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[The Associations between country specific breast cancer incidence and mortality and country specific risk factors (ecological study).]

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ABSTRACT

Background - Breast cancer is the major cause of cancer morbidity and mortality globally. While individual-level risk factors for breast cancer have received a significant amount of focus, there has been little study on the ecological-level relationships between country-specific risk factors and breast cancer outcomes, such as incidence and mortality. The purpose of this ecological study is to look into the links between country-specific breast cancer incidence and mortality rates and numerous risk variables.

Aim - The aim of the study is to collate country specific breast cancer incidence and mortality data and country specific risk factor data and look to see if there are any associations between the number of breast cancer cases and deaths (or the cancer incidence and mortality rates) and various country specific factors such as healthcare system; health care funding system, population density, gross domestic product.

Method – The study design is an ecological study. It involves the secondary data collection of cancer data of 185 countries from many sources and international databases such as Cancer Today, World Health Organization and National Cancer registries. It includes the collection of data of country specific risk factors such as (Gross domestic product, Per capita income, health care expenditure etc.) and individual level risk factors such as (sex, lifestyle, age etc.) and compare them with the variables that are the incidence and mortality rates by the standardization of the age. Descriptive Analysis followed by the comparison of coefficients using the multivariable linear regression method is used.

Results - The regression analysis reveals a robust model ($R = 0.821$), elucidating 67.4% of "cancer occurrence" variance. Coefficient analysis highlights life expectancy's positive impact ($B = 1.641$, $p < 0.001$) and male tobacco use's influence ($B = 0.398$, $p = 0.016$), while female tobacco use negatively associates ($B = -0.511$, $p = 0.046$). Correlation analysis underscores significant positive correlations between "cancer occurrence" and median population age ($r = 0.714$) and alcohol consumption per capita ($r = 0.548$).

Conclusion - This ecological analysis sheds light on the relationships between country-specific breast cancer incidence and mortality rates and a variety of risk variables. The findings emphasize the need of taking both individual-level and country-level variables into account when developing breast cancer preventive and control methods. Tailored treatments focused at modifying

modifiable risk factors and improving healthcare access in specific country contexts may aid in reducing the global burden of breast cancer.
Keywords – Breast Cancer, Incidence, Mortality, Country level risk factors, Individual Risk Factors, Age Standardization, Gross Domestic product, healthcare infrastructure, Lifestyle, Cultural factors.

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Chapter 1: Introduction

1.1 Background and Rationale

Breast cancer can be identified as one of the most common cancers internationally and one of the deadliest cancers; it actually takes 25% of the weightage of total cancer cases in women and 0.5-1% of cases in men. It is believed that in the year 2020, breast cancer was responsible for the death of 685000 people all over the world (WHO, 2020). Breast cancer can be characterized by its various etiological factors. Genetic predisposition, age, family history, hormonal influences, lifestyle choices, as well as reproductive factors mainly contribute to its development. However, only understanding these individual-level risk factors will not be sufficient; in order to learn about this, it is equally crucial to recognize the role of broader country-specific factors in shaping breast cancer incidence as well as outcomes. The probability of breast cancer can be determined through a screening test; this probability or incidence can be divided into certain factors or categories. The primary two categories of breast cancer incidence are individual risk factors and country-level risk factors. As per a recent study, the rates of breast cancer incidence vary from “27 per 100,000” in Afghanistan to “94 per 100,000 in Belgium” (Sharma, 2019).

On the other hand, the latest report is also effective in mentioning the mortality rates that differ from “7 per 100,000 in Japan” to “30 per 100,000 in Hungary” (Lei et al. 2021). However, the dissimilarities indicate the limitations in healthcare access, inadequacies in the screening process, and the effect of different lifestyle factors. In this way, these statistics are effective in highlighting the requirement for tailored interventions that address country-specific obstacles in the prevention of breast cancer and treatment. Various known individual risk factors are related to breast cancer. Several factors contribute to the risk of developing breast cancer, and understanding these variables is crucial for early detection and prevention (Feng et al., 2018; Starosławska, 2015). Age is a significant determinant, as the likelihood of breast cancer increases with advancing age. Additionally, a family history of breast cancer places women at a higher risk, underscoring the genetic component of the disease. The reproductive period also plays a role, with both early and late onset of menstruation associated with an elevated risk of breast cancer. Leading a sedentary lifestyle is identified as a risk factor, highlighting the importance of physical activity in reducing the likelihood of breast cancer (Negrei & Gălățeanu, 2019).

Moreover, heavy alcohol consumption has been linked to the occurrence of breast cancer, emphasizing the need for lifestyle modifications to mitigate risk. These factors collectively underscore the complex interplay between genetics, lifestyle, and reproductive patterns in influencing the susceptibility to breast cancer. Awareness and proactive management of these risk factors are essential for promoting breast health and reducing the incidence of this prevalent form of cancer (Feng et al., 2018; McPherson et al., 2000).

This comparative analysis of healthcare indicators across various countries sheds light on the intricate relationship between healthcare metrics, socio-economic factors, and their potential impact on breast cancer outcomes. In Japan, boasting a substantial life expectancy of approximately 84.45 years, there is a notable correlation between longer lifespans and enhanced breast cancer outcomes (Li et al., 2019). The emphasis on longevity suggests a healthcare system that contributes to overall well-being, potentially influencing positive breast cancer outcomes.

Contrastingly, Nigeria exhibits a considerably lower life expectancy of around 52.68 years, highlighting significant disparities in healthcare outcomes (Abubakar et al., 2018). The juxtaposition of these life expectancy figures underscores the need for further examination of healthcare accessibility, quality, and their potential repercussions on breast cancer care in diverse global contexts. Examining infant and under-five mortality rates provides additional insights into the healthcare disparities among nations. Norway's impressive infant mortality rate of 2.1 per 1,000 live births reflects a high-quality healthcare system, possibly linked to lower breast cancer mortality rates (Li et al., 2019). Conversely, Afghanistan faces a significantly higher infant mortality rate of 43 per 1,000 live births, signaling challenges in both healthcare accessibility and quality (Vanderpuye et al., 2017). Germany's remarkable provision of 8 hospital beds per 1000 patients underscores a robust healthcare infrastructure capable of early breast cancer detection (Li et al., 2019).

In contrast, India's lower score of 0.5 hospital beds per 1,000 population raises concerns about equitable healthcare access, posing questions about its potential impact on breast cancer care (Kamińska et al., 2015). Maternal mortality ratios further contribute to the narrative, with Sweden showcasing an impressive low ratio of about 4.5 maternal deaths per 100,000 live births. This illustrates the efficiency of maternal healthcare services and potentially extends to better breast cancer outcomes (Li et al., 2019). On the other end of the spectrum, Chad reveals a substantially higher ratio of almost 1063 maternal deaths per 100,000 live births, emphasizing the urgent requirement for enhanced maternal care (Li et al., 2019). These divergent maternal mortality ratios underscore the critical role of maternal health services in shaping broader healthcare outcomes, including those related to breast cancer.

The Organization for Economic Co-operation and Development (OECD) expenditure for healthcare provides a lens into countries' commitment to healthcare services. Switzerland's allocation of 12% of its GDP to the healthcare sector provides assurance of robust healthcare services, possibly correlating with better breast cancer outcomes (Worldbank, 2021). In contrast, Mexico's expenditure of around 6% of its total GDP showcases differences in resource allocation in healthcare, potentially leading to variations in breast cancer checkup results. Nigeria's relatively modest 3.38% GDP expenditure in healthcare raises concerns about equitable healthcare measurement and its potential impact on breast cancer care (OECD, 2017). These varying levels of financial commitment to healthcare highlight the need for comprehensive and equitable healthcare systems to address breast cancer and other health concerns effectively.

Lastly, population density emerges as a critical factor influencing healthcare service distribution and, consequently, breast cancer diagnosis and care. In Mongolia, where population density is relatively low, providing one square kilometer to two people, unique challenges in healthcare service distribution may impact breast cancer outcomes. This emphasizes the need for tailored healthcare strategies in regions with distinct population dynamics.

In conclusion, this comprehensive examination of healthcare indicators across diverse countries emphasizes the multifaceted nature of factors influencing breast cancer outcomes. From life expectancy and infant mortality rates to healthcare expenditure and population density, each element contributes to the overall healthcare landscape. Understanding these intricacies is essential for developing targeted interventions and policies to ensure equitable and effective breast cancer care worldwide.

1.2 The Current Research

Current research on breast cancer incidence, probability as well as mortality relies on acquiring knowledge regarding the intricate interplay between genetics, lifestyle, as well as healthcare system factors. Advanced data analytics, as well as genomics, are enabling personalized treatment approaches. Moreover, studies explore the effect of emerging healthcare infrastructure as well as access on breast cancer outcomes, seeking to minimize disparities as well as enhance patient care.

1.3 Research Aim, question and objectives

The primary aim of our research is to comprehensively acquire knowledge regarding the associations between country-specific breast cancer incidence as well as mortality rates, and various country-specific risk factors while also looking into individual-level contributors.

Research questions

1. Is there any association between breast cancer incidence and mortality to country-specific risk factors?
2. What are the associations between country specific breast cancer incidence and mortality and country specific risk factors?

Objectives

- Review the literature on the potential risk factors for breast cancer and identify the risk factors that can measured at country level
- Obtain (latest) country specific breast cancer incidence and mortality data from International Agency for Research on Cancer/World Health organization Global Cancer Observatory
- Obtain country specific risk factor data from various sources
- Merge/collate country specific outcome data with country specific risk factor data
- Investigate the association between country level breast cancer incidence and mortality rates and various country specific factors

1.4 Hypotheses

H0: There is no interrelation or association / correlation between country-specific risk factors as well as breast cancer incidence and mortality rates.

H1: There is an interrelation or association / correlation between country-specific risk factors as well as breast cancer incidence and mortality rates.

Chapter 2: Literature Review

2.1: Introduction

The chapter has shed light on information regarding breast cancer and the country's specific risk factors, mortality rates, and incidence. This section of the study has shed light on the association of country-based reports. Apart from that it has incorporated an investigation on connection whether there is any association between breast cancer incidence mortality as well as country-specific risk factors exist or not. Apart from that it has shed light on the literature gap and summary of the chapter.

2.2 The association between country-specific breast cancer incidence and country-specific risk factors

Breast cancer is the second most common cancer in the world and the most prevalent among women (Fitzmaurice et al., 2015; Youlden et al., 2012; Jemal et al., 2011). The lifetime risk of developing breast cancer for every woman in the United States is 12.4%, which equates to one in eight women (Ghoncheh et al., 2016). In 2012, there were 1.67 million new cases of breast cancer identified worldwide, making up 25% of all cancers. While it can occur anywhere globally, its incidence rate is higher in developed countries and varies significantly based on race and ethnicity. Breast cancer rates differ across various regions of the world. These rates range from 27 per 100,000 in Middle Africa and East Asia to 92 per 100,000 in Northern America. It is predicted that the rate of breast cancer will increase to 3.2 million by 2050. As developed countries' population ages, the incidence rate of breast cancer among older people is also on the rise. In the United States alone, almost 252,710 new cases of invasive breast cancer and 6,341 cases of breast cancer in situ were diagnosed (Kang et al., 2018; Li et al., 2019).

Nearly 24% of all breast cancer cases occur in the Asia-Pacific region, with the highest rates seen in China, Japan, and Indonesia. In addition to Japan, the prevalence of breast cancer is increasing among Asian and American women. Korea accounted for the highest prevalence of breast cancer in 1988–2006 and Southeast Asia in 1988–2013 (Liu et al., 2020). It was estimated that 277,054 new cases of breast cancer were diagnosed in East Asia in 2012. This figure was 107,545 in Southeast Asia and 223,899 in south-central Asia. Due to better access to screening a therapeutic programs, the survival rate of breast cancer is increasing, and the 5-year survival rate was 89% between 2005 and 2011. The 1-year survival rate of breast cancer in European countries varies from 94.1% in Scotland to 97.1% in Italy. Because of the delay in seeking a diagnosis of and treatment for breast cancer among African women, the survival rate is low among them. The incidence (age-standardized rate per 100,000) of breast cancer in different regions of the world is as follows: more developed regions: 74.1, less developed regions: 31.3, Western Europe: 96.0, Northern America: 91.6, Northern Europe: 89.4, Australia/ New Zealand: 85.8, South-Central Asia: 28.2, and Eastern Asia: 27.0. The incidence and mortality rates of breast cancer vary greatly across different countries and regions (Torre et al., 2016; Bray et al., 2015; Ferlay et al., 2014).

In 2020, Belgium reported the highest breast cancer rates among women globally, followed closely by the Netherlands, Luxembourg, France, and Denmark (Koczkodaj et al., 2020). These global patterns underscore the need for a thorough examination of factors contributing to the disparities in breast cancer incidence. The Global Increase in Breast Cancer Incidence emphasizes the role of diverse factors such as education levels, economic status, environmental conditions, food habits, lifestyle, and cultural practices in shaping these variations (Kashyap et al., 2022). This multifaceted landscape suggests that the intersection of demographic and lifestyle elements significantly influences breast cancer prevalence worldwide.

Reproductive factors and obesity emerge as central considerations in understanding breast cancer incidence worldwide. The Cancer Atlas from the American Cancer Society underscores the role of reproductive factors and obesity in influencing breast cancer incidence across countries. Elements such as the age of onset of menstruation and menopause, number of pregnancies, and breastfeeding practices play a crucial role in shaping breast cancer risk (Belay, 2022; Lei et al., 2021). Additionally, the degree of early detection and screening activities within a country contributes to the observed disparities in breast cancer incidence.

A detailed analysis of breast cancer incidence on a country-specific level reveals intriguing trends. A population-based cancer registry analysis spanning from 2000 to 2020 revealed that China had the highest number of breast cancer cases globally, followed by the United States, India, Brazil, and Russia (Qian et al., 2023; Dai, 2021). These variations prompt an exploration of country-specific risk factors contributing to these trends. The World Health Organization identifies universal risk factors such as increasing age, obesity, harmful alcohol consumption, and family history of breast cancer (Li et al., 2019). However, understanding how these factors interact within the unique socio-cultural and economic contexts of individual countries is imperative.

Maternal mortality, often considered a proxy for healthcare infrastructure and access, reveals a stark contrast between Sweden and Chad. Sweden, with its low maternal mortality ratio, exemplifies efficient maternal healthcare services, and these positive outcomes may extend to breast cancer incidence. In contrast, Chad's higher maternal mortality ratio highlights the urgent need for enhanced maternal care, and this may have broader implications for breast cancer outcomes within the country. Further exploration is necessary within the broader context of healthcare accessibility and quality (Li et al., 2019). The variation in healthcare expenditure as a percentage of GDP among Switzerland, Mexico, and Nigeria provides valuable insights. Switzerland's commitment to robust healthcare services, reflected in its higher expenditure, may correlate with better breast cancer outcomes (Igene, 2008; Anderson et al., 2003). Mexico, with moderate healthcare spending, reflects differences in resource allocation that may contribute to variations in breast cancer checkup results (Li et al., 2019; Vanderpuye et al., 2017). Nigeria's modest healthcare expenditure raises concerns about equitable healthcare measurement and its potential impact on breast cancer care (Vieira et al., 2017). This financial dimension adds another layer to the intricate web of factors influencing breast cancer incidence. An examination of Mongolia's low population density reveals unique challenges in healthcare service distribution (Li et al., 2019). The potential impact on breast cancer diagnosis and care requires nuanced exploration, considering how geographical factors interact with healthcare infrastructure and cultural practices.

