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Non-communicable diseases and economic outcomes in South Africa: a cohort study for the period of 2008-2018

Odwa Mfolozi

Student number: MFLODW001

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Health Economics Unit, School of Public Health and Family Medicine, Faculty of Health Sciences

University of Cape Town

Supervised by: Dr O. A. Alaba

Location: University of Cape Town, Observatory, Cape Town, Western Cape, South Africa

Declaration

I **Odwa Mfolozi**, hereby declare that the work in this thesis is based on my original work (except where acknowledgments indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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Abstract

Background: The total number of people living with non-communicable diseases in South Africa currently is unknown even though non-communicable diseases (NCDs) was accountable for 60% of the top ten causes of death in South Africa for the year 2015. In 2016, according to Stats SA, non-communicable diseases were accountable for 57.4% of all deaths in South Africa. In 2011 they were accountable for 23% of years of life lost and 33% of disability adjusted life years. Government total expenditure is also unknown but it is estimated at more than one billion rands per annum for low to middle income countries such as South Africa. NCDs negatively impact the labour market by decreasing labour productivity, increasing employee turnover and early retraction from the labour market. This further decreases individual and household income especially for the urban poor who carry the heaviest non-communicable disease burden in South Africa and contributes to the medical poverty trap as well as, worsening income inequality in South Africa.

Objective: This dissertation investigates the association between non-communicable diseases and labour market participation (LFP) and the effect it has on household income (HHI).

Methods: Using the longitudinal data from the National Income Dynamics Study (NIDS) with information on labour force participation, household income and diseases such as high blood pressure, diabetes, cancer, chronic lung disease, heart problems, stroke, arthritis; were used for analysis. The analysis used the 2008 (wave1), 2012 (wave 3) and 2016 (wave 5) data sets from the NIDS. The analysis is restricted to the population aged 18 years to 65years. The Study examines these associations using logistic and linear regression models for NCDs exposed households and non NCDs exposed households, comparing the two for differences and the effect observed on labour force participation and household Income. The control variables include location, age, race, gender, marital status and level of education. The NCDs are treated as exposure variables with labour Force Participation (LFP) and House Hold Income (HHI) being outcome variables. The study is guided by a conceptual framework that views the household as a unitary function. Lastly, the Policy Brief summarises the issues at hand, the findings and concludes with policy recommendations.

Results: LFP: Based on the regression results, as a group NCDs show a negative relationship with labour force participation as a non-significant decrease but individually it depends on the type of NCD an individual is exposed to. Cancer, stroke and heart attacks are negatively associated with labour force participation. Asthma, diabetes and hypertension are positively associated with labour force participation. When an individual suffers from one NCD the relationship/association depends on the type of NCD, If and when an individual is burdened by a second or third NCD (Co-morbidities) the relationship with LFP tends to be positive (an increase in LFP). HHI: Counterintuitively as a group NCDs is associated positively with household income; a significant increase of 15% at 5 % level of significance. However, individually, hypertension, cancer, asthma, heart problems and stroke have a negative relationship (a decrease) with household income except Diabetes. Objectively there is insufficient evidence to conclude that NCDs decrease household income via decreasing labour force participation indirectly contributing to poverty in South Africa, as majority of household income comes from wages and remittances. Individually almost all NCDs (with Cancer and Hypertension having significant results) decrease household income but as a group increase household income. This requires further investigation into the NCD burdened household dynamics in South Africa.

Conclusion: Therefore, as recommended by the WHO; individual specific interventions will be more effective than population-based interventions to alleviate the ripple effects of the non-communicable disease burden in low to middle income countries (LMIC). Universal Health Care and up scaled prioritisation at Primary Health Care level is needed as NCDs accounted for half the global burden of disease but only received 2% of international donations compared to human immune-deficiency virus (HIV/AIDS) that accounted for 4% of the global burden of disease receiving 29% of international donations and grants.

Dedication:

To the South African homelands and locations, the former labour reservoirs that are undergoing rapid lifestyle and cultural changes. May the information contained in this thesis enlighten you to better position yourselves for the future.

Acknowledgments

My family, all my friends, Chief Mwelo Nonkanyana, Lwando Tanale, Junours Marire and my supervisor Dr Olufunke Alaba. "No bhuti Sipho, Bhala thanks for opening the door"

Abbreviations:

ASgiSA - Accelerated and Shared Growth Initiative for South Africa
CD – Communicable Diseases
CHIPS - Community Health Intervention Programme
COPD – Chronic Obstructive Pulmonary Disease
DALYs - Disability-Adjusted life year
DOH – Department of Health
DPRU - Development Policy Research Unit
GEAR - Growth, Employment and Redistribution Strategy
GEIS - General Export Incentive Scheme
GDP – Gross Domestic Product
GNP - New Growth Path
GP – General Practitioner
HHI – Household Income
HIV/AIDS – Human Immuno-deficiency Virus/Acquired Immuno-Deficiency Syndrome
HREC - Health Research Ethics Committee
JSE – Johannesburg Stock Exchange
LFP – Labour Force Participation
LMIC – Low to Middle Income Countries
NCDs – Non-Communicable Diseases
NDOH – National Department of Health
NDP- National Development Plan
NIDS - National Income Dynamics Study
NPC – National Planning Commission
OECD - Organisation for Economic Co-operation and Development
OOP – Out of Pocket Payments
PSU – Primary Sampling Units
RDP - Reconstruction and Development Programme
SA NBD - South African National Burden of Disease
SES – Socio-Economic Status
TB – Tuberculosis
UN – United Nations
UNAIDS - Joint United Nations Programme on HIV and AIDS
WHO – World Health Organisation
YLL - Years of Life Lost

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Non-communicable diseases and economic outcomes in South Africa: a cohort study for the period of 2008-2018

Background

According to the World Health Organisation (2018), 71% (41million) of all reported deaths globally were due to non-communicable diseases (NCDs), compared to 20 years (1990) before; where they accounted for 47% of deaths globally. The four leading NCDs identified or attributed to these deaths were cardiovascular diseases (17.9 million deaths), cancers (9.0 million deaths), diabetes (1.6 million deaths) and respiratory diseases (including asthma and chronic obstructive pulmonary disease (3.9 million deaths)) with their burden rising rapidly among lower income countries and populations. NCD disease burden measured in DALYs was projected to increase from 33% in 2002 to 45% by 2030 but these have been revised to 57% with the highest incidence going to be in LMIC (Kristensen, 2009), with 79% of deaths due to NCDs already occurring in LMIC, (Meyrowitsch & Bygbjerg, 2006). NCDs have been associated with epidemiological transitions due to urbanization, globalization and modernization resulting in unhealthy lifestyles, poor social habits and dietary changes, (ibid)(GBD 2015 Risk Factors Collaborators *et al,* 2016).

