diagnosed with cervical cancer
RQ 4	Treatment (radiation, no radiation (surgery, other treatment)	Women diagnosed with cervical cancer
RQ 5	Regions in U. S.	Women diagnosed with cervical cancer

The only participants for the study included the group of women diagnosed with cervical cancer between 1973 and 2012 in the United States. The radiation therapy (yes, no), two levels of testing (early, late), four categories of race (Black, White, Hispanics, and Asians), four levels of age groups (20-29, 30-39, 40-49, >50), and five regions (Alaska, East, North plains, South West, Pacific coast) in United States constituted the independent variables. The dependent variable included two levels of survival rates (survived, not

survived). No identifiable time or resource constraints affected the outcome of the study. Conducting the study involved using secondary data that were available to the public SEER. The SEER data sets reliable, made available to the research community at no cost for carrying out research purposes for filling the gaps in cancer research (Kent et al., 2015).

Research Design and Rationale

Conducting the study required using a cross-sectional study. Cross-sectional study scholars estimate variations in the independent variables in the sample that researchers collected at a point in time (Miller, Prosser, & Thompson, 2015). The design was appropriate because there were three levels of treatment assessed in the study. The design was suitable because there was no randomization of the six treatment groups in the study. The goal was to determine the effectiveness of these three levels of treatments among six groups of women with cervical cancer. The treatment levels included (a) radiation therapy alone, (b) no radiation (but using other treatments such as chemotherapy alone and surgery alone), and (c) radiation therapy and surgery for women diagnosed with early stage or late stage cervical cancer. The design included testing whether there was a difference in

survival rates following radiation therapy in early detection of cervical cancer based on women's ages by the group and race.

The cross-sectional study provided the design for investigating the benefits that women with cervical cancer get from treatment categories such as radiation, radiation with surgery, and treatment with no radiation based on treatment group, and control group. This study may fill the gap in the literature by examining what could occur when women undergo early screening for cervical cancer, obtain radiation therapy, and the effect on their survival rates (Question 1). It was not known whether women of particular age typically received early stage or late stage (Question 2).

In this study, I examined the effect of race on survival when contracted with cervical cancer (Question 3). This study provided information on the association between radiation treatment and survival of women with cervical cancer (Question 4), and the association between regions in United States and survival rates (Question 5).

I used a cross-sectional design rather than a quasi-experimental design or experimental design. Quasi-experimental and experimental designs are evidence-based,

using cases and control demonstrating the most conclusive or causal findings related to the research outcomes (Cook, Tankersley, Cook & Landrum, 2015). Deater-Deckard (2016) argued that scholars use Quasi-experimental designs to test hypotheses about potential environmental effects, and they offer stronger inferences than correlational designs. On the contrary, cross-sectional study scholars cannot draw conclusions on causality due to a lack of random assignment of participants into groups (Bernstein et al., 2015; Dougados et al., 2014). Hofmann and Patel (2015) argued that researchers use a cross-sectional study when a random selection of participants into groups to represent each section of the population is not possible.

This study was a convenient placement of people into groups for early and late HPV testing and radiation therapy based on age and race. When researchers conduct research in which random placement of volunteers into groups is not possible, they perform perform a convenient selection of participants (Strandell-Laine, Stolt, Leino-Kilpi, & Saarikoski, 2015). The benefits of cross-sectional design are many in that it is inexpensive, and done within a short period (Ferguson, Rowlands, Olds, & Maher, 2015). Ferguson et

al. (2015) argued that cross-sectional study scholars can assess the prevalence of a disease because the sample represents the entire population. This study was a quantitative analysis of the data collected by SEER between 1973 and 2012 that included incidence of cervical cancer, population data, age, sex, race, geographical areas, years of diagnosis, and treatment modalities. To access the research data, however, I had to sign the research data agreement with SEER, no time, and resource constraints were associated with the collection of the data.

Methodology

Population

The population for the study consisted of women diagnosed with cervical cancer in the United States between 1973 and 2012. The strategy for getting the sample from the population was random sampling strategy using the procedure of random sampling table. Researchers draw samples using two sampling strategies: a random sample from the population, and convenient sampling for age, race, and treatment (Stolar & Nielsen, 2015).

Sampling Procedures

The sampling frame consisted of inclusion and exclusion criteria used for this study. Women included in the study were females diagnosed with cervical cancer between 1973 and 2012. Men were excluded from the research. Women who were not diagnosed with cervical cancer but had breast and other cancers were also excluded from the study.

Researchers conducted power analysis to determine the minimum sample size required so that the result is reliable. The interaction between sample size, α, effect size, and the p-value < .005 expresses the value of power (Cumming, 2013; Emerson, 2016). Researchers conduct power analysis to check whether a sample size could answer the research questions within the limits of time and money imposed (Albers, Boevé, & Meijer, 2015). This study, consisted of six independent variables and one dependent variable. I conducted multiple logistic regression analysis. Madan, Lönnroth, Laokri, and Squire (2015) reported that scholars use logistic regression to determine the association between the independent variables and the dependent variable. Researchers use logistic regression analysis to identify a set of variables capable of maximizing prediction of the outcome variable (Tonidandel & LeBreton, 2015).

I used sample size calculation from OpenEpi., the confidence interval (*CI*) = 95%, the power (1-beta, % chance of detecting) = 80%, odds ratio = 2. The ratio of women with radiation therapy to women without radiation therapy (surgery only) was 1:2 (Alexandre et al., 2017). Using the Fleiss method, the total sample size in both exposed and unexposed to treatment = 1211 (Dean, Sullivan & Soe, 2013). I used all cases that met selection criteria for the sample size.

In RQ 1, I used the data to analyze the association between early and late HPV testing and survival rates following treatment. In RQ 2, I examined the association between ages of the participants and the survival rate following treatment in early stage cervical cancer. In RQ 3, I analyzed the association between race and survival in early stage cervical cancer, while in RQ 4, I explained the association between treatment (radiation, and no radiation therapy) at the beginning of cervical cancer and survival rate. In RQ 5, I analyzed the association between regions of the United States where participants came from, and the occurrence of cervical cancer and survival rates.

Procedures for Recruitment, Participation, and Data Collection

This study involved using the data set from SEER database. The SEER medical health outcomes (MHOs) databases use two large population-based sources of evidence of people with cancer. The two sources are SEER's cancer registries and MHOs (National Cancer Institute, n.d.). To access the SEER database, researchers must obtain the necessary permission starting with an online request, signing paperwork, and mailing it to the SEER headquarter for final processing. When approved, the SEER office e-mails the researcher a password and a username to gain access to the SEER database; an update is needed for the dissertation (National Cancer Institute, n.d. b).

Data Analysis Plan

I used secondary data from SEER for this study. The collection of the data involved an online request for the use of the data and SEER issuance of username and temporary password for the assessing the database following the approval. I used SPSS to analyze the data because SPSS can accommodate large sample size and provide logical explanation relevant to the study. After the data collection, I performed data cleaning and

screening by removing items that were not pertinent to this study, and identifying the miscoded and missing data. The cleaning allows researchers to use the relevant data for the study and to ensure validation of the data (DeSimone, Harms, & DeSimone, 2015; Chibanda et al., 2016). Table 6 identifies the level of measurement of the outcome variable and the independent variables for this study.

Table 6

Relationship Between the Independent Variables, Level of Measurements, and Outcome Variable

Variable	Research question	Type	Level of Measurement	Outcome variable
Early testing/Late testing (year)	RQ 1	Independent	Categorical	Survived, not survived
Treatment (Radiation, no radiation)	RQ 4	Independent	Categorical	Survived, not survived
Age (20- 29, 30-39, 40-49, >50)	RQ 2	Independent	Ordinal	Survived, not survived
Race (Black, non-	RQ 3	Independent	Categorical	Survived, not

Hispanic White, Hispanic, and Asians				survived
Regions in U. S. (Alaska, East, Northern Plains, South West, Pacific Coast)	RQ 5	Independent	Nominal	Survived, not survived

Data Analysis

I used SPSS statistical software to analyze the data, calculate descriptive statistics and binary logistic regressions for the five research questions. The descriptive analysis included numerical data frequency followed by binary logistic regression analysis. In binary logistic regression, researchers can predict the probability of an event occurring or not occurring, to determine the association between one independent variable and the outcome (Babyar, Peterson, & Reding, 2016). Multiple logistic regression was used to predict the most parsimonious model for this study. I used logistic regression because the outcome variable was binary or categorical in nature.

Assumptions

The assumptions in multiple logistic regressions are applicable to this study. The assumptions explained how the independent variables (early testing, late testing, race, age, radiation therapy) were associated with the dependent variable (survival rates).

The independent of errors. There should be no relationship between the cases, indicating that researchers should not measure the same set of people at a different point in time (Hansen, Jeske, & Kirsch, 2015).

Multicollinearity. The independent variables or predictors should not have a perfect linear relationship involving two or more independent variables. This Multicollinearity indicates that predictors should not demonstrate high correlation (Sheen, Spiby, & Slade, 2015).

Table 7

Relationship between variables, level of measurement and appropriate statistical tests

Research question	Variable/Level of Measurement	Statistical tests
RQ 1	Early HPV testing/Late HPV testing/ Categorical	Binary logistic regression

RQ 2	Age/ Ordinal	frequency
RQ 3	Race/ Categorical	Frequency
RQ 4	Treatment/Categorical	Binary logistic regression
RQ 5	Regions/Nominal	Frequency

Threats to validity

The study has validity threats. The selection of participants in the cross-sectional design allows for selection bias, which can affect the validity of the result. Oluyomi et al., (2015) reported that cross-sectional design is prone to validity threats. When researchers conduct research that covers a large section of the community in which random selection of the participants was not possible, there may be threat to the validity of the outcomes (Oluyomi et al., 2015). Yi, Chhoun, Suong, Thin, Brody, & Tuot (2015) argued that selection bias resulted in some segments of the population under study than the others, and affects the internal validity of the study. The threat to internal validity can lead to a threat

to external validity, and the outcome may not represent the characteristics of the community.

Summary and Transition

Cervical cancer is a chronic disease that is preventable when detected early through Papanicolaou (Pap) test, HPV DNA test, and the use of HPV vaccines (Subramanian et al., 2016). Since the introduction of radiation therapy, the researchers are yet to investigate the benefits of radiation therapy in early stage cervical cancer (Torre et al., 2015), despite the advantages of radiation therapy in increasing survival in other cancer diseases (Landry et al., 2015).

In this chapter, I reviewed the research design and rationale for the study to understand the association between the use of radiation alone or in combination with surgery and survival of women diagnosed with cervical cancer. This chapter also focused on the review of research questions, and the hypotheses, the methodology, and the threats to the validity of the study. In chapter four, I present the introduction to chapter four, the

data collection, and the treatment and intervention. Chapter 4 included the results analysis, summary, and transition to chapter five.

Chapter 4: Results

Introduction

The purpose of the study was to investigate the association between radiation therapy and early cervical cancer detection among women in the United States based on age, race, and regions. I analyzed secondary data from the SEER between 1973, and 2012. Five research questions and hypotheses were tested.

RQ1*:* What is the association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervical l cancer?

H_o1*:* There is no association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

H_a1*:* There is an association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervica l cancer?

RQ2*:* What is the association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer?

H_o2*:* There is no association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a2*:* There is an association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

RQ3: What is the association between race and survival rates when diagnosed with Stage I to IIa cervical cancer?

$H_0$3: There is no association between race and survival rates when diagnosed with Stage I to IIa cervical cancer.

H_a3: There is an association between race and survival rates when diagnosed with Stage I to IIa cervical cancer.

RQ4: What is the association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer?

$H_0$4: There is no association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a4: There is an association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

RQ5: What are the associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

$H_0$5: There are no associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

H_a5: There are associations between five regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

In this chapter, I will first discuss the data collection process for the study as well as reporting baseline descriptive and demographic characteristics of the sample. Assumptions such as examination of outliers will be addressed. Next, the results of the analysis will be discussed by first providing frequencies for categorical data and descriptive statistics for

quantitative data. The results of the analysis will be organized by each research question and hypotheses. Lastly, the results of this chapter will be summarized in the summary.

