A Comparison of Etiologically Similar Cancers with Behavioral Risk Factors

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Abstract

Many cancers have multiple causes; however certain cancers have causes that are associated with an individual’s voluntary behaviors. The purpose of this study was to research the association between behavioral risk factors and certain cancers, as well as the prevalence of these behavioral risk factors in those with the cancers studied when compared to those without cancer. The sample was acquired from the results of the 2009 Behavioral Risk Factor Surveillance System (BRFSS), and included 259,142 adults ages 50-99. Behavioral risk factors studied were: physical activity level, smoking status, alcohol use, healthy diet, and healthy weight. Cancers examined were: breast, endometrial, and colon/rectal cancers. These cancers were studied because they are etiologically similar. Associations between each cancer and each risk factor were found based on the responses of the participants. The prevalence of risk factors was then compared between the cancer-free group and the cancers-studied group. The findings showed that there is an association between having at least one of the studied cancers and most of the behavioral risk factors. The findings also indicate that there is a difference in the prevalence of behavioral risk factors in those without cancer and those with the studied cancers. In the future, these findings may be used to help target prevention efforts in order to reduce comorbidities and to improve the quality of life in older adults.
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CHAPTER 1
INTRODUCTION

Problem Statement

Many cancers have multiple causes. However, certain cancers have causes that are associated more with individual’s voluntary behavioral factors than with factors that are beyond an individual’s control, such as genetics. By focusing on cancers that have multiple behavioral causes, researchers will be able to weigh the impact of each behavior on each cancer. This should ultimately allow researchers to determine which behavior brings about the biggest risk for developing a certain cancer.

This study looked at breast, endometrial, and colon/colorectal cancers. These cancers were chosen on the basis that they impact a significant amount of the U.S. population, and that many of their potential causes are behaviorally-driven.¹ The behaviors examined for each cancer include: alcohol use, overweight/obesity, physical activity levels, tobacco use, and fruit and vegetable intake. These behaviors are associated with each other, and most are associated with each of the cancers that were examined.

By knowing which behavioral factors are more detrimental in potentially causing cancer, health care workers can help focus their behavioral modifications in order to reduce their risk of developing cancer. Modifying all behaviors for the better would be the most beneficial to the overall health of the patient, but sometimes patients need to start changing their lifestyles based on what they perceive to be the current biggest threat to their health. In order to reduce the risk of certain cancers, health care workers need to know which behavior change will have the greatest beneficial impact. This will allow the health care worker to guide the patient into seeing that a change is necessary in a certain area, and can also help the patient understand what the
risks are if they choose not to change the behavior. Once the patient perceives that there is a threat to his or her health and decides that a change will occur, the health care worker will then be able to help the patient implement the chosen lifestyle change. Once the first change has been successfully put into place, other positive changes can follow.

As cancer is a global problem, as are the behaviors associated with each of the cancers examined, this problem is important at the international level. For the purposes of this research study, all data is from the U.S.

Review of Literature

Cancer is a worldwide problem, and is the second leading cause of death in the United States, claiming approximately 559,880 American lives in 2006.¹ Many of these cancers and these cancer-related deaths are preventable through regular screenings and behavior modification.

Though there are many kinds of cancer, three types are particularly troubling. Breast, colon/colorectal, and endometrial cancers are problematic since these are among the most commonly diagnosed cancers in the United States.² Each of these has high incidence and mortality rates, which is unacceptable in this day and age given the knowledge and technology that society has. In 2006, for women with breast cancer, 191,410 were diagnosed and 40,820 died. For that same year, 139,127 people were diagnosed with colon/colorectal cancer, and 53,196 died from it. For endometrial cancer in 2006, approximately 35,000 women were diagnosed with it and 7,384 died from it. What makes these cancers problematic, aside from the high incidence and mortality rates, is that many of the possible causes for these cancers are due to an individual’s behavioral factors, or lifestyle choices. These behaviors can be modified, meaning that it would be possible for individuals to lower their risk of developing any of the cancers examined in this study. These behavioral risk factors include: smoking, alcohol use,
physical activity level (or lack thereof), diet (high in fat, low in fruits and vegetables), and overweight/obesity. In the following sections, each cancer and its known associated behavioral risk factors will be discussed. This should demonstrate that there is a need to change these behaviors in order to improve an individual’s overall health as well as reduce the risk of developing any of these cancers.