Non-communicable diseases place a huge economic burden on households and individuals. This is evident in the maintenance or control measures of these diseases (Treatment costs, time, lifestyle & diet change), rescue measures (seeking interventions- GP, hospitalisation, transportation) and disability or permanent lifestyle changes for the household (opportunity costs, death of a breadwinner). According to Bloom et al. (2011), it is estimated that NCDs will cost the global market more than 50 trillion US dollars between the years 2011 and 2025. In the context of a global population of six billion people with 80% living in LMIC; NCDs comprise of 49% of the estimated 1.5 billion DALY's that form the overall global burden of disease (Meyrowitsch & Bygbjerg, 2006). According to Mahal, Karan, & Engelgau (2010a), in 2004 India spent 3.3 % of its GDP in out of pocket payments for healthcare, with NCDs accounting for 47% of the expenditure. The economic benefit (using DALY's) of reducing NCD mortality in Russia from 2008 to 2025 at rate of 4.6% per year would save Russia 3.6 to 4.8% of its GDP

(measured using 2002 Russian GDP), (Suhrcke et al., 2006). According to Kankeu et al. (2013), due to lack of financial protection (health insurance) in a number of LMICs, financial costs of NCDs are borne by the Households rather than the governments. Therefore, health insurance is necessary but not enough (Abuosi et al., 2016). This heavy burden on the household can lead to adverse economic outcomes such as impoverishment, early retraction from the labour market with limited ability to generate income (Suhrcke et al., 2006). Impoverishment due to NCD is 50% greater when compared to Communicable Diseases (Ngugi, 2014). Adverse economic consequences of NCDs are more pronounced (both at micro and macro level) in LMIC with poor access (availability, affordability and acceptability) to healthcare (Suhrcke et al., 2006).

In South Africa, in 1996, with a new government in place; a directorate of chronic diseases, disability and genetics was established in an attempt to control and prevent NCDs. The body contributed to new policy and legislation such as the Tobacco Products Controls Act amendment, Liquor Act 59 of 2003, other tax and advertising restrictions. In 2006 the national department of health introduced standard treatment guidelines for management of NCDs; with a shift from an acute care to a chronic healthcare model and other interventions such as CHIPS (community health intervention programme). In 2011 the national planning commission recognised the poor state of healthcare in the country and were aware of their insight shortcomings in the subject matter hence they invited the general public to contribute to possible solutions to the healthcare problem. But all of these have not worked as the prevalence of NCD's among South Africans has continued to increase (Mayosi et al., 2009). South Africa suffers from a quadruple burden of disease (high prevalence of communicable, non-communicable diseases, increasing levels of trauma with high maternal and child mortality), especially among the urban poor population (Mayosi et al., 2009 & 2012). In South Africa, the burden of NCDs increased from accounting for approximately 29% of all deaths in 2008 to accounting for 38,9% of all deaths and 16% of disability-adjusted life years in 2012; with this burden varying between the various age and population groups (Elloker et al., 2012). But according to the 2nd South African National Burden of Disease (SA NBD) Study non-communicable diseases accounted for 43.4% of all deaths in 2012 (Nojilana, n.d.). In 2010 more than 36% of these deaths occurred before the age of 60 years (Nojilana et al., 2016).

According to Bloom et al. (2011), "health is an important aspect of socioeconomic welfare and shapes ones behaviour and capabilities". Health has a direct effect on worker's productivity which translates into labour force participation and income for the individual and household. In South Africa where the economy and the labour markets are anchored by the service industry and cheap labour, this can have adverse economic outcomes for the long run unless precautionary measures are taken (Bertoldi, 2014; Bhorat et al., n.d.; DPRU, 2016).

Problem Statement

South Africa with a population of 57million people, at a growth rate of 1.3%, has 38.3% of its population being vulnerable to NCD's (between ages 30 and 70 years) with a probability of dying from an NCD being 27%, (WHO, 2014). The total number of people living with NCDs in South Africa is unknown, but estimates based on death rates highlight the severity of the situation. Together as a group NCDs are the leading causes of death in South Africa, followed by infectious diseases. But individually TB and HIV/AIDS are responsible for most deaths (29,1%) followed by cerebrovascular disease (7,5%) and lower respiratory infections (4,9%) (Pillay-van Wyk et al. 2016) with Ischaemic heart disease, stroke, diabetes mellitus, and COPD accounting for 6.6%, 6.5%, 2.6%, and 2.5% of all deaths respectively (Elloker et al., 2012).

In a general household survey of 2002 to 2008; Ataguba (2011), found NCD's to be evenly distributed across the socio-economic groups in South Africa as a result of changing prevalence trends. NCD's accounted for 23% of YLL and 33% of DALYs (Bradshaw et al., 2003). NCD's decrease one's quality of life and expected/potential life span whilst contributing to the medical poverty trap. In spite of the vast amount of research and literature about NCD's in South Africa there is a lack of information about the impact of NCDs at household level looking specifically at household income and labour force participation for those in the household. As the individual is affected by a chronic illness their productivity is reduced (Chaker et al., 2015) therefore their ability to maximize wages given their circumstances and capacity is reduced, therefore reducing the individual's income which is translated into the household income and in the long run will affect the socioeconomic status or economic welfare of the household. Individuals never regain their pre-NCD productivity levels despite

treatment (Ngugi, 2014). This reduction in labour productivity often leads to early retirement (Lumsdaine & Mitchell, 1999; Quinn, 1990).