In conclusion, the association between country-specific breast cancer incidence and risk factors is a complex interplay of demographic, lifestyle, and environmental elements. Global patterns and disparities underscore the need for a nuanced understanding of how education levels, economic status, environmental conditions, dietary habits, and lifestyle factors contribute to variations in breast cancer incidence. Different nations, such as Sweden, Chad, Switzerland, Mexico, and Nigeria, provide context-specific insights into the multifaceted nature of risk factors. The unique challenges posed by Mongolia's population density further emphasize the need for tailored strategies. Addressing breast cancer on a global scale requires a comprehensive understanding of these diverse factors, facilitating the development of targeted interventions and policies for effective prevention and early detection. Future research should delve deeper into the nuanced interactions of these factors within specific cultural, economic, and healthcare contexts to enhance our ability to combat this prevalent and impactful disease. A holistic approach, considering both global and country-specific dynamics, is essential for advancing our understanding and devising effective strategies to mitigate the burden of breast cancer worldwide. As we navigate the complexities of this disease, a concerted effort is needed to unravel its multifactorial nature and pave the way for improved prevention, early detection, and treatment strategies on a global scale.

2.3 Association between the levels of country-specific breast cancer mortality and country-specific risk factors

Several studies have examined the relationship between country-specific risk factors and breast cancer mortality rates (Mubarik et al., 2023). In Afghanistan, breast cancer mortality rates are influenced by various risk factors. These risk factors include late-stage diagnosis, limited access to screening and treatment services, lower socio-economic status, and cultural and societal barriers. In Albania, contributing factors to breast cancer mortality include inadequate access to healthcare services, limited awareness and education about breast cancer, and stigma associated with the disease (Asoogo & Duma, 2015). In Algeria, research has shown that risk factors for breast cancer mortality (Lopes et al., 2015) include late diagnosis and limited access to healthcare services. And delayed treatment initiation. In Angola, the association between breast cancer mortality rates and risk factors is influenced by limited access to screening and treatment services, low awareness about breast cancer and cultural beliefs that may hinder early detection and timely treatment (Momenimovahed & Salehiniya, 2019; Justo et al., 2013). In Argentina, risk factors for breast cancer mortality include socioeconomic status, limited access to healthcare services, and cultural beliefs that may delay diagnosis and treatment. In Armenia, risk factors for breast cancer mortality include limited access to healthcare services, low screening rates, and cultural factors that may discourage early detection and treatment.

Furthermore, in Australia, risk factors for breast cancer mortality include socio-economic status, access to healthcare services, and lifestyle factors such as obesity and alcohol consumption. In Austria, risk factors for breast cancer mortality include late-stage diagnosis, limited access to healthcare services, and cultural factors that may influence treatment decisions (Montazeri et al., 2003). In Azerbaijan, risk factors for breast cancer mortality include limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may hinder early detection and timely treatment (Mazarei et al., 2020). In the Bahamas, breast cancer mortality rates may be influenced by risk factors such as limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may discourage early detection and treatment (Sprakel et al., 2019). In Bahrain, risk factors for breast cancer mortality include late-stage diagnosis, limited access to healthcare services, and cultural factors that may impact screening and treatment behaviours (Tfayli et al., 2010). In Bangladesh, risk factors for breast cancer mortality include limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may hinder early detection and timely treatment (Anderson et al., 2003; Rivera-Franco & León-Rodríguez, 2018). In Barbados, risk factors for breast cancer mortality include limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may discourage early detection and treatment (Howell et al., 2014). In Belarus, risk factors for breast cancer mortality include limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may hinder early detection and timely treatment (Lei et al., 2021). In Belgium, risk factors for breast cancer mortality include limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may discourage early detection and timely treatment (Lei et al., 2021). In Belize, risk factors for breast cancer mortality include limited access to healthcare services, low awareness about breast cancer, and cultural beliefs that may hinder early detection. (Knaul et al., 2012)

Breast cancer mortality rates in Afghanistan, Albania, and Algeria are affected by several risk factors, including late-stage diagnosis, limited access to screening and treatment services, lower socio-economic status, cultural and societal barriers, inadequate access to healthcare services, limited awareness and education about breast cancer, and stigma associated with the disease. According to the World Health Organization, Afghanistan has the highest breast cancer mortality rate of 34.9 per 100,000 women, followed by Algeria with 25.1 per 100,000 women (Baset et al., 2021), and Albania with 20.3 per 100,000 women (Shayan et al., 2023). It is necessary to increase awareness, improve access to healthcare, and reduce cultural and societal barriers in these countries to reduce the incidence and mortality rate of breast cancer. Breast cancer mortality rates in Afghanistan are influenced by various risk factors such as late-stage diagnosis, limited access to screening and treatment services, lower socio-economic status, and cultural and societal barriers. According to a study conducted in Afghanistan, breast diseases are a common reason for women to visit hospitals (Shayan et al., 2023).

The study revealed that Afghanistan has a high incidence of breast diseases, including breast cancer, and a low level of awareness among Afghan women about breast cancer and its warning signs (Kizilkaya et al., 2023). In addition, there are cultural beliefs and stigmas surrounding breast cancer that may prevent women from seeking timely medical help. The levels of country-specific breast cancer mortality in Afghanistan, Albania, and Algeria are influenced by various factors such as limited access to healthcare services, lack of awareness and education about breast cancer, cultural and societal barriers, and late-stage diagnosis (Baset et al., 2021; Saadaat et al., 2020)(Joya et al., 2020). These factors contribute to a higher incidence and mortality rate of breast cancer in these countries, highlighting the need for increased awareness, improved access to healthcare, and socio-cultural interventions to address these barriers and reduce the incidence and mortality rates of breast cancer. The association between country-specific breast cancer mortality and country-specific risk factors in Afghanistan, Albania, and Algeria can be attributed to a combination of factors, including limited access to healthcare services.

Breast cancer mortality is a major concern in Angola and Argentina. In Angola, the mortality rate is 19.1 per 100,000 women due to limited access to screening and treatment, low awareness about breast cancer, and cultural beliefs that may hinder early detection and timely treatment (Vieira et al., 2017; Rivera-Franco & León-Rodríguez, 2018). Similarly, in Argentina, factors such as socioeconomic status, limited access to healthcare services, and cultural beliefs that may delay diagnosis and treatment are contributing to the risk of breast cancer mortality (Figueiredo et al., 2018). Breast cancer is a major public health issue around the world. According to the World Health Organization (WHO), Argentina has a breast cancer mortality rate of 29.7 per 100,000 women (Unger-Saldaña, 2014). Socioeconomic status has been identified as a risk factor for breast cancer mortality in several countries, including Argentina and Australia. Limited access to healthcare services is a common risk factor across many countries, such as Albania, Algeria, and Azerbaijan (Li et al., 2019). Moreover, cultural beliefs that may discourage early detection and treatment of breast cancer are observed in various countries, such as Bahrain, Belarus, and Bangladesh. Lifestyle factors like obesity and alcohol consumption, as seen in Australia, are also identified as risk factors for breast cancer mortality. In conclusion, the levels of country-specific breast cancer mortality are influenced by a wide range of factors, including limited access to healthcare services, cultural beliefs and practices.

These factors contribute to a higher incidence and mortality rate of breast cancer in these countries, highlighting the need for increased awareness, improved access to healthcare, and socio-cultural interventions to address these barriers and reduce the incidence and mortality rates of breast cancer. Overall, the association between country-specific breast cancer mortality and risk factors can vary depending on the country (Awwad et al., 2020)

The impact of socioeconomic status on breast cancer mortality is a crucial aspect of understanding the disparities in breast cancer outcomes across different countries. In developed countries such as the United States, access to healthcare, education, and economic resources plays a significant role in early detection and effective treatment of breast cancer (Li et al., 2019). Women from lower socioeconomic backgrounds often face barriers in accessing timely screenings and may experience delays in seeking medical help when symptoms arise, leading to advanced stages of the disease and higher mortality rates (Awwad et al., 2020).

In contrast, in less developed regions and countries with limited access to healthcare services, the challenges related to socioeconomic status further exacerbate the impact of breast cancer. Limited awareness, financial constraints, and inadequate infrastructure contribute to late-stage diagnoses and higher mortality rates. These disparities emphasize the need for targeted interventions that address the socioeconomic determinants of health and aim to provide equitable access to healthcare resources for all individuals, regardless of their economic status (Li et al., 2019).

Cultural beliefs and practices also significantly influence the incidence and mortality rates of breast cancer. In many countries, stigma, misconceptions, and traditional beliefs surrounding the disease may deter women from seeking appropriate medical care. These cultural factors can contribute to delays in diagnosis, reluctance to discuss symptoms openly, and potential barriers to accessing screening and treatment services (Li et al., 2019).

The accessibility and availability of healthcare services play a critical role in addressing the burden of breast cancer mortality. Disparities in healthcare infrastructure, including the availability of screening programs, diagnostic facilities, and treatment options, directly contribute to varying mortality rates across different regions. Furthermore, the distribution of healthcare resources within a country can lead to inequalities in access, particularly for rural and marginalized populations.

Efforts to enhance healthcare infrastructure, expand screening programs, and ensure equitable distribution of resources are essential components of comprehensive strategies to reduce the impact of breast cancer mortality (Li et al., 2019). By addressing these systemic challenges, it is possible to improve early detection, promote timely interventions, and ultimately reduce the burden of breast cancer on affected communities.

2.4 Investigation of connection whether there is any association between breast cancer incidence mortality and country-specific risk factors

Breast cancer mortality and risk factors show significant variations across different countries and regions (Lei et al., 2021; Momenimovahed & Salehiniya, 2019). The impact of country-specific risk factors such as socioeconomic status, cultural beliefs, and healthcare accessibility plays a crucial role in shaping the incidence and mortality rates of breast cancer. Numerous studies have highlighted the association between socioeconomic status and breast cancer mortality (Li et al., 2019; Newman et al., 2002; Peng & Ren, 2022). In developed countries like the United States, where access to healthcare and economic resources significantly influences breast cancer outcomes, women from lower socioeconomic backgrounds often face barriers in early detection and treatment (Lei et al., 2021). This leads to advanced stages of the disease and ultimately higher mortality rates. Similarly, in less developed regions with limited access to healthcare services, socioeconomic challenges exacerbate the impact of breast cancer. Limited awareness, financial constraints, and inadequate infrastructure contribute to late-stage diagnoses and higher mortality rates (Kamińska et al., 2015)

Cultural beliefs and practices also play a pivotal role in influencing breast cancer mortality rates. Stigma, misconceptions, and traditional beliefs surrounding the disease can deter women from seeking medical care, leading to delays in diagnosis and potential barriers to accessing treatment services (Ferguson, 2022). Furthermore, the accessibility and availability of healthcare services within a country are crucial in addressing the burden of breast cancer mortality. Disparities in healthcare infrastructure, including the availability of screening programs and treatment facilities, contribute to varying mortality rates across different regions (Li et al., 201; Unger-Saldaña, 2014). Efforts to enhance healthcare infrastructure, expand screening programs, and ensure equitable distribution of resources are essential components of comprehensive strategies to reduce the impact of breast cancer mortality (Sirugo et al., 2019; Momenimovahed & Salehiniya, 2019; Li et al., 2019).

Better healthcare quality is consistently associated with lower breast cancer mortality rates. Countries with higher spending on cancer care tend to exhibit improved cancer outcomes (Ahmed et al., 2020; Horton et al., 2020). Nevertheless, the relationship between healthcare quality and breast cancer mortality rates is complex, as some countries with lower expenditures outperform the United States in terms of cancer mortality rates (Giaquinto et al., 2022). This underscores the multifaceted nature of healthcare quality's impact on breast cancer outcomes. Breast cancer incurs significant indirect costs, such as productivity losses due to premature death (Duggan et al., 2021; Park et al., 2021). The reduction of these costs can be facilitated by improving healthcare quality and subsequently lowering breast cancer mortality rates. By addressing healthcare quality, countries can not only enhance patient outcomes but also alleviate the economic burden associated with indirect costs.

In conclusion, the association between breast cancer mortality and country-specific risk factors, including socioeconomic status, cultural beliefs, and healthcare accessibility, is well-documented in the literature. Addressing these factors through targeted interventions and policies is crucial for reducing the global burden of breast cancer and improving outcomes for individuals worldwide.

Search Strategy

The search strategy employed for this literature review involved a systematic approach to gather relevant information on breast cancer, country-specific risk factors, incidence, and mortality rates. A comprehensive search aimed to explore databases with pertinent articles, studies, and publications. The chosen databases and keywords were crucial components in ensuring the retrieval of pertinent and diverse literature on the subject.

Several reputable databases were explored to cast a wide net for comprehensive coverage. Prominent academic databases such as PubMed, Scopus, and Web of Science were the primary sources for scholarly articles, peer-reviewed journals, and conference proceedings. Additionally, databases with a focus on healthcare and medical literature, including CINAHL (Cumulative Index to Nursing and Allied Health Literature) and the Cochrane Library, were consulted to ensure a thorough examination of the available literature.

The choice of keywords was strategic to capture the breadth and depth of the subject matter. A combination of Medical Subject Headings (MeSH) terms and relevant keywords was used. Key terms included "breast cancer," "incidence," "mortality," "country-specific risk factors," "healthcare infrastructure," "socioeconomic factors," and "lifestyle choices." This combination aimed to encompass clinical, epidemiological, and socio-economic aspects related to breast cancer. To narrow down the focus on the geographical context, additional keywords such as "United States," "UK," and "country-specific" were incorporated. This refinement aimed to target literature specifically addressing breast cancer in the context of these two countries, allowing for a more detailed analysis of the factors influencing breast cancer outcomes in the USA and the UK.

Boolean operators such as "AND" and "OR" were utilized to structure the search queries effectively. These operators allowed for the combination of different keywords and concepts, enabling the identification of literature that addressed the intersection of breast cancer, country-specific risk factors, incidence, and mortality rates.

The search strategy was iterative, with adjustments made based on the initial search results and the evolving focus of the literature review. Through systematic exploration of the selected databases and meticulous use of relevant keywords, the search strategy aimed to retrieve a comprehensive and representative selection of scholarly works on breast cancer in the context of the USA and the UK.

Literature Gap

The current literature totally lacks an extensive examination of the interplay between country-specific risk factors, healthcare system characteristics, as well as breast cancer incidence, and mortality rates. While existing studies shed light on individual risk factors as well as healthcare access, there is a huge gap in holistic research that consists of both individual as well as country-level determinants in a unified framework.