Data Collection

Conducting the study involved using the data set from the SEER database. To gain access, SEER granted permission, both username and password were e-mailed to me. The original dataset contained both males and females of varying demographics; however, only females of at least 20 years of age were included in the study. There were 520,153 females in the study. Sixteen thousand seven hundred and twenty-five (16,725, 3.2%) were ages 20–29; 41,594 (8%) were ages 30–39; 82,617 (15.9%) were ages in 40–49 and 399,217 (72.9%) were older than 50 years. There were 448,739 (86.3%) Whites and 66,918 (12.9%), and non-Whites with 4,496 (0.9%) were missing. U.S regions included 499 (.1%) Alaska; 173,932 (33.4%) East; 76,990 (14.8%) Northern Plains; 32,595 (6.3%) Southwest; and 236,137 (45.4%) Pacific Coast. Table 8 below summarizes this information.

Table 8

Demographic Characteristic of Study Variables

Variable	Frequency	Percentage
Females	520,153	100%
Age:		
20 – 29	16,725	3.2%
30-39	41,594	8%
40 – 49	82,617	15.9%
>50	399,217	72.9%
Total N:	520,153	100%
Race:		
White	448,739	86.3%
Non-White	66,918	12.9%
Missing	4496	0.9%
Total N:	520,153	100%
U.S Region:		
Alaska	499	0.1%
East	173,932	33.4%
Northern Plains	76,990	14.8%
Southwest	32,595	6.3%
Pacific Coast	236,137	45.4%
Total N:	520,153	100%

Of the 520,153 subjects, 257,757 (49.6%) were still alive and 262,396 (50.4%) were deceased. In addition, 68.6% did not receive radiation therapy and 28.8% did receive

radiation therapy. I found that 28.8% had early HPV testing and 68.6% were late in testing (Table 9 below).

Table 9

Vital Statistics, Radiation Therapy and HPV Testing

Variable		Frequency	Percent
Vital Status:			
Alive		257,757	49.6%
Dead		262,396	50.4%
Total		520,153	100.0%
Radiation:			
Yes		149,985	28.8%
No		356,578	68.6%
Missing		13,590	2.6%
Total		520,153	100%
HPV Testing:			
Early Testing		140,936	28.8%
Late Testing		379,217	68.6%
Total		520,153	100%

I assumed that the secondary data collected from SEER wee reliable and could generalize the cervical cancer statistical data obtained if collected by any other agencies. The delimitation of the study was to participants living in the United States, and the result may not be generalizable to countries beyond the United States.

Results

I conducted binary logistic regression to study the relationships between type of therapy (radiation/no-radiation), age of diagnosis, stage type (early/late), race, U.S. regions, and survival rates of females with cervical cancer. In the first research question, I examined the relationships between testing (early HPV VS late HPV) and survival rates.

A one-unit increase in early HPV testing (i.e. [early] testing) resulted in decreased odds of dying by .917. Individuals who had late testing had an increased odds of 1/.917 = 1.0905 of dying compared to those who had early testing. Individuals who had radiation had an increased likelihood of 1.646 of dying; for every year of increase of age at diagnosis, the odds of dying increased by 1.043; Whites had a decreased odds of death by .735. Non-whites had an increased odds of 1/.735 = 1.3605 of dying compared to Whites. I,

therefore, rejected the null hypothesis that says that there is no association between testing (early HPV VS late HPV) and survival rate of women when diagnosed with Stage IA to IIA cervical cancer. Table 10 below provides the odds ratio and confidence intervals.

Table 10

Logistic Regression Predicting Survival Rates From Early HPV testing

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
	Early HPV Testing	-.086	.012	52.685	1	.000	.917	.896	.939
	Constant	-2.202	.030	5399.787	1	.000	.111		

a. Variable(s) entered on step 1: Early HPV Testing at diagnosis.

In the second research question, I investigated the relationship between age and survival rates.

The binary logistic regression was statistically significant, $\chi^2(1) = 30940.69$, $p < .005$. The *Nagelkerke R* square was .077; thus, this explained 7.7% of the variation in survival rate from age. Age at diagnosis was statistically significant ($p < .005$). For every year of increase, there was an increased odds of death by 1.045 times. I, therefore, rejected the null hypothesis that says that there is no association between age and survival rates of women when diagnosed with Stage I to IIa cervical cancer. Table 11 below provides odds ratios as well as 95% confidence intervals.

Table 11

Logistic Regression Predicting Survival Rates From Age at Diagnosis

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)

								Lower	Upper
Step 1[a]	Age at diagnosis	.044	.000	28371.496	1	.000	1.045	1.045	1.046
	Constant	-2.442	.015	26636.818	1	.000	.087		

Note. a. Variable(s) entered on step 1: Age at diagnosis.

For research question 3, I used logistic regression to investigate the association between race and survival rates. The predictor was statistically significant, $\chi^2(1) = 552.27$, $p < .005$. The *Nagelkerke R* square was .001, and it explained only 0.1% of the variation in survival rate from race. Race was a statistically significant predictor. Non-White females had an increased chance of dying than White females by 1/.823 = 1.215 times when diagnosed with Stage I to IIa cervical cancer. I found that non-Whites (Black)

had higher risk of developing cervical cancer. I, therefore, rejected the null hypothesis that says that there is no association between race and survival rates of women when diagnosed with Stage I to IIa cervical cancer. Table 12 below has information regarding odds ratios and confidence intervals.

Table 12

Logistic Regression Predicting Survival Rates From Race

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
	Race	-.195	.008	550.120	1	.000	.823	.809	.836
	Constant	.201	.008	670.161	1	.000	1.223		

Note. a. Variable(s) entered on step 1: Race. (Note: For non-White females, Race = 0.

White females, Race = 1).

For Research Question 4, I explored the relationship between radiation therapy and survival rates. Logistic regression was used to investigate the relationships between radiation therapy and survival rates. The predictor was statistically significant, $\chi^2(1) = 5770.91$, $p < .005$. The *Nagelkerke R* square was .015; thus, the binary logistic regression explained 1.5% of the variation in survival rate from radiation therapy. Individuals who had radiation therapy were 1.600 times likely to have died than those with nonradiation treatments. I, therefore, rejected the null hypothesis that says that there is no association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer. Table 13 below has more detailed information on odds ratios and 95% confidence intervals.

Table 13

Logistic Regression Predicting Survival Rates From Radiation Therapy

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
	Radiation	.470	.006	5711.252	1	.000	1.600	1.581	1.620
	Constant	-.138	.003	1698.838	1	.000	.871		
Note. a. Variable(s) entered on step 1: Radiation.									

In Research Question 5, I explored the association between U.S regions and survival rates. The binary logistic regression was statistically significant, $\chi^2(4) = 146.56$, $p < .005$. U.S region was a statistically significant predictor of cervical cancer survival. I used binary logistic regression analysis to determine the association between five regions (independent variables) and survival rates (dependent variable) of women with cervical cancer. The nature of the variables is categorical, and this dictated the analysis.

Compared to the Pacific Coast, females in Alaska had a decreased likelihood of dying by .714 times. Females in the Pacific Coast were 1.4005 times as likely to die when diagnosed with Stage I to IIa cervical cancer. Compared to the Pacific Coast, females who resided in the Eastern region of United States had an increased likelihood of dying by 1.044 times when diagnosed with Stage I to IIa cervical cancer. Females who resided in the Northern plains had a decreased likelihood by .997 of dying when diagnosed with Stage I to IIa cervical cancer (compared with females in the Pacific Coast). Females who resided in the Southwest had a decreased likelihood of dying by .918 when diagnosed with stage I to IIa cervical cancer (compared with females in the Pacific coast). I, therefore, rejected the null hypothesis that says that there is no association between regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer. Table 14 below has more detailed information on odds ratios and 95% confidence intervals.

Table 14

Logistic Regression Predicting Survival Rates From U.S Region							
	B	S.E.	Wald	df	Sig.	Exp(	95% C.I.for

							B)	EXP(B)	
								Lower	Upper
	U.S Region Code			146.286	4	.000			
	Alaska(1)	-.337	.091	13.761	1	.000	.714	.598	.853
	East(2)	.044	.006	47.441	1	.000	1.044	1.032	1.058
	Northern Plains(3)	-.003	.008	.131	1	.718	.997	.981	1.013
	Southwest (4)	-.085	.012	52.071	1	.000	.918	.897	.940
	Constant	.009	.004	5.208	1	.022	1.009		
Note: Reference category is Pacific Coast									

Modeling

This is the full multiple logistic regression (MLR) including all variables to predict the most parsimonious model. The result was statistically significant, $\chi^2(4) = 36441.89$, $p < .005$. The *Nagelkerke R* square increased to .093; thus, the result explained 9.3% of the variation in survival rate by including both demographic variables as well as radiation therapy and early HPV testing. Table 15 below provides odds ratios as well as 95% CIs for these coefficients. All predictors were statistically significant ($p < .005$).

There were no studentized residuals larger than 2.5; therefore, there were no outliers in the data set. The full model included all of the variables, and was it statistically significant, $\chi^2(2) = 30309.82$, $p < .005$. The *Nagelkerke R* square was .078; thus, this model explained 7.8% of the variation in survival rate from the demographic variable of age ($p < .005$). The model had 7.8% variation in survival rate for race (*Nagelkerke R* square = .078, $p < .005$).

Table 15

Logistic Regression Predicting Survival Rates From Race, Age at Diagnosis, Radiation Therapy and Early HPV testing									
	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)		Effect size
							Lower	Upper	(ES)

	Race	-.308	.009	1225.361	1	.000	.735	.722	.748	-.170
	Age at diagnosis	.042	.000	8006.604	1	.000	1.043	1.042	1.044	.042
	Radiation	.499	.006	5980.917	1	.000	1.646	1.626	1.667	.275
	Early HPV Testing	-.086	.012	52.685	1	.000	.917	.896	.939	-.048
	U. S. Regions	-.088	.017	63.264	1	.000	.831	.772	.865	.101
	Constant	-2.202	.030	5399.787	1	.000	.111			

Summary

I performed binary logistic regression in order to investigate the association between early HPV testing, radiation therapy, age, race, U.S. region, diagnosis, and survival rates of women when diagnosed with Stage I to IIa cervical cancer. In the first research question, I investigated the association between early HPV testing and survival

rates for women diagnosed with early Stage IA to IIA cervical cancer. No outliers detected in the data set by inspection of studentized residuals.

All predictors were statistically significant ($p < .005$). Individuals who had early HPV testing resulted in a decreased odds of dying. Individuals who had late HPV testing had an increased likelihood of dying compared to those who had early testing. I rejected the null hypothesis that there is no association between early versus late testing and survival rates of women diagnosed with Stage I to IIa cervical cancer. In Research Question 2, investigated the association between ages and survival rates of women when diagnosed with Stage I to IIa cervical cancer. The overall model was statistically significant. Age at diagnosis was statistically significant. For every year of increase, there was an increased odds of death. I therefore, rejected, the null hypothesis that there is no association between ages and survival rates of women when diagnosed with Stage I to IIa cervical cancer.

In Research Question 3, I examined the association between race and survival rates when diagnosed with Stage I to IIa cervical cancer. The overall model was statistically significant. Race was a statistically significant predictor. Non-White females had an

increased chance of dying compared to White females by 1.215 times when diagnosed with Stage I to IIa cervical cancer. I, therefore, rejected the null hypothesis that there is no association between race and survival rates of women when diagnosed with Stage I to IIa cervical cancer. In Research Question 4, I investigated the association between radiation therapy and survival rates of women when diagnosed with Stage I to IIa cervical cancer. The overall model was statistically significant. Individuals who had radiation therapy were more likely to have died than those with non-radiation treatments.