From an economic perspective NCDs introduce deadweight (household inefficiency, increased intra and inter household dependency) and therefore hinders the progress of the individual, household, community and country (Goryakin & Suhrcke, 2017; Suhrcke et al., 2006).

According to Abegunde and Stanciole (2008), in Russia, NCDs have been associated with increased household healthcare expenditures and non-health care expenditures, transfer payments and productivity loses therefore decreasing efficiency in labour supply and decreasing households income whilst economic demands have increased. Subject to contextual factors such as SES, income or wage rate, baseline productivity levels/capacity and social networks the household's disposable income decreases (Gertler & Gruber, 2002; Moodley & Rambiritch, 2007). NCD shock affects household dynamics; financial and intra-household substitution. The dynamics is influenced by current knowledge about NCDs, treatment options and treatment availability, social circumstances, members' role in the household, social welfare of household and capacity to deal with NCD etc. (Mahal, Karan & Engelgau, 2010b). NCDs may also force the patient and other household members to increase labour supply to labour market (Goryakin & Suhrcke, 2017). This is a response to the increasing financial demand of increased household running costs (Nikolic, Staniciole & Zaydman, 2011; World Bank, 2018; Goryakin & Suhrcke, 2017).

Studies investigating microeconomic effects of NCDs as a group and how they affect household dynamics in developing countries, especially Africa is sparse. Many researchers have investigated the effects of health shocks on employment in Bangladesh India, Asia, Russia and Europe (Wagstaff, 2007; Alam & Mahal, 2014; Trevisan & Zantomio, 2016; Garciía Gómez & López Nicolás, 2006; García-Gómez, Jones & Rice, 2010; García-Gómez, 2011). Suhrcke et al. (2007) found using panel regression models, looked at how each NCD individually affected income and employment decisions in Russia while Huffman et al. (2011) looked at how hospitalization due to a cardiovascular disease impacted on household income and individual income in Tanzania, India, China and Argentina. However, this study plans to investigate NCDs as a group and how they affect household income and labour force

participation in South Africa, in the context of high inequality, unemployment and a quadruple disease burden.

Justification/Rationale

The 1996 directorate of chronic diseases, disability and geriatrics, 2006 national guidelines for NCDs management and the WHO global action plan for prevention of NCD's 2013-2020 have prioritised NCDs as they cause a heavy economic burden on individuals, households and the country's economy. According to Bloom et al. (2011), without any intervention NCDs will cost LMIC more than 7 trillion US dollars from 2011 to 2025. Despite the well-known link between health and economic development, low-middle-income countries have paid very little attention to this relationship. This lack of attention or prioritisation is not justifiable. Better health increases labour supply and productivity, indirectly income. There is vast amount of evidence that health is a major contributor to economic growth (Suhrcke et al. 2006). A number of studies have investigated the effect of health on labour market using various diseases as tracer. However, there is limited evidence on the labour market impact of NCDs as a group of diseases, and existing evidence tends to come from developed countries on single diseases. Secondly, majority of the studies rely on cross-sectional data, limiting the possibilities to account for unobserved independent individual characteristics. This study intends to add to the body of literature on the economic burden of NCDs on the household economics in a developing country where there is dearth of literature with regards to this topic. Furthermore, this study plans to apply a panel estimation strategy and estimate models for different types of employment i.es self-employment, formal employment, due to the fact that NCDs illness may have unique effects across these various activities. The study attempts to present the influences of NCD's on South African labour markets and how it affects household income. The findings will contribute to South Africa public health literature by analysing the association of NCDs and the households' income and labour market contributions of those living with and those living with those that carry the burden of NCD's in South Africa. Detailed analysis of the relationship between these factors will enrich the debate on poverty elevation in South Africa and inform relevant policy that will reduce the incidence and prevalence of NCDs.

Aim

To analyse individual and household economic outcomes in the event of NCDs incidence in South Africa

Objectives
The study seeks to address the following objectives;

1. Analyse the impact of NCDs on labour market outcomes using labour market participation as an indicator
2. Examine the effect of NCDs on household income

Literature Review

There is limited empirical evidences assessing the microeconomic effects of NCDs in developing countries including South Africa despite the increasing morbidity and mortality been observed. Non-communicable diseases are defined as a group of idiopathic non-transmittable long-term illnesses. These include diabetes mellitus, cancers, chronic respiratory illness (chronic obstructive airway diseases, Asthma), cardiovascular illness (Hypertension, heart diseases, stroke), osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases. These illnesses develop as the individual grows and are not transmittable from one person to another. Also defined as "a disease that has a prolonged course, that does not resolve spontaneously, and for which a complete cure is rarely achieved" (McKenna et al, 1998). NCDs impose a heavy burden on households globally and across all social classes affected by these diseases. The severity/extent of this burden is somehow always under estimated especially in LMIC due to issues of access into the health system, study methods variability (outcomes looked at, sampling techniques, context, population groups etc.) (Chaker et al., 2015; Ngugi, 2014). A study by Marc Suhrcke and colleagues at the WHO in 2011 showed that there has been a steady increase in household expenditure on NCDs throughout the globe between the period of 1999 to 2014 hence the 'WHO global action plan for prevention of NCD's 2013-2020' especially in LMIC. In Sub Saharan Africa, the 2016 Dar Salam call for action on Diabetes and other non-communicable diseases acknowledged the 2063 development framework for ensuring healthy citizens, with

the global plan for action as a backdrop of the four time bound commitments, therefore an exchange of ideas on how to tackle the NCD burden in these member states was addressed. There has been an increase globally in the amount of money spent on NCDs from 1999 to 2014 (Jaspers et al., 2014) but very little effect is noticeable because NCDs differ from other illnesses due to their chronic nature requiring continuous attention and care. Jaspers et al. (2014) found that NCD's decrease one's ability to earn, changes the Households spending patterns and subjects one to early retirement (therefore decreasing economic activity/potential, reducing savings and contraction of the labour force thereby hindering development).

Effect of NCD incidence on labour supply and income

Table 1 summarizes key studies identified by our review that contain evidence of the impacts of NCDs on labour supply and income. These studies have used various indicators of NCDs and varied economic indicators and models.