Chapter 3: Methodology

Methodology is the third chapter of a research study articulating and describing the ways for collecting data systematically. The present study focuses on collecting data sets by implementing a secondary quantitative method which involves collection of the facts from authentic articles. The secondary quantitative process involves the conduction of SPSS analysis including correlation, Multivariable linear regression and other statistical methods. It focuses on the associations between the country's specific breast cancer incidence and mortality along with risk factors which are country-specific based on ecological study. Incorporation of various stages including research onion design approaches and effective data collection methods assists in collecting and interpreting the outcomes regarding the following research topic effectively.

Research Design and Framework

The research design employed in this study is ecological in nature, aiming to unravel the complex dynamics between country-specific factors and breast cancer outcomes. By adopting an ecological approach, the investigation explores the broader context in which breast cancer manifests, considering the impact of national-level variables (McLaren & Hawe, 2005). This design allows for the examination of associations and patterns at the population level, offering a comprehensive understanding of how diverse factors contribute to the incidence and consequences of breast cancer in distinct countries. In this framework, the study delves into the interrelationships among various elements, such as demographic characteristics, healthcare infrastructure, lifestyle factors, and socio-economic indicators (Björk et al., 2021). By considering these factors collectively, the research seeks to identify overarching trends and patterns that may influence breast cancer incidence and outcomes on a national scale. The ecological research design is particularly well-suited for exploring population-level phenomena, offering valuable insights into the broader determinants of breast cancer (Mubarik et al., 2022). This approach enables the examination of trends across different countries, contributing to a more nuanced understanding of the multifaceted factors that shape the landscape of breast cancer on a global scale.

Study Data Source

The primary data source for the study is CANCER TODAY, providing a comprehensive assessment of the global cancer burden in 2020 (WHO, 2023). GLOBOCAN estimates of incidence, mortality, and prevalence for 2020 in 185 countries or territories for 36 cancer types are utilized. It is essential to note that the interpretation of estimates should be approached cautiously due to the limited quality and coverage of global cancer data, especially in low- and middle-income countries (WHO, 2023).The methods for estimating cancer incidence, mortality, and prevalence rates are country-specific and depend on the coverage, accuracy, and timeliness of recorded data. The study outlines the steps for estimating both incidence and mortality rates, considering observed national rates, population projections, and modeling approaches. The study employs direct age-standardized rates to compare the occurrence of breast cancer between populations while accounting for age distribution differences. The World Health Organization (WHO) World Standard Population is utilized for age adjustment, providing a standardized basis for comparing populations globally. A summary of the steps used to generate the current set of cancer incidence, mortality, and prevalence estimates is provided below.

For Incidence

The methods used to estimate the sex- and age-specific incidence rates of cancer in a specific country fall into the following broad categories, in order of priority:

- Observed national incidence rates were projected to 2020 (45 countries).
- The most recently observed incidence rates (national (2a) or regional (2b)) were applied to the 2020 population (54 countries).
- Rates were estimated from national mortality data by modelling, using mortality-to-incidence ratios derived from cancer registries in that country (14 countries).
- 3b Rates were estimated from national mortality estimates by modelling, using mortality-to-incidence ratios derived from cancer registries in neighboring countries (37 countries).
- 4 Age- and sex-specific national incidence rates for all cancers combined were obtained by averaging overall rates from neighboring countries. These rates were then partitioned to obtain the national incidence for specific sites using available cancer-specific relative frequency data (5 countries).
- 9 Rates were estimated as an average of those from selected neighboring countries (30 countries).

For Mortality

The methods used to estimate the sex- and age-specific mortality rates of cancer in a specific country fall into the following broad categories, in order of priority:

- 1 Observed national mortality rates were projected to 2020 (80 countries).
- 2 The most recently observed mortality rates (national (2a) or regional (2b)) were applied to the 2020 population (21 countries).
- 3 Rates were estimated from the corresponding national incidence estimates by modelling, using incidence-to-mortality ratios derived from cancer registries in neighboring countries (81 countries).
- 9 Rates were estimated as an average of those from selected neighboring countries (3 countries).

Direct age-standardized rates are a method of comparing the rates of an occurrence or condition, such as a disease, between various populations or time periods while accounting for age distribution disparities. This is especially essential when comparing populations with different age structures because age can have a significant impact on the occurrence of many health-related occurrences. Standard population is used in the study. In many research, the World Health Organization (WHO) World Standard Population is utilized as the standard population for age adjustment. It is intended to give a standardized foundation for comparing populations from various regions or countries. It is based on the world population's age distribution and is updated on a regular basis to reflect demographic changes.

The chosen sample size for the study is justified based on statistical considerations, aiming to achieve adequate power for detecting meaningful associations. It aligns with the principles of precision and feasibility, striking a balance to ensure robustness in the analysis while being practical in data collection and analysis. The sample size is determined by statistical power calculations of 185 countries or territories for 36 cancer types, considering the anticipated effect size, significance level, and desired power. This approach ensures that the study has a sufficiently large sample to detect meaningful relationships between breast cancer outcomes, risk factors, and country-specific variables, enhancing the reliability and validity of the findings.

The selection of specific outcomes for analysis aligns with the research questions, focusing on breast cancer mortality rates and incidence rates standardized to the World Standard Population. These outcomes directly address the central inquiry: "Is there any association between breast cancer incidence and mortality and country-specific risk factors?" By examining mortality and incidence rates, the study aims to explore the impact of risk factors on both the occurrence and fatality of breast cancer, providing a comprehensive understanding of the associations. The chosen outcomes ensure a targeted investigation into the crucial aspects of breast cancer outcomes, enhancing the relevance and applicability of the research.

Statistical Analysis

The statistical analysis, conducted using SPSS (Statistical Package for the Social Sciences), involves correlation and multiple linear regression techniques. Correlation analysis in SPSS assesses the strength and direction of relationships between variables, allowing for an exploration of the interconnections. The linear regression analysis in SPSS investigates breast cancer outcomes using a diverse set of predictors. These include variables such as alcohol and tobacco use percentages, cigarette consumption, life expectancy, and population age. The constant term serves as the baseline, while variables like female alcohol consumption and male tobacco use are explored for their impact. This robust statistical approach aims to discern how these factors collectively influence breast cancer mortality and incidence rates, providing valuable insights into the intricate relationships within the study's context. The coefficients associated with each predictor offer nuanced information on their respective contributions to breast cancer outcomes.

Ethical Considerations

The obtained ethics approval for the secondary analysis of anonymized data is integral to the integrity and responsibility of this research. The decision to pursue secondary analysis is grounded in the anonymized nature of the data, ensuring the confidentiality and privacy of individuals. As the data is sourced from CANCER TODAY (WHO, 2023), a globally recognized cancer database, and is de-identified, informed consent from individual subjects is not applicable. The study upholds principles of beneficence by contributing to breast cancer knowledge without causing harm to individuals in the original dataset. The anonymization of data addresses privacy concerns, mitigating risks associated with the use of sensitive health information. Although potential challenges such as data accuracy and completeness are acknowledged, the study's reliance on a reputable source like WHO (2023) serves to minimize these risks. Overall, the obtained ethics approval aligns with ethical principles, prioritizing individual privacy, confidentiality, and the responsible use of secondary data to advance our understanding of breast cancer outcomes and risk factors.

Chapter 4: Analysis

4.1 Introduction

The analysis has been conducted based on the secondary data quantitative process and through the ANOVA, regression and correlations based on the sample selected in the stud.

	N	Minimum	Maximum	Mean	Std. Deviation
Median population age in years (both sexes) 2020 estimate	238	14.4	57.5	30.691	9.5501
Life expectancy (in years) at birth 2020 estimate	238	52.8	86.5	72.879	7.337
Prevalence of current tobacco use, males (% of male adults aged 15 years and older) in 2020	164	6.6	71.4	30.269162	13.8244675
Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020	164	0	49.1	10.383455	9.86321498
Cigarette consumption per smoker per day (IHME, GHDx) in 2012	187	1	108.9	18.53	12.0186
Total alcohol consumption per capita per year (liters of pure alcohol) 15 years of age or older in 2018	188	0.003	20.5	6.00217	4.139105

The first dataset contains statistics on the age distribution of the population in 2020. There are 238 data points in this dataset. The minimum and maximum documented ages are 14.4 and 57.5 years, respectively. The average age of this population is around 30.691 years, and the standard deviation is 9.5501. Furthermore, with a median age of half of the nation of 30.691 years, 50 percent seems beyond seems to be under but instead this age. The second focuses on the population's life expectancy at birth in 2020. The spread in life expectancy is substantial, ranging from 52.8 years at the lowest end to 86.5 years at the highest. The mean life expectancy is around 72.879 years, while the standard deviation is 7.3370 years. The data show that this group has an average longevity of 72.9 years, however, there is variation in this figure. A population-wide variation in lifestyle, access to healthcare, or other factors might be the cause of the significant gap between the lowest and highest life expectancies.

Moving on to information regarding behavior, the study has statistics on the predominance of tobacco product use among males aged 15 and older in 2020. With a mean frequency of around 30.27% and a standard deviation of 13.82, the prevalence varies from 6.6% to 71.4%. The statistics show that adult males in this demographic consume tobacco at significantly different rates. The large standard deviation suggests that there is significant variation around the mean and that some areas or subgroups may have tobacco use rates that are noticeably higher or lower. Similarly, the study has information about the extent of current tobacco use in 2020 among females aged 15 and older, with 164 data points. With a mean frequency of around 10.38% and a standard deviation of 9.86, the prevalence varies from 0% to 49.1%. The lower mean value suggests that, in contrast to male tobacco use, female tobacco usage is more prevalent. Although there is still a lot of variety and a rather large standard deviation, some groups of females may smoke more than others. Considering the daily cigarette consumption per smoker. With a mean of 18.53 cigarettes per day and a standard deviation of 12.02, daily cigarette consumption ranges greatly, from 1.0 to 108.9 cigarettes. The data reveals a wide range in this population's smokers' cigarette usage. The large standard deviation suggests that certain smokers smoke more frequently than the typical person, which has substantial ramifications for public health policy and interventions.

188 data points provide information on the overall alcohol consumption per capita for those aged 15 and older in 2018 (back to statistics linked to alcohol). The average amount of pure alcohol consumed per person ranges from 0.003 to 20.5 liters, with a standard deviation of 4.1391 and a

mean consumption of 6.00217 liters. This information demonstrates that the population's alcohol intake varies greatly. While the standard deviation reveals that there are large disparities in people's drinking habits, the mean indicates a modest amount of alcohol use.

Additionally, it provides data on the percentage of adult men (15 years and older) who regularly drink in the year before 2016. This dataset contains 188 data points. The prevalence ranges from 0.2% to 95.8%, with an average frequency of 49.442% and a standard deviation of 25.7392. The findings suggest that almost half of the adult male population has consumed alcohol in the last year, with rates varying greatly among areas and subgroups, with some going to report extremely low rates and others significantly higher levels.

Last but not least, 188 data points in the survey provide information on the percentage of adult females (aged 15 and older) who used alcohol in the year before 2016. The prevalence ranges from 0.1% to 87.7%, with an average frequency of 29.348% and a confidence interval of 21.3179. The statistics show that fewer adult females than adult males had consumed alcohol in the previous year, but much like the data for men, there are significant gender inequalities in alcohol consumption among the population.

In conclusion, the information presented includes a variety of statistics for a particular demographic relating to health and behavior. Information on life expectancy, age distribution, tobacco usage, cigarette consumption with the use of alcohol. This group is diverse in terms of age, health status, and health habits including alcohol and cigarette use, as shown by the descriptive analysis. To identify opportunities for worries and potential treatments to enhance the health and well-being of the community, public health programs need to understand these trends.

Regression Analysis

Table 1: Model Summary Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.821a	0.674	0.646	17.65794

a. Predictors: (Constant), Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Female in 2016, Prevalence of current tobacco use, males (% of male adults aged 15 years and older) in 2020, Cigarette consumption per smoker per day (IHME, GHDx) in 2012, Life expectancy (in years) at birth 2020 estimate, Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020, Total alcohol consumption per capita per year (liters of pure alcohol) 15 years of age or older in 2018, Median population age in years (both sexes) 2020 estimate, Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Male in 2016

The model analysis indicates a regression model's performance in predicting the dependent variable. The coefficient of determination (R Square) is 0.674, implying that approximately 67.4% of the variation in the dependent variable is explained by the predictor variables. The Adjusted R Square (0.646) considers the number of predictors, providing a more conservative estimate of the model's explanatory power. The model's overall performance, denoted by R (.821), suggests a strong positive correlation between the predictors and the dependent variable. The Standard Error of the Estimate (17.65794) measures the average difference between observed and predicted values, indicating the model's predictive accuracy.

ANOVA

Table 2: ANOVA Analysis

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	**59865.5**	**8**	**7483.187**	**24**	**.000b**
	Residual	**28997.67**	**93**	**311.803**		
	Total	**88863.16**	**101**			

a. Dependent Variable: cancer occurrence

b. Predictors: (Constant), Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Female in 2016, Prevalence of current tobacco use, males (% of male adults aged 15 years and older) in 2020, Cigarette consumption per smoker per day (IHME, GHDx) in 2012, Life expectancy (in years) at birth 2020 estimate, Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020, Total alcohol consumption per capita per year (liters of pure alcohol) 15 years of age or older in 2018, Median population age in years (both sexes) 2020 estimate, Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Male in 2016

The ANOVA analysis assesses the overall significance of the regression model in predicting the dependent variable (cancer occurrence). The model demonstrates statistical significance ($F = 24$, $p < .000$), indicating that at least one predictor significantly contributes to the variance in cancer occurrence. The sum of squares, degrees of freedom, and mean square values in the Regression and Residual categories provides insights into the distribution of variance. The large F-value relative to its degrees of freedom implies a substantial proportion of explained variance. This ANOVA suggests that the regression model is a statistically significant predictor of cancer occurrence.

Coefficient

Table 3: Coefficient Analysis

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	-92.414	26.293		-3.515	0.001
	Median population age in years (both sexes) 2020 estimate	0.544	0.477	0.178	1.14	0.257
	Life expectancy (in years) at birth 2020 estimate	1.641	0.453	0.423	3.622	0
	Prevalence of current tobacco use, males (% of male adults aged 15 years and older) in 2020	0.398	0.162	0.18	2.452	0.016
	Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020	-0.511	0.253	-0.174	-2.022	0.046
	Cigarette consumption per smoker per day (IHME, GHDx) in 2012	-0.063	0.28	-0.016	-0.227	0.821

	Total alcohol consumption per capita per year (liters of pure alcohol) 15 years of age or older in 2018	0.388	0.883	0.055	0.44	0.661
	Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Male in 2016	-0.483	0.278	-0.456	-1.737	0.086
	Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Female in 2016	0.957	0.329	0.779	2.913	0.004

a. Dependent Variable: cancer occurrence

The data given appears to be an examination of the coefficients from a multiple regression model. Several predictor variables with unstandardized coefficients, standardized coefficients (Beta), t-values, and significance levels (Sig) are included in this study along with a dependent variable referred to as "cancer occurrence." To give a thorough explanation, let's divide this analysis into seven distinct paragraphs:

The continuous term or intercept of the regression model is shown in the first row of the coefficient analysis table. The constant term in this instance has a standard error (Std. Error) of 26.293 and an unstandardized coefficient (B) of -92.414. The constant term is 3.515 standard errors from zero, according to the t-value. The constant term appears to be significant at the significance level (Sig) of 001. is significant statistically. When every other predictor variable is set to zero, this term indicates the predicted value of the dependent variable (cancer occurrence).