In Research Question 5, I explored the associations between regions in the United States and survival rates of women when diagnosed with Stage I to IIa cervical cancer. The predictor was statistically significant. U.S. region was a statistically significant predictor. Compared to the Pacific Coast, females in Alaska had a decreased odds of dying when diagnosed with Stage I to IIa cervical cancer. Compared to the Pacific Coast, females who resided in the Eastern region of United States had an increased odds of dying when diagnosed. Females who resided in the Northern plains had a decreased likelihood of dying when diagnosed with Stage I to IIa cervical cancer (compared with females in the Pacific

Coast). Females who resided in the Southwest had a decreased likelihood of dying when diagnosed with Stage I to IIa cervical cancer (compared with females in the Pacific coast). I, therefore, rejected the null hypothesis that there is no association between regions in United States. and survival rates of women when diagnosed with Stage I to IIa cervical cancer. Table 16 below explains the association between the variables, the findings, and the null hypothesis.

Table 16

Table Summarizing Findings, Significance, and Null Hypotheses

Variables	Clinical findings	Sig.	Reject/failed to reject null hypothesis
Early HPV Testing	Improve survival	$P < .005$	1
Radiation therapy	Did not improve survival	$P < .005$	1
Age	Younger age at diagnosis Increase survival	$P < .005$	1
Race	Some races Improve survival	$P < .005$	1

Regions In U. S.	Some regions in U. S. Improve survival	$P < .005$	1

Note. Reject null hypothesis – 1, failed to reject null hypothesis = 0, null hypothesis = no association

Chapter 5: Conclusion

Epidemiologists have under researched the benefits of using radiation therapy for treating women with early cervical cancer detection. Globally, for every 530,000 diagnoses of cervical cancer, 275,000 people died, demonstrating a survival rate of only 48% annually (Pimenta et al., 2013). There had been a steady improvement in cancer survival in the United States, but the improvement in relation to age, sex, and race remains unaccounted for in the current literature (Zeng et al., 2015).

I conducted this study among women diagnosed with early staged cervical cancer to investigate the association between testing (early versus late testing HPV), age, race, radiation therapy, and regions in the United States (independent variables), and survival rates (dependent variable). I used secondary data from SEER. Currently, there is a dearth of information on the effects of treating early stage cervical cancer with radiation for increasing patient survival among different age groups and races in the United States. In

this cross-sectional study, I used a sample size of 520,153 participants. Statistical analyses included descriptive statistics and binary logistic regression using SPSS.

Some women received screening early in life, but did not undergo subsequent screenings because of a lack of mechanisms in place to receive additional screenings. There is limited existing research on the effects of early testing and related early radiation therapy on survival rates among women. Researchers found that using radiation therapy in early breast and lung cancer treatment in the United States was effective for respective survival rates. However, such information is lacking for using radiation therapy for treating early cervical cancer stages among women in the United States compared to surgery alone (Robinson et al., 2014).

The purpose of this quantitative, cross-sectional study was to examine the association between radiation therapy (yes, no) and early detection of HPV (early HPV vs late HPV testing), race (four categories), age (four groups), five U.S. regions as the independent variables and survival rates (two classes) as the outcomes. Researchers need to understand the effects of radiation treatment on early stage cervical cancer based on

women's age by group and race. The intent of this study was to add to the body of knowledge and to close a gap in the literature on the effects of treating early cervical cancer with radiation and survival rates among women in the United States.

Summary of Findings

In this study, early HPV testing resulted in decreased odds by .917, and women who had late testing had increased odds of 1/.917 = 1.0905 of dying. The effect size for early HPV testing was -.048 (negative effect size) the significant *p* value did explain how well the early HPV testing would improve survival of women from cervical cancer. The early HPV testing was a strong predictor of survival from cervical cancer. I examined the age at diagnosis, the odds of dying increased by 1.043; the effect size was .042, which is a positive effect size, and signified a strong predictor of survival from cervical cancer. Race was a predictor of survival from cervical cancer; the effect size for race was -.170. The significant level of *p* value indicated that race was a meaningful and strong predictor of survival from cervical cancer. Individuals who had radiation therapy had an effect size of .275. A positive effect size of .275 supported the significance of *p* value of less than .005,

and the radiation was a strong predictor of survival for women when diagnosed early from cervical cancer.

In this study, I found U. S. Regions to be a strong and meaningful predictor of survival from cervical cancer. The effect size for U. S. Regions was .101, a positive effect size, and a significant p value of less than .005.

Strongest and More Meaningful Predictors

The two levels of testing (early, late), radiation therapy (yes, no), four categories of race (Black, White, Hispanics, and Asians), four levels of age groups (20-29, 30-39, 40-49, >50), and five regions (Alaska, East, Northern Plains, South West, Pacific Coast) in the United States constitute the independent variables. The dependent variable was two levels of survival rates (survived, not survived). The five predictors are meaningful, and are strong predictors of survival from cervical cancer. Early HPV testing had 91.7 percent decrease in odds of dying, and for each year increase in age at diagnosis there was 104 percent odds of dying. White women had an 82 percent increase odds of dying from cervical cancer, while non-White women had 122 percent odds of dying from cervical

percent odds of dying from cervical cancer. Women with radiation therapy had160 percent increased odds of dying than women without radiation therapy. The U. S. regions are meaningful and strong predictors of survival from cervical cancer. Women in Alaska had 71 percent decreased odds of dying from cervical cancer, while women in the Pacific Coast had 140 percent increase odds of dying

Interpretation of the Findings

The United States is not an exception in the global persistence of cervical cancer. The incidence of cervical cancer was on the rise among younger women in the United States with poor clinical outcomes, despite the knowledge, prevention, and treatment modalities for the causative organism (Wang et al., 2014). Fleming et al. (2014) argued that there was unequal treatment after early detection of cervical cancer. Some women received radiation; others received surgery, and there were no data on control variables such as a race on radiation therapy.

Researchers have demonstrated that early testing for cervical cancer could speed up the treatment of cervical cancer, and late HPV testing worsened the diagnosis, a finding

confirmed by this study's results. Sankaranarayanan (2014) stated that HPV testing offered early detection of precancerous lesions of the cervix, and cancerous lesions if women present late. Benard et al. (2014) reported that early HPV and Pap tests are useful to determine the health status of a woman before or during HPV infection and the development of cervical cancer, and they are the sources of education for women concerning the disease. Benard et al. stated that the HPV and Pap tests provide evidence-based screening practices for cervical cancer, and they help to prevent precancerous lesions from progressing to invasive cervical cancer.

Logistic regression analysis, however, revealed that women with early detection of cervical cancer had an increased likelihood of dying with radiation therapy. Some previous researches revealed that radiation therapy led to complications that resulted in death (Vaidya et al. 2014). Vaidya et al. reported that women who received radiation therapy for early breast cancer had cardiovascular complications that resulted in death. Hurem et al. (201) argued further that reduction in survival from radiation therapy resulted from oxidative stress or genetic damage in the living organism.

Some exceptions to cervical cancer screening occur. Exceptions include women with two consecutive negative Pap and HPV tests within the last ten years or women who had a hysterectomy (Saslow et al., 2012). Also, Smith et al. (2015) stated that the criteria for an exception were for women older than 65 years of age and women with three consecutive negative Pap smear tests. These women did not need screening for the HPV and cervical cancer. Researchers argued that SES is an important factor in determining when some women were likely to engage cervical cancer screening (Tervonen et al., 2016).

Perkins and Stier (2014) explained that HPV testing had higher sensitivity than Pap tests and that HPV test detects 95% of HPV, while Pap test detects about 40-70% of HPV. When the physicians asked for the two tests, the detection rate increased above 95%. Perkins and Stier stated that early HPV and Pap tests detect precancerous lesions before progression to invasive lesions detected by late HPV testing, and early HPV and Pap tests reduce the incidence by 50%. The risk of developing cervical cancer or cervical dysplasia after three years of negative Pap test is .78%, after three years of negative HPV test is .34% and after three years for both Pap and HPV tests was .30% (Perkins & Stier, 2014). Women

with late testing and women missing their testing dates progressed to cancerous lesions if there were preexisting precancerous lesions (Perkins & Stier, 2014).

Participation in screening for cervical cancer among women in developed countries was not as high as possible. Researchers believed that 42% of women in the United States did not engage in early screening (Cohen et al., 2016). Cohen et al. argued that the screening rates among women varied by region in the United States and by age. The researchers indicated that 44% to 81% of women between the ages 45 and 64 underwent early screening.

Approximately 67% of the women did not adhere to the U.S. screening recommendations, indicating a high level of non-adherence among U.S. women, despite awareness of screening centers on a nationwide level (Cohen et al., 2016). Despite the available knowledge of causative organisms of cervical cancer and effective treatment modalities, there remains inadequate awareness of the effectiveness of using radiation therapy among women of all races and ages that undergo early screening in the United States (Chen, Kessler, Mori, & Chauhan, 2012). Researchers have argued that there is a

benefit from increasing the number of women that undergo early (under age 40) cervical cancer screening because these researchers have observed an increase in nulliparous women diagnosed with early cervical cancer (Choi et al., 2015).

In this study, I found that age was an important predictor of cervical cancer. Smith et al. (2015) reported that age was important in the development of the cervical cancer, and the screening procedures were Pap smear tests and HPV DNA tests for women between 21 to 65 years old. Saslow et al. (2012) argued that screening must start at age 21 and that women between 21 and 29 years old must receive screening every three years using a Pap test. Women who were 30-65 years old must screen for HPV using the Pap smear and HPV DNA tests every five years. Some women must screen every three years using the Pap smear test alone (Park et al., 2015). Screening should continue for 20 years after the treatment for CIN2, CIN3, and adenocarcinoma in situ (Saslow et al., 2012).

The treatment modalities for early cervical cancer are surgery and radiation. In this study, radiation was not a strong predictor of survival from cervical cancer. Treatment for cervical cancer is effective and can be cured when detected early, and the prognosis of

cervical cancer depends on the staging (Lau et al., 2015). Radiation therapy alone or in combination with another therapy has increased survival in many diseases such as lung, breast, and colorectal cancers (Landry et al., 2015). Researchers have noted the disparities in the outcomes of the use of radiation therapy for breast cancer among different age groups and races (Powers et al., 2015). There is a lack of information on the benefit of using radiation therapy in cervical cancer in early age groups and races and needs to be further studied (Fang et al., 2015).

Surgery is one of the recommended treatment modalities for addressing early stage cervical cancer in women, a finding confirmed by this study's results, which determined that there were higher death rates from radiation alone as opposed to other treatment modalities. Shazly, Murad, Dowdy, Gostout and Famuyide (2015) revealed that surgery is of importance, but there is a lack of evidence to support the effectiveness of surgery for early cervical cancer. Pareja et al. (2015) argued that surgeons used radical trachelectomy or cervicectomy (removal of cervix only to preserve fertility in young women who may want to bear children).

The theory of epidemiological triad of disease model was the theoretical framework for the study. According to Cohen and Shang (2015), Clark (1954) developed the epidemiological triad to explain a spatiotemporal relationship between three areas known as the agent, the host, and the environment. Cohen and Shang found that Clark's theory was useful for breaking disease transmission by predicting the agent (procedures such as early HPV - testing), the host (age and race), and the environment or place (regions in U. S.). Cohen and Shang believed that a triad was a form of isolation precautions useful for the control of infectious diseases with increased morbidity and mortality outcomes.

The theory is useful when testing multiple interventions based on specific pathogens in a cross-sectional study such as this one. Rohrer, Grover and Moats (2013) applied the epidemiological triad to medical care studies and further argued that there is a benefit for researchers to use variations of the theory to person, place, and time associated with the theoretical model. Chaney and Rojas-Guyler (2015) argued that a triad is a tool that explained health promotion, educational research, and practice.

Theoretical implication of this study

In this study, the epidemiological triad of person, place, and time helped in educating people about disease spread and prevention. Chaney and Rojas-Guyler (2015) reported that age, race, and place influenced the decision of the people to use drugs (marijuana, tobacco, and alcohol). I found some places to be high and low risk areas for both races to develop cervical cancer, variations in the awareness for early HPV testing among women in U. S. regions, and this led to variations in survival rates from cervical cancer in United States.