Effect of income:

Using McIntyre's framework for economic costs; in India, Grover et al. (2005) found that loss of income accounted for 60% of indirect costs for diabetes mellitus and caregivers lost up to 34% of their income. Earlier in India, (Ryappa et al., 1999), found that in diabetic patients' personal income decreased by 20% and household income by 17%. According to Grover et al (2005), these costs had increased (by 5 to 8 times) compared to those observed by Rayappa et al. (1999) but due differences in measurement are unable to compare relative income losses from 1999 to 2005. Huffman et al. (2011) found in patients that were hospitalised due to cardiovascular diseases there was a decrease in individual and household income for all income groups but with varying effects. The study was done in 4 different countries namely, china, India, Argentina and Tanzania. McKevitt et al. (2011) found that due to the physical and cognitive impairment of stroke there was a loss of income to varying degrees. In London (United Kingdom) in a study by Busch et al. (2009), only 35% of stroke patients were able to return to work with full pay (subject to type of employment and functional state of the patient). Contextual influences were highlighted when Chirikos et al. (2002), found that breast cancer decreased income for the Household in the United States but Eaker et al. (2011), in Sweden, found that breast cancer did not affect income due to sickness benefits. It increased the use of sick leave in the early stages of diagnosis. Paalman et al. (2016) found that breast

cancer increased the risk of losing paid employment. In Cote de Ivoire and Ghana, Khan, Bedi, and Sparrow (2015) found that sick leave decreased average wages by 10%. Employers find ill health and sick leave (including maternity leave) to be costly to organisations; in South Africa the Western Cape government's preference for maximising use of casual employees via labour brokers to decrease employee costs (no work no pay on sick days) is due to the above reasoning. According to Mwai (2016), in a study done in Kenya, NCDs were found to decrease household income by 28% and relative to communicable diseases they decreased household income by 23%.

Effect on labour force participation

Numerous authors found evidence that NCDs lead to decreased labour supply at various points in one's life cycle, lowering household and individual income across all social classes globally. Arrossi et al. (2007) found that Households of patients with cervical cancer had a reduction in working hours by 45%, work interruption by 28%, loss of family income up to 39% with a resultant increase in impoverishment by 10% (45% to 53% of Households are pushed into poverty). These income loses applied to the patient, caregiver and the Household. Using panel regression models; in Russia, Suhrcke (2017), found that patients with chronic respiratory diseases did not decrease their labour supply into the labour market but actually increased as the illnesses' in their controlled state did not limit their ability to work significantly. But on the other hand, he found that chronic kidney diseases reduced the patients wage rate in the long run. He concluded with findings that the effect of chronic illnesses on labour supply varied based on income level. The lower the income the greater the influence over retirement decisions with low income earners retiring much earlier than their rich counter parts.

Garcia and colleagues analysed the effects of health on labour supply and household income but more specifically in relation to health shocks (Garciía-Gómez & López Nicolás, 2006; García-Gómez et al., 2010; García-Gómez et al., 2013). Initially they looked at how being unemployed leads to poor health. In 2010, Gomez looked at several countries in Europe and found that a health shock increases the chances of being unemployed and is associated with lower wage rates. Gomez again used the British household panel survey in 2008, where he found similar results, with a health shock increasing the probability of being unemployed by 3.5% and decreasing the probability of finding employment for those who were already

unemployed. He also found that poor health limits one's options in the labour market and limits the duration of time spent employed. These results were similar to those of Taylor in 2000 (using the British household survey) and Stewart in 2001. But Riphahn in 1998 had used panel data in Germany and found that even though the financial impact of health shocks seems small, state welfare interventions targeted at the poor were unable to absorb these effects. This has led to the suspicion that the problem is bigger than it appears to be. In 2014 Alam and Mahal did a literature review and concluded that health shocks did decrease labour supply by the household to the market and they suffer income loses due to health shocks. He also noted that the definition of health shocks was broad and encompasses acute illnesses hence he recommended measuring the economic impact of NCD's on household income and labour market participation using longitudinal data. This is further supported by the fact that the WHO global action plan for prevention of NCD 2013-2020 motivates for research on Households and NCDs.

Table 1: Study Proposal Mini Literature Review Table

#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	Study outcome
		Study Description				**Explanatory Variables**			**Outcome variables**		**Study outcome**
1	(Garcíía Gómez and López Nicolás, 2006)	Spain	European Community Household Panel	Probit regression model	Self-reported	Employment transitions (Employed to unemployed)	Education Age gender			Self-reported Health status	No significant difference found
	(García-Gómez, 2011)	Netherlands, Denmark, Spain, Ireland, France and Italy.	European Community Household Panel	Probit regression with fixed effect model for panel data	Self-reported	Health shock	age, gender, marital status, household income, number of children, % individual income that goes to household income, works full-time, duration and type of employment, occupation, chronic condition, disability due to illness, region		Employed to unemployed/ disability		Outcomes are country context specific
	(García-Gómez, Jones and Rice, 2010)	Britain	British Household Panel Survey (1991-2002)	Ordered Probit regression model	Self-reported	Ill health (Effect of ill health on labour market transitions)	age, gender, marital status, educational, ethnicity and region		Employed Unemployed		Health status affects entry and exit into the labour market by the same intensity

#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	Study outcome
			Study Description			**Explanatory Variables**			**Outcome variables**		**Study outcome**
	(García-Gómez *et al.*, 2013)				Self-reported Health shock measure as an acute hospitalisation	Health shock on employment outcome and income 6 years post shock		% decrease in income	Probability of employment		Health shock lowers the employment probability by 7 percentage points and results in a 5 percent loss of personal income two years post shock.
2	(Trevisan and Zantomio, 2016)	Europe	English Longitudinal Study of Ageing and the Survey of Health, Ageing and Retirement in Europe	Propensity score matching	Self-reported	Health shock	•age, gender, income, number of children, education, employment, household size, disability, father dead, mother dead,		Employed or unemployed	Perceived health status, subjective life expectancy	acute health shock on average doubles the risk of an older worker leaving the labour market, as well a reduction in perceived life expectancy
3	(Kankeu *et al.*, 2013)	LMIC	literature review	literature review		NCD				Financial costs of NCDs on households	financial costs of obtaining care impose barriers to access, which illustrates the urgency of improving financial risk protection in health in LMIC