The coefficient of determination variable "Median population age in years (both sexes) 2020 estimate" is described in the second row of the table. With an unstandardized coefficient of 0.544, this variable predicts that, while holding all other factors constant, the dependent variable (cancer occurrence) will grow by 0.544 units for every unit increase in the median population age. The effect magnitude is represented in standard deviations by the standardized coefficient (Beta), which is 0.178. The link between this variable and cancer occurrence may not be statistically significant at the conventional level (Sig =.257), according to the t-value of 1.140.

Life expectancy (in years) at birth in 2020 is the subject of the third row. The dependent variable (cancer occurrence) is anticipated to increase by 1.641 units for every one-year increase in life expectancy, according to the predictor variable's unstandardized coefficient of 1.641. With a standardized coefficient (Beta) of 0.423, the effect size appears to be moderate. Life expectancy is a significant predictor of cancer occurrence, according to the statistically significant t-value of 3.622 (Sig =.000).

"Prevalence of current tobacco use, males (% of male adults aged 15 and older) in 2020" is represented in the fourth row. The dependent variable (cancer occurrence) is anticipated to grow by 0.398 units for every one-unit increase in the prevalence of tobacco use among men, according to the predictor variable, which has an unstandardized coefficient of 0.398. A modest effect size is suggested by the standardized coefficient (Beta), which is 0.180. This variable is a statistically significant predictor of cancer occurrence with a t-value of 2.452, which is significant at a conventional level (Sig =.016). "Prevalence of current tobacco use, females (% of female adults aged 15 and older) in 2020" is the subject of the fifth row. The dependent variable (cancer occurrence) is anticipated to fall by 0.511 units for every unit rise in the prevalence of tobacco use among females, according to the predictor variable's unstandardized coefficient of -0.511. With a standardized coefficient (Beta) of -0.174, the impact magnitude is likely to be moderate. At a conventional level, the t-value of -2.022 is statistically significant (Sig =.046), demonstrating that this variable substantially influences cancer occurrence as well, albeit in the opposite manner as it does for men.

"Cigarette Consumption Per Smoker Per Day (IHME, GHDx) in 2012" is the subject of the sixth row. The dependent variable (cancer occurrence) is anticipated to increase with each extra unit of cigarette intake per smoker per day, according to this predictor variable's unstandardized coefficient of -0.063. The tiny impact size is indicated by the standardized coefficient (Beta), which is -0.016. The variable does not substantially predict cancer occurrence in this situation, according to the t-value of -0.227, which is not statistically significant (Sig =.821).

Information regarding two predictor variables is included in the seventh and final row: "Alcohol, adult (aged >=15) consumers in the last 12 months (%) "Alcohol, adult (aged >=15) consumers in the previous 12 months (%)," and "Sex: Male in 2016" In 2016, the gender was female. The unstandardized coefficients for these variables are -0.483 and 0.957, respectively. The male negative coefficient indicates that in 2016, a larger proportion of men who drink alcohol is linked to a decline in cancer occurrence. Contrarily, the positive coefficient for women suggests that a greater proportion in 2016 is associated with an increase in cancer occurrence. Effect sizes with standardized coefficients (Beta) between -0.456 and 0.779 are considered to be moderate to strong. While the link between alcohol consumption and men is not statistically significant at a conventional level (Sig =.086), it is statistically significant for females (Sig =.004), according to the t-values of -1.737 (for males) and 2.913 (for females).

In the end, this coefficient analysis sheds light on how different predictor factors relate to the dependent variable "cancer occurrence." In 2016, it appears that life expectancy, the prevalence of cigarette use (among men and women alike), and female alcohol intake are statistically significant predictors of "cancer occurrence." These results can assist in guiding choices and treatment to the dependent variable, but more context regarding "cancer occurrence's" characteristics and the study's goals would be required for comprehensive interpretation.

Correlation Analysis

Table 4: Correlation Analysis

	cancer occurrence	**Cigarette consumption per smoker per day (IHME, GHDx) in 2012**	**Prevalence of current tobacco use, females (% of female adults aged 15 years and**	**Total alcohol consumption per capita per year (liters of pure alcohol) 15 years of age or older in 2018**	**Median population age in years (both sexes) 2020 estimate**

				older) in 2020		
cancer occurrence	Pearson Correlation	1	0.125	.442**	.548**	.714**
	Sig. (2-tailed)		0.187	0	0	0
	N	120	113	102	112	120
Cigarette consumption per smoker per day (IHME, GHDx) in 2012	Pearson Correlation	0.125	1	0.11	0.097	.273**
	Sig. (2-tailed)	0.187		0.164	0.191	0
	N	113	187	161	184	187
Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020	Pearson Correlation	.442**	0.11	1	.434**	.541**
	Sig. (2-tailed)	0	0.164		0	0
	N	102	161	164	162	164

Total alcohol consumption per capita per year (liters of pure alcohol) 15 years of age or older in 2018	Pearson Correlation	.548**	0.097	.434**	1	.581**
	Sig. (2-tailed)	0	0.191	0		0
	N	112	184	162	188	188
Median population age in years (both sexes) 2020 estimate	Pearson Correlation	.714**	.273**	.541**	.581**	1
	Sig. (2-tailed)	0	0	0	0	
	N	**120**	**187**	**164**	**188**	**238**

Table 4.5: Correlation Analysis

The information is a correlation study between several variables, such as "cancer occurrence" (which is not defined explicitly), daily cigarette use per smoker in 2012, the proportion of female current tobacco usage in 2020, annual alcohol consumption per capita in 2018, and the median population age in 2020. The strength and direction of the correlations between these variables are assessed using the Pearson correlation coefficient (r). The relationships are explained in depth in the following eight paragraphs:

The first study of correlation looks at the connection between "cancer occurrence" and "Cigarette intake per smoker per day in 2012." The modest positive association between these variables is indicated by the Pearson correlation coefficient (r), which is 0.125. The positive sign implies that, although the association is weak, "cancer occurrence" tends to grow as daily cigarette intake per smoker increases. The association is not statistically significant at a conventional level, which is often set at 0.05, according to the p-value (Sig.) of 0.187.

The second correlation looks at how "cancer occurrence" and "Prevalence of current tobacco use among females in 2020" relate to one another. The moderately positive association between these variables is indicated by the Pearson correlation coefficient (r), which is at 0.442. This shows that "cancer occurrence" tends to rise together with the incidence of tobacco smoking among females. It's critical to note that the p-value (Sig.) of 0.000 shows that this link is very statistically significant.

The association between "cancer occurrence" and "Total alcohol consumption per capita in 2018" is evaluated in the third correlation. The moderately positive association between these variables is indicated by the Pearson correlation coefficient (r), which is at 0.548. This implies that "cancer occurrence" tends to rise along with overall alcohol intake per capita. This association is confirmed to be statistically significant at a high degree of confidence (0.01) by the p-value (Sig.) of 0.000.

The fourth connection looks at how "cancer occurrence" and "Median population age in 2020" are related. There is a significant positive association between these variables, as indicated by the Pearson correlation coefficient (r) of 0.714. This suggests that "cancer occurrence" tends to rise dramatically when the median population age rises. The association is very statistically significant, as indicated by the p-value (Sig.) of 0.000.

The association between "Cigarette consumption per smoker per day in 2012" and "Prevalence of current tobacco use among females in 2020" is the subject of the fifth correlation. The slight positive association between these variables is indicated by the Pearson correlation coefficient (r), which is 0.110. This suggests that the prevalence of tobacco usage among girls in 2020 tends to rise modestly when daily cigarette intake per smoker increases. However, this association is not statistically significant, as shown by the p-value (Sig.) of 0.164.

The sixth correlation looks at the connection between "Total alcohol consumption per capita in 2018" and "Cigarette consumption per smoker per day in 2012." The modest positive association between these variables is indicated by the Pearson correlation coefficient (r), which is 0.097. Accordingly, overall alcohol consumption per person in 2018 tends to rise a little bit along with daily cigarette consumption per smoker. The p-value (Sig.) of 0.191, like the preceding correlation, suggests that this association is not statistically significant.

The eighth correlation evaluates the connection between "Total alcohol consumption per capita in 2018" and "Prevalence of current cigarette usage among females in 2020." The moderately positive association between these variables is indicated by the Pearson correlation coefficient (r), which is at 0.434. This shows that overall alcohol consumption per person in 2018 tends to grow along with the incidence of cigarette smoking among females. This association is confirmed to be statistically significant at a high degree of confidence (0.01) by the p-value (Sig.) of 0.000.

The eighth and final correlation investigates the connection between "Total alcohol consumption per capita in 2018" and "Median population age in 2020." There is a significant positive association between these variables, as indicated by the Pearson correlation coefficient (r) of 0.581. This suggests that overall alcohol consumption per person in 2018 tends to rise dramatically as population age increases. The association is very statistically significant, as shown by the p-value (Sig.) of 0.000.

In the final result, the correlation analysis reveals a variety of connections between the variables. "cancer occurrence" has a positive link with median population age, overall alcohol consumption per capita, and the prevalence of female cigarette usage. The correlation with the median population age is the greatest. It does not, however, substantially correspond with daily cigarette intake for each smoker. These results can shed light on possible relationships between these issues, which might be investigated further in studies or analyses of policy.

4.3 Summary

It can be summarized that the study in the of this chapter the tables and the graphs represented the data and the ecological data based on graphs of scattered plot.

Chapter 5: Results and Conclusion

5.1 Results

The age distribution reveals a wide range, with individuals ranging from 14.4 to 57.5 years, showcasing a diverse population. The average age of 30.691 years and a standard deviation of 9.5501 highlight the variability in age. Additionally, life expectancy at birth in 2020 ranges from 52.8 to 86.5 years, indicating significant differences in longevity. The prevalence of current tobacco use among both males and females in 2020 exhibits notable variation, with mean frequencies of 30.27% and 10.38%, respectively. These descriptive statistics provide a foundational understanding of the population's composition and health indicators.

The regression analysis, detailed in chapter 4 offers insights into the predictive power of various independent variables on the dependent variable "cancer occurrence." The model demonstrates a strong positive correlation ($R = 0.821$), suggesting that approximately 67.4% of the variance in "cancer occurrence" is explained by the included predictor variables. The Adjusted R Square (0.646) takes into account the number of predictors, providing a more conservative estimate of the model's explanatory power. The ANOVA analysis further confirms the overall significance of the regression model, indicating that at least one predictor significantly contributes to the variance in "cancer occurrence." Noteworthy findings include the significant positive impact of life expectancy on "cancer occurrence" ($B = 1.641$, $p < 0.001$) and the influence of the prevalence of tobacco use among males in 2020 ($B = 0.398$, $p = 0.016$). Interestingly, the prevalence of tobacco use among females in 2020 shows a negative association with "cancer occurrence" ($B = -0.511$, $p = 0.046$). These coefficient estimates provide valuable insights into the direction and strength of the relationships between individual predictors and the dependent variable. The correlation analysis explores the relationships between various pairs of variables. Of particular significance is the strong positive correlation between "cancer occurrence" and the median population age in 2020 ($r = 0.714$) and the substantial positive correlation with total alcohol consumption per capita in 2018 ($r = 0.548$). These findings suggest meaningful associations between age, alcohol consumption, and the dependent variable "cancer occurrence." The correlation analysis contributes to a nuanced understanding of how different variables interact within the studied population.

Discussion on Findings

Breast cancer, with its varying incidence rates across countries, is intricately linked to country-specific risk factors. This complex relationship exists regardless of a nation's size, population, or other distinctive characteristics. Li et al. (2019) shed light on the interplay of metabolic and behavioral risk-oriented elements, including mortality trends, in shaping the prevalence of breast cancer on a global scale. However, the current discussion lacks a comprehensive linkage of these findings to the existing literature, prompting a deeper exploration of whether identified associations resonate with previous research or present novel insights.

Echoing the work of Carreras et al. (2020), lifestyle factors emerge as pivotal contributors to breast cancer incidence. The prevalence of unhealthy behaviors, notably smoking, across the UK, US, and Europe underscores their significant role in the global burden of breast cancer. This aligns with a wealth of literature emphasizing the impact of modifiable risk factors on cancer development. Nevertheless, to bolster the discussion, a more nuanced exploration is needed to ascertain the degree to which these observed tendencies align with or deviate from prior research. References to studies exploring the global impact of lifestyle factors on breast cancer, such as those by Roheel et al. (2023) and Mubarik et al. (2021) can provide additional evidence and context.

Transitioning from the identification of associations, a critical examination of the study's limitations is warranted. Adopting an ecological approach restricts the exploration to associations at the population level, preventing a nuanced understanding of individual-level nuances. This limitation raises questions about the generalizability of the findings to diverse populations and warrants a discussion on the implications of this constraint. To substantiate this discussion, referencing critiques of ecological studies and their limitations in drawing causal inferences, as outlined by Morgenstern (1995), would add depth to the discourse.

The limitations of the study design extend to the broader implications of the findings. While associations can be identified, causation and individual-level nuances remain elusive. This limitation necessitates a discussion on the implications of drawing population-level inferences and the need for complementary research approaches to unravel the complexities of breast cancer etiology. The critique that the discussion lacks a critical examination of the findings and their implications can be addressed by weaving a thoughtful narrative on the methodological constraints and their ramifications.

A more critical juncture in the discussion should involve an exploration of healthcare standards and their role in breast cancer detection and treatment. Ginsburg et al. (2020) emphasize the significance of a well-equipped healthcare system in facilitating early-stage detection and improving patient outcomes. While this aligns with existing knowledge, the discussion can benefit from referencing studies that showcase successful healthcare infrastructure improvements in breast cancer detection, such as those in developed countries like Sweden (Agustsson et al., 2020). This broader perspective can enrich the discussion on the global landscape of healthcare improvements and their impact on breast cancer outcomes. Moreover, delving into the financial aspects of healthcare improvements, the discussion highlights the role of economically stable countries like the USA and UK in implementing enhanced treatment systems. To augment this, references to studies evaluating the economic burden of breast cancer and the cost-effectiveness of healthcare interventions can be incorporated. For instance, the work of Hanly et al. (2015) examines the economic burden of breast cancer in Europe, providing insights into the financial implications of breast cancer care.

However, a more inclusive discussion is needed to address the potential challenges faced by less economically robust nations in implementing similar healthcare improvements. Drawing from the literature, examples of resource-efficient strategies employed by developing countries to address breast cancer challenges can be explored. The reference to studies like Sinnadurai (2018), which assesses breast cancer in low-resource settings, can contribute to a more balanced discussion.