Limitations of the Study

This study examined the secondary data from SEER database for women that used or did not use radiation for early cervical cancer. This study was limited to participants living in the United States, and may not be generalizable to countries beyond the United States. This study does not apply to women who developed early cervical cancer from in-utero exposure to diethylstilbestrol, organ transplant or the use of chemotherapy such as chronic use of corticosteroid. This study did not identify which HPV types were in the

secondary data. The secondary data collected from SEER could not assume a causal role because the data were not primary data, and could only measure associations between independent and dependent variables.

Recommendations for Future Research

The main recommendations for future research center on the prevention of the development of cervical cancer and raising awareness of the importance of early testing among young women, especially those from vulnerable populations, such as non-White women in the United States. As cervical cancer is a disease with high death rates throughout the world, researchers need to replicate similar studies in other nations, particular those in the developing world where researches are less conducted. Age, race, and regions are variables the researchers should consider in studies of early versus late testing.

Implications of the Findings

The findings of this study offer no support for promoting radiation therapy.

This study would be a source of information for policy makers to customize programs that will encourage women to undertake early cervical cancer screening, and provide additional source of information for health care professionals. The findings from this study may motivate women to seek screening and treatment for early cervical cancer cases. This study would be a source of health education for non-Hispanic Blacks, White non-Hispanics, Hispanics, and Asians to correct any misperception about early screening for cervical cancer, radiation therapy, and similar survival rates.

The results of this study add to the body of knowledge in epidemiology for understanding the effects of radiation for treating early stage cervical cancer for non-Hispanic Blacks, White non-Hispanics, Hispanics, and Asians living in the United States. This study contributed to social change by providing evidence for women for getting regular Papanicolaou tests (Pap smears) and cervical cytology tests early in life. The results of this study can contribute to positive social change if early detection of cervical cancer proves to reduce mortality among women who otherwise succumb to the disease. A positive social change from this study is that the results would help to keep families

together and provide a better quality of life for women who receive early testing and that women with cervical cancer have the knowledge that radiation therapy may increase the likelihood of death in some patients.

Overall, this study's findings are consistent with the theoretical framework of the epidemiological triad, and help advance quantitative, cross-sectional methodological approaches. As noted public health researchers, as well as female patients and their physicians may be interested in knowing and acting on this study's findings in relation to early testing and the use of radiation therapy.

Summary and Conclusions

To conclude, this cross-sectional, quantitative study's results have shown that early testing for cervical cancer reduces death rates, and that higher rates of death from the disease are associated with older age, radiation therapy, non-White race, and women residing on the East Coast and Pacific Coast of the United States. The epidemiological triad was a useful theoretical framework for this study. I hope that this study's findings will help

raise awareness of the importance of early testing to reduce death rates from cervical cancer.

References

Abdizadeh, R., Maraghi, S., Ghadiri, A. A., Tavalla, M., & Shojaee, S. (2015). Cloning and expression of major surface antigen 1 gene of toxoplasma gondii RH strain using the expression vector pVAX1 in Chinese hamster ovary cells. *Jundishapur Journal of Microbiology, 8(*3), E22570. doi:10.5812/jjm.22570

Abe, A., Matoda, M., Okamoto, S., Kondo, E., Kato, K., Omatsu, K., . . . Takeshima, N. (2015). Resection of the vaginal vault for vaginal recurrence of cervical cancer after hysterectomy and brachytherapy. *World Journal of Surgical Oncology, 13*(1). doi:10.1186/s12957-015-0495-8

Abou-Taleb, H. A., Koshiyama, M., Matsumura, N., Baba, T., Yamaguchi, K., Hamanishi, J., . . . Konishi, I. (2016). Clinical efficacy of neoadjuvant chemotherapy with irinotecan (CPT-11) and nedaplatin followed by radical hysterectomy for locally

advanced cervical cancer. *Journal of International Medical Research.* doi:10.1177/0300060515591858

Albers, C. J., Boevé, A. J., & Meijer, R. R. (2015). A critique to Akdemir and Oguz (2008): Methodological and statistical issues to consider when conducting educational experiments. *Computers & Education*, 87, 238-242. doi:10.1016/j.compedu.2015.07.001

Alexander, N. M., Harper, D. M., Comes, J. C., Smith, M. S., Heutinck, M. A., Handley, S. M., & Ahern, D. A. (2014). Intent to Participate in Future Cervical Cancer screenings Is lower when satisfaction with the decision to be vaccinated is neutral. *PLoS ONE, 9*(6). doi:10.1371/journal.pone.0098665

Alexandre, E., Sebastien, G., Renaud, M., Enrica, B., Warren, B., Pierre, M., ... & Eric, D. (2017). Outcome of early stage cervical cancer patients treated according to a radiosurgical approach: clinical results and prognostic factors. *Gynecologic Oncology. 144* (3) Retrieved from https://doi.org/10.1016/j.ygyno.2016.12.026

Alford, S. H., Leadbetter, S., Rodriguez, J. L., Hawkins, N. A., Scholl, L. E., & Peipins, L. A. (2015). Cancer screening among a population-based sample of insured women. *Preventive Medicine Reports, 2,* 15-20. doi:10.1016/j.pmedr.2014.11.004

Baalbergen, A., Veenstra, Y., & Stalpers, L. (2013). Primary surgery versus primary radiotherapy with or without chemotherapy for early adenocarcinoma of the uterine cervix. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.cd006248.pub3

Babyar, S. R., Peterson, M. G., & Reding, M. (2016). Case–control study of impairments associated with recovery from "Pusher syndrome" after stroke: logistic regression analyses. *Journal of Stroke and Cerebrovascular Diseases. 26.1* (2017): 25-33.

Bagiella, E. (2008). Kaplan-Meier method. Thousand Oaks, *CA: SAGE* Publications.

Barron, S., Austin, R. M., Li, Z., & Zhao, C. (2015). Follow-up outcomes in a large cohort of patients with HPV-negative LSIL cervical screening test results. *American Journal of Clinical Pathology*, *143*(4), 485-491. doi:10.1309/ajcpu57uelkuzcyy

Benard, V. B., Saraiya, M., Greek, A., Hawkins, N. A., Roland, K. B., Manninen, D., . . . Unger, E. R. (2014). Overview of the CDC Cervical Cancer (Cx3) study: An educational intervention of HPV testing for cervical cancer screening. *Journal of Women's Health, 23*(3), 197-203. doi:10.1089/jwh.2013.4655

Bernstein, K., Park, S., Hahm, S., Lee, Y. N., Seo, J. Y., & Nokes, K. M. (2016). Efficacy of a culturally tailored therapeutic intervention program for community-dwelling depressed Korean American women: A non-randomized quasi-experimental design study. *Archives of Psychiatric Nursing, 30*(1), 19-26. doi:10.1016/j.apnu.2015.10.011

Bezabih, M., Tessema, F., Sengi, H., & Deribew, A. (2015). Risk factors associated with invasive cervical carcinoma among women attending Jimma University Specialized Hospital, Southwest Ethiopia: A case-control study. *Ethiopian Journal of Health Sciences, 25*(4), 345. doi:10.4314/ejhs.v25i4.8

Bhopal, R. S. (2012). Essay Review: Epidemiology and the people's health. Theory and context. (review by Anthony J. McMichael of Nancy Krieger's book of that title):

Figure 1. *International Journal of Epidemiology, 41*(1), 315-317. doi:10.1093/ije/dyr201

Bill-Axelson, A., Holmberg, L., Garmo, H., Rider, J. R., Taari, K., Busch, C., & Andrén,, O. (2014). Radical prostatectomy or watchful waiting in early prostate cancer. *New England Journal of Medicine, 370*(10), 932-942. doi:10.1056/NEJMoa1311593

Blennow, K., Dubois, B., Fagan, A. M., Lewczuk, P., Leon, M. J., & Hampel, H. (2015). Clinical utility of cerebrospinal fluid biomarkers in the diagnosis of early Alzheimer's disease. *Alzheimer's & Dementia, 11*(1), 58-69. doi:10.1016/j.jalz.2014.02.004

Borras, J. M., Barton, M., Grau, C., Corral, J., Verhoeven, R., Lemmens, V., . . . Lievens, Y. (2015). The impact on cancer incidence and stage on optimal utilization of radiotherapy: Methodology of a population-based analysis by the ESTRO-HERO project. *Radiotherapy and Oncology, 116*(1), 45-50. doi:10.1016/j.radonc.2015.04.021

Bregendahl, S., Emmertsen, K. J., Lindegaard, J. C., & Laurberg, S. (2015). Urinary and sexual dysfunction in women after resection with and without preoperative radiotherapy for rectal cancer: a population-based cross-sectional study. *Colorectal Disease: The Official Journal Of The Association Of Coloproctology Of Great Britain And Ireland*, *17*(1), 26-37. doi:10.1111/codi.12758

Bross, P. F., Fan, C., George, B., Shannon, K., Joshi, B. H., & Puri, R. K. (2015). Regulation of biologic oncology products in the FDA′s Center for Biologics Evaluation and Research. Seminars and original investigations. *Urologic Oncology*. 33(3), 133-136. doi:10.1016/j.urolonc.2014.10.016

Bulliard, J., Garcia, M., Blom, J., Senore, C., Mai, V., & Klabunde, C. (2014). Sorting out measures and definitions of screening participation to improve comparability: The example of colorectal cancer. *European Journal of Cancer, 50*(2), 434-446. doi:10.1016/j.ejca.2013.09.015

Bunnik, B. A., Ssematimba, A., Hagenaars, T. J., Nodelijk, G., Haverkate, M. R., Bonten, M. J., . . . Jong, M. C. (2014). Small distances can keep bacteria at bay for days.

Proceedings of the National Academy of Sciences USA, 111(9), 3556-3560. doi:10.1073/pnas.1310043111

Cancer surveillance programs in United States. (2015). Retrieved from http://www.cancer.org/cancer/cancerbasics/cancer-surveillance-programs-and-registries-in-the-united-states

Carvallo-Michelena, A., Rojas-Dominguez, J. L., & Piscoya, A. (2015). Early prevention and screening of cervical cancer in a developing country. *American Journal of Preventive Medicine, 48*(3), 1. doi:10.1016/j.amepre.2014.11.001

CDC. (2012). Lesson 1: Introduction to Epidemiology. Retrieved from http://www.cdc.gov/ophss/csels/dsepd/SS1978/Lesson1/Section8.html

Chaney, R. A., & Rojas-Guyler, L. (2015). Spatial analysis methods for health promotion and education. *Health Promotion Practice*. doi:10.1177/1524839915602438

Chang, J. Y., Bezjak, A., & Mornex, F. (2015). Stereotactic ablative radiotherapy for centrally located early-stage non–small-cell lung cancer: what we have learned. *Journal of Thoracic Oncology, 10*(4), 577-585. doi:10.1097/jto.0000000000000453

Chen, H., Kessler, C. L., Mori, N., & Chauhan, S. P. (2012). Cervical cancer screening in the United States, 1993–2010: characteristics of women who are never screened. *Journal of Women's Health, 21*(11), 1132-1138. doi:10.1089/jwh.2011.3418

Chibanda, D., Verhey, R., Gibson, L. J., Munetsi, E., Machado, D., Rusakaniko, S., . . . Abas, M. (2016). Validation of screening tools for depression and anxiety disorders in a primary care population with high HIV prevalence in Zimbabwe. *Journal of Affective Disorders, 198*, 50-55. doi:10.1016/j.jad.2016.03.006

Choi, M. C., Jung, S. G., Park, H., Lee, S. Y., Lee, C., Hwang, Y. Y., & Kim, S. J. (2014). Fertility preservation by photodynamic therapy combined with conization in young patients with early-stage cervical cancer: a pilot study. *Photodiagnosis and photodynamic therapy, 11*(3), 420-425. doi:10.1016/j.pdpdt.2014.06.001

Chung, S. (2015). Targeting female hormone receptors as cervical cancer therapy. *Trends in Endocrinology & Metabolism, 26*(8), 399-401. doi:10.1016/j.tem.2015.06.004