			Study Description			Explanatory Variables			Outcome variables		Study outcome
#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	
4	(Suhrcke, Nugent, *et al.*, 2006).		Mini literature review			NCD			labour supply and labour productivity	consumption and savings education and human-capital	There is evidence on the impact of chronic disease on both labour supply and labour productivity
	(Suhrcke *et al.*, 2005)	Europe	Literature review	Cost of illness approach, literature review		Health status		Individual income	Employed unemployed		Several studies from high-income countries show that poor health negatively affects wages and earnings, but the extent of the impact differs across studies. In the studies reviewed, men appear to reduce their own labour supply by substantial amounts in the event of their wives' illness, while in the reverse case women tend to increase their labour supply.
	(Goryakin and Suhrcke, 2017)	Russia	Russia Longitudinal Monitoring Survey—Panel	OLS models with individual fixed effects	Self-reported	ill health	Age, gender, location, education,		Employed or unemployed		People with poor self-assessed health living in rural areas are less likely to stop working, compared to people living in cities.

		Study Description				**Explanatory Variables**		**Outcome variables**		**Study outcome**
#	**Reference**	**Country**	**Study Population**	**Study Design**	**measurement**	**Type of exposure**	**Control Variables**	**income**	**Labour force participation**	**Other**	
5	(Chaker *et al.*, 2015)	Global	Systemic literature review	Literature review		NCD	Age		Unemployed, return to work, sick leave		People with DM, COPD and survivors of breast and especially lung cancer are at a higher risk of reduced labour market participation.
6	(Ngugi, 2014)	Kenya	Kenya household health expenditure and service utilization data Cross-sectional	Linear Probability regression Model	Self-reported	NCD	Age, gender, location, education, health state, employment, marital status, alcohol, smoking, fruit & veg consumption, health insurance, OOP expenditure	Household income		Catastrophic expenditure	NCDs reduce household income by 28.64 percent
7	(Ryappa *et al.*, 1999)	India	Survey	Pilot study	Self-reported during interviews	Diabetes	sex, location, education, occupation, family income, family history of diabetes, age of diagnosis, duration of illness and complications			indirect costs are mainly related to lost productivity from those working and employed	Personal Income ↓ 20.9% Family Income ↓ 17.4% Forced other family member to work (7.9%) Changed jobs 5.9% Unable to work 14.7%

		Study Description					Explanatory Variables		Outcome variables		Study outcome
#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	
8	(Huffman *et al.*, 2011)	Argentina, China, India, and Tanzania	Survey	Univariate and multivariate logistic regression models	Self-report via questionnaire	Cardiovascular disease Hospitalisation	age, gender, marital status, educational, ethnicity and region, income, comorbidities	Individual income			Participants from all countries and all income groups (esp. the poor) reported a decrease in individual incomes after a CVD event.
9	(McKevitt *et al.*, 2011)	United Kingdom	Survey from Medical Research Council General Practice Research Framework general practices and 2 population-based stroke registers	Cross-sectional data, linear regression models	Self-reported	Stroke event	Age gender, race, disability, SES	Individual income		Unmet needs	Proportions reporting unmet clinical needs ranged from 15% to 59%; 52% reported reduction in or loss of work activities, significantly more from black ethnic groups; 18% reported a loss in income and 31% an increase in expenses with differences by age, ethnic group, and deprivation score.
10	(Busch *et al.*, 2009)	Britain	Survey Questionnaire to people from the South London Stroke Register.	multivariable logistic regression analysis	Self-reported	Stroke event			Return to employment		At 1 year only 35% of 266 survivors had returned to paid work.

#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	Study outcome
					Study Description		**Explanatory Variables**		**Outcome variables**		**Study outcome**
11	(Eaker *et al.*, 2011),	Swedish	Swedish population-based clinical register during 1993–2003	A cohort study. Conditional logistic Regression models	Self-reported	breast cancer		Individual income	Employment probability		No effect on income was found, breast cancer negatively influences working capacity both 3 and 5 years after diagnosis
12	(Paalman *et al.*, 2016)	Netherlands	14 916 Patients were identified Netherlands Cancer Registry (NCR). Income and social benefits data from Statistics Netherlands.	A cohort study. multivariable Cox regression models		breast cancer			Employment outcomes		BC survivors experienced higher risk of losing paid employment. Axillary lymph node dissection increased losing paid employment
13	(Khan, Bedi and Sparrow, 2015)	Bangladesh	poor urban households in Bangladesh Panel data		Self-reported	Health shock	Age, gender, location, education, health state, employment, marital status, food and non-food consumption, OOP expenditure, debt, income	household income	labour supply		Despite maintaining household labour supply, serious illness exerts a negative effect on income for the poor.

			Study Description			**Explanatory Variables**			**Outcome variables**		**Study outcome**
#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	
14	Mwai, (2016)	Kenya	Kenya Household Health Expenditure and Utilization Survey of 2007 data	OLS regression models	Self-reported	NCDs	age, household size, gender, location, marital status, epidemiological environment such as prevalence of NCDs or sickness	household income			NCDs reduce household income by 28.64%. NCDs are associated with a 23.17% reduction in household income relative to a household affected by communicable disease.
15	(Pelkowski and Berger, 2004)	USA	Health and Retirement Study data	retrospective study OLS regression with fixed effects	Self-reported	Health shock	age, race, and years of education, marital status	Individual income	Employment (hours worked)		Females are found to have larger reductions in wages, but males have bigger decreases in hours worked.
16	(Jaspers *et al.*, 2014)	Global	Systemic review	Systemic review and meta-analysis		NCDs		Household income			Heterogeneity in results There is evidence that a number of people Experience financial hardship due to NCDs, as income losses affect patients and their caregivers driving households into financial catastrophe and impoverishment.