BREAST CANCER

Breast cancer is one of the most common kinds of cancer for women in the United States. The Centers of Disease Control and Prevention lists being overweight, drinking more than one alcoholic beverage per day, and not getting enough exercise as potential risk factors for developing breast cancer.

Being overweight or obese has long been associated as a potential cause for breast cancer, particularly in post-menopausal women. A 2009 review has found convincing causal evidence for the association between general obesity and the development of post-menopausal breast cancer. The National Cancer Institute and many other studies such as the Iowa Women’s Health Study have also suggested that the distribution of where body fat is located on the body many influence breast cancer risk. According to the National Cancer Institute and the Iowa Women’s Health Study, women with an excessive amount of abdominal fat are greater risk for developing breast cancer than those who have fat distributed elsewhere on their bodies. However, being overweight or obese will increase the risk of developing breast cancer, regardless of where the body fat is located. In addition, it has been suggest that obesity may lead to worse outcomes in breast cancer patients. Many observational studies have found that avoiding weight gain can lower the risk of developing post-menopausal breast cancer.
Engaging in physical activity is one way to reduce the risk of developing breast cancer. According to one study, engaging in regular “physical activity may reduce the relative risk of breast cancer by 20%-40%.” The Centers of Disease Control and Prevention recommends that adults engage in at least 150 minutes of moderate exercise per week in order to enjoy the protective benefits of exercise. In addition to reducing the risk of developing breast cancer, engaging in physical activity has many other beneficial health benefits that may also help reduce the risk of developing cancer.

“Alcohol is classified as a carcinogen.” Researchers believe that alcohol may serve as an irritant, thereby promoting carcinogenesis. Moderate alcohol consumption (on average one drink per day) has also been found to increase the risk of developing breast cancer by 7 percent.

Modification of all of these behavioral risk factors can help to reduce the risk of developing breast cancer in post-menopausal women. While each risk factor can contribute on its own to the risk of developing breast cancer, it is important to know which factor has the greatest impact overall.

COLON/COLORECTAL CANCER

Colon/colorectal cancer is the second leading cause of cancer deaths of cancers that affect men and women in the United States. This cancer is one of the most commonly diagnosed in the United States, which is a shame since so many of its causes are behavior-based. These behavioral risk factors include: physical activity, overweight/obesity, diet, alcohol, and tobacco.

Not getting enough physical activity may be one of the contributing factors for developing colon/colorectal cancer. There is convincing evidence showing that engaging in physical activity and avoiding a sedentary lifestyle actually protects individuals against...
colon/colorectal cancer. Other studies have found that engaging in physical activity can reduce the risk of developing this by as much as 40 percent. There are many possible explanations for this, but one possible explanation as to why physical activity acts as a protective measure is that it helps prevent diabetes from developing, which increases the risk of developing this cancer. Additionally, being physically active reduces the likelihood of becoming overweight/obese, which is another contributing factor to developing colon/colorectal cancer.

It has long been established that being overweight/obese puts individuals at risk for many diseases, including colon/colorectal cancer. Having a high body-mass index (BMI) does not help the body protect itself against this cancer, and it really does not help the body survive the cancer once it has developed. One study found that colon/colorectal cancer patients that had higher BMIs often had higher mortality rates than patients who had a healthy or normal BMI.