Cohen C.C. & Shang J. (2015) Evaluation of conceptual frameworks applicable to the study of isolation precautions effectiveness. *Journal of Advanced Nursing 71(*10*)*, 2279–2292. *doi:* 10.1111/jan.12718

Cohen, E. L., Scott, A. M., Record, R., Shaunfield, S., Jones, M. G., & Collins, T. (2016). Using communication to manage uncertainty about cervical cancer screening guideline adherence among Appalachian women. *Journal of Applied Communication Research, 44*(1), 22-39. doi:10.1080/00909882.2015.1116703

Cook, B. G., Tankersley, M., Cook, L., & Landrum, T. J. (2015). Republication of "evidence-based practices in special education: Some practical considerations" *Intervention in School and Clinic, 50*(5), 310-315. doi:10.1177/1053451214532071

Cooper, A., & Gordon, B. (2015). Young New Zealand women's sexual decision making in casual sex situations: a qualitative study. *The Canadian Journal of Human Sexuality, 24*(1), 69-76. doi:10.3138/cjhs.24.1-a7

Cumming, G. (2013). The new statistics: why and how. *Psychological Science, 25*(1), 7-29. doi:10.1177/0956797613504966

Dall'Ora, C., Griffiths, P., Ball, J., Simon, M., & Aiken, L. H. (2015). Association of 12 h shifts and nurses' job satisfaction, burnout and intention to leave: Findings from a cross-sectional study of 12 European countries. *BMJ Open, 5*(9). doi:10.1136/bmjopen-2015-008331

Dan, S., Hong, L., Haibo, L., & Jianrong, D. (2015). Effect of human papillomavirus infection on the immune system and its role in the course of cervical cancer (review). *Oncology Letters, 10*(2), 600-606. doi:10.3892/ol.2015.3295

Dean, A. G., Sullivan, K. M., & Soe, M. M. (2013). OpenEpi: Open source epidemiologic statistics for public health. Retrieved from http://openepi.com/Menu/OE_Menu.htm

Deater-Deckard, K. (2016). Is self-regulation "All in the family"? Testing environmental effects using within-family quasi-experiments. *International Journal of Behavioral Development, 40*(3), 224-233. doi:10.1177/0165025415621971

De Angelis, R., Sant, M., Coleman, M. P., Francisci, S., Baili, P., Pierannunzio, D., ... & Bielska-Lasota, M. (2014). Cancer survival in Europe 1999–2007 by country and

age: results of EUROCARE-5—a population-based study. *The lancet oncology, 15*(1), 23-34. doi:10.1016/S1470-2045(13)70546-1

Desantis, C., Ma, J., Bryan, L., & Jemal, A. (2013). Breast cancer statistics, 2013. CA. *Cancer Journal for Clinicians, 64*(1), 52-62. doi:10.3322/caac.21203

Desimone, J. A., Harms, P. D., & Desimone, A. J. (2014). Best practice recommendations for data screening. *Journal of Organizational Behavior, 36*(2), 171-181. doi:10.1002/job.1962

Dhama, K., Saminathan, M., Jacob, S. S., Singh, M., Karthik, K., ., A., . . . Singh, R. K. (2015). Effect of immunomodulation and immunomodulatory agents on health with some bioactive principles, modes of action and potent biomedical applications. *International Journal of Pharmacology International, 11*(4), 253-290. doi:10.3923/ijp.2015.253.290

Diels, J., Hamberg, P., Ford, D., Price, P. W., Spencer, M., & Dass, R. N. (2015). Mapping FACT-P to EQ-5D in a large cross-sectional study of metastatic castration-resistant prostate cancer patients. *Quality Of Life Research: An International Journal Of*

Quality Of Life Aspects Of Treatment, Care And Rehabilitation, 24(3), 591-598. doi:10.1007/s11136-014-0794-5

Documet, P., Bear, T. M., Flatt, J. D., Macia, L., Trauth, J., & Ricci, E. M. (2014). The association of social support and education with breast and cervical cancer screening. *Health Education & Behavior, 42*(1), 55-64. doi:10.1177/1090198114557124

Dossett, M. L., Davis, R. B., Kaptchuk, T. J., & Yeh, G. Y. (2016). Homeopathy use by US adults: results of a national survey. *American Journal of Public Health, 106*(4), 743-745. doi:10.2105/ajph.2015.303025

Dougados, M., Soubrier, M., Antunez, A., Balint, P., Balsa, A., Buch, M. H., . . . Kay, J. (2013). Prevalence of comorbidities in rheumatoid arthritis and evaluation of their monitoring: Results of an international, cross-sectional study (COMORA). *Annals of the Rheumatic Diseases 73*(1), 62-68. doi:10.1136/annrheumdis-2013-204223

Driscoll, D. O., Halpenny, D., Johnston, C., Sheehy, N., & Keogan, M. (2014). 18F-FDG-PET/CT is of limited value in primary staging of early-stage cervical cancer. *Abdominal Imaging, 40*(1), 127-133. doi:10.1007/s00261-014-0194-x

Egger, G. (2012). In search of a germ theory equivalent for chronic disease. *Preventing Chronic Disease. 9.* doi:10.5888/pcd9.110301

Ellinor et al. (2015). Barriers to and facilitators of compliance with clinic-based cervical cancer screening: population based cohort study of women aged 23-60 years. PLoS ONE, 10 (5), 19. Retrieved from http://eds.b.ebscohost.com.ezp.waldenulibrary.org/eds/pdfviewer/pdfviewer?sid=af7239ce-97c1-480c-81c8-54d2c8c1ccbb%40sessionmgr198&vid=8&hid=103

Emerson, R. W. (2016). Statistical power: a reflection of reality. *Journal of Visual Impairment & Blindness, 110*(2), 142-144 2p. Retrieved from http://sfxhosted.exlibrisgroup.com/waldenu?sid=google&auinit=RW&aulast=Emerson&atitle=Statistical+Power:+A+Reflection+of+Reality&title=Journal+of+Visual

+Impairment+%26+Blindness&volume=110&issue=2&date=2016&spage=142&issn=0145-482X

Eskander, R. N., & Tewari, K. S. (2015). Immunotherapy: An evolving paradigm in the treatment of advanced cervical cancer. *Clinical Therapeutics, 37*(1), 20-38. doi:10.1016/j.clinthera.2014.11.010

Fang, P., Tan, K., Grover, S., Mcfadien, M. K., Troxel, A. B., & Lin, L. (2015). Psychosocial encounters correlates with higher patient-reported functional quality of life in gynecological cancer patients receiving radiotherapy. *Radiation Oncology, 10*(1), 34. doi:10.1186/s13014-015-0339-2

Ferguson, T., Rowlands, A. V., Olds, T., & Maher, C. (2015). The validity of consumer-level, activity monitors in healthy adults worn in free-living conditions: A cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity, 12*(1). doi:10.1186/s12966-015-0201-9

Fleming, S., Schluterman, N. H., Tracy, J. K., & Temkin, S. M. (2014). Black and White women in Maryland receive different treatment for cervical cancer. *PLoS ONE, 9*(8). doi:10.1371/journal.pone.0104344

Foran, C., & Brennan, A. (2015). Prevention and early detection of cervical cancer in the UK. *British Journal of Nursing, 24,* 22-9. Retrieved from http://eds.b.ebscohost.com.ezp.waldenulibrary.org/eds/pdfviewer/pdfviewer?sid=19ac8f88-7ae0-4140-a397-9a707f315264%40sessionmgr112&vid=21&hid=103

Fournel, P., Vergnenégre, A., Robinet, G., Léna, H., Gervais, R., Caer, H. L., . . . Martel-Lafay, I. (2016). Induction or consolidation chemotherapy for unresectable stage III non-small-cell lung cancer patients treated with concurrent chemoradiation: A randomised phase II trial GFPC – IFCT 02-01. *European Journal of Cancer, 52,* 181-187. doi:10.1016/j.ejca.2015.10.072

Fu, Z., Peng, Y., Cao, L., Chen, Y., Li, K., & Fu, B. (2015). Value of apparent diffusion coefficient (ADC) in assessing radiotherapy and chemotherapy success in cervical

cancer. *Magnetic Resonance Imaging, 33*(5), 516-524. doi:10.1016/j.mri.2015.02.002

Gange, S. J., & Golub, E. T. (2015). From smallpox to big data: The next 100 years of epidemiologic methods. *American Journal of Epidemiology, 183*(5), 423-426. doi:10.1093/aje/kwv150

Gassama, M., Bénichou, J., Dartois, L., & Thiébaut, A. C. (2017). Comparison of methods for estimating the attributable risk in the context of survival analysis. *Medical Research Methodology, 17*(1), 10.

Ghose et al. (2015). A review of segmentation and deformable registration methods applied to adaptive cervical cancer radiation therapy treatment planning. *Artificial Intelligence in Medicine, 64* (2), 75–87. doi:10.1016/j.artmed.2015.04.006

Grundmeier, R. W., Song, L., Ramos, M. J., Fiks, A. G., Elliott, M. N., Fremont, A., & ... Localio, R. (2015). Imputing missing race/ethnicity in pediatric electronic health records: reducing bias with use of U.S. census location and surname data. *Health Services Research, 50*(4), 946-960. doi:10.1111/1475-6773.12295

Guertin, K. A., Gu, F., Wacholder, S., Freedman, N. D., Panagiotou, O. A., Reyes-Guzman, C., & Caporaso, N. E. (2015). Time to first morning cigarette and risk of chronic obstructive pulmonary disease: Smokers in the PLCO cancer screening trial. *PLoS ONE, 10*(5), e0125973. http://doi.org/10.1371/journal.pone.0125973

Hagan, H. (2011). Agent, host, and environment: Hepatitis C virus in people who inject drugs, *The Journal of Infectious Diseases, 204*(12), 1819–1821. Retrieved from https://doi-org.ezp.waldenulibrary.org/10.1093/infdis/jir654

Hansen, A. M., Jeske, D., & Kirsch, W. (2015). A chi-square goodness-of-fit test for autoregressive logistic regression models with applications to patient screening. *Journal of Biopharmaceutical Statistics, 25*(1), 89-108. doi:10.1080/10543406.2014.919938

Hariri, S., Markowitz, L. E., Bennett, N. M., Niccolai, L. M., Schafer, S., Bloch, K., . . . Group, H. W. (2015). Monitoring Effect of Human Papillomavirus Vaccines in US Population, Emerging Infections Program, 2008–2012. *Emerging Infectious Diseases, 21*(9), 1557-1561. doi:10.3201/eid2109.141841

Hautala, J., & Jauhiainen, J. S. (2014). Spatio-temporal processes of knowledge creation. *Research Policy, 43*(4), 655-668. doi:10.1016/j.respol.2014.01.002

Heijkoop, S. T., Langerak, T. R., Quint, S., Mens, J. W., Zolnay, A. G., Heijmen, B. J., & Hoogeman, M. S. (2015). Quantification of intra-fraction changes during radiotherapy of cervical cancer assessed with pre- and post-fraction cone beam CT scans. *Radiotherapy and Oncology, 117*(3), 536-541. doi:10.1016/j.radonc.2015.08.034

Henderson, S. E., & Elsass, P. (2015). Predictors of trauma and distress in Sri Lanka five years after the Indian Ocean tsunami: A cross-sectional study. *International Journal of Disaster Risk Reduction, 14,* 438-444. doi:10.1016/j.ijdrr.2015.09.010

Hillard, P. J. A. (2015). Cervical cancer screening. *Contemporary OB/GYN. 60*(3), 43-43. Retrieved from http://eds.a.ebscohost.com.ezp.waldenulibrary.org/eds/pdfviewer/pdfviewer?sid=ca4d01a6-4fa8-4cdb-b919-06ea3b35deac%40sessionmgr4001&vid=25&hid=4108

Hofmann, W., & Patel, P. V. (2014). SurveySignal: A convenient solution for experience sampling research using participants' own smartphones. *Social Science Computer Review, 33*(2), 235-253. doi:10.1177/0894439314525117