	Study Description				Explanatory Variables		Outcome variables			Study outcome
#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	
17	(Liu and Zhu, 2014)	China		OLS regression models with fixed effects	Self-reported income and measured HbA1c concentration levels	Diabetes		Individual income			Diabetes leads to a 16.3% decrease in annual income.
19	(Abegunde and Stanciole, 2008)	Russia	Living Standard Measurement Surveys (LSMS) from Russia	(OLS) regression model, Probit regression	Self-reported	NCDs	Age, gender, education, number of kids, income, obesity, marital status	Household income		Employment status	Chronic diseases are significantly associated with higher levels of household healthcare expenditure in Russia and productivity losses reflected by reduced labour supply and reduced household labour income.
20	(Gertler and Gruber, 2002)	Indonesia	Panel data from the National Socio-Economic Survey of House- holds (SUSENAS)	OLS regression with fixed effects	Self-reported	Health shock	Age, sex, family size, education	Individual and household income	labour supply measured as hours worked and as employed or unemployed	Consumption	These results have several implications. First, neither illness nor chronic illness symptoms have any effect on total household earnings and, therefore, are unlikely to have any effect on consumption. Second, since the head's ADLs did

#	Citation	Country	Data source	Method	Data type	Condition		Outcome			Findings
											not affect the labour supply of other family members, households are using methods other than labour substitution to insure consumption if at all.
21	(Mahal, Karan and Engelgau, 2010b).	India	Multiple databases from the Central Statistical Organization (CSO) and the Reserve Bank of India	Literature review and ordinary least squares (OLS) regression models.	Self-reported data from surveys such as National Sample Survey Organization	NCD		Household income		Aggregated gross Income loss	In 2004, assuming that all care-givers and sick individuals above the age of 15 years were productive yielded an annual income loss from NCDs of one trillion rupees. More than one-third of all income losses were due to CVD and hypertension.
	(Alam and Mahal, 2014)	LMIC		Literature review		health shocks		Household income	Labour supply		Health shocks cause reductions in labour supply among households in LMICs, and households (esp. low-income ones) are unable to fully smooth income losses from health shocks.

#	Reference	Country	Study Population	Study Design	measurement	Type of exposure	Control Variables	income	Labour force participation	Other	Study outcome
			Study Description				**Explanatory Variables**		**Outcome variables**		**Study outcome**
22	(Nwosu and Woolard, 2015)	South Africa	National income dynamics study	Cross-sectional data (Waves 1 and 3) bivariate Probit model	Self-reported	Communicable diseases	Age, gender, occupation, race, industry, location, education,		labour force participation		A positive and significant association found between health and LFP
	(Nwosu, Woolard and Patrizio Piraino, 2015)	South Africa	National income dynamics study	Cross-sectional data bivariate Probit model and linear probability model	Self-reported	Self-assessed health status	Age, gender, occupation, race, industry, location, education,	Individual wages	labour force participation		Better health had a positive impact on labour force participation in both cross-sectional and temporal setting. Males had higher labour force participation probability than females, household grant receipt was associated with reduced LFP probability. Education and age were associated with increased LFP. Location also played an important role in determining LFP as living in traditional authority areas was associated with reduced LFP relative to residing in other areas.

Study conceptual framework

The labour market is a platform or arena where the household sells off its labour for a wage or income. The consumer theory is also used to analyse the trade-off between labour and leisure time. Time becomes the constraining factor, as it is limited, so a trade-off is made between how much time is spent on labour (implicit in labour is the wage rate or income) and how much time is spent on leisure. Pertaining to labour force participation (labour supply) there are two conflicting effects, the income effect and the substitution effect (Robbins, 1997; Economica, 1997; Becker, 1965; Dickinson, 1999; Derobert, 2001). The substitution effect states that poor health decreases productivity hence wages therefore people substitute low wages for more leisure time (Zhang, Bansback & Anis, 2011). The income effect states that poor health leads to low wages therefore people work more to make up for the low wages (e.g. nurses overtime) (Suhrcke et al., 2007). The study's conceptual framework uses Abegunde and Stanciole's (2006) conceptual framework as a platform to build a new framework (Figure 1) that highlights the effect of NCDs on the economy starting at individual level, household level, the firm and eventually feeding into the macroeconomic arena. According to Abegunde and Stanciole (2006), there three common approaches to analysing the economic impact of NCDs; the cost of illness approach, the full-income method and the economic growth models (focusing on the impact on human capital or on labour supply). We shall limit our study to the latter.

At the individual level, Becker's (1965) human capital theory was modified by Grossman in 1972 where the commodity of health is seen as capital stock that yields healthy time but depreciates over time but can be augmented through health market inputs and time. Ignoring its underlying assumptions and conceptual limitations, it assumes that young healthy people have a lower rate of depreciation with a wider time horizon and are therefore more inclined to invest in themselves (hence the higher savings compared to the unhealthy).

Grossmans Human capital theory advocates for investments in health stock. Health stock is a form of human capital that depreciates over time, NCD's increase the depreciation rate of this health stock. NCDs decrease the individuals' current productivity as seen in the study's conceptaul framework. NCD's also decrease one's ability to generate investment or health inputs into the health stock such as decreasing one's ability to exercise and generate income.

This occurs against the backdrop of fixed costs/expenses therefore decreasing the individuals' disposable income.

Based on Grossman's theory, poor health causes people to value leisure time more (to be able to attend to themselves). This is supported by the fact that healthy people retire later than unhealthy people (whether they are more educated is still a debate). But Goryakin and Suhrcke (2017), found that the unhealthy do not reduce their supply of labour hours in an effort to be able to meet their financial needs and at times provide slightly above average hours. This change in labour supply is support by the income effect argument hence the conceptual framework allows for both increases and decreases in labour supply post NCD burden. But poor health does change the time horizon for labour market participation for the unhealthy as they tend to retire earlier (Chaker et al., 2015; Trevisan & Zantomio, 2016). Hence the WHO in 2001 and 2002 advocated for investments in health for developing nations using the human capital approach to support their reasoning.

A good health baseline for human capital allows for better education outcomes and contributing to a bigger more productive/efficient labour force. This intern allows for bigger retirement savings for the population as these are used as the main source of funds for investment by the state in developed countries. NCD translates in wasted investments or less incentive to invest in people as the investment is not worth the reward.