A good way to prevent becoming overweight/obese is to eat a healthy diet. One’s dietary pattern can be a risk factor for developing colon/colorectal cancer. Diets that are high in fat, low in fiber, and low in fruits and vegetables have often been associated with an increased risk for developing this cancer. The National Cancer Institute has found that there is “an association between fat and red meat intake and colon cancer risk.” Other studies have also found “that eating red and preserved meats increases the risk of colon cancer.” However, a diet that includes fruits and vegetables can actually help protect against the development of colon/colorectal cancer, especially in men. The study done by van Duijnoven et al. goes further by saying that there is convincing evidence that a diet that is low-fat, high in fiber, and includes fruits and vegetables can protect the body against the risk of developing colon/colorectal cancer. A study done by Williams & Hord says that increasing the amount of fiber that is consumed daily can reduce the rate of this cancer by up to 40 percent. By
combining a healthy diet with physical activity, there may be a 70 percent decrease in colon/colo-rectal cancer rates. Alcohol is another risk factor for developing colon/colo-rectal cancer. Unlike many other risk factors that are usually associated with developing a cancer later in life, alcohol use is associated with an earlier onset of colon/colo-rectal cancer. The National Cancer Institute has found that there is convincing evidence of alcohol contributing to the increased risk of colorectal cancer in men, while the evidence for women developing colorectal cancer due to the consumption of alcohol is probable. It appears that the amount of alcohol consumed may have an impact on the risk of developing colon/colo-rectal cancer; moderate to heavy use of alcohol is associated with an increased risk of developing these cancers. Tobacco is an interesting risk factor for developing colon/colo-rectal cancer, since it can compound already existing risk factors and negate beneficial behaviors. For instance, tobacco is a risk factor for colon/colo-rectal cancer in its own right. Tobacco use is generally associated with a later onset of colon/colo-rectal cancer. However, if alcohol use and tobacco use occurs simultaneously, colon/colo-rectal cancer is more likely to have an earlier onset. This demonstrates how tobacco use can compound other existing risk factors. However, tobacco use can also negate beneficial behaviors. As previously established, a diet that is high in fruits and vegetables can help protect against the risk of developing colon/colo-rectal cancer. However, one study has found that one’s smoking status (never, former, and current smoker) can affect whether or not consuming fruits and vegetables helps protect against this risk.

ENDOMETRIAL CANCER

Endometrial cancer is the most commonly diagnosed gynecological cancer, and is the fourth most common cancer for women in the United States. While many of the risk factors for
developing endometrial cancer are due to genetics and are therefore out of the individual’s control, there are behavioral risk factors that may be associated with this cancer. Overweight/obesity, and therefore diet and physical activity levels, are the behavioral risk factors for this cancer.

There is strong evidence that being overweight/obese increases one’s risk for developing endometrial cancer.4,3,5 “Obese women have two to four times greater risk of developing the disease than do women of a healthy weight” and that “obesity has been estimated to account for about 40 percent of endometrial cancer cases in affluent societies.”3

As previously discussed, overweight/obesity is often caused by a poor diet and low (or no) physical activity levels. One study found that endometrial cancer is associated with a high BMI, an excess of calories (poor diet choices), and a lack of physical activity.16 Diets that are high in vegetables and other related nutrients may actually serve to reduce the risk of developing endometrial cancer.17 By improving dietary choices and engaging in regular physical activity, perhaps the likelihood of becoming overweight/obese will be reduced. Reducing the likelihood of being overweight/obese may reduce the risk for developing endometrial cancer.

This study will help extend the body of knowledge in this area by ranking each behavioral factor for each of these cancers. It is known that all of these behavioral factors have a role in the development of each cancer. The relative importance of each of these factors towards the development of each cancer, however, is not known. By ranking each of the behavioral risk factors, health care workers will know where to focus their efforts when working with patients, and researchers will be able to concentrate on better treatments and methods for treating each of these cancers.

The Health Belief Model (HBM) works well for this problem. The HBM says that “the
likelihood of someone engaging in a recommended health action is based predominately on individuals’ perceptions.” These perceptions are based off of an individual’s perceived susceptibility and perceived severity; in other words, how big the problem could be. If a person views the problem as serious and likely, they will ultimately engage in the recommended course of action. This works theory works in the favor of this study, as the ultimate goal of the project is to rank the behavioral risk factors for each cancer so that health care practitioners know which behaviors they should focus their energy on immediately. If they are able to do this, they should be able have clients perceive the threat to their health as real, likely, and serious. This would then hopefully motivate the patients to modify their behaviors.

Objectives
The overall goal of this study was to create a “risk factor profile” of breast, colon/colorectal, and endometrial cancers. This profile could then be used by health care providers to indicate what a patient with a certain cancer may look like behaviorally. This would allow health care providers to encourage patients with these specific behavioral risk factors to change at least one of the behaviors in order to reduce the risk for developing cancer. The research questions used for this study are as follows:

1. To what extent is there an association between the behavioral risk factors of overweight/obesity, physical activity level, fruit and vegetable intake, tobacco use, and alcohol use with breast, colon/colorectal and endometrial cancers?