Huh, W. K., Ault, K. A., Chelmow, D., Davey, D. D., Goulart, R. A., Garcia, F. A., ... & Schiffman, M. (2015). Use of primary high-risk human papillomavirus testing for cervical cancer screening: interim clinical guidance. *Gynecologic oncology, 136*(2), 178-182. doi:10.1016/j.ygyno.2014.12.022

Hurem, S., Leonardo Martín Martín, Brede, D. A., Skjerve, E., Nourizadeh-Lillabadi, R., Lind, O. C., . . . Lyche, J. L. (2017). Dose-dependent effects of gamma radiation on the early zebrafish development and gene expression. *PLoS One, 12*(6) doi:http://dx.doi.org.ezp.waldenulibrary.org/10.1371/journal.pone.0179259

Isaza-Restrepo, P. A., Carvajal, H. E. M., & Montoya, C. A. H. (2016). Methodology for quantitative landslide risk analysis in residential projects. *Habitat International, 53,* 403-412. doi:10.1016/j.habitatint.2015.12.012

Jansen, L., Hoffmeister, M., Arndt, V., Chang-Claude, J., & Brenner, H. (2014). Stage-specific associations between beta blocker use and prognosis after colorectal cancer. *Cancer, 120*(8), 1178-1186. doi:10.1002/cncr.28546

Jolly, P., Bessler, P., Ncube, B., Bey, A., & Knight, J. (2015). Factors associated with the uptake of cervical cancer screening among women in Portland. *Jamaica. North American Journal of Medical Sciences, 7*(3), 104. doi:10.4103/1947-2714.153922

Juan, W., Tao, W., Yun-Yi, Y., Yan-Lan, C., Fan, S., & Zi, L. (2015). Patient age, tumor appearance and tumor size are risk factors for early recurrence of cervical cancer. *Molecular & Clinical Oncology, 3*(2), 363-366. doi:10.3892/mco.2014.465

Kaur, H., Avasthi, D. K., Pujari, G., & Sarma, A. (2013). Radiosensitizing effect of gold nanoparticles in carbon ion irradiation of human cervical cancer cells. AIP Conference Proceedings, 1530(1), 205-210. doi:10.1063/1.4812924

Kent, E. E., Ambs, A., Mitchell, S. A., Clauser, S. B., Smith, A. W., & Hays, R. D. (2014). Health-related quality of life in older adult survivors of selected cancers: data from the SEER-MHOS linkage. *Cancer, 121*(5), 758-765. doi:10.1002/cncr.29119

Kenya, S., Carrasquillo, O., Fatil, M., Jones, J., Jean, C., Huff, I., & Kobetz, E. (2015). Human papilloma virus and cervical cancer education needs among HIV-Positive Haitian women in Miami. *Women's Health Issues, 25*(3), 262-266. doi:10.1016/j.whi.2014.12.007

Kim, J. J., Campos, N. G., Sy, S., Burger, E. A., Cuzick, J., Castle, P. E., ... & Wheeler, C. M. (2015). Inefficiencies and High-Value Improvements in US Cervical Cancer Screening Practice: A Cost-Effectiveness Analysis. *Annals of internal medicine, 163*(8), 589-597. DOI: 10.7326/M15-0420

Kjær, S. K., Munk, C., Junge, J., & Iftner, T. (2013). Carcinogenic HPV prevalence and age-specific type distribution in 40,382 women with normal cervical cytology, ASCUS/LSIL, HSIL, or cervical cancer: What is the potential for prevention? *Cancer Causes & Control Cancer Causes Control, 25*(2), 179-189. doi:10.1007/s10552-013-0320-z

Knight, G. L., Needham, L., Ward, D., & Roberts, S. (2016). Pilot study investigating the prevalence of oral Human Papilloma Viral (HPV) infection in young adults. *Public health*.doi:10.1016/j.puhe.2015.12.006

Kyung, M., Kim, H., Seoung, J., Choi, I., Joo, Y., Lee, M., . . . Park, Y. (2015). Tumor size and lymph node status determined by imaging are reliable factors for predicting advanced cervical cancer prognosis. *Oncology Letters. 9*, 2218-2224. doi:10.3892/ol.2015.3015

Lai, P., Chow, C. B., Wong, H. T., Kwong, K. H., Kwan, Y. W., Liu, S. H., . . . Wong, W. L. (2015). An early warning system for detecting H1N1 disease outbreak – a spatiotemporal approach. *International Journal of Geographical Information Science, 29*(7), 1251-1268. doi:10.1080/13658816.2015.1030671

Landoni, F., Sartori, E., Maggino, T., Zola, P., Zanagnolo, V., Cosio, S., ... & Gadducci, A. (2014). Is there a role for postoperative treatment in patients with stage Ib 2–IIb cervical cancer treated with neo-adjuvant chemotherapy and radical surgery? An Italian multicenter retrospective study. *Gynecologic oncology, 132*(3), 611-617.

Landry, J. C., Feng, Y., Prabhu, R. S., Cohen, S. J., Staley, C. A., Whittington, R., . . . Benson, A. B. (2015). Phase II trial of preoperative radiation with concurrent capecitabine, oxaliplatin, and bevacizumab followed by surgery and postoperative 5-fluorouracil, leucovorin, oxaliplatin (FOLFOX), and bevacizumab in patients with locally advanced rectal cancer: 5-year clinical outcomes ECOG-ACRIN cancer research group E3204. *The Oncologist, 20*(6), 615-616. doi:10.1634/theoncologist.2015-0106

Lau, Y. M., Cheung, T. H., Yeo, W., Mo, F., Yu, M. Y., Lee, K. M., . . . Chan, P. K. (2015). Prognostic implication of human papillomavirus types and species in cervical cancer patients undergoing primary treatment. *PLoS ONE, 10*(4). doi:10.1371/journal.pone.0122557

Lazzari, R., Cecconi, A., Jereczek-Fossa, B. A., Travaini, L. L., Dell' Acqua, V., Cattani,, F., & Orecchia, R. (2014). The role of [18F]FDG-PET/CT in staging and treatment planning for volumetric modulated Rapidarc radiotherapy in cervical cancer:

Experience of the European Institute of Oncology, Milan, Italy. *Ecancermedicalscience, 8*(381-412), 1-11. doi:10.3332/ecancer.2014.409

Legge, F., Chiantera, V., Macchia, G., Fagotti, A., Fanfani, F., Ercoli, A., . . . Ferrandina, G. (2015). Clinical outcome of recurrent locally advanced cervical cancer (LACC) submitted to primary multimodality therapies. *Gynecologic Oncology, 138*(1), 83-88. doi:10.1016/j.ygyno.2015.04.035

Liang, S. Y., Chao, T. C., Tseng, L. M., Tsay, S. L., Lin, K. C., & Tung, H. H. (2016). Symptom-management self-efficacy mediates the effects of symptom distress on the quality of life among Taiwanese oncology outpatients with breast cancer. *Cancer nursing*, *39*(1), 67-73.

Lin, Y., Schootman, M., & Zhan, F. B. (2015). Racial/ethnic, area socioeconomic, and geographic disparities of cervical cancer survival in Texas. *Applied Geography, 56,* 21-28. doi:10.1016/j.apgeog.2014.10.004

Liu, M., He, Z., Zhang, C., Liu, F., Liu, Y., Li, J., . . . Ke, Y. (2015). Transmission of genital human papillomavirus infection in couples: A population-based cohort study in rural China. *Scientific Reports, 5*, 10986. doi:10.1038/srep10986

Lutgens, L. C., Koper, P. C., Jobsen, J. J., Steen-Banasik, E. M., Creutzberg, C. L., Berg, H. A., . . . Zee, J. V. (2016). Radiation therapy combined with hyperthermia versus cisplatin for locally advanced cervical cancer: Results of the randomized RADCHOC trial. *Radiotherapy and Oncology*. doi:10.1016/j.radonc.2016.02.010

Madan, J., Lönnroth, K., Laokri, S., & Squire, S. B. (2015). What can dissaving tell us about catastrophic costs? Linear and logistic regression analysis of the relationship between patient costs and financial coping strategies adopted by tuberculosis patients in Bangladesh, Tanzania and Bangalore, India. *BMC Health Services Research, 15*(1). doi:10.1186/s12913-015-1138-z

Maguire, R., Kotronoulas, G., Simpson, M., & Paterson, C. (2015). A systematic review of the supportive care needs of women living with and beyond cervical cancer. *Gynecologic Oncology, 136*(3), 478-490. doi:10.1016/j.ygyno.2014.10.030

Marcel A. L. M. Van Assen, Aert, R. C., & Wicherts, J. M. (2015). Meta-analysis using effect size distributions of only statistically significant studies. *Psychological Methods, 20*(3), 293-309. doi:10.1037/met0000025

Mathie, R. T., Wassenhoven, M. V., Jacobs, J., Oberbaum, M., Frye, J., Manchanda, R. K., . . Fisher, P. (2016). Model validity and risk of bias in randomised placebo-controlled trials of individualised homeopathic treatment. *Complementary Therapies in Medicine, 25,* 120-125. doi:10.1016/j.ctim.2016.01.005

Matsuo, K., Mabuchi, S., Okazawa, M., Kawano, M., Kuroda, H., Kamiura, S., & Kimura, T. (2015). Clinical implication of surgically treated early-stage cervical cancer with multiple high-risk factors. *Journal of Gynecologic Oncology*, *26*(1), 3. doi:10.3802/jgo.2015.26.1.3

Mcgowin, C. L., Rohde, R. E., & Redwine, G. (2014). More than just a test result: Molecular screening of human papilloma virus for contemporary management of cervical cancer risk. *Clinical Laboratory Science, 27*(1), 43-46 4p. Retrieved from http://sfxhosted.exlibrisgroup.com/waldenu?sid=google&auinit=CL&aulast=McGo

win&atitle=More+than+just+a+test+result:+Molecular+screening+of+Human+Papilloma+Virus+for+contemporary+management+of+cervical+cancer+risk&title=Clinical+laboratory+science&volume=27&issue=1&date=2014&spage=43&issn=0894-959X

Miao, C., Li, M., Zheng, Y., Cohen, F. S., & Liu, S. (2016). Cell–cell contact promotes Ebola virus GP-mediated infection. *Virology*, 488, 202-215. doi:10.1016/j.virol.2015.11.019

Miller, J. W., Hanson, V., Johnson, G. D., Royalty, J. E., & Richardson, L. C. (2014). From cancer screening to treatment: Service delivery and referral in the National Breast and Cervical Cancer Early Detection Program. *Cancer*, *120*(S16), 2549-2556. doi:10.1002/cncr.28823

Miller, Y. D., Prosser, S. J., & Thompson, R. (2015). Back to normal: A retrospective, cross-sectional study of the multifactorial determinants of normal birth in Queensland, Australia. *Midwifery*, *31*(8), 818-827. doi:10.1016/j.midw.2015.04.005

Mills, M. (2011). *Introducing survival and event history analysis*. Los Angeles, CA: SAGE.