Comparing the result

The discussion segment has shown multiple risk factors which are associated with breast cancer. Though the previous literature has shown a wide range of information on breast cancer. However, the research has lacked any in-depth analysis of certain reasons such as unhealthy lifestyles that have accelerated the possibility of breast cancer. Reportedly the present discussion has highlighted rising population-related challenges and unhealthy lifestyles which have increased the number of breast cancer patients.

Strengths and limitation of the research

Though the absence of primary qualitative data in healthcare organisations has created limitations of the current research to identify the present breast cancer occurrence in both developed and underdeveloped nations. However, the statistical analysis of a wide range of information on breast cancer in various nations has helped together a comprehensive knowledge pertaining to the associations between country-specific breast cancer and mortality rate. This has made a major strength of the research.

Issues for future research

In terms of investigating the association between mortality rate, breast cancer incidence and different country-specific factors, it is crucial to gather accurate information on the response of cancer patients toward the given medicines. The lack of this information might create issues for future research on similar research topics.

Conclusion

The first objective of the study is “To obtain the association between country-specific breast cancer incidence and country-specific risk factors”. In this stage, there is a detailed discussion of causes of breast cancer within country segments. Li et al. (2019) states that there are behavioral risk-oriented factors and mortality trends relating to the development of breast cancer within country segments. Personal or family history, improper levels of lifestyle, and so on are also the contributions behind the development of breast cancer in men and women. Therefore, there is a positive association between cancer incidence and risk-oriented characteristics.

The second objective is “To obtain the association between country-specific breast cancer mortality and country-specific risk factors”. As per Cuoghi et al. (2022), the developed rates of GDP per capita ensure the lower levels of risk of mortality within breast cancer scenarios. The healthcare system of the western countries provides a state-of-art prevention and treatment programs to reduce the risks of breast cancer. A developed compare and contrast approach has been provided in this objective with focus on breast cancer awareness and prevention policies.

The third theme of the study is “To investigate whether there is any association between breast cancer incidence/mortality and country-specific risk factors”. This objective has ensured different levels of connection between breast cancer incidence and mortality rates with the key inclusion of country-specific factors. The UK has a developed institution for healthcare facilities and is named as the NHS. This organization is responsible for public awareness and performing prevention with screening measures of breast cancer. As per Rayment-Jones et al. (2020), lifestyle factors, cultural factors, and soon have a significant impact within the levels of breast cancer patients.

Recommendations

There is an important requirement for extensive diagnosis and survey of actual number of breast cancer patients with their causes and prevention regarding the same. As a result, some countries will benefit in terms of the implementation plan of public awareness policy regarding breast cancer and awareness programs. The present research study has provided extensive details regarding breast cancer including the specific risk factors and mortality rates. Therefore, as per the reports of Mayo Clinic, improvement of physical activity and limitations of alcohol intake will be considered of high levels of significance Hence, for different country segments, these characteristics will be justifiable recommendations.

As per the reports of Breast Cancer Foundation, the strict avoidance of weight gain will be an important suggestion for the common people. In this aspect, different country governments need to address this public issue including the development of public health plans. The plan will be in accordance with health and safety legislations and will be addressing the health and emergency needs of the common people.

According to Nickel et al. (2022), there is an important requirement for systematic access of international breast density information. Therefore, it will allow different healthcare professionals to develop different health procedures and prevention measures against breast cancer. The active role of AI will be an important suggestion regarding screening and prevention policies of breast cancer among women. Ensuring effective levels of sources from government and non-government is a crucial factor behind the prevention of breast cancer and identifying the rates of mortality that will be measured annually

Limitations of the research study

Limitations of the study refer to the area where the research study is limited to provide a certain information. In that same way there are some limitations of the present research study. At first, there is a functional absence of secondary qualitative data that can provide different themes that are associated with the present research study. Secondly, the study fails to provide different government policies and procedures regarding reduction of mortality rates for different country segments for those people suffering from breast cancer. Thirdly, the study has a lack of primary research system for identifying the opinions of different respondents. Therefore, these are the certain limitations of the present research study.

Future scope of the research work

For every research study, there is an identifiable aspect of future cope. Future scope of a research study is the extent where the research study will provide more information regarding the research topic. The present study will focus on mixed methodology and approach to determine association between breast cancer incidence and risk factors behind the same. The future study will also ensure the in-depth findings and analysis system using opinion of different respondents as the relevant findings aspect. The future study will also focus on the representation of different government policies and procedures with reduction of risks of breast cancer including developed screening programs.

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APPENDIX: 1 LETTER OF ETHICAL APPROVAL

The University Of Sheffield.

Downloaded: 11/09/2023
Approved: 17/08/2023

Priya Davuluri
Registration number: 220198125
Division of Population Health
Programme: Public Health

Dear Priya

PROJECT TITLE: The association between country specific breast cancer incidence and mortality and country specific risk factors. (Ecological Study)
APPLICATION: Reference Number 056650

This letter confirms that you have signed a University Research Ethics Committee-approved self-declaration to confirm that your research will involve only existing research, clinical or other data that has been robustly anonymised. You have judged it to be unlikely that this project would cause offence to those who originally provided the data, should they become aware of it.

As such, on behalf of the University Research Ethics Committee, I can confirm that your project can go ahead on the basis of this self-declaration.

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since full ethical review may be required.

Yours sincerely

Email Scharr Rec
Departmental Ethics Administrator

University of Sheffield **School of Health and Related Research (ScHARR)**

Risk Assessment Form for Dissertation Projects

Any Masters student completing a dissertation must complete this risk assessment form in consultation with their academic supervisor before starting their dissertation. The form should be signed by the student and supervisor. Students are advised to keep an electronic copy (preferably a scanned copy of the signed form) for future reference and to include a copy of the risk assessment form as an appendix in their final dissertation. **The risk assessment should be revisited if any changes are made to the proposed research or any circumstances change.**

Please complete the requested details and/or mark the answer(s) that apply to your particular dissertation project.

Q1. Overview of Your Research Project

Your name: PRIYA DAVULURI Your academic supervisor: STEPHEN J WALTERS

Does your project involve any or all of the following?

- primary data collection (e.g. interviewing, surveying or observation in unfamiliar and/or private settings);
- a work-based research placement;
- overseas activities;
- working in an unfamiliar environment in general (i.e. a place that is not known to you, where you have spent little, or no time, previously).

Yes ☐ (If Yes, complete the rest of the form)

No ■ (If No, there is no need to complete the rest of the form, just sign the form - Q5 - and seek your academic supervisor's signature - Q6)

If Yes, please give brief details of your project here (i.e. topic area, details of planned research methods, details of work-based placement, details of any overseas activities, any unfamiliar environments):

Intended site(s) for the project (e.g. details of organisational setting, town, country if not to be completed in the UK):

Over which months will the project will be completed? (approximate start and end dates to the nearest month, e.g. June 2012- August 2012):

Will you be working on your own?

All of the time ☐ Some of the time ☐ Never ☐

Q2. Potential security devices

Will you have a personal alarm? Yes ☐ No ☐

Will you have a mobile phone? Yes ☐ No ☐

Q3. Health

Should we be aware of any medical information concerning your health and fitness, which is relevant to carrying out the project? Please enter 'NONE' if there are no foreseeable health/fitness problems.

Q4. Potential hazards inherent in project site(s) and/or research methods to be used

Are there any hazards associated with the sites at which you will be conducting your project and/or the research methods you will use? For example, will you be working on your own in private spaces (e.g. people's homes), travelling through potentially unsafe areas to reach your project site, or conducting interviews in politically volatile or potentially hazardous environments (e.g. around dirty water, at night, busy urban markets)?

If so, what are these hazards and what arrangements will you make to manage and reduce these?

Please use the space/table below to record identified risks, who might be affected and how you will manage the risks.

The risk assessment should be revisited if any changes are made to the proposed research or any circumstances change.

SIGNIFICANT HAZARD	POTENTIAL COONSEQUENCES OF HAZARD	INITIAL RISK RATING (High/Medium/Low/No risk)	EXISTING CONTROL/PROPOSED CONTROL MEASURES	FINAL RISK RATING (High/Medium/Low/No risk)

Q5. Student's declaration

I have reviewed safety considerations for my project with my supervisor. I have read and understood the **Dissertation Research Safety Guidelines** in the **Dissertation Module Handbook** and I agree to abide by the recommendations made therein.

I understand that I am responsible for my own safety during this project and will take any necessary steps to minimise the risks the project poses to me and/or other people. I will not undertake the project if circumstances increase the risk of accident or injury (e.g. the presence of suspicious individuals).

Student's signature PRIYA DAVULURI

Date 17/08/2023

Q6. Supervisor's approval

I have read this risk assessment and discussed it with him/her. I think it identifies all readily foreseeable risks in the project as planned at this date. If the appropriate precautions are taken by the student the project should be permitted.

Supervisor's signature S. Walters

Date 18/08/2023

Dissertation Research Safety Guidelines [extract from Dissertation Handbook pages **]
These dissertation research safety guidelines apply to any student studying for their Masters in Public Health dissertation, but, in particular, to those who are conducting primary research, a work-based research placement and/or a project that involves any overseas activities or work in an unfamiliar environment in general.

General
Each student must behave responsibly during the conduct of their dissertation project work in order to reduce the risk of accidents.

- You must discuss your project and any potential risks with your academic supervisor.
- No project that has an undue safety risk will be sanctioned.
- You are responsible for your own safety.
- A written risk assessment for dissertations (Form HAR1) must be completed and approved by your academic supervisor before any dissertation project work is undertaken.

Dimensions of Risk
There are a number of dimensions to the potential risks that students may face when involved in a dissertation project (including work-based research placement activities); particularly if it involves social interaction of any sort.

There is potentially risk of:

- physical threat or abuse;
- psychological trauma, as a result of actual or threatened violence or the nature of what is disclosed during the interaction (e.g. during interviews);
- being in a comprising situation, in which there might be accusations of improper behaviour;
- increased exposure to risks of everyday life and social interaction, such as road accidents and infectious illness; and/or
- causing psychological or physical harm to others.

It is important that you consider the potential dimensions of risk associated with your particular dissertation project.

Assessing Risk: Project Site(s)
In selecting and appraising the project site(s) and before starting any project work, it is important that you consider any potential risks associated with the particular location in which you will be working. Some relevant questions to ask may include:

- How safe is travel to/from the project site(s)?
    - Is there reliable local public transport?
    - Are reputable taxis firms easy to access?
    - Is it safe to use private cars and leave them in the area?
- Is there a local contact person for you at the project site and are you clear about how you can contact them when you are there? (details of where they are based, a contact telephone number etc.)?
- If you are staying away from home, is there appropriately priced, comfortable and safe accommodation within easy reach if this is needed?
- Are there any local tensions to be aware of, such as strong cultural, religious, political or racial divisions?
- What do local sources, such as the police, say about risks in the project site(s)?
- Would it be useful to prepare for the project work locally by, for example:
    - Meeting with local leaders to explain the project and seek their involvement and/or endorsement;
    - Informing other significant local actors about the project and seeking local contact details;

- Notifying the local police in writing about the purpose and conduct of the project and asking for a contact telephone number.

Insurance

- Students who engage in overseas activities as part of their dissertation project should ensure that they have adequate insurance for accidents, illness and personal belongings for the duration of their overseas visit.
- Students travelling abroad or within the UK and staying overnight may purchase University insurance. Students should contact Emma Earle in the Teaching and Support Unit to arrange this.
- Students travelling in the UK but not staying overnight are advised to check that they have adequate insurance to cover their personal belongings while away from home.
- Please refer to http://www.shef.ac.uk/finance/staff-information/help/insurance for more information about the University's insurance as it relates to postgraduate students.

Travelling to project or data collection sites

If you are carrying out project work, such as interviews or observations in unfamiliar areas, pay attention to the following:

- Study a map of the area or existing information sources for clues as to its character. Look for schools, offices (post offices), railway stations, markets and other hubs of activity. Think about escape routes from any dense housing areas. Use the Internet, Google Maps etc. to thoroughly research the area.

- If doubts about safety are indicated, make enquiries about the vicinity in advance of any practical work, to assess the need for accompanied visits, shadowing or pre-arranged pick-ups.

- If your project involves travelling to remote areas, ensure that you have adequate survival gear and supplies with you in case you have difficulty returning for some reason.

- Avoid travelling to a project site by foot if you are feeling vulnerable. Use convenient public transport, a private car or a reputable taxi firm. Plan your route in advance and always take a map. Input local taxi numbers into your mobile phone in advance.

- Try to avoid appearing out of place: dress inconspicuously and non-provocatively, taking account of cultural norms.

- Equipment and valuable items should be kept out of sight where possible.

- Carry a personal alarm or other device to attract attention in an emergency.

Dealing with People

Wherever possible, you should try to obtain prior information about the characteristics of the people you will come into contact with during the project and/or and possible project participants. The following general guidance should be taken into account, as relevant to your particular project:

- The topics for discussion in some projects relating to health and social issues - for example, poverty, unemployment, social isolation, bereavement and ill-health - may provoke strong feelings in some participants and also angry reactions.

- Some respondents may present a greater possibility of risk than others. For instance when conducting research with people who have a history of psychological disturbance or violent behaviour. If such characteristics are known in advance, the researcher and supervisor should be as fully briefed as possible on the risks involved and understand the precautions they need to undertake to manage the situation.

- To avoid engaging in inappropriate or provocative behaviour with people you come into contact with during the project, make sure that you are:
    - fully aware of any professional, social or cultural norms;
    - aware of the potential gender dynamics of interactions; and
    - aware of ways in which you can establish the right 'social distance' - neither over-familiar nor too detached.

- Issues of race, culture and gender can impact significantly on your safety when carrying out a project in certain situations (see Cardiff report listed under further information and resources). For example, lone female researchers may be more vulnerable than lone males. You should identify the factors that may contribute to any risk situation in your project working, and identify strategies to try and mitigate these.

- Always obtain permission before entering private land/property.

- Always carry identification, for example, your university card or a letter authenticated by your academic supervisor, giving the School of Health and Related Research's address and your contact details. Research participants should be given an opportunity to check you are who you say you are, and to review your documents/ identification.

- In relation to face-to-face interviews conducted in participants' homes:
  Unscheduled interviews:
    - If the study design requires you to make opportunistic door-to-door visits to complete short interviews, try where possible to conduct these briefly at the door and without entering the property.
    - If you are 'cold calling' in this manner, assess the situation before beginning the interview and if in doubt re-arrange the interview for when a colleague can be present.

  Scheduled interviews:
    - However, many projects involved arranging interviews in advance and it is not always practical to speak with people briefly and without entering their homes. If you are required to conduct interviews in a participant's home, contact them in advance of the interview (by telephone) to assess how comfortable you feel about them, and to enquire whether any other members of the household will be at home. If you have the choice, try and arrange for the interview to take place in a room where you can see the door (to exit) and always keep your belongings with you (so you have your phone, money and car keys to hand if you need to leave quickly).
    - If after speaking with a participant, you do not feel comfortable to visit their home, arrange an alternative venue for the interview that has already been assessed for safety (for instance bookable interview rooms at the University or a public venue such as a library).
    - Let the participant's know that you have a schedule and that other people (a family member, your supervisor) know where you are if you are carrying out face-to-face interviews. You can tell them this directly as you arrive by mentioning it in general conversation. Or you can do this more subtly by stating you need to quickly make a phone call to tell someone where you are. You can also arrange for calls to be made to you – for instance ask a friend to call you mid-way through the interview as a way to 'check in'. Remember leave your mobile phone switched on.

