ESTIMATING INCOME-RELATED HEALTH INEQUALITIES ASSOCIATED WITH TOBACCO AND ALCOHOL CONSUMPTION IN NAMIBIA

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ABSTRACT

A number of studies have examined the contribution of tobacco and alcohol use to the socioeconomic-related inequalities in health. Such evidence has been important for the formulation of anti-smoking and alcohol policies. However, focus has been on self-assessed health, a subjective health outcome and much is not known regarding the joint contribution of tobacco and alcohol to income-related health inequalities. This study contributes to this growing literature by estimating the separate and joint contribution of tobacco and alcohol to income-related health inequalities using more objective measures of health. The study made use of the 2015/16 Namibia Household Income and Expenditure Survey (NHIES), a national representative survey. The study employed the Erreygers corrected concentration index (CCI) to estimate income-related health inequalities and a decomposition technique to estimate the contribution of tobacco and alcohol use to income-related health inequalities. The probit and ordinary least square to estimate the effects of tobacco and alcohol on health.

Based on the CCI for income-related health inequality, the majority of the health outcomes are found to concentrate significantly among the poor. The CCI for tobacco-related health inequality is positive and significant for many of the health indicators, suggesting that poor health is concentrated among tobacco users and even more on heavy consumers. The CCI for alcohol-related health inequality is negative and significant for several health outcomes, suggesting that the prevalence of these health outcomes is concentrated among non-alcohol consumers. The probit estimates indicate that consuming alcohol increases the probability of being sick by 0.8% points, and being diagnosed with a chronic disease by 2.5% points. Tobacco consumption has no significant effect on the probability of having a chronic disease but increases the probability of being sick by 2% point. The results show that consuming both goods contribute positively to income-related health inequalities. The contributions from tobacco use alone are positive ranging from 0.07% for the health index to 0.29% for being diagnosed with a chronic disease, while those from alcohol consumption alone are negative. This illustrates that individuals who jointly consume these goods have a higher risk of being diagnosed with a chronic disease than those who consume only one or none of the goods. This is consistent with existing literature suggesting that while alcohol and tobacco alone are strongly related to the risk of ill-health, the simultaneous exposure to tobacco use and alcohol consumption had a strong multiplicative effect on health. Thus, any policy options that reduce the consumption of both goods are essential in reducing income-related health inequalities.

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LIST OF ABBREVIATIONS

ACBF	African Capacity Building Foundation
CCI	Corrected Concentration Index
CI	Concentration Index
COPD	Chronic Obstrcutive Pulmonary Disease
LMICs	Low and Middle Income Countries
NCDs	Non-Communicable Diseases
NDHS	Namibia Demographic and Health Survey
NENDU	Namibian Epidemiology Network on Drug Use
NHIES	Namibia Household Income and Expenditure Survey
NSA	Namibia Statistics Agency
OLS	Ordinal Least Square
PSUs	Primary Sampling Units
REEP	Research Unit on the Economics of Excisable Products
SAH	Self-Assessed Health
SES	Socio-Economic Status
WHO	World Health Organisation
WHO FCTC	World Health Organisation's Framework Convention on Tobacco Control

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DECLARATIONS

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CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Many countries around the world are experiencing a significant improvement in population health status, and this has resulted in an overall increase in better health outcomes worldwide (Rezaei *et al.,* 2020). However, socioeconomic-related inequalities in health remain a public health challenge for both developed and developing countries (Ostlin *et al.,* 2005; Nedjat *et al.,* 2012; Mukong *et al.,* 2017). Evidence suggests that the socioeconomic-related inequalities in health status are attributed to socioeconomic inequalities in resources and access to material opportunities such as employment, education, nutrition and household assets (Smith 1999; Smith 2004; Sözmen *et al.,* 2012). Evidence further suggests that the gradient of the socioeconomic-related inequalities in health can be exacerbated by adopted lifestyles or unhealthy behaviour of individuals (Vallejo-Torres and Morris, 2010; Mukong *et al.,* 2017). Unhealthy practices have negative health effects and if concentrated among the socioeconomically disadvantaged or vulnerable population, the socioeconomic-related inequalities in health will widen (Borg and Kristensen, 2000; Contoyannis and Jones, 2004; Vallejo-Torres and Morris, 2010; Mukong *et al.,* 2017).

There is consensus between epidemiologists regarding the transition of the burden of diseases from communicable to non-communicable diseases in many developing countries (Bloom *et al.* 2012). Non-communicable diseases (NCDs) remain the leading cause of premature deaths worldwide and accounted for 71% of all deaths in 2016 (WHO 2018). Evidence suggests that low- and middle-income countries (LMICs) account for over 80% of the NCDs-related deaths (Lee *et al.,* 2015). This is mainly a consequence of personal behaviour or unhealthy lifestyle practices, including unhealthy diet, tobacco use, alcohol abuse, and physical inactivity. Tobacco use and alcohol abuse are among the major causes of NCD-related morbidity and

premature mortality and respectively account for over 7.2 million and 3.3 million deaths each year (WHO, 2018). Tobacco use and alcohol abuse increases the risk for multiple chronic conditions, such as cardiovascular disease, diabetes mellitus, different kinds of cancers and other health disorders (WHO, 2018). The prevalence of these diseases varies with socioeconomic status and these inequalities can be exacerbated by differences in lifestyle practices of individuals (Rehm, 2011; Loring, 2014; Mukong *et al.,* 2017). Therefore, a reduction in tobacco and alcohol related health inequalities hinges upon the ability of control policies to reduce their consumption, especially among the vulnerable population.

There is vast evidence on the economic burden of tobacco and alcohol consumption (Saqib *et al.* 2018; Laramée *et al.* 2013) and the economic burden of smoking and alcohol related diseases (Bundhamcharoen *et al.* 2016; Han, 2020). There is also vast evidence on the health effect of tobacco and alcohol consumption (Pereira *et al.* 2020; Fernández-Solà 2015). However, there is limited but growing evidence suggesting that tobacco use, and alcohol abuse are key lifestyle factors associated with income-related inequalities in health (Vallejo-Torres and Morris, 2010; McCartney *et al.*, 2011, Mukong *et al.,* 2017) . These studies have examined the contribution of tobacco and alcohol use to socioeconomic-related inequalities in health. For example, Vallejo-Torres and Morris (2010) and Mukong *et al.* (2017) showed that tobacco use and alcohol abuse contribute positively to income-related inequalities in health, suggesting that the health effect of these goods is higher among the poor. Mukong *et al.* (2017) further showed that the income-related health inequalities are higher for alcohol consuming than cigarette smoking individuals and the health effects might be more dangerous when the two goods are consumed together.

While such evidence has been important for the formulation of anti-smoking and alcohol policies, focus has been on self-assessed health (SAH) a subjective evaluation of health rather

than more objective measures (Vallejo-Torres and Morris 2010; Wu *et al*. 2013; Mukong *et al.,* 2017). Secondly, Mukong *et al.* (2017) noted that much is not known regarding the joint effects of tobacco and alcohol consumption on income-related health inequalities. There is therefore, need to unpack the joint effects of tobacco and alcohol consumption on income-related health inequalities, using more objective measures of health. In what follows, this study contributes to the growing literature by analysing the independent and joint effects of tobacco and alcohol use on income-related inequality in health in Namibia. The study also considers health outcomes that are directly associated with tobacco and alcohol consumption. The main argument is that differences in lifestyle practices between the poor and the rich are likely to affect the gradient of health inequalities. That is, the negative health consequences of unhealthy practices will broaden existing income-related health inequalities if concentrated among the poor (Contoyannis and Jones 2004; Vallejo-Torres and Morris 2010).

1.1.1 The Namibian context

Namibia is one of Southern Africa's largest and least populous countries, with a population of 2.45 million in 2018 (Christians, 2020). According to the Worldometer (2020) the population density in Namibia is 3 per Km^2 (8 people per mi^2). The total land area is 823,290 Km^2 (317,874 sq. miles). There are two health systems in Namibia: private (serving 18 percent of the population with medical assistance) and public health services (serving the remaining 82 percent), a consequence of high income inequality in the country (Christians, 2020). Namibia had one of the highest income equalities in the world in 2010, expressed in the persistent inequalities in access to health-care and health outcomes across income levels, races, and geographical locations (Zere *et. al.,* 2011). In terms of overall inequality, the Gini coefficient is 0.42. On average, the inequality is higher in rural (0.45) than urban (0.24) regions, implying

that the rural population has a more unequal distribution of income than the urban population (Namibia Statistics Agency, 2014).

Namibia is experiencing rapid urbanisation, population transformation and shifts in lifestyle behaviour, including changes in drinking and smoking habits (He and Bishwajit, 2019). Prevalence of drinking was observed to be higher than that of smoking, whereby higher prevalence of alcohol abuse was found in men. Men and women who drink alcohol were more likely to be smokers, and the prevalence of both alcohol and tobacco use showed important sociodemographic patterns. Evidence on the incidence of tobacco use and alcohol abuse further suggests a higher prevalence of drinking and smoking in Namibia, especially among non-poor people and comparatively highly educated (He and Bishwajit, 2019). The National Health Policy Framework (2010) emphasised that alcohol is linked to a variety of social and medical problems. In a national Knowledge Attitude and Practice (KAP) Baseline Survey on Alcohol and Drug Use in Namibia, 47.9% of respondents reported to have consumed excessive alcohol.

Tobacco and alcohol control legislation is viewed as an effective instrument for reducing tobacco usage, harmful alcohol use, and unhealthy diets and the associated diseases. For this reason, the World Health Organisation (2006) designed the WHO Framework Convention on Tobacco Control (WHO FCTC) that has been adopted by many countries around the world. On February 5, 2006, Namibia ratified the WHO Framework Convention on Tobacco Control (WHO, 2020). In 2010, Namibia voted a tobacco control act with the aim of reducing cigarette demand through initiatives that enable people to follow healthy lifestyles. The Tobacco Products Control Act of 2010 is Namibia's primary tobacco control statute, regulating smoke-free zones, tobacco advertisements, promotion, and sponsorship, and tobacco packaging and labelling, among other things.

On the other hand, according to data collected for the Namibian Epidemiology Network on Drug Use (NENDU), alcohol continues to be the most commonly abused substance in Namibia (WHO, 2004). In 1998, Namibia enacted its Liquor Act, 1998 (Act 6 of 1998) with three primary objectives. They are: to minimise alcohol abuse, the sale and supply of alcohol meets the community's expectations, and that the balanced development of the industry is weighed against the need for controls and restrictions (Liquor Act 6 of 1998). This Act's goal is to reduce the harm that alcohol causes to individuals, families, and society by reducing alcohol consumption, with special emphasis on protecting children and young people from harm from alcohol.

Evidence suggests that market regulation of tobacco, alcohol, and food, through high taxes or restrictions on advertising and availability, is likely to be effective in improving health and therefore reducing inequalities in health. However, income inequality and economic downturns, seem to exacerbate health disparities (Naik *et al.*, 2019). Several tobacco control policies have been implemented around the world, yet tobacco companies, because of their profits continue to obstruct and hinder these steps (Arcaya *et al.,* 2015). According to a WHO report (2016) NCDs accounted for 53% of the 14,000 total deaths in Namibia in 2012. About 21% of total deaths in Namibia were caused by cardiovascular diseases, 5% by cancer, 4% by diabetes, 4% by chronic respiratory disease, 9% by other NCDs, and 10% by accidents. Smoking, lack of physical activity, alcohol abuse, unhealthy diets, and obesity are therefore, all risk factors for cardiovascular diseases in Namibia (MoHSS, 2017).

A review of the literature indicates that evidence on the role of tobacco and alcohol consumption in income-related health inequalities remains particularly scarce in Africa. In what follows, this study contributes to the growing literature by analysing the independent and joint effects of tobacco and alcohol use on income-related inequality in health by considering

health outcomes that are directly associated with smoking and alcohol use. The main argument is that differences in lifestyle practices between the poor and the rich are likely to affect the gradient of health inequalities. That is, the negative health consequences of unhealthy practices will broaden existing income-related health inequalities if concentrated among the poor (Contoyannis and Jones 2004; Vallejo-Torres and Morris 2010).