2. Are there differences in the prevalence of these behavioral risk factors in those individuals who have any of these cancers when compared to those who do not have any of these cancers?
CHAPTER 2
METHODOLOGY

Population and Sample

This study analyzed data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS).19 The BRFSS surveys adults via telephone about their health status and behaviors, as well as demographics that may impact health. To reduce the number of confounding variables, only data from adults over the age of 50 years who reported having at least one of the three cancers examined or no cancer at all were included in the study. The study did not require IRB approval since all data was analyzed from an existing database.

Design

This study was a retrospective cross-sectional design that attempted to create a “risk factor profile” of people who may be at risk for developing breast, endometrial, and/or colon/colorectal cancers by using the most recent data from the BRFSS database. Specifically, this study explored the prevalence of engaging in any of the following behavioral risk factors: physical activity level, smoking status, alcohol use, healthy diet, and healthy weight. The prevalence of these risk factors in those with the defined cancers was compared to the prevalence of risk factors in those without the defined cancers.

Data and Instrumentation

The specific data areas from the BRFSS survey were used to identify the presence of behavioral risk factors and demographic factors are as follows.19

- Section 1: Health Status
- Section 5: Exercise
• Section 11: Tobacco Use
• Section 12: Demographics
• Section 13: Alcohol Use
• Section 18: Fruits and Vegetables
• Section 19: Physical Activity
• Section 22: Cancer Survivorship
• Module 12: Cancer Survivorship

Participants were identified as meeting the specific behavior risk factors by the following criteria:

Physical Activity Level: Participants reporting moderate exercise 5-7 days a week (Section 5 and Section 19) met the requirements for the risk factor.

Smoking Status: Participants reporting their current smoking status (Section 11) were identified as they have identified themselves: current every day smoker, current some days smoker, former smoker, or never smoked.

Alcohol use: Participants reporting any alcoholic drink consumption in the past 30 days (Section 13) were identified as alcohol users.

Healthy Diet: Participants consuming five or more fruits/vegetables per day (Section 18) were identified as meeting healthy diet recommendations.

Healthy Weight: Participants answering no to being overweight/obese were identified as meeting healthy weight recommendations.
The rationale for using this criterion is provided in the background research. Access to the 2009 BRFSS database was the only resource needed and was readily accessible. Data was analyzed using SPSS 19.0. The research questions were answered using chi-square analysis, comparing those who were meeting the health-promoting recommendations to those who were not meeting the recommendations.
CHAPTER 3

RESULTS

Participants with any other cancer were eliminated from the data set, resulting in a sample size of 259,142. Respondents were also eliminated if they answered “I don’t know” or refused to answer the question in the demographic samples. The sample was made up of 59.3 percent Caucasians, 6.9 percent African-Americans, 5.3 percent Asians, and 3.7 percent Hispanics. The majority of respondents (62.5 percent) were female. Most of the respondents were married (54.4 percent). The vast majority of respondents were retired (43.0 percent). The sample demographics are further described in Table 1.

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Figure 1 shows the percentage of people in the examined cancer groups who engaged in health promoting behaviors. In general, most people with these cancers did not drink any alcohol within the past 30 days (range from 60% to 68%), consumed more than five servings of fruits and vegetables a day (range from 25% to 33%), most engaged in regular moderate activity (range from 77% to 80%), more than a third were neither overweight nor obese (range from 32% to 42%), and approximately half had never smoked (range from 45% to 55%), while approximately a third identified as former smokers (range from 31% to 45%). The participants in this survey self-identified themselves for each category.

Figure 1: Percentage of Those with Cancer Engaging in Health Promoting Behavior
Alcohol is defined as the consumption of any alcoholic drink during the past month (30 days), F&V is defined as the consumption of five or more fruits and vegetables per day, and moderate means that the participants engaged in at least the minimum recommended amount of moderate physical activity (moderate activity for at least 30 minutes a day for five or more days per week). Obesity is defined as respondents declaring that they were neither overweight nor obese. Former smokers are those who used to smoke but have since quit, while never smoked is defined as stated.