  For all types of interview and fieldwork activity:
    - This is very important: be sure to let another person know that you plan to be interviewing or carrying out fieldwork on a particular day and agree a time by which you should have contacted them. If you are working in the UK this person could be a member of your family, a fellow student or your supervisor. If you are working outside of the UK you could arrange to contact a local, trusted person and your supervisor in the UK. If for some reason you do fail to make contact by the agreed time, these people can try to contact you. If they are

unable to make contact with you and become worried, they can sound the alarm (see below).

Maintaining Contact and Communication

Following on from the last point in the previous section, it is essential to establish reliable lines of communication during your project, both with your family/friends, and also your academic supervisor. You should consider the following guidelines during the conduct of your project.

- Use a mobile telephone (check the battery is fully charged before setting out) when and where available. Remember to give your mobile telephone number to family/friends/your academic supervisor to enable return contact. Make sure the mobile is switched on, but don't rely on it as a safety device as you may find you are in an area without signal.

- If you are undertaking primary research or project work make sure that you provide your academic supervisor (and/or family and friends) with the following in advance of carrying out project activities (observation, interviews etc.):
    - Details of your itinerary (if relevant)
    - Possible activities / appointment times - including names, addresses and telephone numbers of people being interviewed or called (explain that these details should remain *confidential* unless in the event of an emergency when they should be provided to the police (and other appropriate services) to ascertain your safety).
    - Travel routes and accommodation details (if relevant)

- If you are travelling overseas:
    - Do all 3 things in the previous section
    - Give a family member or friend a copy of your passport details, and also personal accident /injury insurance details in case of any emergency.
    - Also make sure that you have your insurance details (specifically your policy number and emergency telephone contact) easily to hand at all times when you are overseas.
    - You should arrange to communicate with your academic supervisor at pre-arranged times and that you have agreed a procedure to follow in the event of your non-communication.
    - In foreign environments, ensure that you have at least a basic competence in the relevant local language for emergency use.
    - If you are conducting research in very remote areas, emergency signals are: Six signals within one minute (whistle blast, torch flashes, shouts, waves of cloth); One minute pause; Repeat six signals. Reply is: Three signals; One minute pause.

- **Golden Rule for Everyone**
    - During your project, always inform someone of your departure, route, activity(s) and return time (friend, parent, academic supervisor etc), and always inform the same person(s) of your return. It is essential that the person(s) you have informed of your whereabouts and likely return time knows exactly what procedure to follow in the event of your non-return.

Further Reading and Resources

Bloor, M., Fincham, B. and Sampson, H. (2007) Qualiti (NCRM) commissioned inquiry into the risk to well-being of researchers in qualitative research. Available at:
http://www.cardiff.ac.uk/socsi/qualiti/CIReport.pdf

Social Research Association, A Code of Practice for the Safety of Social Researchers. Available at:
http://www.the-sra.org.uk/documents/word/safety_code_of_practice.doc

The University of Sheffield, Health and Safety Tips for Working Overseas. Available at:
http://safety.dept.shef.ac.uk/guidance/overseasmar07.pdf

UCEA/USA (1998) Health and Safety Guidance when Working Overseas. Available at: http://www.ucea.ac.uk/objects_store/UCEA%20H&S%20Guidelines%20for%20Working%20Overseas.pdf

Appendix 2: SPSS output

Custom Tables

	Valid N	Mean	Median	Standard Deviation	Minimum	Maximum	Percentile 25	Percentile 75
Estimated number of deaths from female breast cancer in 2020	185	3688	821	11763	8	117174	251	2108
Crude breast cancer death rate per 100,000 population in 2020	185	20.6	16.5	12.5	2.2	74.9	11.1	29.5
Age-standardised breast cancer death rate 2020 (World standard population) per 100,000	185	15.9	15.0	5.9	2.6	42.2	12.1	18.7
Cumulative life time risk (0-74) of dying from breast cancer (%) in 2020	185	3.45	3.30	1.35	.36	8.52	2.50	4.22
Estimated number of cases of female breast cancer in 2020	185	12156	1945	40081	16	416371	574	6912
Crude breast cancer incidence rate per 100,000 population in 2020	185	66.0	47.8	50.3	4.4	200.7	24.5	100.6
Age-standardised breast cancer incidence rate 2020 (World standard population) per 100,000	185	50.0	46.6	22.4	5.0	113.2	32.9	65.1
Cumulative life time risk (0-74) of breast cancer (%) in 2020	185	7.91	7.30	3.65	.60	17.29	5.11	10.33

Correlation

Correlations

Variable	Variable2	Correlation	Count	Lower C.I.	Upper C.I.	Notes
				Statistic		
ASR_death_rate	Prevalence_of_obesity	.079	175	-.070	.225	
	Median_age	-.151	185	-.289	-.007	
	Life_expectancy	-.210	185	-.343	-.067	
	Prevalenceofcurrenttobaccousefemalesoffemaleadults	-.016	155	-.173	.142	
	CurrenthealthexpenditurepercapitaPPPcurrentinternational$2019	-.155	170	-.298	-.004	
	GDPpercapitaPPPcurrentinternational$2019	-.133	170	-.278	.018	
	DomesticgeneralgovernmenthealthexpenditurepercapitaPPPcurrentint	-.174	170	-.317	-.025	
	Taxrevenuespercapitacurrentinternational$2019	-.110	120	-.284	.070	
	CurrenthealthexpenditureCHEaspercentageofgrossdomesticproductGDP	-.116	170	-.262	.035	
	Population_density	-.036	180	-.181	.111	
	Underfivemortalityrate	.247	177	.103	.381	

Missing value handling: PAIRWISE, EXCLUDE. C.I. Level: 95.0

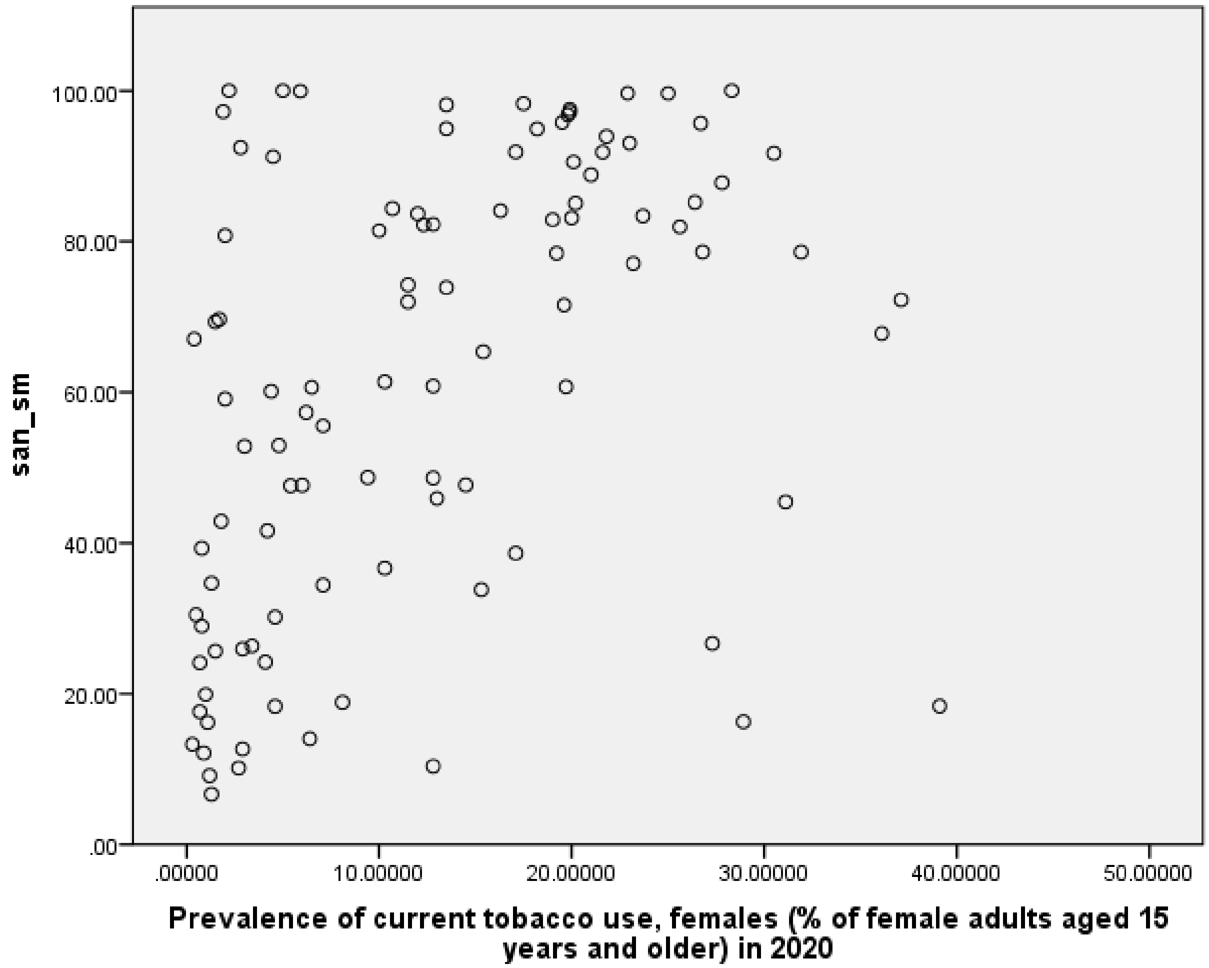
Correlations

		Crude breast cancer death rate per 100,000 population in 2020	Age-standardised breast cancer death rate 2020 (World standard population) per 100,000	Cumulative life time risk (0-74) of dying from breast cancer (%) in 2020	Current health expenditure per capita, PPP (current international $) in 2019	GDP per capita, PPP (current international $) in 2019	Population (historical estimates) 2019	Domestic general government health expenditure per capita, PPP (current international $) in 2019	Tax revenues per capita (current international $) in 2019	Current health expenditure (CHE) as percentage of gross domestic product (GDP) (%) in 2019	Prevalence of obesity among adults (both sexes) in 2016, BMI >= 30 (crude estimate) (%)	Median population age in years (both sexes) 2020 estimate	Life expectancy (in years) at birth 2020 estimate	Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020	Cigarette consumption per smoker per day (IHME, GHDx) in 2012	Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Female in 2016	Population density (number of people per km2) in 2020	Under-five mortality rate - Deaths per 1,000 live births - Both sexes - 2020
Crude breast cancer death rate per 100,000 population in 2020	Pearson Correlation	--																
	N	185																
Age-standardised breast cancer death rate 2020 (World standard population) per 100,000	Pearson Correlation	.417**	--															
	Sig. (2-tailed)	<.001																
	N	185	185															
Cumulative life time risk (0-74) of dying from breast cancer (%) in 2020	Pearson Correlation	.629**	.811**	--														
	Sig. (2-tailed)	<.001	<.001															
	N	185	185	185														
Current health expenditure per capita, PPP (current international $) in 2019	Pearson Correlation	.537**	-.155*	.191*	--													
	Sig. (2-tailed)	<.001	.044	.013														
	N	170	170	170	187													
GDP per capita, PPP (current international $) in 2019	Pearson Correlation	.472**	-.133	.206**	.860**	--												
	Sig. (2-tailed)	<.001	.085	.007	<.001													
	N	170	170	170	181	193												
Population (historical estimates) 2019	Pearson Correlation	-.066	-.087	-.079	-.010	-.032	--											
	Sig. (2-tailed)	.372	.240	.285	.895	.657												
	N	185	185	185	187	193	237											
Domestic general government health expenditure per capita, PPP (current international $) in 2019	Pearson Correlation	.517**	-.174*	.173*	.960**	.852**	-.019	--										
	Sig. (2-tailed)	<.001	.023	.024	<.001	<.001	.795											
	N	170	170	170	187	181	187	187										
Tax revenues per capita (current international $) in 2019	Pearson Correlation	.574**	-.110	.226*	.816**	.889**	-.052	.880**	--									
	Sig. (2-tailed)	<.001	.231	.013	<.001	<.001	.561	<.001										
	N	120	120	120	125	128	128	125	128									
Current health expenditure (CHE) as percentage of gross domestic product (GDP) (%) in 2019	Pearson Correlation	.414**	-.116	.110	.500**	.219**	-.076	.453**	.359**	--								
	Sig. (2-tailed)	<.001	.132	.152	<.001	.003	.302	<.001	<.001									
	N	170	170	170	186	180	188	186	124	188								
Prevalence of obesity among adults (both sexes) in 2016, BMI >= 30 (crude estimate) (%)	Pearson Correlation	.501**	.079	.366**	.378**	.347**	-.082	.362**	.285**	.452**	--							
	Sig. (2-tailed)	<.001	.299	<.001	<.001	<.001	.258	<.001	.001	<.001								
	N	175	175	175	184	183	192	184	126	185	192							
Median population age in years (both sexes) 2020 estimate	Pearson Correlation	.766**	-.151*	.203**	.713**	.700**	-.008	.704**	.597**	.311**	.410**	--						
	Sig. (2-tailed)	<.001	.040	.006	<.001	<.001	.904	<.001	<.001	<.001	<.001							
	N	185	185	185	187	193	237	187	128	188	192	238						
Life expectancy (in years) at birth 2020 estimate	Pearson Correlation	.575**	-.210**	.174*	.717**	.735**	-.012	.714**	.664**	.245**	.404**	.831**	--					
	Sig. (2-tailed)	<.001	.004	.018	<.001	<.001	.860	<.001	<.001	<.001	<.001	<.001						
	N	185	185	185	187	193	237	187	128	188	192	238	238					
Prevalence of current tobacco use, females (% of female adults aged 15 years and older) in 2020	Pearson Correlation	.630**	-.016	.281**	.458**	.346**	-.028	.457**	.418**	.390**	.460**	.541**	.430**	--				
	Sig. (2-tailed)	<.001	.844	<.001	<.001	<.001	.721	<.001	<.001	<.001	<.001	<.001	<.001					
	N	155	155	155	161	159	164	161	116	160	164	164	164	164				
Cigarette consumption per smoker per day (IHME, GHDx) in 2012	Pearson Correlation	.238**	.045	.164*	.176*	.227**	-.021	.171*	.235**	.134	.264**	.273**	.261**	.110	--			
	Sig. (2-tailed)	.001	.549	.030	.018	.002	.778	.022	.009	.074	<.001	<.001	<.001	.164				
	N	176	176	176	179	178	187	179	123	178	185	187	187	161	187			
Alcohol, adult (aged >=15) consumers in past 12 months (%) - Sex: Female in 2016	Pearson Correlation	.621**	-.128	.131	.718**	.641**	.014	.710**	.730**	.313**	.195**	.706**	.552**	.506**	.149*	--		
	Sig. (2-tailed)	<.001	.092	.084	<.001	<.001	.851	<.001	<.001	<.001	.007	<.001	<.001	<.001	.044			
	N	174	174	174	180	179	188	180	122	182	188	188	188	160	182	188		
Population density (number of people per km2) in 2020	Pearson Correlation	.042	-.036	-.005	.027	.230**	-.009	.024	.347**	.011	.030	.076	.091	.064	.037	.114	--	
	Sig. (2-tailed)	.572	.636	.946	.714	.001	.887	.744	<.001	.880	.684	.251	.169	.423	.620	.124		
	N	180	180	180	183	189	231	183	125	184	187	232	232	159	182	184	233	
Under-five mortality rate - Deaths per 1,000 live births - Both sexes - 2020	Pearson Correlation	-.506**	.247**	-.121	-.548**	-.584**	.031	-.537**	-.528**	-.259**	-.525**	-.776**	-.883**	-.403**	-.290**	-.428**	-.057	--
	Sig. (2-tailed)	<.001	<.001	.108	<.001	<.001	.667	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.430	
	N	177	177	177	187	186	201	187	127	188	192	201	201	164	186	188	196	201