1.2 Problem Statement

Tobacco and alcohol use have significant societal costs through among others the harmful effects on health, cost of medical care and productivity loss (Vallejo-Torres & Morris, 2010; Fernández-Solà 2015; Rezayatmand *et al.*, 2017). Tobacco and alcohol use are avoidable risk factors associated with chronic diseases and premature mortality (Bellis, 2015) and are the leading cause of NCD-related deaths accounting for over 10.5 million deaths each year (WHO 2018). Like many developing countries, Namibia is undergoing an epidemiological transition from communicable to non-communicable diseases. The burden of NCDs is likely to continue as it accounted for over 43% of all deaths in 2014 (Christian, 2020).

Namibia is one of the most unequal countries in the world and these inequalities are reflected in the persistent disparities in healthcare access and health outcomes across income groups, race and geographic locations (WHO 2018). With the growing burden of tobacco and alcohol consumption, these inequalities are likely to be exacerbated. The average number of tobacco related deaths is less in Namibia than other middle-income countries. However, a registered number of approximately 20 smoking-related deaths each week is still very high (WHO, 2018). Over 60% of drinkers in Namibia are excessive drinkers and 18% of the population are heavy episodic drinkers (WHO, 2018).

There is little evidence of the effects of tobacco and alcohol use on income-related health inequalities and no study has investigated these effects in Namibia. Secondly, there is little evidence on the joint effect of tobacco and alcohol consumption on socioeconomic-related inequality in health (Mukong *et al.*, 2017). Thirdly, self-assessed health (SAH) a subjective evaluation of health rather than more objective measures has been commonly used in literature. This study used the corrected concentration index approach to measure income-related inequalities in poor health in Namibia. A decomposition analysis of income-related inequalities in poor health is used to determine the independent and joint contributions of tobacco and alcohol to the observed inequality in health. This study used more objective (tobacco/alcohol-related health measures) health outcomes to estimate the effects of tobacco and alcohol use on income-related inequality on health in Namibia.

1.3. Objectives of the Study

The main objective of the study is to estimate income-related health inequalities associated with tobacco use and alcohol consumption in Namibia. The specific objectives seek to:

- Estimate the effects of tobacco and alcohol use on related health outcomes in Namibia
- Assess the contribution of tobacco and alcohol consumption on income-related health inequalities in Namibia.

1.4. Hypotheses of the study

- H_0^a: Tobacco and alcohol consumption have no effect on health outcomes in Namibia.

  H_1^a: Tobacco and alcohol consumption have an effect on health outcomes in Namibia.
- H_0^b: Tobacco and alcohol use do not contribute to the income-related health inequalities in Namibia.

  H_1^b: Tobacco and alcohol use contribute to income-related health inequalities in Namibia.

1.5. Significance of the Study

While there is growing literature on income-related health inequalities associated with tobacco consumption and harmful use of alcohol, there is a dearth of sufficient empirical evidence in many African countries. Consuming both goods could have more devastating health consequences, but research has generally focused on the independent health effect of tobacco and alcohol abuse (Vallejo-Torres and Morris 2010; Wu *et al.* 2013). Emphasis has been on the important contribution of these lifestyle practices on income-related inequality in self-assessed health (SAH) and mortality.

According to Mukong *et al.* (2017) SAH is a subjective measure and may underestimate the contribution of tobacco and harmful alcohol use. This study contributes to the literature by estimating the independent and joint effect of tobacco and alcohol consumption on income-related health inequalities using more objective measures of health. Evidence from this study is useful for policy formulation, especially towards reducing the prevalence of non-communicable diseases.

1.6. Limitations

This study acknowledges that health indicators are bounded (binary) and the standard concentration index (CI) may not be a good measure for comparing inequality between countries over time (Wagstaff 2005). To resolve this problem, the study used a corrected concentration index (CCI) proposed by Erreygers (2009). While understanding the independent and joint contribution of tobacco and alcohol consumption on the income-related health inequalities of related outcomes is essential, data was not available for some of these diseases. To address this limitation, it is recommended that future surveys consider including these diseases.

1.7. Delimitation

The study used the Namibia Household Income and Expenditure Survey (NHIES) to investigate the independent and joint effect and contribution of tobacco and alcohol consumption on income-related inequalities in health in Namibia. This is a nationally representative and cross-sectional survey conducted between 2015 and 2016.

1.8. Organisation of the study

The research is organised into five chapters as follows: Chapter One is devoted to providing a clear introduction of the concepts under investigation. It introduces the study and outlines the statement of the problem, objectives of the study, hypotheses of the study, significance of the study, limitations and delimitations of the study, and structure of the study. Chapter Two focuses on a critical review of the relevant literature. These include the theoretical literature review and empirical literature review and summary. Chapter Three presents the research methodology used in the study. It outlines the research methods, data type and sources, the construction and definition of variables and chapter summary. Chapter Four is exclusively for data analysis, presentations and discussion of empirical results. It provides an analysis of the results to get the gist of the issues raised. Chapter Five is devoted for conclusions and policy recommendations. The conclusions summarise what the study sought to achieve, what it found or where it diverges or converges from existing evidence. It makes policy recommendations and suggests possible areas for further research.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter reviews related literature to guide the study's problem and purpose. The study estimates the income-related health inequalities associated with tobacco and alcohol consumption. This chapter therefore reviews the theoretical and empirical literature on income-related health inequalities associated with tobacco and alcohol consumption.

2.2. Theoretical Review

Health status of individuals varies with their socioeconomic background, social groups, and geographical location (Smith and Foster, 2016). In addition, psychosocial, material deprivation, environment, and lifestyle practices among others are important in explaining disparities in health (Kjellsson *et al.,* 2015). Tobacco use and alcohol abuse are among the lifestyle practices explaining disparities in health across different social groups. For instance, the damaging health effects associated with tobacco and alcohol are well-established (Arcaya *et al.,* 2015). The argument is that these lifestyle practices augment the risk associated with cancer, chronic obstructive pulmonary disease, and other respiratory problems as well as cardiovascular diseases and increases the propensity for pneumonia (Lund *et al.,* 2019). What follows, are the relevant theories of socioeconomic-related health inequalities and the associated determinants.

2.2.1. Health Capital Theory

A regular framework of analysis was the human-capital theory, the fundamentals of which have been positioned by the formative works of Schultz (1961) and Mincer (1974). Although this idea was established to be an effective causative to the understanding of decisions with respect

to education and training, it tumbles with respect to health. It is perceived that, investments in human capital should fall with age, over which the yields to be accumulated decreases (Galama & Van Kippersluis, 2013). However, investments in health visibly surge with age. This, as well as other peculiarities identified by Mushkin (1962) between health and other types of human capital led to the development of ostensible health-capital theory by Grossman (1972a, b). The health-capital theory has served as a mainstay theory in health economics and has contributed to the understanding of a wide range of phenomena in health and health-care (Galama & Van Kippersluis, 2013). In the health-capital theory, health is preserved as a stock that offers direct utility given as follows:

$$\int_0^T U[C(t), H(t)]e^{-\beta t}dt \qquad (2.1)$$

Where utility $U[.]$ is provided by consumption $C(t)$ and health $H(t)$ and β is the rate at which individuals discount future utility. Health depreciates with age at the biological aging rate $d(t)$.

$$\frac{\partial H(t)}{\partial t} = f[I(t)] - d(t)H(t) \qquad (2.2)$$

The aging process $d(t)$ may be answered through health investments $I(t)$ which advance health through the production process $f[I(t)]$ and comprises of direct spending $m(t)$ as well as one's own time inputs $\tau_I(t)$, such as medical overheads and exercise, Assets $A(t)$ surge with the rate of return to capital

$$\frac{\partial A(t)}{\partial t} = rA(t) + Y[H(t)] - p_C(t)X_C(t) - p_m(t)m(t) \qquad (2.3)$$

With earnings from labour $Y[H(t)]$ (a function of health) and decrease with expenditures on consumption goods and services $X_C(t)$ and on health investment goods and services $m(t)$ at prices $p_C(t)$ and $p_m(t)$, respectively. Earnings comprises of the time spent working in a period

$\tau_W(t)$ multiplied by the wage rate $w(t)$: $Y[H(t)] = w(t)\,\tau_W(t)$. The total time offered in a period Ω is the summation of all its potential uses.

$$\Omega = \tau_W(t) + \tau_I(t) + \tau_C(t) + s[H(t)] \qquad (2.4)$$

$\tau_W(t)$ (Work) $\tau_I(t)$ (health investment) $\tau_C(t)$ (own-time inputs into consumption) and $s[H(t)]$ (sick time). Lastly, initial and end conditions are presented below: and individuals may perish as soon as health reached the minimum level.

Galama and Van Kippersluis (2013) pointed out few important concepts of the theory which are: first, individuals request good health for production benefit, health increases earnings (reduced sick time, boost output) and for consumption benefit, health offers utility. This is in contrast to other components of human capital that are generally not displayed as providing a consumption benefit. Second, the demand for health investment is a resultant demand, whereby individuals invest on health owing to the causal demand for good health, not because they enjoy consuming care. Lastly, the efficiency of health investment process rises with knowledge because more educated individuals are expected to be more efficient consumers and producers of good health.

2.2.2. Lorenz Curve

The fundamental aspect and first step in identifying health inequality is measuring health inequality (McGrail *et al.,* 2009). Performing these analyses is essential to addressing the inequality that characterises your health profile. There are several summary indicators of the degree of health inequalities. There are many existing methodologies on measuring health inequality (Tao *et al.,* 2014). A specific indicator is the Lorenz curve, which, along with the concentration index, is derived from economics and is applied to the study of health inequalities (Distribution *et al.,* 2002; Tao *et al.,* 2014).

Moreover, the Lorenz curve was first developed by Max O. Lorenz in 1905 Among, 2002; Tao *et al.,* 2014). Heshmati (2004) defined it as a cumulative frequency curve that compares the distribution of a particular variable with an equal distribution that represents equality, mostly as a graphical representation of the income distribution. In the context of the health sector, the Lorenz curve is a way to measure horizontal fairness, and its X-axis represents the cumulative proportion of people according to their level of health resources in ascending order. Thus, it starts with the people with the least resources and ends with the people with the most resources. The y-axis, on the other hand, represents the cumulative total share of relative regional health resources. If the health resources are evenly distributed among the individuals, the Lorenz curve will be diagonal (Wang *et al.,* 2017). The farther off the diagonal, the greater the degree of allocation of inequality.

In addition, the Lorenz curve (concentration curve) provides more detailed information about the accurate wealth or income distribution of the population than summary statistics (Bank, 2008; Liao, Deng and Kang, 2010). Hence, it is one of the crucial aspects considered by the study to aid in achieving the research objectives. There are several ways to distribute a particular "size" for instance , it can be sorted from low to high according to certain criteria, such as family income, wealth, and age (Bank, 2008; Tao *et al.,* 2014). However, it is not a complete measure of health as it ignores the length of life (Crombie *et al.,* 2005; Bundhamcharoen *et al.,* 2016). Therefore, to better understand the meaning of a health burden distribution, it is helpful to follow approaches of health inequality theories.

2.2.3. Health Inequality Theory

Wagstaff, Paci, and Doorslaer (1991) used the concept of concentration curves and indices to measure how health inequality is associated with indicators of socioeconomic status such as income and education. They argued that the concentration index must meet the three minimum

requirements of the inequality index: (i) reflecting the experience of the entire population studied, (ii) socio-economic aspects of health inequality, and (iii) the composition of the underlying socio-economic ranking variables' sensitiveness. Furthermore, the concentration curve represents the cumulative distribution of population health, sorted according to socioeconomic status, concentration index and measures deviations from uniform distribution as the region between the concentration curve and the diagonal (Bleichrodt & Doorslaer, 2005).