Figure 2 compares the percentage averages of people engaging in health promoting behaviors between those with an examined cancer and those without cancer. Those with cancer had the following characteristics: Most (61%) did not drink any alcohol within the past month, almost a third (31%) consumed more than five fruits and vegetables per day, 79 percent engaged in some amount of moderate physical activity, 39 percent were neither overweight nor obese, slightly more than a third (36%) identified as a former smoker, and slightly more than half (53%) reported never smoking. For those who are cancer-free, the following characteristics appear: 50 percent did not consume alcohol within the past month, a quarter of the population consume five or more fruits and vegetables each day, 85 percent engage in some moderate physical activity, slightly more than a third (35%) are neither overweight nor obese, less than a third (29%) self-identified as being a former smoker, and slightly more than half (54%) reported never smoking. As with those reported having a specific cancer, all cancer-free participants self-identified themselves for each category. The labeling definitions from Figure 1 apply to Figure 2.
The results show that there is a statistically significant difference in levels of engagement in health promoting behaviors between those with one of the examined cancers and those without cancer ($p<0.001$). This suggests that there is strong relationship between the variables.

**Discussion**

The results of this study look at the behaviors of adults with and without cancer, based on five behavioral risk factor categories: physical activity level, smoking status, alcohol use, healthy diet (measured by fruit and vegetable consumption), and healthy weight. Participants are usually not meeting recommended guidelines for any category in both the cancer and non-cancer groups.
Overall, the results show that there is in fact a relationship between each cancer and the specific behavioral risk factors. The exact nature of this relationship is unknown from this study. The results also show that there is a significant difference in behavior between those with cancer and those without cancer. While further investigation is needed, it appears as though those with cancer are doing a better job overall of meeting health promoting recommendations than those without cancer.

There were certain interesting trends among those who had cancer. First of all, those with cancer did a fairly decent job at avoiding alcohol consumption, engaging in physical activity, and in not smoking (for either quitting or never started). Those with endometrial cancer were the least likely to consume alcohol; 68 percent did not consume alcohol in the past month, as opposed to 60 percent of those with breast cancer or 62 percent of those with colon/colorectal cancer. Those with colon/colorectal cancer were the most likely to have been former smokers (45%), whereas those with breast cancer were the most likely to have never started smoking (55%).

Secondly, those with cancer did not do as well of a job in terms of their fruit and vegetable consumption or at managing a healthy weight. Only 25 percent of those with colon/colorectal cancer consumed the recommended amount of fruits and vegetables each day, which is an unexpected finding, given the fact that diet is a known risk factor in terms of developing this particular type of cancer. One would have expected to find dietary improvements, or at least a higher percentage of individuals meeting the recommendations for fruit and vegetable consumption.

The cancer-free group also had some interesting trends occurring. The cancer-free group was not necessarily doing a better job of engaging in health promoting behaviors; in many cases,
the cancer group had a higher percentage of individuals meeting health recommendations than the cancer-free group. The cancer-free group, as stated earlier, was more likely to engage in regular moderate physical activity as well as maintain a healthy weight. These variables are often linked together, so these results were not surprising.

Smoking is socially taboo, so having the majority of respondents for the cancer and cancer-free groups report that they do not smoke is not surprising. What is surprising, however, is the percentage of those in the cancer group who report that they were former smokers (36%), as opposed to the cancer-free group (29%). Further investigation is needed in order to determine the “why” behind the decision to quit: timing could be an important factor in an individual’s health status. For instance, those with cancer could have chosen to quit smoking prior to receiving the cancer diagnosis for a variety of reasons, or they could have chosen to quit smoking after receiving the cancer diagnosis for a variety of reasons, one of which may be as a means to gain some sort of control back over their health status.

The fact that the percentages for engaging in health promoting behaviors were higher in general for the group with cancer suggests that getting cancer may have scared healthy behaviors into individuals, which falls in line with the Health Belief Model. Although nothing can be done to prevent cancer once a diagnosis is made, engaging in health promoting behaviors can reduce the risk of exacerbating the disease or may reduce the risk of comorbidities, which would threaten the health of an already vulnerable population. The perceived threat and susceptibility of developing other health problems must be high after receiving a cancer diagnosis, and this may encourage individuals with cancer to take control of their health for the better.