The effect of NCDs on individual productivity is translated into changes in labour supply depending on circumstances, less disposable income available and decreased investment in health. This makes the individual more dependent on available support systems (e.g. family, social security benefits etc.). As the individual is less productive the household as a functional unit also becomes less productive therefore having less disposable income with changes in labour supply, less investment and greater dependency on available support structures. As with the household the firm is affected by less productive individuals translating into a less efficient labour force with lower profit margins and less investment in labour force and a higher dependency on government interventions. This all leads to overall poor economic growth, increased poverty and inequality as depicted in figure 1.
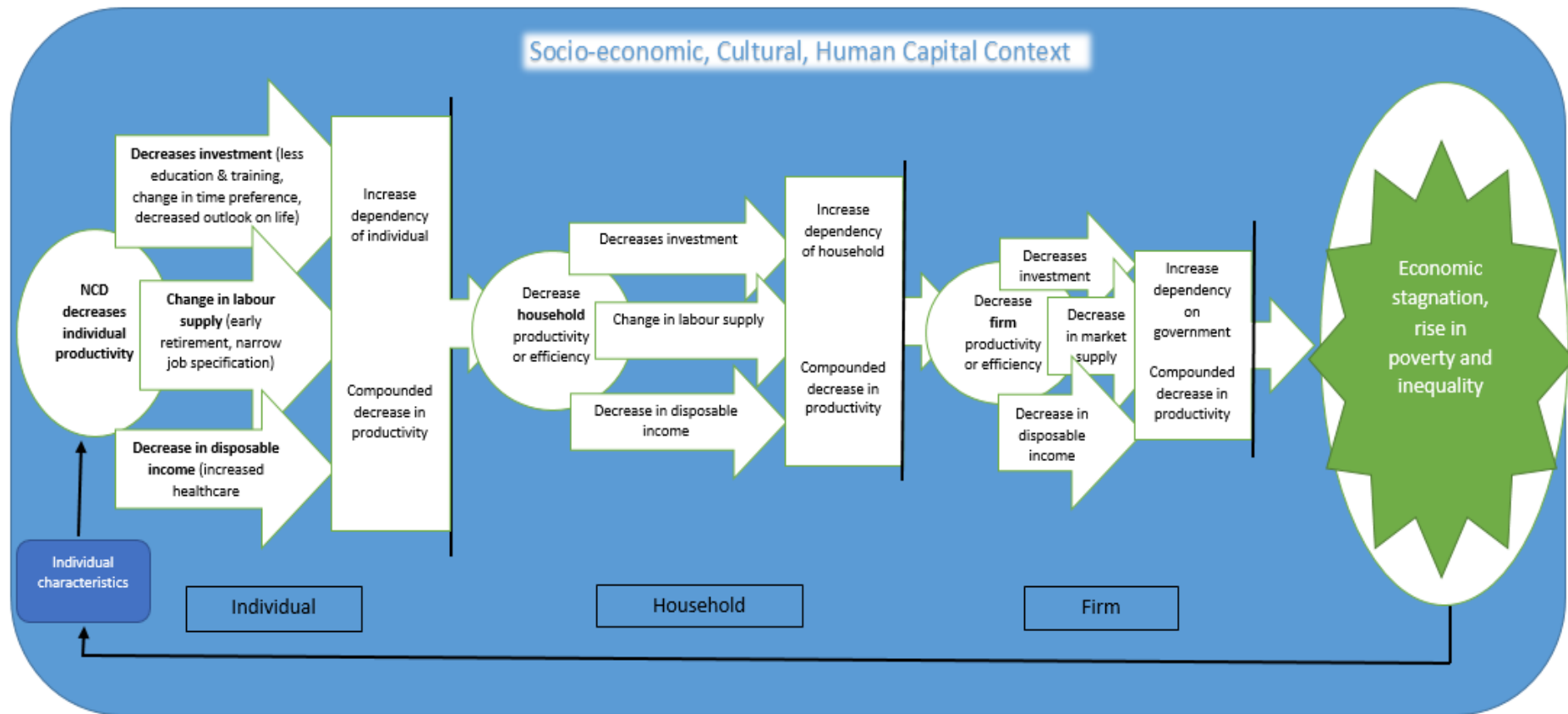
Socio-economic, Cultural, Human Capital Context

Decreases investment (less education & training, change in time preference, decreased outlook on life)

Increase dependency of individual

NCD decreases individual productivity

Change in labour supply (early retirement, narrow job specification)

Decrease in disposable income (increased healthcare

Compounded decrease in productivity

Individual characteristics

Individual

Decreases investment

Increase dependency of household

Decrease household productivity or efficiency

Change in labour supply

Decrease in disposable income

Compounded decrease in productivity

Household

Decreases investment

Increase dependency on government

Decrease firm productivity or efficiency

Decrease in market supply

Decrease in disposable income

Compounded decrease in productivity

Firm

Economic stagnation, rise in poverty and inequality

Figure 1: Study's Conceptual Framework

Source: Abegunde & Stanciole 2006. conceptual framework was used as a starting point for building the study's conceptual framework

Methodology

Data source

The study will utilize data collected by the School of Economics at the University of Cape Town as an initiative of the South African government (South African Presidency) via Southern Africa Labour and Development Research Unit and Department of Planning Monitoring and Evaluation. Using the National Income Dynamics study (NIDS) to "track and understand the shifting face of poverty", over period of 8 years from wave 1 in 2008 to wave 5 in 2018. The NIDS is a data set consisting of four waves, the first wave was conducted in 2008 and it consists of 7300 South African households and 28000 individuals, with an average attrition rate of 16% between the waves .This master sample was stratified into 53 districts with 3000 PSU and NIDS used 400 of these (a random selection of PSU within each strata (subset) of the master sample), spread across the 9 provinces of South Africa (48% of Households are in rural areas while 52% are in urban areas). The NIDS data sets are also open source and are available to the public for download on the website http://www.nids.uct.ac.za/. Ethical consideration/approval of the questionnaire, study protocols and consent forms were done by the University of Cape Town's Senate ethics committee.

Model specification

This study aims to examine the impact of self-reported NCD status on economic outcomes of individuals and households using labour force participation and household income as indicators respectively, applying a fixed effect model. Compared to a single cross-sectional analysis, a fixed effect model allows controlling for unobserved personal characteristics that could bias the estimates.