According to Galama and Van Kippersluis (2010) a theory of inequalities in health was developed based on the Grossman model. First, it was assumed that the scale in health investment of the health production function will decline, addressing the degeneracy of linear investment models (Ehrlich & Chuma, 1990; Galama, 2011). Second, to expecting the observed association between measures of health and SES, it captures the spreading and ensuing narrowing of health inequalities with age (Galama & Van Kippersluis, 2013).

Further, literature on the development of health inequality relies on the development of a rank-dependent measure on income inequality. According to Bleichrodt and Doorclaer (2005) the question that has long been discussed in the literature on health inequality is whether to measure all inequality or only those that are systematically relevant to indicators of socioeconomic status (Gakidou, Murray and Frenk, 2000, Wagstaff, 2003). Some of the early contributions of economists (LeGrand, 1989) used the Lorenz curve and the Gini coefficient to measure inequality. However, the health index is binary and the standard concentration index (CI) is not a good measure for comparing inequality across the country and over time (Wagstaff, 2005). Therefore, the corrected concentration index (CCI) is considered by many authors to be more suitable because it meets the degree of independence (Wagstaff *et al.*, 1991).

2.3. Empirical Review

Health inequalities are systemic health disparities amongst social classes within a community (Smith and Foster, 2016). Inequalities in health across Socio-economic Status (SES) often called the SES-health gradient, are believed to be substantial. That is, inequalities affect everyone and conditions that lead to health disparities are detrimental to all members of society. A number of factors, including socioeconomic status, are thought to be contributing to health disparities (Bellis, 2015). Thus, risky health outcomes associated with unhealthy lifestyles (smoking and alcohol consumption) are likely to increase the health disparities between poor and wealthy individuals (Rehm, 2011; Rehm *et al.*, 2017). Moreover, scientific evidence has routinely demonstrated that tobacco-smoke exposure causes death, sickness, disability, and continues to affect global health inequalities especially in low- and middle- income countries (Evans, Ringel & Stech, 1999; Bartal, 2001).

A study by Mukong *et al.* (2017) investigated lifestyle and income-related inequality in health in South Africa. The paper used the National Income Dynamic Study panel data for South Africa and the Erreygers corrected concentration index to measure inequalities in health outcomes while a decomposition technique was used to identify the contribution of smoking and alcohol use to the income-related inequalities in health. The study found significance in smoking-related and income-related inequalities in both self-reported and lifestyle related ill-health. The results further suggest that smoking and alcohol use contribute positively to income-related inequality in health.

Case and Deaton (2005) using cross sectional data found that the disparity in health between low and high SES groups appears to increase over the life cycle until ages 50–60, after which it narrows. These patterns exist across a wide range of measures of SES, such as education and wealth, and across all indicators of health, including the onset of chronic diseases, disability

and mortality (Adler *et al.*, 1994; Marmot, 1999). Broad research drew similar conclusions and further suggests an important role of lifestyle factors, particularly smoking and alcohol consumption, in explaining SES disparities in health (Mackenbach, 2004). According to Fuchs (1986) the greatest variation in health in developed countries, is caused by personal lifestyles.

Ellina *et al.* (2019) conducted a systematic review of studies on socioeconomic inequalities in health-related quality of life in Europe. The study revealed that social gradient was associated with poorer self-rated health and poorer quality of life in both men and women. Regardless of their health status, people with lower social status are more likely to report poor health status (self-rated) and poorer quality of life. Galama and Van Kippersluis (2013) distinguished between healthy consumption such as healthy foods, sports and exercise from unhealthy consumption such as smoking and excessive alcohol consumption. According to them, healthy consumption provides utility, and is associated with health benefits, while unhealthy consumption provides consumption benefits that are not associated with health benefit. In addition, poor individuals are more likely to engage in unhealthy consumption than wealthy individuals (Galama and Van Kippersluis, 2019) a source of income-related health inequalities.

McGrail *et al.* (2009) examined the income-related inequalities in self-reported health in the United States and Canada and the extent to which they are associated with individual-level risk factors and health-care system characteristics. The study suggests that by far the single most important variable associated with income-related health inequalities was income itself, accounting for close to 50% of the total inequalities in both countries. This importance was a result of both an unequal distribution of income and a strong positive association between income and health that remained even after they controlled for all other factors. The study also revealed that smoking contributed approximately 2% to income-related health inequalities in both countries.

There is evidence that low income was associated with a high prevalence of smoking and fair/poor self-rated health, with some differences among sex and age groups and income indicators (Fukuda, Nakamura and Takano, 2005). A detailed comparative dynamic analysis was performed by Galama and Van Kippersluis (2013) which found that greater wealth, perpetually higher earnings, and higher educational levels encourage individuals to invest more on health, thus shifting consumption towards healthy consumption, and enable individuals to afford healthier working environments and living environment, as a result, they live longer. This may sustain the theory that offers economic rationale for the observation that wealthy individuals are more likely to drink reasonably, but less likely to drink heavily and smoke (Cutler & Lleras-Muney, 2012).

Van Kippersluis and Galama (2013) presented evidence that variances in health costs may undeniably offer an account for behavioural dissimilarities, and eventually health outcomes between different groups. There is vast evidence that health disparities are influenced by a variety of factors, including biological and genetic factors, as well as the social environment in which people live (Jamieson *et al.,* 2020). In their study they found that inequalities in health emerge from the unequal distribution of power, wages, goods and services globally and nationally. Another study by (Pampel *et al.,* 2011) emphasized that medical care, which depends greatly on access to insurance relates directly to income and affluence has some similarities to lifestyle behaviours.

2.4. Summary

Socio-economic health disparities in high-income countries have been thoroughly studied. However, not much work has been done in LMICs including Namibia. It is equally important to note that, unhealthy behaviours are known to result in greater health-care use and consequently greater health-care costs, which the poor are likely not to afford. Although, there

is vast evidence on the economic burden of tobacco and alcohol consumption (Saqib *et al.,* 2018) the economic burden of smoking and alcohol related diseases (Han *et al.,* 2020) and the health effect of tobacco and alcohol consumption (Pereira *et al.,* 2020) much is not known about their effect and contribution to socioeconomic-related health inequalities. Hence, this study contributes to the literature by estimating the independent and joint effect of tobacco and alcohol use on income-related health inequalities considering objective measures of health.

CHAPTER THREE: METHODOLOGY

3.1. Introduction

This chapter discusses the research methodology that was used in answering the research questions or in addressing the research objectives. The chapter outlines the sources of data, the estimation approaches used and possible pre- and post-estimation diagnostic tests required. The chapter further discusses the measurement and definition of variables used and the ethical considerations.

3.2. Data and Sources

This study employed household cross-sectional data to estimate income-related health inequalities associated with tobacco and alcohol consumption in Namibia. The data used for the study was extracted from the Namibia Household Income and Expenditure Survey (NHIES). The survey was conducted by the Namibia Statistics Agency (NSA) between April 2015 and March 2016. This is the most recent nationally representative survey with detailed information on individual and household disease profile as well as tobacco and alcohol consumption behaviour. Individuals were interviewed on a range of topics, including their socioeconomic status, disease profile, and tobacco/alcohol use. This research's analysis focuses on individuals aged 15 years and older

A probability sampling technique, particularly the two-stage stratified cluster sampling procedure was used to select a nationally representative sample. In the first stage, 864 clusters were selected and in the second stage a total sample of 10,368 households was selected. The response rate was 97% - that is 10,090 out of 10,368 were successfully interviewed. The data was collected over a twelve-month period consisting of thirteen survey rounds to account for seasonal changes that may affect household expenditure or income patterns. It provides

information on several tobacco and alcohol-related diseases including diabetes, high blood pressure, joint inflammation, cancer, heart disease, epilepsy, respiratory disease, ulcers, chronic kidney disease, anaemia, psychological and other chronic diseases. It also collected information on household and individual tobacco and alcohol consumption behaviour.

3.3. Measurement of Variables

This study estimates the independent and joint effects of tobacco and alcohol use on income-related health inequality. The study considers health outcomes (being sick, has chronic disease and chronic diseases such as diabetes, high blood pressure, joint inflammation, cancer, heart disease, epilepsy, respiratory disease, stomach ulcer, kidney disease, anaemia, chronic mental, and other chronic disease) that are mostly associated with alcohol and tobacco consumption. Other controls included in the analysis include: income, education, and demographic characteristics such as gender, marital status, age, and residential area.

3.3.1. Measurement of Income

Previous studies have focused on household per capita consumption (Mulyanto *et al.*, 2019) and asset ownership (Najafi *et al.*, 2020) when estimating income-related health inequalities. However, Mukong *et al.* (2017) suggests the use of household per capita income and household per capita income by adult equivalent as appropriate measures of income in the estimation of income-related health inequalities. Specifically, households differ in size and demographic structure and thus the use of aggregate household income to measure income-related inequality may be misleading. Thus, some form of normalisation is required for making comparisons regarding household income.

For robustness, this study considered both household per capita income and household income per adult equivalent as measures of income. First, the simplest way is by comparing household

per capita income by taking household total income as a ratio of household size. This approach assumes that household expenditure on a child is equivalent to their expenditure on an adult. The literature has consistently advocated the need for a more complex approach that controls for household demographic composition when comparing income across households. This approach assumes that the expenditure on a child is generally smaller than expenditure on an additional adult (May *et al.,* 1995; Buchmann *et al.,* 1988; Woolard & Leibrandt, 2006). In this study, household income is converted into household income per "equivalent adult" by assuming that monthly household expenditure on a child is smaller than the expenditure on an additional adult.

The household income per adult equivalent approach assumes that if E is a measure of household expenditure index, then E is likely to depend on household size and age composition of household members. The unadjusted household income per adult equivalent is $AE = X/E$. Where AE is the adult equivalent household income and X is the unadjusted household income. Although there are different formulations for E, the double parameter class of equivalence scales formulated by Cutler and Katz (1992) is commonly used. The double parameter class of equivalence for adults is as follows:

$$E = (NA + cNc)\theta \qquad (3.1)$$

Where NA is the number of adults and Nc is number of children; c is a parameter for expenditure on a child relative to that on an adult and θ measures overall economies of scales within the household. A child is equivalent to an adult when c = 1 (Buchmann *et al.*, 1988). However, the values of c and θ are mostly between 0 and 1 and may differ between countries. While the values of c and θ have not been established for Namibia, this study adopts the South African values set at $c = 0.5$ and $\theta = 0.9$ as proposed by Deaton in 1993.

Using a variety of combinations of c and θ for meaningful comparisons, Woolard and Leibrandt (2006) found no significant difference from the bench marked values of $c = 0.5$ and $\theta = 0.9$. The adoption of these values assumes that Namibia and South Africa are both upper middle-income countries, belonging to same regional blocs and Namibia was colonised by the apartheid South African government until independence in 1990.

3.3.2. Health Outcomes

This study made use of several tobacco and alcohol related health outcomes to estimate income-related health inequalities associated with tobacco and alcohol consumption. The selection of these health outcomes is guided by existing literature and data availability. Health outcomes used in this study include diabetes, high blood pressure, joint inflammation, cancer, heart disease, epilepsy, respiratory disease, ulcers, chronic kidney disease, anaemia, psychological and other chronic diseases. The health measures are defined as binary outcomes equivalent to 1 if the respondent reported to have been diagnosed of a particular disease and zero otherwise. The health outcomes though reported by the respondents, are more objective since they are based on medical diagnoses. For a more generic measure, the study constructed a composite index for health status using the Min-Max rescaling transformation procedure.