Min Sun, K., Hong Bae, K., Jung Yeob, S., In Young, C., Young Soo, J., Me Yeon, L., & ... Young Han, P. (2015). Tumor size and lymph node status determined by imaging are reliable factors for predicting advanced cervical cancer prognosis. *Oncology Letters*, *9*(5), 2218-2224. doi:10.3892/ol.2015.3015

Morabia, A. (2014). Invited Commentary: Do-It-Yourself Modern Epidemiology--At Last! *American Journal of Epidemiology*, *180*(7), 669-672. doi:10.1093/aje/kwu221

Mullins, T. L. K., Widdice, L. E., Rosenthal, S. L., Zimet, G. D., & Kahn, J. A. (2015). Risk perceptions, sexual attitudes, and sexual behavior after HPV vaccination in 11–12 year-old girls. *Vaccine*, *33*(32), 3907-3912. doi:10.1016/j.vaccine.2015.06.060

Murakami, N., Okamoto, H., Isohashi, F., Murofushi, K., Ohno, T., Yoshida, D., . . . Itami, J. (2015). A surveillance study of intensity-modulated radiation therapy for

postoperative cervical cancer in Japan. *Journal of Radiation Research, 56*(4), 735-741. doi:10.1093/jrr/rrv020

Natarajase, K., Enthumathi, R., Shanmughap, S., Sumathi, S., & Das, B. (2015). Prevalence of human papillomavirus, cytomegalovirus and chlamydia trachomatis among women with normal cervical cytology and their impact on TLRs expression. *Research Journal of Obstetrics and Gynecology Research. 8*(1), 1-9. doi:10.3923/rjog.2015.1.9

Nayak, S. (2015). Human papilloma virus and its relation to cervical cancer prevention strategies. *Pediatric Infectious Disease, 7*(1), 27-32. doi:10.1016/j.pid.2015.04.003

Nguyen, V. A., Choisy, M., Nguyen, D. H., Tran, T. H., Pham, K. L., Dinh, P. T., . . . Dang, D. A. (2012). High Prevalence of Beijing and EAI4-VNM Genotypes among M. tuberculosis Isolates in Northern Vietnam: Sampling Effect, Rural and Urban Disparities. *PLoS ONE, 7*(9). doi:10.1371/journal.pone.0045553

Nieder, C., Dalhaug, A., Pawinski, A., Haukland, E., Mannsåker, B., & Engljähringer, K. (2015). Palliative radiotherapy with or without additional care by a

multidisciplinary palliative care team in patients with newly diagnosed cancer: A retrospective matched pairs comparison. *Radiation Oncology, 10*, 1-5. doi:10.1186/s13014-015-0365-0

Nygård, M., Hansen, B. T., Dillner, J., Munk, C., Oddsson, K., Tryggvadottir, L., & ... Kjær, S. K. (2014). Targeting human papillomavirus to reduce the burden of cervical, vulvar and vaginal cancer and pre-invasive neoplasia: establishing the baseline for surveillance. *Plos ONE, 9*(2), 1-9. doi:10.1371/journal.pone.0088323

O'connor, M., Costello, L., Murphy, J., Prendiville, W., Martin, C., O'leary, J., & Sharp, L. (2014). 'I don't care whether it's HPV or ABC, I just want to know if I have cancer.' Factors influencing women's emotional responses to undergoing human papillomavirus testing in routine management in cervical screening: A qualitative study. BJOG: *An International Journal of Obstetrics & Gynaecology, 121*(11), 1421-1430. doi:10.1111/1471-0528.12741

Oluyomi, A. O., Byars, A., Byrd-Williams, C., Sharma, S. V., Durand, C., Hoelscher, D. M., . . . Kelder, S. H. (2015). The utility of geographical information systems (GIS)

in systems-oriented obesity intervention projects: The selection of comparable study sites for a quasi-experimental intervention design—TX CORD. *Childhood Obesity, 11*(1), 58-70. doi:10.1089/chi.2014.0054

Östensson, E., Alder, S., Elfström, K. M., Sundström, K., Zethraeus, N., Arbyn, M., & Andersson, S. (2015). Barriers to and Facilitators of Compliance with Clinic-Based Cervical Cancer Screening: Population-Based Cohort Study of Women Aged 23-60 Years. *PLoS ONE, 10*(5). doi:10.1371/journal.pone.0128270

Paaso, A., Koskimaa, H., Welters, M. J., Grénman, S., Syrjänen, K., Burg, S. H., & Syrjänen, S. (2015). Cell-mediated immunity against HPV16 E2, E6 and E7 peptides in women with incident CIN and in constantly HPV-negative women followed-up for 10-years. *Journal of Translational Medicine. 13*(1). doi:10.1186/s12967-015-0498-9

Pan, D., Wei, K., Ling, Y., Su, S., Zhu, M., & Chen, G. (2015). The prognostic role of Ki-67/MIB-1 in cervical cancer: A systematic review with meta-analysis. *Medical Science Monitor, 21*, 882-889. doi:10.12659/msm.892807

Pareja, R., Rendón, G. J., Vasquez, M., Echeverri, L., Sanz-Lomana, C. M., & Ramirez, P. T. (2015). Immediate radical trachelectomy versus neoadjuvant chemotherapy followed by conservative surgery for patients with stage IB1 cervical cancer with tumors 2cm or larger: A literature review and analysis of oncological and obstetrical outcomes. *Gynecologic Oncology, 137*(3), 574-580. doi:10.1016/j.ygyno.2015.03.051

Parham, G. P., Mwanahamuntu, M. H., Kapambwe, S., Muwonge, R., Bateman, A. C., Blevins, M., . . . Sahasrabuddhe, V. V. (2015). Population-level scale-up of cervical cancer prevention services in a low-resource setting: development, implementation, and evaluation of the cervical cancer prevention program in Zambia. *PLoS ONE, 10*(4). doi:10.1371/journal.pone.0122169

Park, I. U., Wojtal, N., Silverberg, M. J., Bauer, H. M., Hurley, L. B., & Manos, M. M. (2015). Cytology and Human Papillomavirus Co-Test Results Preceding Incident High-Grade Cervical Intraepithelial Neoplasia. *PLoS ONE, 10*(3). doi:10.1371/journal.pone.0118938

Pask, E. B., & Rawlins, S. T. (2015). Men's intentions to engage in behaviors to protect against human papillomavirus (HPV): testing the risk perception attitude framework. *Health Communication, 31*(2), 139-149. doi:10.1080/10410236.2014.940670

Paxton, E. W., Torres, A., Love, R. M., Barber, T. C., Sheth, D. S., & Inacio, M. C. (2016). Total joint replacement: a multiple risk factor analysis of physical activity level 1–2 years postoperatively. *Acta Orthopaedica, 87*(Sup1), 44-49. doi:10.1080/17453674.2016.1193663

Pazaitou-Panayiotou, K., Panagiotou, G., Polyzos, S. A., & Mantzoros, C. S. (2015). Serum adiponectin and insulin-like growth factor 1 in predominantly female patients with thyroid cancer: association with the histologic characteristics of the tumor. Endocrine Practice, 22(1), 68-75. doi:10.1016/j.ejso.2014.11.040

Perkins, R. B., & Stier, E. A. (2014). Should U.S. women be screened for cervical cancer with Pap tests, HPV tests, or both? *Annals of Internal Medicine, 161*(4), 295. doi:10.7326/m14-1043

Pfaendler, K. S., & Tewari, K. S. (2016). Changing paradigms in the systemic treatment of advanced cervical cancer. American Journal of Obstetrics and Gynecology, 214(1), 22-30. doi:10.1016/j.ajog.2015.07.022

Pimenta, J. M., Galindo, C., Jenkins, D., & Taylor, S. M. (2013). Estimate of the global burden of cervical adenocarcinoma and potential impact of prophylactic human papillomavirus vaccination. *BMC Cancer, 13*(1), 553. doi:10.1186/1471-2407-13-553

Powers, B. D., Montes, J. A., Nguyen, D. C., Nick, D. A., Daly, M. P., Davey, A., & Willis, A. I. (2015). Demographic risk factors impacting timely radiation therapy completion after breast conserving surgery. *The American Journal of Surgery, 210*(5), 891-895. doi:10.1016/j.amjsurg.2015.04.023

Pourghasemi, H. R., Moradi, H. R., & Aghda, S. F. (2013). Landslide susceptibility mapping by binary logistic regression, analytical hierarchy process, and statistical index models and assessment of their performances. *Natural hazards*, *69*(1), 749-779.

Prat, J., & Mbatani, N. (2015). Uterine sarcomas. *International Journal of Gynecology & Obstetrics,, 131*(2), S105-S110. doi:10.1016/j.ijgo.2015.06.006

Rajaraman, P., Anderson, B. O., Basu, P., Belinson, J. L., D'Cruz, A., Dhillon, P. K., & Mehrotra, P. (2015). Recommendations for screening and early detection of common cancers in India. *The Lancet Oncology, 16*, E352-E361. doi:doi:10.1016/S1470-2045(15)00078-9

Ramondetta, L. M., Meyer, L. A., Schmeler, K. M., Daheri, M. E., Gallegos, J., Scheurer, M., . . . Sun, C. C. (2015). Avoidable tragedies: disparities in healthcare access among medically underserved women diagnosed with cervical cancer. *Gynecologic Oncology, 139*(3), 500-505. doi:10.1016/j.ygyno.2015.10.017

Regan, D., Guth, A., Coy, J., & Dow, S. (2016). Cancer immunotherapy in veterinary medicine: current options and new developments. *The Veterinary Journal, 207*, 20-28. doi:10.1016/j.tvjl.2015.10.008

Río, C. D., & Alonso-Villar, O. (2015). The Evolution of Occupational Segregation in the United States, 1940–2010: Gains and losses of gender–race ethnicity. *Groups. Demography, 52*(3), 967-988. doi:10.1007/s13524-015-0390-5

Robison, K., Clark, L., Eng, W., Wu, L., Raker, C., Clark, M., . . . Dizon, D. S. (2014). cervical cancer prevention: Asian-American women's knowledge and participation in screening practices. *Women's Health Issues, 24*(2), 231-236. doi:10.1016/j.whi.2013.12.005

Rohrer, J. E., Grover, M. L., & Moats, C. C. (2013). Utilising the epidemiologic triad in analysing quality improvement data: Antibiotic use for respiratory infections as a case example. *Quality In Primary Care, 21*(13), 165-170 6p. Retrieved from http://hpp.sagepub.com.ezp.waldenulibrary.org/content/early/2015/08/25/1524839915602438.full.pdf+html

Sankaranarayanan, R. (2014). Magnivisualizer in the early detection of cervical neoplasia. *Journal of Gynecologic Oncology 25*(4), 263. doi:10.3802/jgo.2014.25.4.263

Santesso, N., Mustafa, R. A., Schünemann, H. J., Arbyn, M., Blumenthal, P. D., Cain, J., . . . Broutet, N. (2016). World Health Organization guidelines for treatment of cervical intraepithelial neoplasia 2–3 and screen-and-treat strategies to prevent cervical cancer. *International Journal of Gynecology & Obstetrics, 132*(3), 252-258. doi:10.1016/j.ijgo.2015.07.038

Saraiya, M., Benard, V., Greek, A., Steinau, M., Patel, S., Manninen, D., . . . Unger, E. (2014). Abstract B92: HPV and Pap test results among low-income, underserved women: Providing insights into management strategies. *Cancer Epidemiology Biomarkers & Prevention, 23(*11 Supplement), B92. doi:10.1158/1538-7755.disp13-b92

Saslow, D., Solomon, D., Lawson, H. W., Killackey, M., Kulasingam, S. L., Cain, J., . . . Myers, E. R. (2012). American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology screening guidelines for the prevention and early detection of cervical cancer. CA: *A Cancer Journal for Clinicians, 62*(3), 147-172. doi:10.3322/caac.21139

Sert, B., Boggess, J., Ahmad, S., Jackson, A., Stavitzski, N., Dahl, A., & Holloway, R. (2016). Robot-assisted versus open radical hysterectomy: A multi-institutional experience for early-stage cervical cancer. *European Journal of Surgical Oncology (EJSO), 42*(4), 513-522. doi:10.1016/j.ejso.2015.12.014

Shazly, S. A., Murad, M. H., Dowdy, S. C., Gostout, B. S., & Famuyide, A. O. (2015). Robotic radical hysterectomy in early-stage cervical cancer: A systematic review and meta-analysis. *Gynecologic Oncology, 138*(2), 457-471. doi:10.1016/j.ygyno.2015.06.009

Sheen, K., Spiby, H., & Slade, P. (2015). Exposure to traumatic perinatal experiences and posttraumatic stress symptoms in midwives: Prevalence and association with burnout. *International Journal of Nursing Studies, 52*(2), 578-587. doi:10.1016/j.ijnurstu.2014.11.006

Siegel, R. L., Miller, K. D., & Jemal, A. (2015). Cancer statistics, 2015. CA: *A Cancer Journal for Clinicians, 65*(1), 5-29. doi:10.3322/caac.21254