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

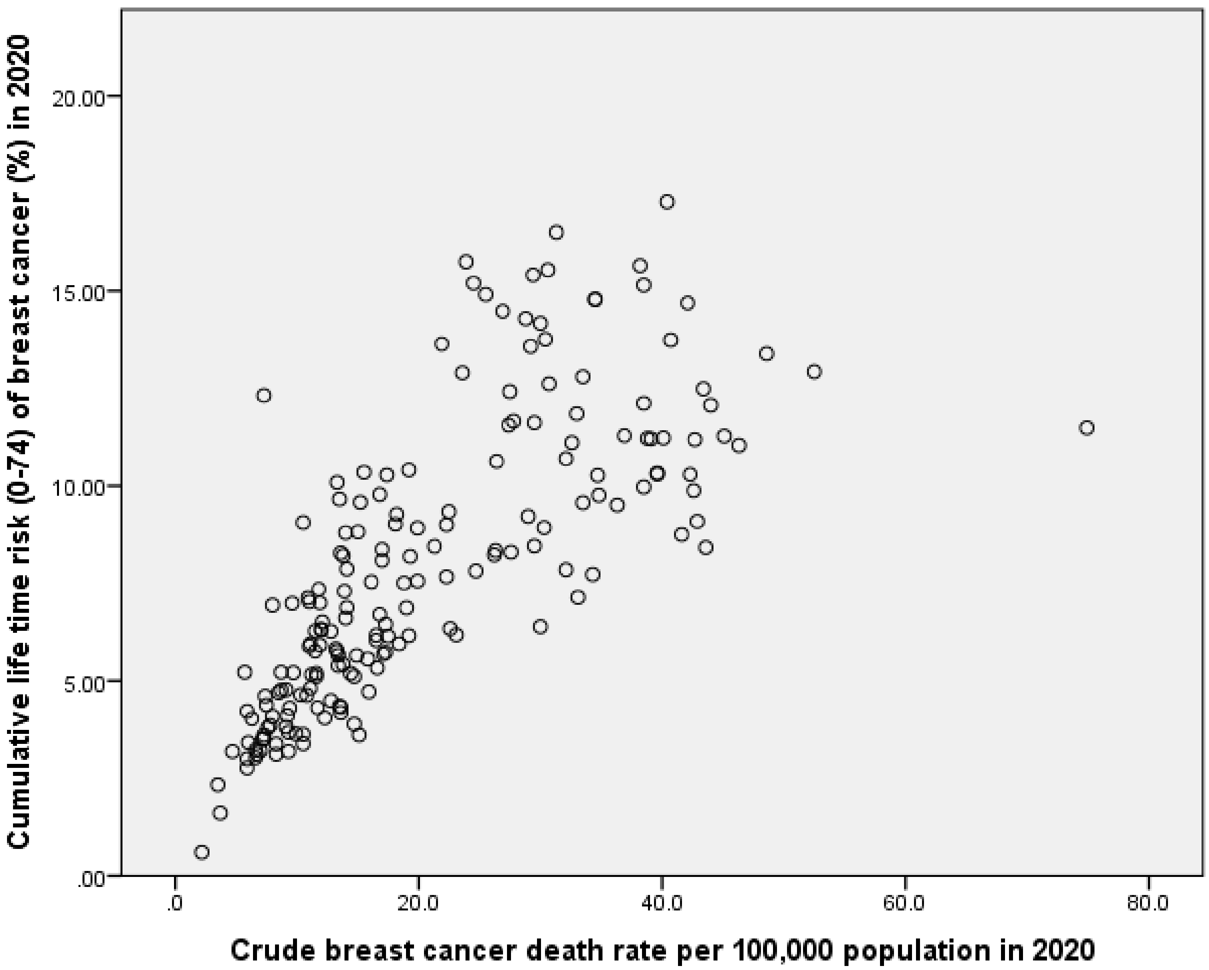
The number of breast cancer cases SAME COPIED SCATTER PLOTS.



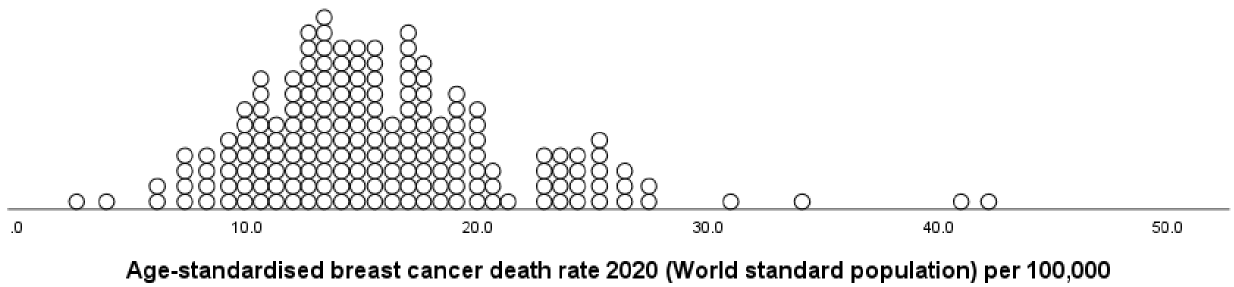
(san_sm – Cancer Occurrence)

Figure 4.2: Scatter Plot Analysis for Cancer occurrence and Cause of Occurrence of Tobacco usage across Females

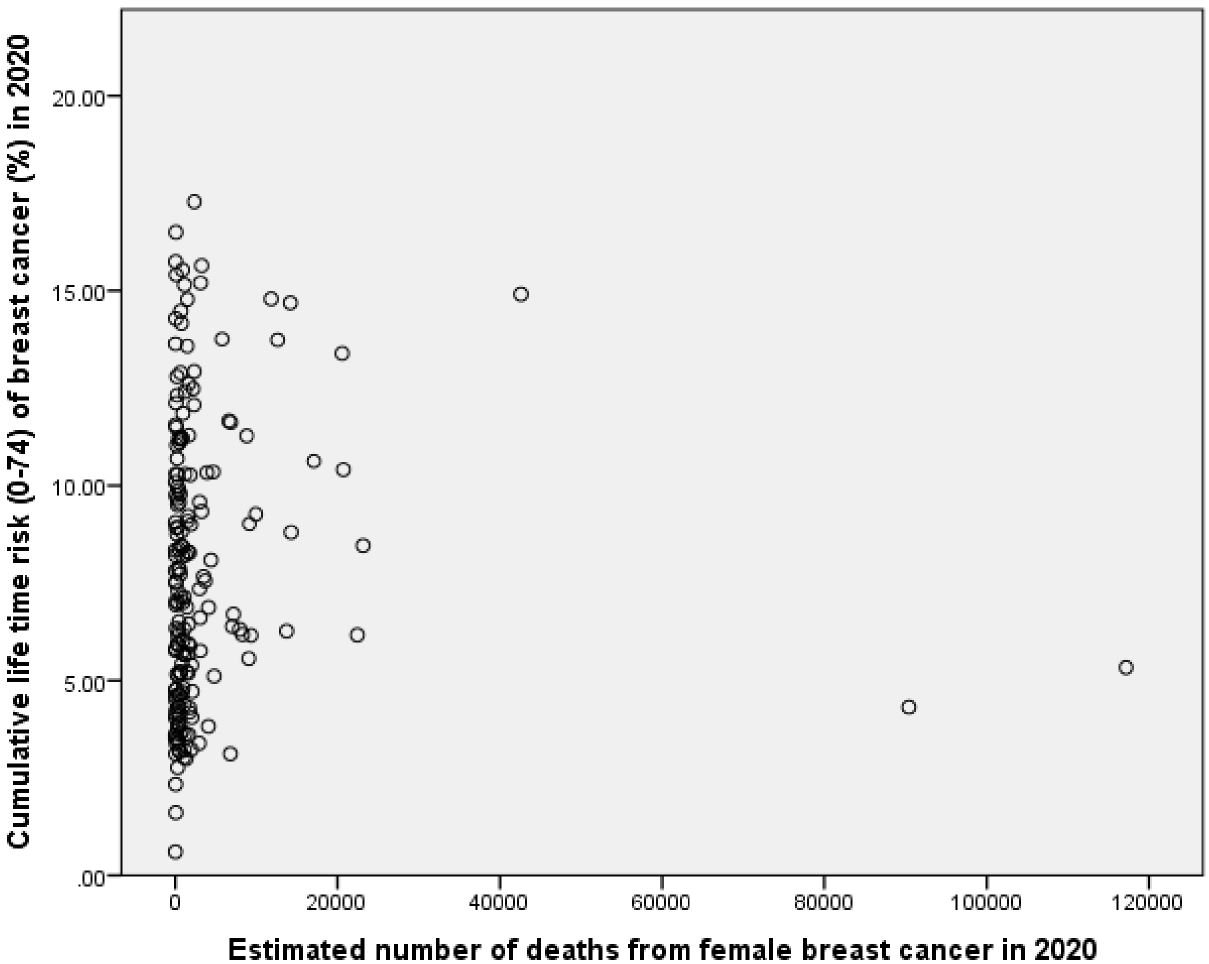
The crude breast cancer incident rate:

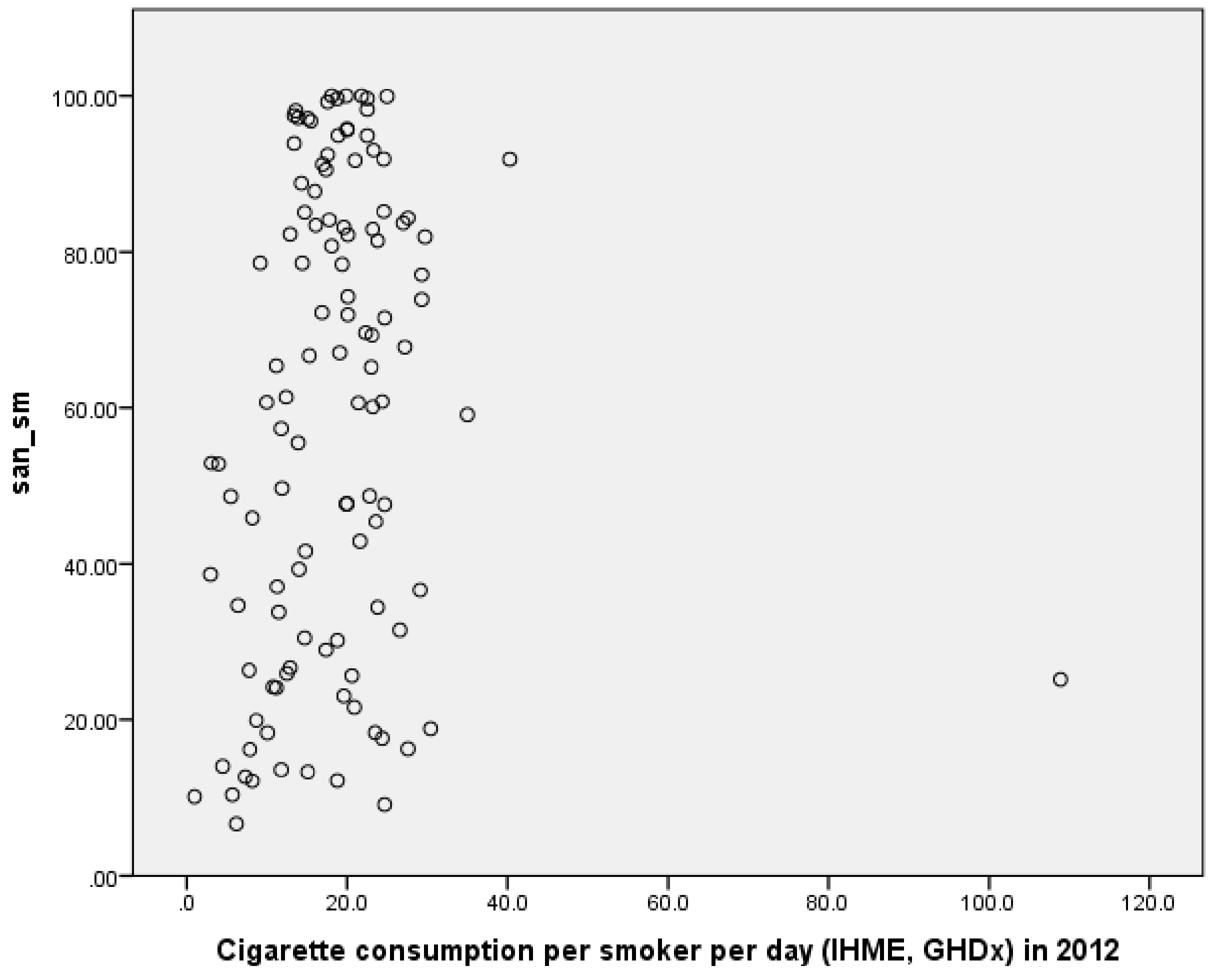


The age-standardized incident rate:



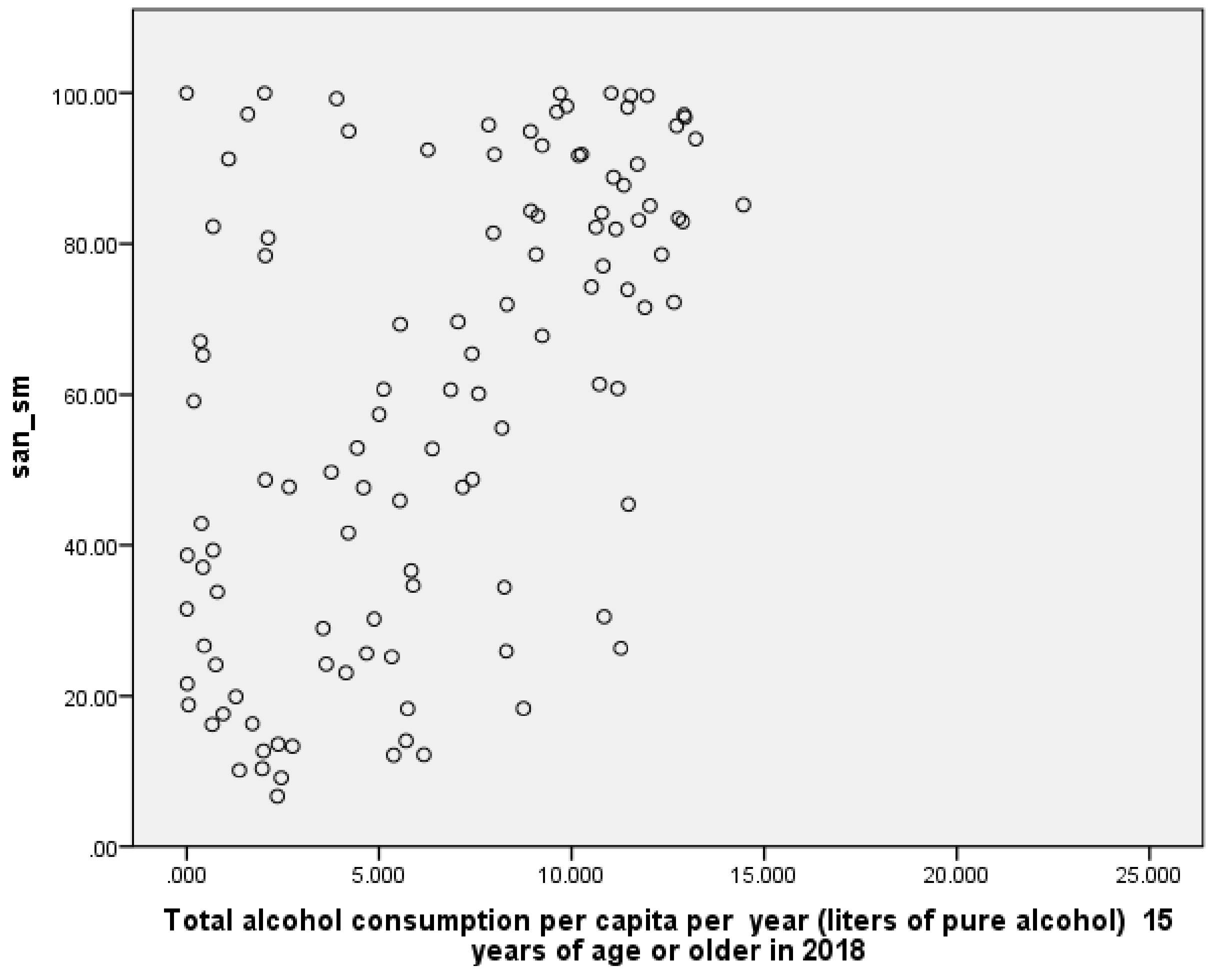
Cumulative lifetime risk of breast cancer:


Cumulative life time risk (0-74) of breast cancer (%) in 2020
20.00
15.00
10.00
5.00
.00
0
20000
40000
60000
80000
100000
120000
Estimated number of deaths from female breast cancer in 2020



(san_sam – Cancer Occurrence)

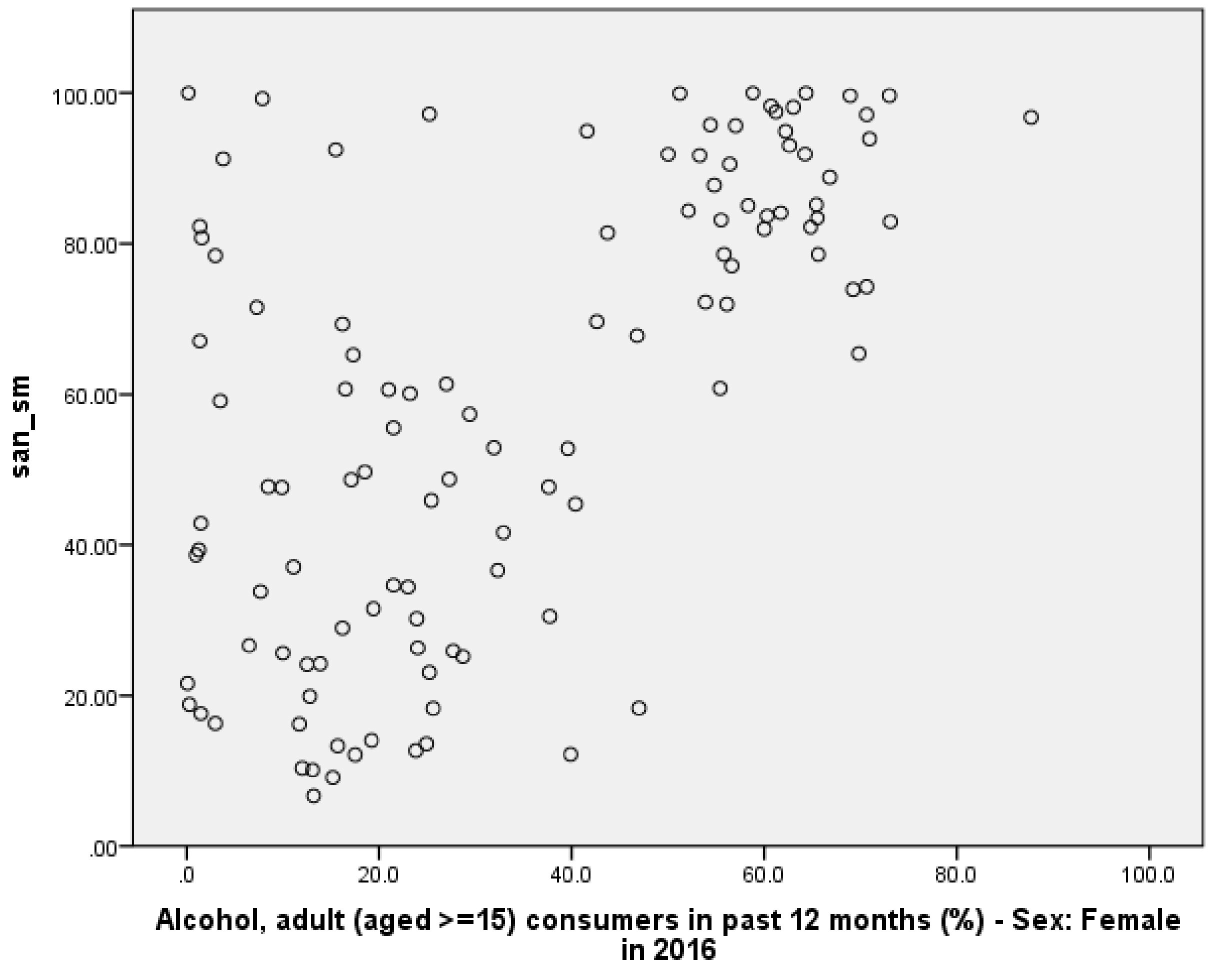
Figure 4.3: Scatter Plot Analysis for Cancer occurrence and Cigarette Consumption per smoke per day



(san_sm – Cancer Occurrence)

Figure 4.4: Scatter Plot Analysis for Cancer occurrence and Cause of Occurrence of Alcohol Consumption per Capita per Year

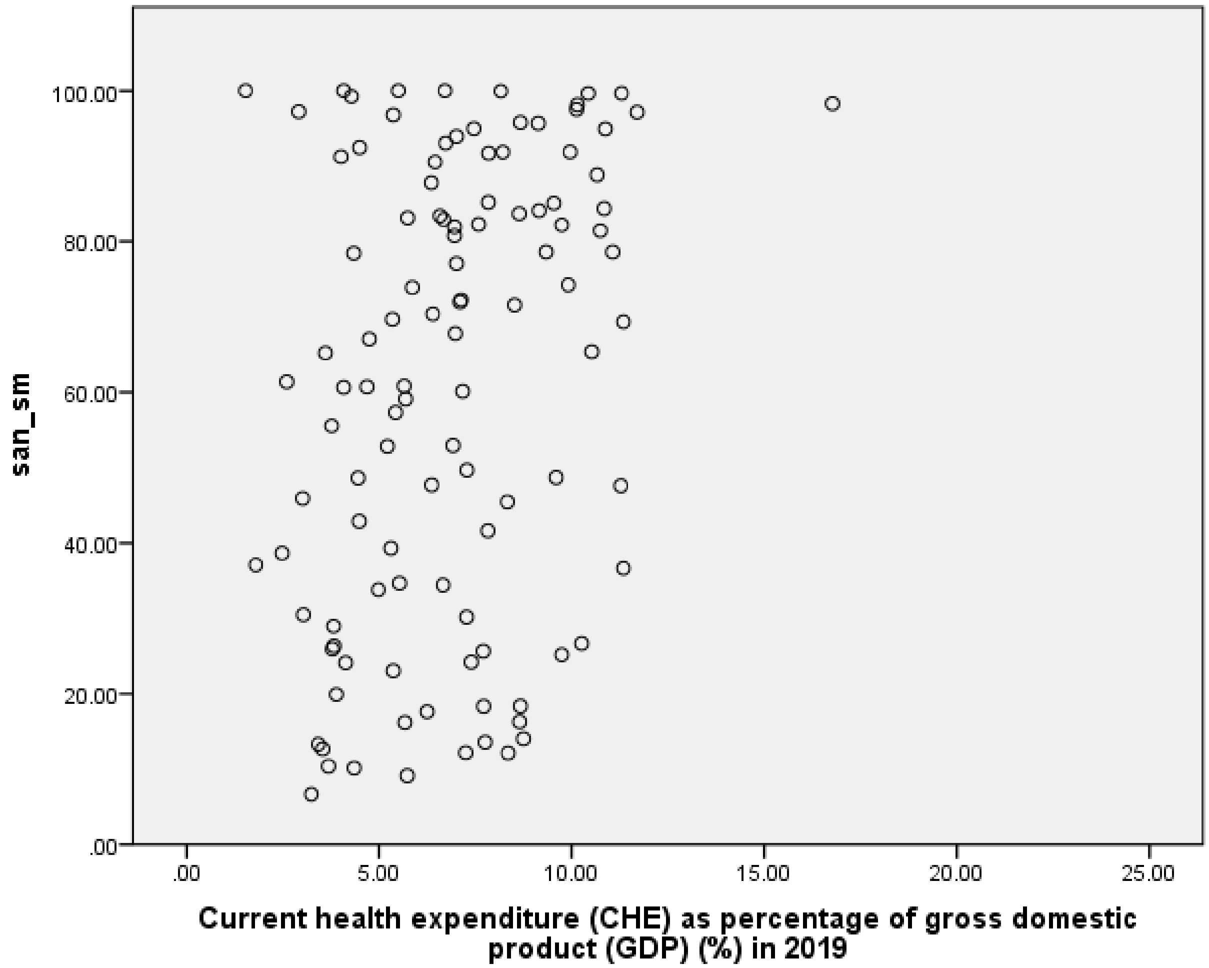
(Source: SPSS)



(san_sm – Cancer Occurrence)

Figure 4.6: Scatter Plot Analysis for Cancer occurrence and Alcohol consumption over the age of 15 consumption among Female

Ss



(cancer occurrence – Cancer Occurrence)

Figure 4.7: Scatter Plot Analysis for Cancer occurrence and Current Health Expenditure among the Gross Domestic Product

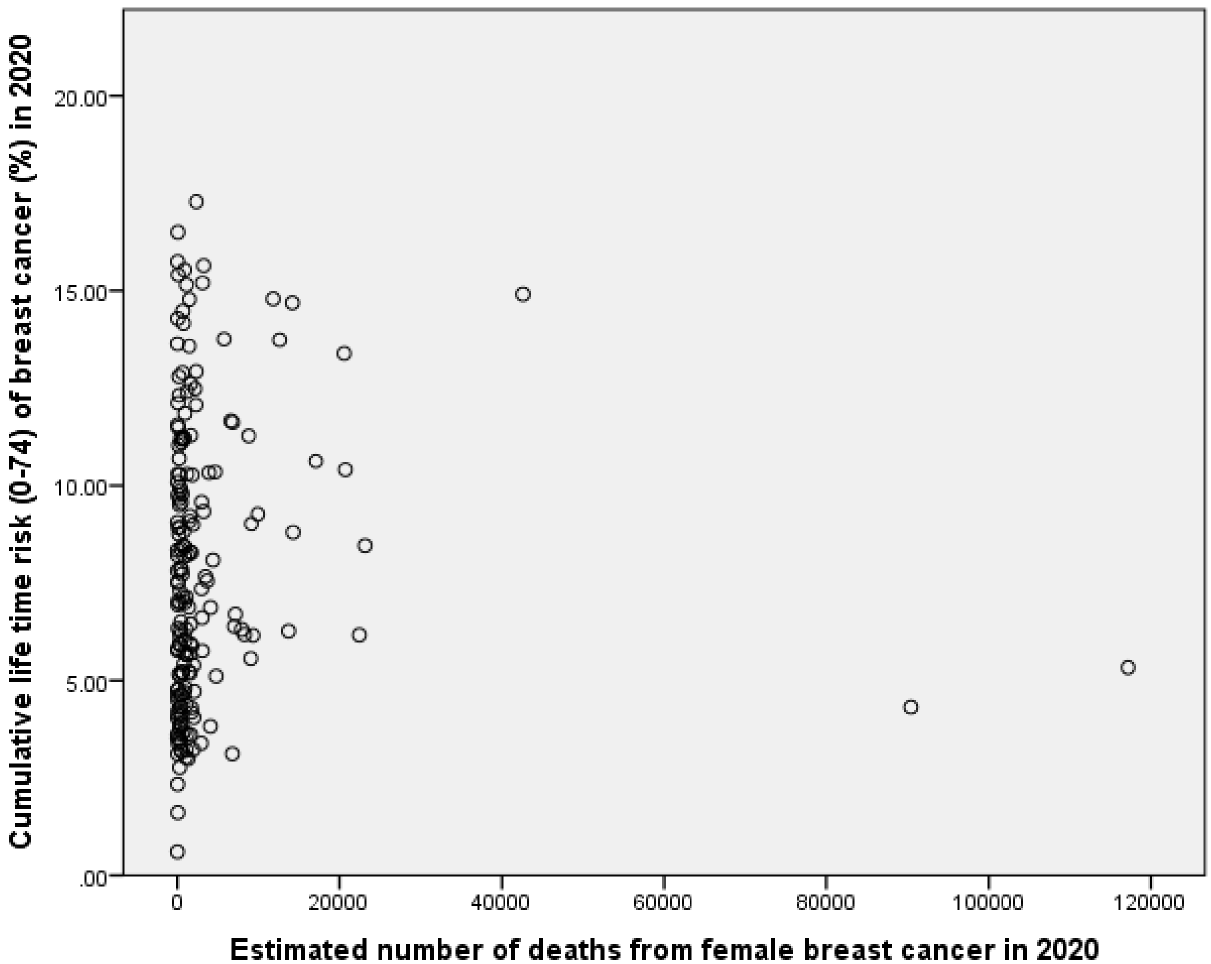


Figure 4.9: Scatter Plot Analysis for Cumulative Risk for Cancer Occurrence and Estimated Number of Deaths from Female Breast Cancer