The Min-Max rescaling transformation is a method in which each variable is decomposed into an identical range between zero and one, with a score of 0 being the worst rank for a specific indicator and a score of 1 being the best. In this study, the score is zero if an individual is not suffering from a specific chronic disease and one otherwise. All other values are then scaled between the minimum and maximum values. According to Yoon (2012) in Wang (2017) the scaling procedure ultimately subtracts the minimum value (X_{min}) and divide it by the observed difference between the maximum value (X_{max}) and the minimum value (X_{min}) as illustrated in Equation 3.2.

$$C_i = \frac{X_i - X_{min}}{X_{max} - X_{min}} \qquad (3.2)$$

Where X_i is equivalent to 1 if diagnose of a particular chronic disease and zero otherwise. With this approach, differentially-scaled indicators can be standardized into indices. This approach has been used by several scholars including Bernard (2007) and Cutter *et al.,* (2010) to aggregate variables and create composite scores. It has also been employed by the UNDP to compute human development indices (HDIs). However, to free the disease types from assuming their initial measurement units, the indices generated were standardized and the standardized indices are between 0 and 1. There are 12 indicators of chronic diseases used in computing the health index and thus, the standardization was obtained by calculating the average values of the different diseases as follows:

$$HI \quad = \frac{\sum_{i=1}^{n} IndexA_i}{n} \qquad (3.3)$$

Where $IndexA_i$ are the different health indicators that make up the health index and n is the number of chronic diseases used (12 in our case). However, given all health indicators are code as 0 and 1, the health index simply follows an additive process. The composite index ranges from 0 to 1 with high values denoting higher prevalence rate of related diseases.

3.3.3 Alcohol- and tobacco-related disease profiles

This section discusses how the considered health conditions are associated with tobacco and alcohol use. Generally, the health effects of alcohol consumption could be positive or negative depending on the patterns and volumes of alcohol consumed (Mukong *et al.,* 2017). Alcohol consumption is cited to be a causal factor in over 200 diseases (Saqib *et al.,* 2018) and injury outcomes, such as various cancers, heart disease, diabetes, liver cirrhosis, stroke, pancreatitis, hypertension (Pereira *et al.* 2020), neuropsychiatric conditions, road traffic accidents (Laramée *et al.,* 2013). According to Rota *et al.* (2012) there is a strong relationship between ethanol

intake and cancer. Through systematic reviews, Fedirko *et al.* (2011) and Vallejo-Torres *et al.* (2014) revealed that alcohol consumption increases the risk of developing cancer. The effects of alcohol use on diabetes are dose dependent and the risk of type 2 diabetes reduces with moderate alcohol use (Baliunas *et al.,* 2009). In addition, it is evident that alcohol abuse is likely to increase body weight, the concentration of fats in the blood, resulting in blood pressure (Wannamethee & Shaper, 2003). The harmful use of alcohol is associated with multiple aspects of the cardiovascular system, increasing the risk of hypertension, heart disease, respiratory diseases and stroke (Gorelick, 1987).

Evidence suggests that the bioactive compounds in nicotine have numerous avoidable health consequences. That is, nicotinic receptors are found throughout the body, including muscle, lungs, kidneys, skin and the brain (Hurst *et al.,* 2013; Improgo *et al.,* 2011). Evidence suggests a strong and positive relationship between smoking and lung cancer (Murray *et al.,* 2009). Also, the associated risk from smokeless tobacco is less than the risk from smoking traditional tobacco products (Boffetta *et al.,* 2008). Every level of tobacco consumption increases the risk of having cardiovascular heart diseases. For example, Schane *et al.* (2010) showed that even smoking less than five cigarettes per day increases the risk of having cardiovascular heart diseases. Epidemiologic and pathogenesis-based evidence suggests that there is a potential causal relationship between cigarette consumption and type 2 diabetes (Xie *et al.,* 2009). Even after controlling for age, hypertension, and cardiovascular disease risk factors, Wolf *et al.* (1988) showed that smoking was significantly related to the incidence of stroke.

3.4. Model Specification

3.4.1 Estimating health inequality

This study makes use of the health concentration index (CI) to estimate the extent of income-related health inequalities in Namibia. While the Gini index is useful in measuring inequalities

in health, the CI is a bivariate measure that has been extensively used to measure socioeconomic-related health inequalities, by ranking related health outcomes to other variables including income, education and smoking and alcohol (Vallejo-Torres & Morris, 2010; Vallejo-Torres *et al.,* 2014; Mukong *et al.,* 2017). The concentration index ranges between −1 and +1, with positive values suggesting that the inequality favours the rich, negative values suggest it favours the poor and zero, if the health of the population is evenly distributed among the rich and the poor (Wagstaff *et al.,* 1991). According Ataguba *et al.* (2011) and Vallejo-Torres *et al.* (2014) the value of −1 suggests that poor health is concentrated among the poor and +1 suggest that poor health is concentrated among the rich.

While the standard CI has the potential of summarising the extent of inequality in a single measure, it may not be a good measure for comparing health inequality between countries and over time, especially when health indicators are bounded (Wagstaff, 2005). When the health outcome is binary, the bounds of the CI depend on the mean (μ) of the variable and ranges between $\mu - 1$ and $1 - \mu$. According to Wagstaff (2005) the CI can be normalised using $(1 - \mu)$. However, Erreygers (2009) claims that this is an ad hoc procedure, suggesting the use of a corrected concentration index (CCI). The argument is that the CCI satisfies level independence such that equal increment of health for all individuals does not affect the value of the index. The health indicators used in this study are binary and bounded in nature (between 0 and 1) suggesting the use of the Erreygers CCI specified as follows:

$$CCI = \frac{4\mu}{d - e} * C \qquad (3.4)$$

Where μ is mean health status, C is the standard CI, *d* is the maximum level of health (1) and *e* is the minimum level of health status (0).

3.4.2 Estimating the Contribution of Tobacco and Alcohol on Income-related Health Inequalities

The contribution of tobacco and alcohol consumption and other covariates to income-related health inequality can be estimated by decomposing the CCI, through a regression technique. This approach is according to Doorslaer *et al.*, (2004) and Wagstaff *et al.,* (2003) who used it to decompose the standard CI. It is important to note that the CCI only modifies the standard CI to satisfy the desired properties of a rank dependent index, but can be decomposed using the same technique used to decompose the CI. The approach requires the health variable to be first regressed as a function of its determinants as follows:

$$h_i = \alpha + \sum_{k=1}^{n} \beta_{ki} x_{ki} + \varepsilon_i \qquad (3.5)$$

Where *hi* is the health outcome of individual i, x_{ki} is a set of covariates, including tobacco use and alcohol consumption, α is the constant and ε_i is the error term. The decomposed CCI is the weighted sum of the CI for each health covariate. The weights are the partial effects and the CCI can be re-written as:

$$CCI = 4 * \left[\sum_{k} (\beta_k \, GC_k) + GC_\varepsilon \right] = 4 * \left[\sum_{k} \left((\beta_k \, \bar{x}_k CI_k) \right) + GC\varepsilon \right] \qquad (3.6)$$

Where $\bar{x}_k$ and CI_k are the means of x_k and CI respectively, GC_k and GC_ε are the generalised concentration indices for x_k and the error term. This quantifies the contribution of tobacco and alcohol use to health disparities linked to income. The overall contribution to income-related inequality in the respective health outcomes is the product of three separate components, namely, the coefficient β_k; the prevalence of each variable given by its mean $\overline{x}_k$; and the distribution of the variable across income groups, given by the concentration index CI_k.

Erreygers and Kessels (2013) highlighted that these decomposition approaches are one-dimensional and ignore the covariance between health and income. Fortin *et al.* (2011) and Kessels and Erreygers (2015) further argued that most of the approaches give little thought to identification strategies. Hence, they suggested that to be explicit about the parameter of interest requires some identifying assumptions. Erreygers and Kessels (2013) and Kessels and Erreygers (2015) develop a set of two-dimensional indices that consider the covariance between health and income. In order to relax some of the assumptions of Wagstaff *et al.* (2003) decomposition, Heckley *et al.* (2016) proposed the use of a regression-based decomposition of a bivariate rank dependent index.

This approach states clearly the parameter of interest and the underlying assumptions and is a suitable method for determining the causal effect of covariates on the index. Heckley *et al.* (2016) further highlighted that this approach is a useful descriptive decomposition method when no causal inference is made, but relies on a suitable identification strategy. That is, the approaches are potential ways to acknowledge the bivariate nature of such inequality indices, but the structural equation modelling are data demanding limiting their application. Thus, this study adopts Wagstaff *et al.* (2003) decomposition approach.

3.4.3 Estimating the effect of tobacco and alcohol consumption on related diseases

The outcome variable (health status) is whether an individual was diagnosed of the tobacco/alcohol-related health outcomes (diabetes, high blood pressure, joint inflammation, cancer, heart disease, epilepsy, respiratory disease, ulcer, chronic kidney disease, anaemia, psychological and other chronic diseases) or the individual reported being sick. These are dichotomized and the effect of tobacco and alcohol is estimated using a probit model specified as follows:

$$Prob(Y = 1/X_i) = f(X_i\beta) + \varepsilon_i \qquad (3.7)$$

Where Y are health outcomes, X_i is a vector of the determinants of health, including tobacco and alcohol, β is a vector of parameters to be estimated and ε_i is a random error term.

This estimation approach chosen is explained by its suitability and applicability to the research objective and the structure or nature of the dependent available. For instance, estimates from Linear Probability Model (LPM) are bound to be biased due to the presence of heteroscedasticity and the likelihood of predicted probability values not staying within the unit interval. Apart from differences in the distribution of the error term, there is no significant difference between the probit and logit results. This study gives preference to the probit estimation technique assuming that the standard errors are normally distributed.

3.5. Research Ethics

The research endeavoured to respect professional integrity. The study acknowledged all sources and avoided plagiarism. Furthermore, the data used in the study was not distorted, fabricated or falsified in any manner.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter presents and discusses the results from the empirical analysis. First, it presents the descriptive statistics for individual and household characteristics, distribution of disease profile by income quintile, probit estimates and corrected concentration index results. In the final part, results on the contribution of tobacco and alcohol to income-related inequality in health are discussed.

4.2 Descriptive statistics on individual and household characteristics

Table 4.1 presents descriptive statistics for individual and household characteristics including tobacco and alcohol consumption. The results show that alcohol and tobacco prevalence rates are 41.3% and 15.1% respectively. This suggests that 4 out of every 10 adults in Namibia drink alcohol and about 2 out of every 10 consume tobacco products. The average household income per capita is N$3,751 (Namibian dollars) and the average household income per adult equivalent is N$4,562. At least 59.3% of all individuals have some secondary education, 8.9% have some tertiary education and about 31.8% have less than secondary education.

Close to half (49%) of the individuals reside in urban areas and about 45% of the sample are male. Individuals are grouped into different age-cohorts and the results suggest that 29%, 21%, 14%, 8% and 7% are in the 25 – 34, 35 – 44, 45 – 54, 55 – 64 and 65+ age group respectively. This indicates that about 21% of the sample are younger than 25 years. The results show that 13% of the individuals are living with their partners, 5% are widows/widowers, 3% divorced, 50% have never married and 29% are married.

Table 4.1 Descriptive statistics for individual and household characteristics

Variable	Obs	Mean	Std. Dev.
Individual consumes alcohol	17,813	0.413	0.492
Individual consumes tobacco	17,813	0.151	0.358
Individual is male	17,813	0.449	0.497
Individual is employed	17,813	0.673	0.469
Individual is an urban dweller	17,813	0.491	0.500
Have secondary education	17,813	0.593	0.491
Have tertiary education	17,813	0.089	0.285
Age interval			
25-34 years	17,813	0.287	0.452
35-44 years	17,813	0.213	0.409
45-54 years	17,813	0.139	0.346
55-64 years	17,813	0.083	0.276
65+ years	17,813	0.065	0.246
Individual is living with partner	17,813	0.129	0.335
Individual is widowed	17,813	0.046	0.210
Individual is divorced/separated	17,813	0.032	0.176
Individual is never married	17,813	0.504	0.500
Household income per adult equivalent	17,813	4,562	27,054
Household income per capita	17,813	3,751	24,961

4.3. The concentration curves

The study used concentration curves to depict income-related health inequality. A concentration curve shows the cumulative share of the population who reported being diagnosed with chronic diseases or tobacco/alcohol-related diseases against the cumulative population shares, ranked by household income. If the concentration curve coincides with the 45-degree line, it indicates that the prevalence rate of chronic diseases or tobacco/alcohol-related diseases is equally distributed across the income groups, implying a proportional distribution. However, if the disease profile is more than proportionately concentrated among the poor, the concentration curve would lie above the 45-degree line. On the contrary, if the

disease profile was more than proportionately concentrated on the richer population, the concentration curve would lie below the line of equality (O'Donnell *et al.*, 2008).