Further research, however, is necessary in order to confirm whether or not those with cancer were scared into changing their behavior after receiving a diagnosis. It is possible that
these individuals changed their behavior prior to receiving a cancer diagnosis, or never changed their behavior—they may have started out healthier to begin with.

Receiving a cancer diagnosis may have had three potential effects on health behavior. First, it may have pushed those with cancer into changing their behavior, which, as discussed earlier, follows the Health Belief Model. Second, individuals may have just maintained their behavior, neither doing anything to improve their health, but also not doing anything that could make it potentially worse. The last effect is that receiving a cancer diagnosis may actually make individuals worsen their health behaviors, following the mindset of “If I’m going to be miserable and/or die from this disease, I might as well enjoy myself.” From this particular study, it is impossible to know where each of the participants fell, but from a clinical perspective, it could be potentially critical to understand which category one’s patient has put him/herself in order to treat the patient in the most effective manner.

**Implications**

The population statistics derived from the BRFSS database have several important functions as a health promotion tool. The data from population statistics can be used to demonstrate correlations in health behaviors. Because this sample was large and weighted, the data is nationally representative, and can be used as a gauge for measuring improvement of health behaviors, if they occur from health promotion campaigns.

The implications from this study demonstrate the importance of behavioral influences on health in society. While it is impossible to definitively determine a cause-and-effect pattern between engaging in negative health behaviors and developing breast, endometrial, or colon/colorectal cancer, it is known that continuing these negative health behaviors while have an impact on an individual’s quality of life. Encouraging health promotion behaviors, such as
engaging in moderate physical activity or quitting smoking, will greatly benefit both kinds of patients. Encouragement of health promotion can serve as a preventive measure in those without cancer. For those with cancer, health promotion may be used in order to reduce the risk of comorbidities and running the risk of having the patient become worse, as well as improve quality of life for the patient. Health promotion matters when it comes to the behavioral influences on health.

The overall purpose of this study was to determine if a relationships and differences exist. This study was not attempting to discover the exact mechanism of the relationships and differences. From this study, it is not clear why there is a difference between those with cancer and those without cancer. It is enough, however, to know that there is a difference. Knowing that there is a difference can be used to promote further research in the health promotion field. Health care professionals need to be willing to investigate why there is a difference, as that may have an impact in how they treat patients. As discussed, it is important to meet the patient where they are at in order to effectively promote healthy behaviors.

Limitations

This study may have limitations due to the nature of self-reported data; however, the BRFSS data sets have been proven to be reliable and valid.²

Another possible limitation to this study is that this study provides a snapshot of current behaviors. The researcher has no way of knowing what past behavior was like in the current cancer participants, nor of what the future may hold for participants who are currently cancer-free. This means that the data collected is a reflection of what behaviors people are engaging in currently. Past behavior may have been different, potentially aiding in the development of the
cancer in those currently diagnosed, and cancer may still yet develop in those who are currently cancer-free based on their behaviors.

This study also does not provide a causation relationship between the behavioral risk factors and the various cancers. It does, however, provide some correlational data showing that those with cancer and those without cancer are different behaviorally. As of right now, it is unknown why there is a difference in behavior between these two groups, as well as what is causing the difference. This is an area for future research.

Another potential limitation is that this study only examined behavioral risk factors. Many of these cancers also have a strong hormonal component to them, which may have impacted some of the data, such as overweight/obesity. The genetic component, in conjunction with the behavioral risk factors, may have skewed the data in some way. Additionally, it is unknown how much weight to give each behavioral risk factor in its relationship with cancer. Some behavioral risk factors may be more important overall when it comes to cancer. It is also impossible to determine from this study how the many possible combinations of factors of positive and negative behavioral risk factors may actually impact health.

Conclusion

This research analysis found that there is a strong association between behavioral risk factors and certain cancers. Additionally, there is a difference in the prevalence of risk factors in those with cancer when compared to those without cancer. These findings can be used encourage behavioral changes earlier in those at risk for developing cancer in order to prevent the prevalence of behaviorally-influenced cancer, as well as reducing the risk of comorbidities in those already with cancer.


5 Iowa Women’s Health Study. (2000). Associations of general and abdominal obesity with multiple health outcomes in older women. Archives of Internal Medicine, 160, 2117-2128.