Skinner, S. R., Szarewski, A., Romanowski, B., Garland, S. M., Lazcano-Ponce, E., Salmerón, J., . . . Dubin, G. (2015). Efficacy, safety, and immunogenicity of the human papillomavirus 16/18 AS04-adjuvanted vaccine in women older than 25 years: 4-year interim follow-up of the phase 3, double-blind, randomised controlled VIVIANE study. *The Lancet, 384(*9961), 2213-2227. doi:10.1016/s0140-6736(14)60920-x

Smith, R. A., Manassaram-Baptiste, D., Brooks, D., Doroshenk, M., Fedewa, S., Saslow, D., . . . Wender, R. (2015). Cancer screening in the United States, 2015: A review of current American cancer society guidelines and current issues in cancer screening. CA: *A Cancer Journal for Clinicians, 65*(1), 30-54. doi:10.3322/caac.21261

Stolar, J., & Nielsen, S. E. (2014). Accounting for spatially biased sampling effort in presence-only species distribution modelling. *Diversity and Distributions, 21*(5), 595-608. doi:10.1111/ddi.12279

Strandell-Laine, C., Stolt, M., Leino-Kilpi, H., & Saarikoski, M. (2015). Use of mobile devices in nursing student–nurse teacher cooperation during the clinical practicum: An integrative review. *Nurse Education Today, 35*(3), 493-499. doi:10.1016/j.nedt.2014.10.007

Stub, T., Musial, F., Kristoffersen, A. A., Alræk, T., & Liu, J. (2016). Adverse effects of homeopathy, what do we know? A systematic review and meta-analysis of randomized controlled trials. *Complementary Therapies in Medicine, 26,* 146-163. doi:10.1016/j.ctim.2016.03.013

Subramanian, S., Sankaranarayanan, R., Esmy, P. O., Thulaseedharan, J. V., Swaminathan, R., & Thomas, S. (2016). Clinical trial to implementation: cost and effectiveness considerations for scaling up cervical cancer screening in low- and middle-income countries. *Journal of Cancer Policy, 7,* 4-11. doi:10.1016/j.jcpo.2015.12.006

Tacconelli, E., Cataldo, M. A., Paul, M., Leibovici, L., Kluytmans, J., Schröder, W., . . . Cookson, B. (2016). STROBE-AMS: Recommendations to optimise reporting of

epidemiological studies on antimicrobial resistance and informing improvement in antimicrobial stewardship. *BMJ Open, 6*(2). doi:10.1136/bmjopen-2015-010134

Tang, N. K., Lereya, S. T., Boulton, H., Miller, M. A., Wolke, D., & Cappuccio, F. P. (2015). Nonpharmacological treatments of insomnia for long-term painful ponditions: a systematic review and meta-analysis of patient-reported outcomes in randomized controlled Trials. *Sleep, 38*(11), 1751-1764. doi:10.5665/sleep.5158

Tay, K., Tay, S. K., Tesalona, K. C., Rashid, N. M., Tai, E. Y., & Najib, S. J. (2015). Factors affecting the uptake of cervical cancer screening among nurses in Singapore. International Journal of Gynecology & Obstetrics, 130(3), 230-234. doi:10.1016/j.ijgo.2015.03.037

Tervonen, H. E., Walton, R., Roder, D., You, H., Morrell, S., Baker, D., & Aranda, S. (2016). Socio-demographic disadvantage and distant summary stage of cancer at diagnosis—a population-based study in New South Wales. *Cancer Epidemiology, 40*, 87-94. doi:10.1016/j.canep.2015.10.032

Testa, P., & Block, W. E. (2013). Applying the free market philosophy to healthcare. *Humanomics, 29(*2), 105-114. doi:10.1108/08288661311319175

Thrall, M. J., Janssen, B. L., & Mody, D. R. (2015). The clinical impact of including pictures in papanicolaou test reports. *Journal of the American Society of Cytopathology, 4(3),* 122-127. doi:10.1016/j.jasc.2014.11.004

Tonidandel, S., & Lebreton, J. M. (2014). RWA Web: A Free, Comprehensive, Web-Based, and User-Friendly Tool for Relative Weight Analyses. *Journal of Business and Psychology, 30*(2), 207-216. doi:10.1007/s10869-014-9351-z

Tonkin, M., Woodhams, J., Bull, R., Bond, J. W., & Santtila, P. (2015). A Comparison of Logistic Regression and Classification Tree Analysis for Behavioural Case Linkage. *Journal of Investigative Psychology and Offender Profiling, 9*(3), 235-258. doi:10.1002/jip.1367

Torre, L. A., Bray, F., Siegel, R. L., Ferlay, J., Lortet-Tieulent, J., & Jemal, A. (2015). Global cancer statistics, 2012. CA: *A Cancer Journal for Clinicians, 65*(2), 87-108. doi:10.3322/caac.21262

Trimble, C. L., Morrow, M. P., Kraynyak, K. A., Shen, X., Dallas, M., Yan, J., . . . Bagarazzi, M. L. (2015). Safety, efficacy, and immunogenicity of VGX-3100, a therapeutic synthetic DNA vaccine targeting human papillomavirus 16 and 18 E6 and E7 proteins for cervical intraepithelial neoplasia 2/3: A randomised, double-blind, placebo-controlled phase 2b trial. *The Lancet, 386*(10008), 2078-2088. doi:10.1016/s0140-6736(15)00239-1

Vaidya, J. S., Wenz, F., Bulsara, M., Tobias, J. S., Joseph, D. J., Keshtgar, M., . . . Baum, M. (2014). Risk-adapted targeted intraoperative radiotherapy versus whole-breast radiotherapy for breast cancer: 5-year results for local control and overall survival from the TARGIT-A randomised trial. *The Lancet, 383*(9917), 603-13. doi:http://dx.doi.org.ezp.waldenulibrary.org/10.1016/S0140-6736(13)61950

Vermandere, H., Naanyu, V., Degomme, O., & Michielsen, K. (2015). Implementation of an HPV vaccination program in Eldoret, Kenya: Results from a qualitative assessment by key stakeholders. *BMC Public Health, 15*(1). doi:10.1186/s12889-015-2219-y

Vinekar, K. S., Vahratian, A., Hall, K. S., West, B. T., Caldwell, A., Bell, J. D., & Dalton, V. K. (2015). Cervical cancer screening, pelvic examinations, and contraceptive use among adolescent and young adult females. *Journal of Adolescent Health, 57(*2), 169-173. doi:10.1016/j.jadohealth.2015.04.001

Vizza, E., Corrado, G., Mancini, E., Vici, P., Sergi, D., Baiocco, E., . . . Cutillo, G. (2015). Laparoscopic versus robotic radical hysterectomy after neoadjuvant chemotherapy in locally advanced cervical cancer: A case-control study. *European Journal of Surgical Oncology (EJSO), 41*(1), 142-147. doi:10.1016/j.ejso.2013.08.018

Wakatsuki, M., Kato, S., Kiyohara, H., Ohno, T., Karasawa, K., Tamaki, T., . . . Shozu, M. (2015). Clinical Trial of Prophylactic Extended-Field Carbon-Ion Radiotherapy for Locally Advanced Uterine Cervical Cancer (Protocol 0508). *PLoS ONE, 10*(5). doi:10.1371/journal.pone.0127587

Wang, J., Wang, T., Yang, Y., Chai, Y., Shi, F., & Liu, Z. (2014). Patient age, tumor appearance and tumor size are risk factors for early recurrence of cervical cancer. *Molecular and Clinical Oncology*. doi:10.3892/mco.2014.465

Warwick, J., Falaschetti, E., Rockwood, K., Mitnitski, A., Thijs, L., Beckett, N., . . . Peters, R. (2015). No evidence that frailty modifies the positive impact of antihypertensive treatment in very elderly people: An investigation of the impact of frailty upon treatment effect in the Hypertension in the Very Elderly Trial (HYVET) study, a double-blind, placebo-controlled study of antihypertensives in people with hypertension aged 80 and over. *BMC Medicine, 13*(1). doi:10.1186/s12916-015-0328-1

Wegwarth, O., Gaissmaier, W., & Gigerenzer, G. (2011). Deceiving numbers: survival rates and their impact on doctors' risk communication. *Medical Decision Making, 31*(3), 386-394. doi:10.1177/0272989x10391469

Wieland, U., Hellmich, M., Wetendorf, J., Potthoff, A., Höfler, D., Swoboda, J., . . . Kreuter, A. (2015). Smoking and anal high-risk human papillomavirus DNA loads in HIV-positive men who have sex with men. *International Journal of Medical Microbiology, 305*(7), 689-696. doi:10.1016/j.ijmm.2015.08.019

Wiist, W. H. (2014). Use of complex systems modelling to strengthen public health's role in preventing war. *Medicine, Conflict and Survival, 30*(3), 152-164. doi:10.1080/13623699.2014.922374

Williams, C., Lewsey, J. D., Mackay, D. F., & Briggs, A. H. (2016). Estimation of survival probabilities for use in cost-effectiveness analyses. A comparison of a multi-state modeling survival analysis approach with partitioned survival and markov decision-analytic modeling. *Medical Decision Making*, 0272989X16670617.

Williams, M., Moneyham, L., Kempf, M., Chamot, E., & Scarinci, I. (2015). Structural and Sociocultural Factors associated with cervical cancer screening among HIV-infected African American women in Alabama. *AIDS patient care and STDs, 29*(1), 13-19. doi:10.1089/apc.2014.0063

Winer, I., Alvarado-Cabrero, I., Hassan, O., Ahmed, Q. F., Alosh, B., Bandyopadhyay, S., . . . Ali-Fehmi, R. (2015). The prognostic significance of histologic type in early stage cervical cancer – A multi-institutional study. *Gynecologic Oncology, 137(*3), 474-478. doi:10.1016/j.ygyno.2015.02.005

Wolff, A. C., Hammond, M. E., Hicks, D. G., Dowsett, M., Mcshane, L. M., Allison, K. H., . . . Hayes, D. F. (2014). Recommendations for human epidermal growth factor receptor 2 testing in breast cancer: American society of clinical oncology/college of American pathologists clinical practice guideline update. *Archives of Pathology & Laboratory Medicine, 138*(2), 241-256. doi:10.5858/arpa.2013-0953-sa

Wright, T. C., Stoler, M. H., Behrens, C. M., Sharma, A., Zhang, G., & Wright, T. L. (2015). Primary cervical cancer screening with human papillomavirus: End of study results from the ATHENA study using HPV as the first-line screening test. *Gynecologic Oncology, 136*(2), 189-197. doi:10.1016/j.ygyno.2014.11.076

Yanagihara, H. Wakaki, H. and Fujikoshi, Y. (2015). A consistency property of the AIC for multivariate linear models when the dimension and the sample size are large. *Electronic Journal of Statistics, 9* (2015) 869–897. DOI: 10.1214/15-EJS1022

Yi, S., Chhoun, P., Suong, S., Thin, K., Brody, C., & Tuot, S. (2015). AIDS-related stigma and mental disorders among people living with HIV: A cross-sectional study in Cambodia. *PLoS ONE, 10*(3). doi:10.1371/journal.pone.0121461

Yu, J. B., Soulos, P. R., Cramer, L. D., Decker, R. H., Kim, A. W., & Gross, C. P. (2015). Comparative effectiveness of surgery and radiosurgery for stage I non-small cell lung cancer. *Cancer, 121*(14), 2341-2349. doi:10.1002/cncr.29359

Zaal, A., de Wilde, M. A., Duk, M. J., Graziosi, G. C., van Haaften, M., von Mensdorff-Pouilly, S., ... & Verheijen, R. H. (2015). The diagnostic process of cervical cancer; areas of good practice, and windows of opportunity. *Gynecologic oncology, 138*(2), 405-410. doi:10.1016/j.ygyno.2015.05.037

Zeng et al. (2015). Disparities by race, age, and sex in the improvement of survival for major cancers: results from the National Cancer Institute Surveillance, Epidemiology, and End Results (SEER) Program in the United States, 1990 to 2010. *JAMA Oncology, 1*(1):88-96. DOI:10.1001/jamaoncol.2014.161.