Figure 4.1 presents concentration curves for being sick and/or for being diagnosed with a chronic disease. The results suggest that income-related health inequalities were generally concentrated on the poor when being sick is the considered health outcome and the dominance cannot be determined when chronic disease is the health outcome. The concentration curves for the individual chronic diseases are presented in Figure A1 in the appendices. While some of the diseases are concentrated among the poor (heart disease, epilepsy, stomach ulcer, kidney disease, and chronic mental) the dominance of others cannot be determined (high blood pressure, joint inflammation, and respiratory disease) and others are concentrated among the rich (diabetes, cancer, anaemia and other chronic disease). This may suggest why dominance of the general concentration index for chronic disease cannot be determined. Thus, being sick concentration index is more pro-poor than the chronic disease index given that the former generally lays somewhere above the line of equality while the latter curve mostly coincided with the line of equality for most parts of the income distribution.

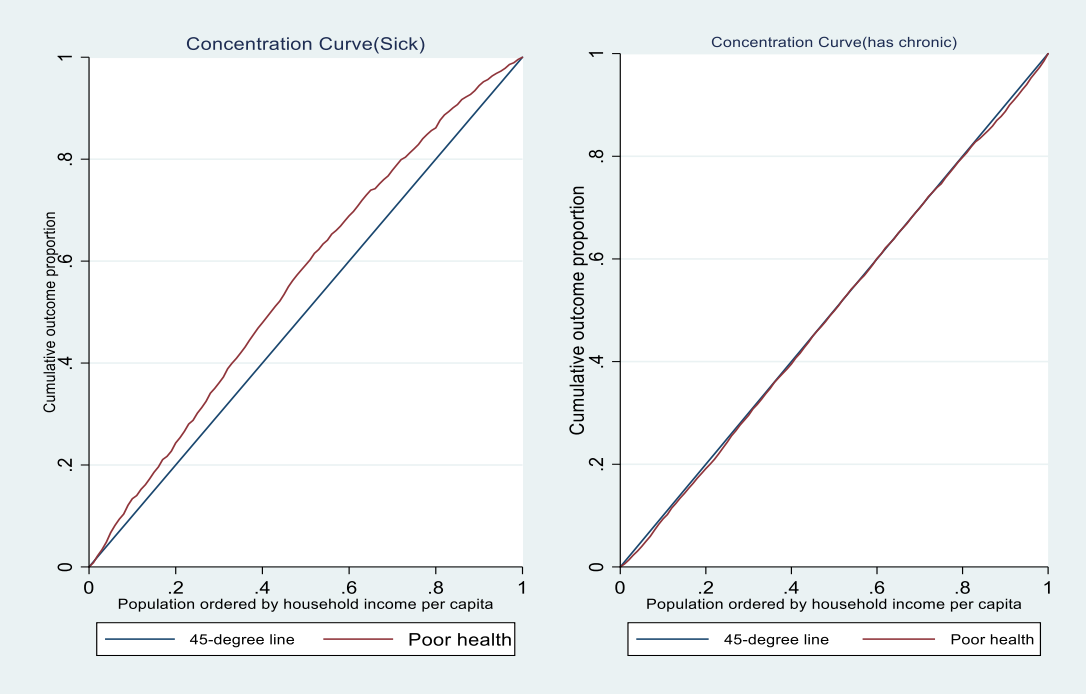

Figure 4.1: The concentration curves for being sick and/or having a chronic disease

Source: Author's computation

The concentration curve is important in illustrating socioeconomic inequality at each point on the income distribution for the health outcomes of interest, but it cannot be used to quantify the magnitude of such socioeconomic inequality (Kakwani *et al.,* 1997; Wagstaff *et al.,* 1989 in Mukong *et. al* (2017). In addition, it is impossible to determine dominance when the concentration curves cross each other. For these reasons, it is important to quantify the magnitude of socioeconomic inequality in each health outcome of interest with a summary index; this necessitates the estimation of the concentration index, especially for the individual chronic and/or tobacco/alcohol-related diseases.

4.4. Descriptive statistics on tobacco and alcohol related health outcomes

Table 4.2 illustrates mean health outcomes and the student t-test for differences in mean health outcomes by the tobacco and alcohol consuming status of individuals, offering interesting

patterns on the distribution of chronic diseases between tobacco and alcohol consumers. A positive and significant difference in mean health outcome suggests that tobacco and/or alcohol consumers are more likely to suffer from such a disease, while a negative and significant difference suggests that they are less likely to suffer from the disease.

Table 4.2 Mean health and differences in mean health by smoking and drinking status

	Entire sample		Smokers	Non smokers	Mean difference	Drinkers	Non drinkers	Mean difference
	Obs	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Individual is sick	17,813	0.08	0.106	0.079	-0.027***	0.082	0.083	0.002
		(0.27)	(0.308)	(0.270)	(0.005)	(0.274)	(0.277)	(0.004)
Has a chronic disease	17,813	0.201	0.234	0.185	-0.049***	0.178	0.200	0.022***
		(0.401)	(0.423)	(0.388)	(0.007)	(0.383)	(0.400)	(0.005)
Individual is diabetic	17,813	0.020	0.016	0.017	0.0006	0.008	0.021	0.013***
		(0.141)	(0.126)	(0.128)	(0.002)	(0.091)	(0.145)	(0.002)
Has high blood pressure	17,813	0.129	0.131	0.117	-0.014***	0.108	0.125	0.018***
		(0.335)	(0.337)	(0.321)	(0.006)	(0.310)	(0.331)	(0.004)
Has joint inflammation	17,813	0.022	0.043	0.021	-0.022***	0.026	0.023	-0.003*
		(0.148)	(0.202)	(0.143)	(0.003)	(0.159)	(0.150)	(0.002)
Individual has cancer	17,813	0.004	0.003	0.003	0.000	0.003	0.004	0.001*
		(0.063)	(0.054)	(0.059)	(0.001)	(0.052)	(0.062)	(0.002)
Has heart disease	17,813	0.017	0.022	0.016	-0.006***	0.013	0.019	0.007***
		(0.127)	(0.147)	(0.126)	(0.002)	(0.113)	(0.138)	(0.002)
Individual is epileptic	17,813	0.008	0.010	0.008	-0.002*	0.007	0.009	0.002*
		(0.087)	(0.100)	(0.089)	(0.002)	(0.084)	(0.094)	(0.001)
Has respiratory disease	17,813	0.016	0.022	0.015	-0.007***	0.012	0.018	0.006***
		(0.126)	(0.146)	(0.120)	(0.002)	(0.110)	(0.132)	(0.002)
Has stomach ulcer	17,813	0.004	0.006	0.004	-0.002**	0.004	0.005	0.000
		(0.066)	(0.079)	(0.066)	(0.001)	(0.066)	(0.070)	(0.001)
Has chronic kidney disease	17,813	0.004	0.006	0.003	-0.003***	0.003	0.004	0.001
		(0.064)	(0.078)	(0.056)	(0.001)	(0.056)	(0.062)	(0.001)
Individual is anaemic	17,813	0.003	0.002	0.003	0.001	0.002	0.003	0.001*
		(0.055)	(0.046)	(0.053)	(0.001)	(0.046)	(0.055)	(0.001)
Has chronic psychological	17,813	0.006	0.012	0.007	-0.004***	0.008	0.008	0.001
		(0.079)	(0.107)	(0.085)	(0.002)	(0.087)	(0.090)	(0.001)
Has other chronic disease	17,813	0.009	0.013	0.008	-0.005***	0.009	0.009	0.000
		(0.094)	(0.114)	(0.088)	(0.002)	(0.092)	(0.093)	(0.001)

Note: Standard deviations/errors are in parentheses. *** Statistically significant at 1% level, ** statistically significant at 5% level and * statistically significant at 10% level.

The results depict that about 8% of the sample reported being sick in 30 days before the survey while 20% reported being diagnosed with a chronic disease. Further, 13% of the sample were diagnosed with high blood pressure, about 2% with diabetes, joint inflammation, heart disease

and respiratory diseases. The results further suggest that about 1% were diagnosed with chronic psychology or mental health, epilepsy and other chronic diseases while less than 1% were diagnosed with cancer, stomach ulcers, kidney disease and anaemia. Hence, high blood pressure is the most common chronic disease in Namibia, followed by diabetes, heart and respiratory diseases.

Regarding the test for differences in mean, the prevalence rate of these diseases is generally and significantly higher among smokers than non-smokers. For example, smokers are on average, significantly more likely to be sick, diagnosed with a chronic disease, joint inflammation, high blood pressure, heart disease, epilepsy, respiratory disease, stomach ulcer, kidney disease, chronic psychological and other chronic diseases than non-smokers. The results further suggest that alcohol users are more likely to be diagnosed with joint inflammation than their counterparts, however, it is to be observed that alcohol consumers are significantly less likely to be diagnosed with a chronic disease, diabetes, high blood pressure, cancer, heart and respiratory disease and anaemia.

While the results on alcohol consumption seem surprising, it is important to note that the optimal level of alcohol consumption is not zero, since it has both beneficial and harmful effects on health (Mukong *et al.*, 2017). Their study suggests that it is the harmful and excessive alcohol consumption that contributes significantly to these diseases. Hence, the effects of alcohol use on health are dependent on the pattern of drinking and the volume of alcohol consumed. Unfortunately, the data used in this study has no information on the intensity of alcohol consumption. The results indicate that individuals who jointly consume tobacco and alcohol are more likely to be sick, diagnosed with joint inflammation, kidney disease and chronic psychological or mental health but are less likely to be diagnosed with diabetes, high blood pressure and cancer (see Column 3 of Table 4.3).

Table 4.3: Differences in mean health for individuals who both consume alcohol and tobacco

	(1)	(2)	(3)	(4)	(5)
Individual is sick	0.107	0.080	-0.027***	-0.021***	0.015***
	(0.310)	(0.271)	(0.006)	(0.008)	(0.004)
Has a chronic disease	0.196	0.192	-0.005	-0.124***	0.028***
	(0.397)	(0.394)	(0.008)	(0.011)	(0.006)
Individual is diabetic	0.007	0.018	0.011***	-0.019***	0.011***
	(0.082)	(0.132)	(0.003)	(0.004)	(0.002)
Has high blood pressure	0.103	0.121	0.017***	-0.069***	0.013***
	(0.305)	(0.326)	(0.007)	(0.009)	(0.005)
Has joint inflammation	0.036	0.023	-0.013***	-0.033***	0.003
	(0.187)	(0.149)	(0.003)	(0.004)	(0.002)
Individual has cancer	0.002	0.004	0.002**	-0.002*	0.000
	(0.040)	(0.060)	(0.001)	(0.002)	(0.001)
Has heart disease	0.017	0.017	-0.000	-0.016***	0.008***
	(0.131)	(0.129)	(0.003)	(0.004)	(0.002)
Individual is epileptic	0.010	0.008	-0.002	-0.002	0.003**
	(0.099)	(0.090)	(0.002)	(0.003)	(0.001)
Has respiratory disease	0.016	0.016	-0.000	-0.019***	0.007***
	(0.125)	(0.124)	(0.003)	(0.004)	(0.002)
Has stomach ulcer	0.006	0.005	-0.001	-0.003**	0.001
	(0.074)	(0.068)	(0.001)	(0.002)	(0.001)
Has chronic kidney disease	0.005	0.003	-0.002*	-0.005***	0.002**
	(0.072)	(0.059)	(0.001)	(0.002)	(0.001)
Individual is anaemic	0.002	0.003	0.001	0.000	0.001
	(0.044)	(0.053)	(0.001)	(0.002)	(0.001)
Has chronic psychological	0.012	0.008	-0.005***	-0.002	0.003***
	(0.110)	(0.086)	(0.002)	(0.003)	(0.001)
Has other chronic disease	0.011	0.008	-0.002	-0.010***	0.001
	(0.103)	(0.091)	(0.002)	(0.003)	(0.001)

Note: Standard deviations/errors are in parentheses. Column (1) and (2) are mean health outcomes for individuals who jointly consume tobacco and alcohol and others respectively. Column (3) to (5) are differences in mean health of joint consumers of tobacco and alcohol, tobacco users only and alcohol users only respectively. *** Statistically significant at 1% level, ** statistically significant at 5% level and * statistically significant at 10% level.

4.5. The distribution of disease burden by household income quintile

Smoking prevalence, alcohol consumption, and disease burden by income quintile is presented in Table 4.4. The results suggest that the prevalence rate of tobacco consumption is primarily higher among those in lower income quintiles while alcohol prevalence on the other hand is higher among individuals from wealthy households. For instance, 24% of those in the poorest income quintile consume tobacco compared to 19% in the highest income quintile (richest)

when household income per capita is used and 26% and 18% respectively when household income per capita adult equivalent is used. Over 18% of those in the poorest income quintile consume alcohol compared to 22% in the highest income quintile when household income per capita is used and 18% and 21% respectively when household income per capita adult equivalent. Using panel data for South Africa, Mukong *et al.* (2017) also found that the prevalence of cigarette consumption was higher among those in lower income quintiles while alcohol use was higher among the higher income quintiles.

Table 4.4: The distribution of disease burden by household income quintile

Variables	**Household Income per Capita**					**Household Income per Capita by adult equivalent**				
	Poorer	**Poor**	**Middle**	**Rich**	**Richest**	**Poorer**	**Poor**	**Middle**	**Rich**	**Richest**
Individual consumes alcohol	17.81	20.39	19.64	20.31	21.85	18.23	20.51	20.30	20.09	20.87
Individual consumes tobacco	24.31	21.00	18.35	17.13	19.22	26.00	20.86	18.27	16.89	17.98
Individual is sick	24.33	23.57	20.98	17.26	13.86	23.72	23.43	20.93	18.72	13.20
Has a chronic disease	19.15	20.43	20.57	19.65	20.20	19.57	20.28	19.92	19.82	20.41
Individual is diabetic	7.73	14.04	20.37	21.78	36.07	8.43	12.88	20.37	22.25	36.07
Has high blood pressure	17.18	20.52	20.69	21.15	20.46	17.44	20.56	20.10	21.15	20.75
Has joint inflammation	20.45	20.62	23.05	21.10	14.77	21.59	19.81	22.24	20.62	15.75
Individual has cancer	13.79	14.94	22.99	11.49	36.78	14.94	14.94	18.39	13.79	37.93
Has heart disease	28.38	19.22	20.82	16.48	15.10	27.69	20.59	20.14	16.70	14.87
Individual is epileptic	27.36	32.08	18.87	11.79	9.91	28.30	30.19	21.23	10.85	9.43
Has respiratory disease	19.40	21.89	18.41	20.15	20.15	19.40	19.40	20.65	19.65	20.90
Has stomach ulcer	26.67	10.00	25.83	22.50	15.00	25.83	11.67	24.17	23.33	15.00
Has chronic kidney disease	26.88	19.35	17.20	21.51	15.05	25.81	20.43	16.13	20.43	17.20
Individual is anaemic	24.29	11.43	17.14	18.57	28.57	22.86	14.29	15.71	20.00	27.14
Has chronic psychological	32.20	24.39	21.95	14.15	7.32	33.66	24.88	20.00	14.15	7.32
Has other chronic diseases	14.48	14.48	19.00	16.29	35.75	16.29	14.48	14.93	20.36	33.94

It is evident from Table 4.4 that 24% of those in the poorest quintile reported being sick in 30 days before the survey compared to 14% in the richest quintile, but the distribution of the prevalence rate of a chronic disease across the income quintiles is insignificant. The prevalence

of chronic diseases such as joint inflammation, heart disease, epilepsy, kidney disease, stomach ulcer and chronic mental health are higher among individuals in the poorest quintiles. On the other hand, cancer, anaemia, respiratory disease, high blood pressure and diabetes are more prevalent in the richest quintile. In South Africa, most of these diseases are more prevalence among those in the poorest quintiles except cancer that is common among those in the richest quintile (Mukong *et al.,* 2017).

4.6. Income-related, tobacco-related and alcohol-related health inequalities

Table 4.5 presents income-related, tobacco-related and alcohol-related health inequality indices for each health indicator. The corrected concentration indices (CCI) for both tobacco prevalence and consumption intensity are generally positive and significantly different from zero, suggesting that poor health is concentrated among tobacco users and even more on heavy users (see Column 1 & 2 of Table 4.5 for comparison). That is, the magnitude of the inequality is significantly higher when tobacco consumption intensity rather than tobacco prevalence is used. Generally, tobacco-related health inequality ranges between -0.005 and 0.046 when tobacco consumption intensity is used and between -0.009 and 0.031 when tobacco prevalence is used. For example, tobacco-related inequality for being sick is 0.025, and having a chronic disease is 0.035 when tobacco prevalence is used compared to 0.027 and 0.031 respectively when tobacco consumption intensity is used.

Table 4.5: Income-related, tobacco-related and alcohol-related health inequality

	(1)	(2)	(3)	(4)	(5)
Individual is sick	0.025*	0.027***	0.009***	-0.037***	-0.035***
	(0.013)	(0.007)	(0.002)	(0.005)	(0.005)
Has a chronic disease	0.031*	0.035***	-0.010***	0.025***	0.030***
	(0.018)	(0.003)	(0.004)	(0.007)	(0.007)
Individual is diabetic	0.007***	0.020***	-0.005***	0.022***	0.023***
	(0.006)	(0.003)	(0.001)	(0.002)	(0.002)
Has high blood pressure	0.022***	0.046***	-0.015***	0.031***	0.034***
	(0.014)	(0.008)	(0.003)	(0.006)	(0.006)
Has joint inflammation	-0.009	-0.005	0.003**	-0.000	0.000
	(0.008)	(0.004)	(0.001)	(0.003)	(0.003)
Individual has cancer	0.004	-0.000	-0.001	0.003***	0.003***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Has heart disease	-0.003	0.002	-0.002	-0.007***	-0.006***
	(0.006)	(0.003)	(0.001)	(0.002)	(0.002)
Individual is epileptic	-0.002	0.003	0.000	-0.008***	-0.008***
	(0.004)	(0.002)	(0.001)	(0.002)	(0.002)
Has respiratory disease	-0.004	0.005*	-0.001	0.001	0.002
	(0.006)	(0.003)	(0.001)	(0.002)	(0.002)
Has stomach ulcer	0.004	0.003*	0.001	-0.000	0.000
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Has chronic kidney disease	-0.005	0.002	0.000	-0.002*	-0.002*
	(0.004)	(0.002)	(0.001)	(0.001)	(0.001)
Individual is anaemic	0.001	0.001	-0.000	-0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Has chronic psychological	0.008*	0.005**	0.003***	-0.007***	-0.007***
	(0.004)	(0.002)	(0.001)	(0.001)	(0.001)
Has other chronic disease	-0.006	0.006**	0.000	0.008***	0.008***
	(0.005)	(0.002)	(0.001)	(0.002)	(0.002)

Note: Standard errors are in parentheses. The Erreygers corrected concentration indices (CCI) are presented in Column (1) to (5). The CCI for tobacco consumers, tobacco consumption intensity, alcohol consumers, household per capita income and household per capita income by adult equivalent in Column (1) to (5) respectively. *** Statistically significant at 1% level, ** statistically significant at 5% level and * statistically significant at 10% level.

Concerning alcohol-related health inequalities, the corrected concentration indices (CCI) are negative and significantly different from zero for having a chronic disease, diabetes, and high blood pressure, suggesting that these diseases are concentrated among non-alcohol users. On

the contrary, the CCI are positive and significantly different from zero for the sick, those with joint inflammation and chronic psychology suggesting that they are concentrated among alcohol users. This suggests the need to investigate the CCI for alcohol consumption intensity since the health effects are supposed to vary depending on the volume and pattern of consumption rather than just the prevalence.

4.7. The Regression estimates for tobacco/alcohol-related health outcomes

Table 4.6 presents estimates of the effect of tobacco and alcohol use on related health outcomes. The results in Column (1) and (4) are marginal effect for being sick, Column (2) and (5) are marginal for having a chronic disease and Column (3) and (6) are OLS estimates for the health index of all chronic diseases. The results illustrate that consuming alcohol increases the probability of being sick by 0.8 percentage points, reporting a chronic disease by 2.5 percentage points and increase the health index score by 0.01 units. Tobacco consumption has no significant effect on the probability of having a chronic disease and health index but increases the probability of being sick by 2.1 percentage point.

Table 4.6: Regression estimates for tobacco/alcohol-related health outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
Individual consumes alcohol	0.008*	0.025***	0.006***			
	(0.004)	(0.006)	(0.001)			
Individual consumes tobacco	0.021***	0.005	0.001			
	(0.006)	(0.008)	(0.002)			
Individual consume tobacco and alcohol				0.018***	0.023**	0.006***
				(0.007)	(0.010)	(0.002)
Individual consume tobacco only				0.002	0.012	0.004*
				(0.009)	(0.012)	(0.002)
Individual consume alcohol only				0.013***	0.023***	0.006***
				(0.005)	(0.006)	(0.001)
Constant			0.019***			0.019***
			(0.004)			(0.004)
Observations	17,813	17,813	17,813	17,813	17,813	17,813
R-squared			0.180			0.180

Notes: Results in Column (1) and (4) are probit estimates for being sick, Column (2) and (5) are probit estimates for having a chronic disease and Column (3) and (6) are OLS estimates for the health index of all chronic diseases. The analysis control household income, place of resident, education, age, gender, marital status and employment. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4.8. The Contribution of smoking and alcohol to income-related inequalities

Table 4.7 summarises the percentage contributions of tobacco and alcohol consumption to the observed income-related health inequality. The contribution of each variable can be positive or negative, depending on the sign of its health effects and its distribution by income (shown by the sign of the CCI). A positive (negative) percentage contribution of each covariate implies that ceteris paribus, income-related health inequality will be higher (lower) if the covariate is equally distributed across income groups, or the covariate has a zero-health elasticity. Tobacco accounts for 0.1% of all measured inequality in the health index, 0.06% for being sick and a maximum of 0.6% for inequality in the prevalence of chronic diseases.

Table 4.7: The contribution of smoking and alcohol to income-related inequalities

	Alcohol consumption				**Tobacco consumption**			
	Elasticity	CI	Contribution	%	Elasticity	CI	Contribution	%
Individual is sick	-0.001	0.011	-0.000	-0.527	0.000	-0.018	-0.000	0.063
Individual has a chronic disease	-0.015	0.011	-0.001	-5.982	0.002	-0.018	-0.000	0.595
Individual is diabetic	-0.004	0.011	-0.000	-1.514	0.000	-0.018	-0.000	0.025
Individual has high blood pressure	-0.013	0.011	-0.001	-5.100	-0.002	-0.018	0.000	-0.639
Individual has joint inflammation	-0.000	0.011	-0.000	-0.076	0.001	-0.017	-0.000	0.416
Individual has cancer	-0.001	0.011	-0.000	-0.284	0.000	-0.018	-0.000	0.050
Individual has heart disease	-0.002	0.011	-0.000	-0.950	-0.000	-0.018	0.000	-0.019
Individual is epileptic	-0.001	0.011	-0.000	-0.543	0.000	-0.018	-0.000	0.164
Individual has respiratory disease	-0.001	0.011	-0.000	-0.313	0.001	-0.018	-0.000	0.397
Individual has stomach ulcer	-0.000	0.011	-0.000	-0.040	0.000	-0.018	-0.000	0.150
Individual has chronic kidney disease	0.001	0.011	0.000	0.279	-0.000	-0.018	0.000	-0.046
Individual is anaemic	-0.000	0.011	-0.000	-0.159	0.000	-0.018	-0.000	0.051
Individual has chronic psychological	-0.001	0.011	-0.000	-0.325	0.000	-0.018	-0.000	0.021
Has other chronic disease	-0.000	0.011	-0.000	-0.130	0.000	-0.018	-0.000	0.020
Health index	-0.003	0.011	-0.000	-1.261	0.000	-0.018	-0.000	0.099

Note: Results presented in this table are elasticities, Erreygers corrected concentration index, contributions and percentages contributions of alcohol and tobacco consumption to income-related health inequality. The results are obtained by decomposition the income-related health inequality indices into health-related covariates, including tobacco and alcohol use. The health indicators are all binary outcomes equivalent to 1 if the respondent is diagnosed of a given disease. The health index is continuous with high values representing poor health outcomes. The tobacco and alcohol consumption variables are both binary equal to 1 if the respondent is a current smoker or drinker regularly. Other variables were also controlled including residential type, education, categories for age, gender, marital status and employment.

Concerning individual health outcomes, tobacco use contributes positively to income-related inequality in being sick (0.06%) diabetes (0.03%) joint inflammation (0.42%) cancer (0.05%) epilepsy (0.16%) respiratory diseases (0.4%) stomach ulcer (0.15%) anaemia (0.05%) chronic mental health (0.02%) and other chronic diseases (0.02%). This suggests that tobacco consumption widens the income-related health inequalities gap for these diseases. However, tobacco consumption contributes negatively to inequality in high blood pressure, heart disease and kidney disease. Many of these findings are consistent with existing evidence that found a positive contribution of tobacco to income-related health inequalities (Vallejo-Torres and Morris, 2010; Mukong *et al.,* 2017). Mukong *et al.* (2017) used similar health indicators and methodology and found that cigarette smoking contributes between 3% and 8% to income-related inequality in health. Vallejo-Torres and Morris (2010) used the EQ-5D[1] as a measure of health and found that smoking contributes up to 2.3% to income-related health inequalities. Thus, any policy options that reduces tobacco consumption are important in reducing the income-related inequalities gaps in the associated diseases.

Contrary to tobacco use, alcohol consumption reduces (contribute negatively) the income-related inequalities for many diseases, accounting for -1.26% of all measured inequality in the health index, -0.53% for being sick and -5.98% for inequality in the prevalence of chronic diseases. For individual health outcomes, alcohol consumption contributes negatively to income-related inequality in diabetes, joint inflammation, cancer, epilepsy, respiratory diseases, stomach ulcer, anaemia, chronic mental health, other chronic diseases, high blood pressure and heart disease but contributes positively to inequality in kidney disease. These findings are contrary to existing evidence that found a positive effects and contribution of alcohol consumption on related health inequalities (Mukong *et al.,* 2017; Deaton *et al.,* 2001).

[1] The EQ-5D is a generic measure of health status which is applicable to a wide range of health conditions and treatments, and provides a descriptive profile that is reducible to a single index value for health status.

The differences in results could be attributed to differences in the measures of alcohol used. For example, Mukong *et al.* (2017) used alcohol intensity while this study used alcohol prevalence. As highlighted earlier, the health effect of alcohol consumption depends mostly on the volume and patterns of consumption rather just the prevalence rate. To address this limitation, this study suggests that future surveys should include questions on alcohol consumption intensity.

Interestingly, the data used for this study suggest that some individuals consume both tobacco and alcohol and some neither consume tobacco nor alcohol. This suggests the need to investigate the separate and joint contribution of tobacco and alcohol consumer the measured inequality in health. Table 4.8, presents the joint contribution of tobacco and alcohol consumption to income-related health inequality. The analysis is limited to self-report health (being sick in 30 days before the survey) having a chronic disease and the health index for chronic diseases. The simultaneous consumption of tobacco and alcohol are positive, accounting for 0.25% of all measured inequality in the health index, 0.13% to inequality in being sick and a maximum of 1.03% for inequality in being diagnosed with a chronic disease. The contributions from tobacco consumption alone are generally positive (ranging from 0.07% for the health index to 0.29% for having a chronic disease, while those from alcohol consumption alone are negative. This suggests that individuals who jointly consume tobacco and alcohol have higher risk of being ill than those who consume only one of these goods.

The outcomes are also consistent with literature suggesting that while alcohol and tobacco alone are strongly related to the risk of ill-health, the simultaneous exposure to these goods had a strong multiplicative effect on health (Castellsague *et al.,* 1999; Hart *et al.,* 2010; Mukong *et al.,* 2017; Wang *et al.,* 2021). The analysis controlled for covariates that are associated with health, so that the estimated effects of tobacco and alcohol consumption are unconditional.

Table 4.8: The combined contribution of tobacco and alcohol consumption to income-related inequalities in health

	Health Index				Individual is sick				Individual has a chronic disease			
	Elasticity	CI	Contribution	%	Elasticity	CI	Contribution	%	Elasticity	CI	Contribution	%
Individual consume tobacco and alcohol	0.001	0.022	0.000	0.245	0.0003	-0.022	0.000	0.129	0.003	0.022	0.000	1.025
Individual consume tobacco only	0.000	0.004	0.000	0.066	0.0006	0.004	0.000	0.249	0.001	0.004	0.000	0.292
Individual consume alcohol only	-0.002	0.033	-0.000	-0.922	-0.0020	0.033	-0.000	-0.802	-0.011	0.033	-0.002	-4.464

Note: Results presented in this table are elasticities, Erreygers corrected concentration index, contributions and percentages contributions of household per capita income, alcohol and tobacco consumption to income-related health inequality. The results are obtained by decomposition the income-related health inequality indices into health-related covariates, including tobacco and alcohol use. The sick and has chronic disease variables are binary and the health index is continuous with high values representing poor health outcomes. The tobacco and alcohol use variables are categorical. Other variables were also controlled including household per capita income, residential type, education, categories for age, gender, marital status and employment.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary of findings and conclusions

Previous studies have attempted to measure the contribution of smoking, alcohol use and obesity to socioeconomic-related inequalities in both self-assessed health and related disease profile (Ballia and Jones 2008; Vallejo-Torres *et al., 2010*; Vallejo-Torres *et al.,* 2014; Mukong *et al.,* 2017). These studies consistently found that tobacco and alcohol abuse contribute positively to income-related inequality in health. Yet, there is a dearth of evidence on the joint contribution of tobacco and alcohol use to income-related health inequalities. The pioneer work of Mukong *et al.* (2017) suggested that while alcohol and tobacco alone contribute positively to income-related inequalities in health, the contribution from the simultaneous exposure to tobacco use and alcohol drinking are enormous. This study attempts to provide evidence of the effect and contribution of tobacco and alcohol use to income-related health inequality in Namibia and in the process contributing to the existing and growing literature by incorporating tobacco/alcohol-related health outcomes. The study also estimates the joint effect and contribution of tobacco and alcohol use to income-related health inequalities.

The study measured tobacco and alcohol-related health inequality and income-related health inequality for a number of health indicators, using the 2015/16 Namibia Household Income and Expenditure Survey (NHIES) a national representative survey and the Erreygers corrected concentration index (CCI). Secondly, the study estimates the effects of tobacco and alcohol on related health outcomes using a probit and the ordinary least square (OLS). Thirdly, a decomposition technique is used to estimate the contribution of tobacco and alcohol use to the income-related health inequalities. The results suggest that the prevalence rate for the majority of the tobacco and alcohol-related health outcomes is significantly concentrated among the

poor and tobacco users but less concentrated among alcohol consumers. The magnitude of the inequalities varies significantly across diseases. For example, the magnitude of the inequality is significantly higher when tobacco consumption intensity rather than tobacco prevalence is used. For alcohol-related health inequality, the corrected concentration indices (CCI) are negative and significantly different from zero for having a chronic disease, diabetes, and high blood pressure and positive for the sick, those with joint inflammation and chronic psychology.

Regarding the simultaneous consumption of tobacco and alcohol, the results suggest that consuming both goods contributes positively to income-related inequality in the health index, inequality in being sick and inequality in being diagnosed with a chronic disease. The contributions from tobacco consumption alone are generally positive ranging from 0.07% for the health index to 0.29% for having a chronic disease, while those from alcohol consumption alone are negative. This suggests that individuals who jointly consume tobacco and alcohol have higher risk of being diagnosed with a chronic disease than those who consume only one of these goods. This is consistent with existing literature suggesting that while alcohol and tobacco alone are strongly related to the risk of ill-health, the simultaneous exposure to tobacco use and alcohol drinking had a strong multiplicative effect on health (Castellsague *et al.,* 1999; Hart *et al.,* 2010; Mukong *et al.,* 2017; Wang *et al.,* 2021). The analysis controlled for covariates that are associated with health, so that the estimated effects of tobacco and alcohol consumption are unconditional.

5.2. Recommendations

The study findings provide an overview of the separate and joint contribution of tobacco and alcohol consumption to the observed income-related health inequalities in Namibia. The separate and joint contribution of these goods to income-related health inequalities are in addition an economic and health burden associated with their consumption. Hence, knowledge

of their separate and joint contribution to income-related health inequalities may provide additional support for policy interventions towards limiting the use of tobacco and alcohol. For instance, while Namibia's tobacco and alcohol industries are regulated under the Tobacco Product Act 1 of 2010 and the Liquor Act 6 of 1998 respectively, these industries are still growing. This suggests that concerted efforts are still required to comprehensively increase capacity to enforce tobacco and alcohol control strategies. Namibia is already party to the WHO Framework Convention on Tobacco control and several control policies such as educational media campaigns, health warnings on cigarette packs, smoke-free areas in workplaces, levies on tobacco and alcohol products have been adopted. However, the implementation of these policies remain a challenge and there is a need to enforce implementation plans.

This study confirms some of the findings in the literature, especially on the joint contribution of these goods to income-related health inequalities. While the individual policy options for these goods could be essential in reducing income-related health inequalities, these results indicate the need to advocate additional measures that could simultaneously control consumption of these goods. With taxation being demonstrated as the most effective policy tool (John, 2008; Warner, 2014) others have suggested that an increase in excise taxes may further undermine household welfare, given that tobacco and alcohol are generally addictive in nature and price inelastic. Therefore, knowledge of the price elasticity of tobacco and alcohol products in Namibia is very crucial for such tax policy. Finally, the media can serve as a catalyst in promoting tobacco and alcohol legislation by providing the necessary information on the harmful effects of tobacco and alcohol usage.

5.3. Further research

Knowledge of the price elasticity of demand for tobacco and alcohol will provide a better understanding of the possible effect of taxation policy in Namibia and motivate legislators to consider the role of taxation in reducing tobacco and alcohol usage. The study could therefore be extended in several ways: First, given that there was no information on the intensity of alcohol consumption, the study was not able to analyse the effects and contribution of alcohol consumption intensity on income-related health inequalities. Therefore, to fully understand the contribution of alcohol consumption to income-related health inequalities, future research should consider studying the effects and contribution of alcohol consumption intensity. Finally, there is need to assess consumers' responsiveness to changes in tobacco and alcohol prices. Research in this area would be important to policymakers to predict with some degree of confidence the effectiveness of taxation policies.

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APPENDICES

Table A 1: Mean health and tobacco/alcohol-related health inequality by disease type

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individual is sick	-0.023***	-0.023***	-0.021	-0.018**	-0.030***	-0.023***	-0.018
	(0.006)	(0.007)	(0.014)	(0.008)	(0.010)	(0.006)	(0.018)
Has a chronic disease	0.034***	0.034***	0.040	0.047***	0.016	0.034***	0.033
	(0.010)	(0.011)	(0.028)	(0.014)	(0.015)	(0.011)	(0.033)
Individual is diabetic	0.023***	0.023***	0.024**	0.034***	0.006	0.024***	0.006
	(0.004)	(0.004)	(0.010)	(0.005)	(0.005)	(0.004)	(0.007)
Has high blood pressure	0.040***	0.042***	0.029	0.059***	0.011	0.040***	0.029
	(0.008)	(0.009)	(0.019)	(0.012)	(0.011)	(0.009)	(0.019)
Has joint inflammation	0.004	0.001	0.025**	0.008*	-0.002	0.002	0.021
	(0.003)	(0.003)	(0.013)	(0.004)	(0.006)	(0.003)	(0.016)
Individual has cancer	0.003**	0.003*	0.006**	0.005**	0.000	0.003*	0.005
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
Has heart disease	-0.005*	-0.007**	0.007	-0.010**	0.002	-0.006**	0.006
	(0.003)	(0.003)	(0.006)	(0.004)	(0.004)	(0.003)	(0.005)
Individual is epileptic	-0.011***	-0.009***	-0.023*	-0.010***	-0.012**	-0.008***	-0.034*
	(0.003)	(0.002)	(0.013)	(0.003)	(0.005)	(0.002)	(0.018)
Has respiratory disease	0.004	0.003	0.009	0.004	0.004	0.003	0.015
	(0.003)	(0.003)	(0.012	(0.005)	(0.005)	(0.003)	(0.015)
Has stomach ulcer	0.000	0.001	-0.001	0.001	-0.001	0.000	0.000
	(0.002)	(0.002)	(0.003	(0.002)	(0.002)	(0.002)	(0.005)
Has chronic kidney disease	0.000	0.003	-0.015**	-0.001	0.003	0.002	-0.012*
	(0.002)	(0.002)	(0.007)	(0.002)	(0.004)	(0.002)	(0.007)
Individual is anaemic	0.001	0.002	-0.003	0.001	0.001	0.001	-0.002
	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)	(0.003)
Has chronic psychological	-0.007***	-0.008**	-0.007	-0.010***	-0.003	-0.007**	-0.009
	(0.003)	(0.003)	(0.005)	(0.004)	(0.002)	(0.003)	(0.007)
Has other chronic disease	0.006**	0.004	0.018***	0.004	0.009***	0.006*	0.010**
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)

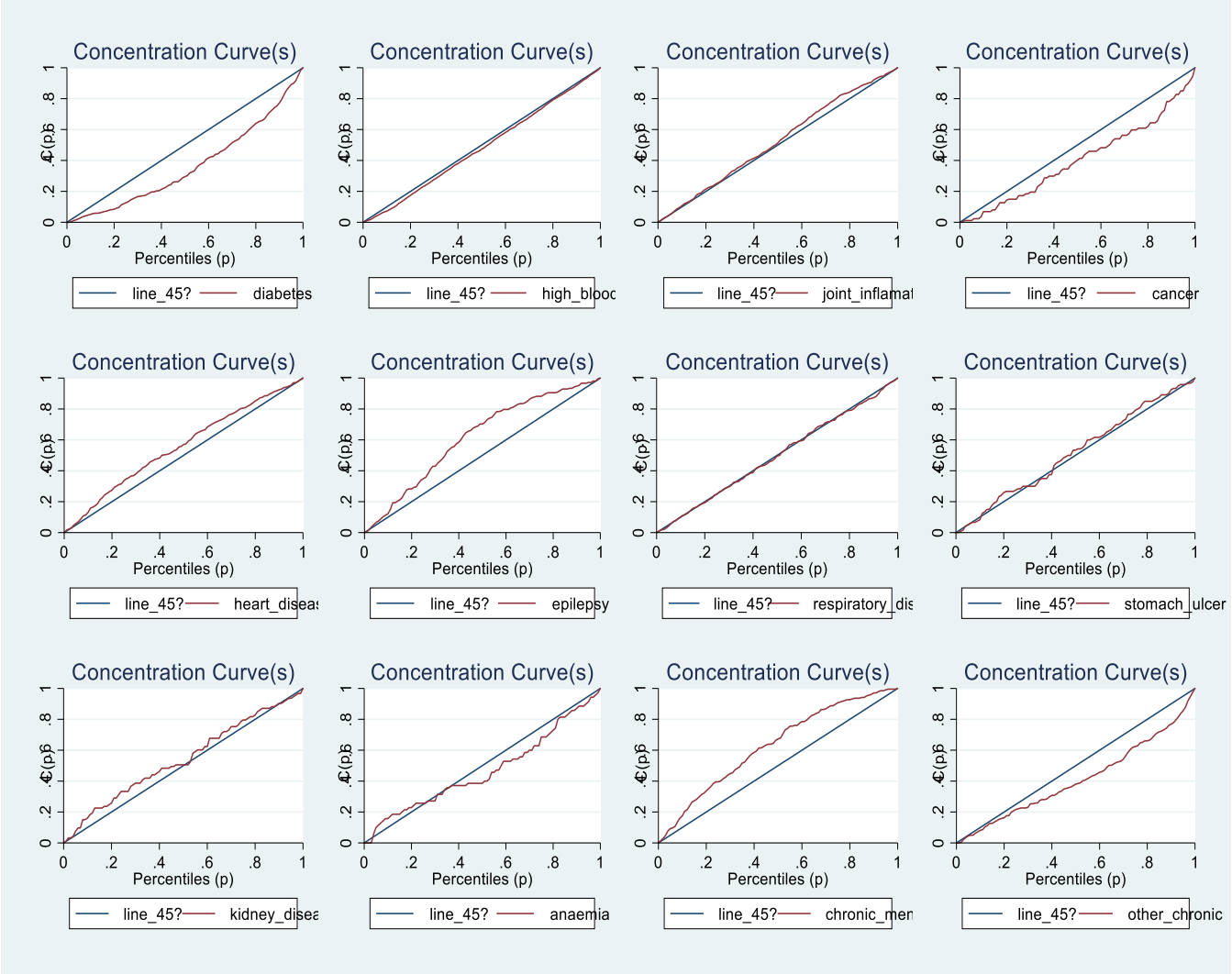
Note: Standard errors are in parentheses. Household income per capita by adult equivalent is used as the ranking variable. The Erreygers corrected concentration indices (CCI) are presented in Column (1) to (7). The CCI for the population, non-smokers and smokers are presented in Column (1) to (3) respectively while the CCI for non-drinkers, drinkers, un-combined smokers/drinkers and combined drinkers and smokers are presented in Column (4) to (7) respectively. *** Statistically significance at 1% level, ** statistically significant at 5% level and * statistically significant at 10% level.

Table A 2: Regression estimates for tobacco/alcohol-related health outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
Individual consumes alcohol	0.008*	0.025***	0.006***			
	(0.004)	(0.006)	(0.001)			
Individual consumes tobacco	0.021***	0.005	0.001			
	(0.006)	(0.008)	(0.002)			
Individual consume tobacco and alcohol				0.018***	0.023**	0.006***
				(0.007)	(0.010)	(0.002)
Individual consume tobacco only				0.002	0.012	0.004*
				(0.009)	(0.012)	(0.002)
Individual consume alcohol only				0.013***	0.023***	0.006***
				(0.005)	(0.006)	(0.001)
Household per capita income	-0.006***	0.004	0.001*	-0.006***	0.004	0.001*
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.001)
Individual is an urban dweller	-0.034***	0.007	0.003**	-0.034***	0.007	0.002**
	(0.004)	(0.006)	(0.001)	(0.004)	(0.006)	(0.001)
Have secondary education	-0.023***	-0.024***	-0.004***	-0.023***	-0.024***	-0.004***
	(0.005)	(0.007)	(0.001)	(0.005)	(0.007)	(0.001)
Have tertiary education	-0.036***	-0.030***	-0.005**	-0.037***	-0.030***	-0.005**
	(0.009)	(0.011)	(0.002)	(0.009)	(0.011)	(0.002)
Age interval 25-34 years	0.012*	0.062***	0.007***	0.012**	0.062***	0.007***
	(0.006)	(0.010)	(0.002)	(0.006)	(0.010)	(0.002)
Age interval 35-44 years	0.014**	0.151***	0.021***	0.014**	0.151***	0.021***
	(0.007)	(0.010)	(0.002)	(0.007)	(0.010)	(0.002)
Age interval 45-54 years	0.017**	0.254***	0.048***	0.017**	0.253***	0.048***
	(0.008)	(0.011)	(0.002)	(0.008)	(0.011)	(0.002)
Age interval 55-64 years	0.012	0.323***	0.073***	0.013	0.322***	0.073***
	(0.009)	(0.012)	(0.002)	(0.009)	(0.012)	(0.002)
Age interval 65+ years	0.022**	0.380***	0.094***	0.023**	0.380***	0.094***
	(0.010)	(0.013)	(0.003)	(0.010)	(0.013)	(0.003)
Individual is male	-0.018***	-0.058***	-0.010***	-0.018***	-0.058***	-0.010***
	(0.004)	(0.006)	(0.001)	(0.004)	(0.006)	(0.001)
Individual is living with partner	0.024***	-0.009	-0.003	0.024***	-0.009	-0.003
	(0.007)	(0.009)	(0.002)	(0.007)	(0.009)	(0.002)
Individual is widowed	0.020**	0.005	0.007**	0.020**	0.005	0.007**
	(0.009)	(0.012)	(0.003)	(0.009)	(0.012)	(0.003)
Individual is divorced/ separated	0.029***	-0.004	0.001	0.029***	-0.004	0.001
	(0.010)	(0.015)	(0.003)	(0.010)	(0.015)	(0.003)
Individual is never married	-0.022***	-0.035***	-0.006***	-0.022***	-0.035***	-0.005***
	(0.006)	(0.007)	(0.001)	(0.006)	(0.007)	(0.001)
Individual is employed	0.007	-0.020***	-0.004***	0.007	-0.020***	-0.004***
	(0.005)	(0.006)	(0.001)	(0.005)	(0.006)	(0.001)
Constant			0.019***			0.019***
			(0.004)			(0.004)
Observations	17,813	17,813	17,813	17,813	17,813	17,813
R-squared			0.180			0.180

Notes: Results in Column (1) and (4) are probit estimates for being sick, Column (2) and (5) are probit estimates for having a chronic disease and Column (3) and (6) are OLS estimates for the health index of all chronic diseases. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Figure A 1: The Concentration Curves for all chronic diseases controlled in the study



Source: Author's computation

APPENDIX C: LANGUAGE EDITING CERTIFICATE

Dr.GM

The Rev. Dr. Greenfield Mwakipesile

ThD, MBA, HBS | mwakipg@outlook.com

CONTACT

PO Box 99539,
UNAM,
Namibia

LANGUAGE & COPY-EDITING CERTIFICATE

22nd November 2021

RE: LANGUAGE, COPYEDITING AND PROOFREADING OF MARTHA TANGENI NGHIPANDULWA's THESIS FOR THE MASTER OF SCIENCE IN ECONOMICS DEGREE OF THE UNIVERSITY OF NAMIBIA

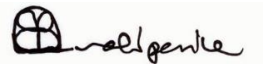
This certificate serves to confirm that I copyedited and proofread **MARTHA TANGENI NGHIPANDULWA's** Thesis for the **MASTER OF SCIENCE IN ECONOMICS DEGREE** entitled: **ESTIMATING INCOME-RELATED HEALTH INEQUALITIES ASSOCIATED WITH TOBACCO AND ALCOHOL CONSUMPTION IN NAMIBIA**

I declare that I professionally copyedited and proofread the thesis and removed mistakes and errors in spelling, grammar, and punctuation. In some cases, I improved sentence construction without changing the content provided by the student. I also removed some typographical errors from the thesis and formatted the thesis so that it complies with the University of Namibia's guidelines.

I am a trained language and copy editor and have edited many Postgraduate Diploma, Masters' Thesis, Dissertations and Doctoral Dissertations for students studying with universities in Namibia, Zimbabwe, Eswatini, South Africa and abroad. I have also copy-edited company documents for companies in the region and abroad.

Please feel free to contact me should the need arise.

Yours Sincerely,



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