For labour force participation, equation 1 will be estimated with a logistic regression. Logistic regressions estimate the odds of a certain event occurring by transforming the dependent variable into a logit using the maximum likelihood estimation (Gujarati, 2004).

Logit model (LFP) $\quad \boldsymbol{y_{it}}^* = \alpha + \Omega + \beta_1\,NCD_{it} + \dots + \beta_k x_{k,it} + \lambda_t + \mu_{it}$----------------------***eqn 1***

> *Where:* $\quad \boldsymbol{y_{it}}$=*labour force participation of individual I at time t (a binary variable)*
>
> $\quad\boldsymbol{\alpha}$= *constant*
>
> $\quad\Omega$=*fixed effect (Individual fixed effect)*

NCD_{it}= a binary variable taking a value of 1 at time t if the respondent reports having any type of NCD (diabetes mellitus, cancers, chronic respiratory illness (chronic obstructive airway diseases, Asthma), cardiovascular illness (Hypertension, heart diseases, stroke), osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases)

x_{it}= Controlled variables (Age,Race,Sex,Education,Occupation,income ,labour force participation)

λ_t = time fixed effect

μ_{it}= error term (captures unmeasurable characteristics such as physical appearance)

For household income, the ordinary least squares regression estimation as expressed in equation 2 will be used to identify the association as the outcome variable is a continuous variable. The outcome variable will be transformed to log. The OLS method uses a set of explanatory variables of a function to apply the least squares estimation method to estimate unknown response parameters (Gujarati, 2004).

OLS model (HHI) $ln\,Y_{ht} = \alpha + \Omega_i + \beta_1 NCD_{ht} + \ldots + \beta_k x_{k,ht} + \lambda_t + \mu_{ht}$ ------------------**eqn 2**

Where: $ln\,Y_{ht}$= log of household income (h) at time (t)

α= constant

Ω_i=fixed effect (household fixed effect)

NCD_{ht}= a binary variable taking a value of 1 at time t if the respondent reports having any type of NCD (diabetes mellitus, cancers, chronic respiratory illness (chronic obstructive airway diseases, Asthma), cardiovascular illness (Hypertension, heart diseases, stroke), osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases)

$x_{k,ht}$= Controlled variables (Age,Race,Sex,Education,Occupation,income, labour force participation)

λ_t = time fixed effect

μ= error term (captures unmeasurable characteristics such as social wealth)

Definition of a household; a household is collection of individuals that form a single unit of dwelling with the same utility and goals in mind. The sum of the individual incomes from the individuals in the household will equal the household income. Based on Becker's household

utility model, unit is assumed to maximise market prices subject to household budget, individuals a have joint decision-making process with similar preferences (Becker, 1987; Becker, 1965; Lancaster, 1975).

Measurement of Variables

Exposure variable:

1. Non-communicable disease/s

A self-reported health status and condition from the adult questionnaire for each primary sample member and continuous sample member above the age 18. All NCDs will be categorized into 1 for expose and 0 for non-exposure. Non-communicable diseases are defined as a group of idiopathic non-transmittable long-term illnesses. These include diabetes mellitus, cancers, chronic respiratory illness (chronic obstructive airway diseases, Asthma), cardiovascular illness (Hypertension, heart diseases, stroke), osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases. These NCDs will be considered as an exposure that affects one's ability to earn and participate in the labour market

Outcome variables:

- Labour force participation
  Labour market participation; a self-reported voluntary engagement in the labour market in return for an income/profit. Each individual is categorized into one of two mutually exclusive categories, employed (formal or self-employed) and unemployed. This will be classified as a binary categorical dependent variable identified as 1 if employed or 0 unemployed.
- Household Income
  Household Income; In the data set, total household income is a continuous variable that will be an outcome of an OLS regression subject to the various explanatory variables to visualise the association between NCDs and income in South Africa for the period. This will be logged so it follows a normal or near normal distribution for a linear regression analysis using ordinary least squares. NCDs directly and indirectly influences the households' income through various pathways; by affecting the

individuals' productivity and expensive high health expenditure that depletes the household savings. For this analysis NCD infected households will be compared to non-NCD infected households.

Controlled Variables: variables considered in this study are informed by literature

1. Area of residence –this is a categorical variable from the household questionnaire and will be transformed into a dummy variable with 1 for urban location and 0 for rural location. Area of residence in South Africa influences both the exposure and the outcome, as the labour reservoirs (previous homelands) still provide the least amount of job opportunities, despite skills set, education and other influential factors. Even thou those that live in urban areas tend to have better access to health care facilities (Nwosu and Woolard, 2017), this does not equate to less NCD burden and less effect on the microeconomic outcomes considered by this research.

2. Age – self-reported from the adult questionnaires. This is captured as a count variable but will be square-root transformed to allow it to follow a normal or near normal distribution. It then will be transformed into a categorical variable with age group categories of ten years starting from 18 years of age. The age category 15 and younger documented via the child questionnaire will be ignored as the South Africa labour laws and human rights do not allow minors to participate in the labour market. Age is considered as an independent variable as various age groups prioritise various social/societal activities. E.g. the duration of schooling which directly affects labour force participation varies based on a variety of factors such as access, academic ability, personal drive etc.

3. Race – Self reported from adult questionnaire. This is a categorical variable that is captured as best race coded as 1 for African, 2 for coloured, 3 for Asian/Indian and 4 for white population groups. This variable will be treated as a categorical variable with white population group as the reference group.

4. Sex – Sex will be captured as a categorical variable and transformed into a dummy variable with 1 for male and 0 for female. Sex must be considered individually and carefully interpreted due to traditional gender discriminatory nature of the South African labour market; women, lesbians, gays and transgender individuals have less prospects of being employed, especially in labour intensive working environments, (Coovadia et al., 2009).

5. Education - self reported categorical variable coded in numeric values as best education from the adult questionnaire. This variable will be transformed into a categorical variable with primary schooling (1), high schooling (2), tertiary schooling (3) and no schooling (0), with no schooling being the reference group.

6. Occupation - This is a self-reported information in the NIDS data set, this will be transformed into a categorical variable of 0 manual labour/unskilled labour, 1 technician/semi-skilled labour, 2 technical/skilled labour and 3 abstract/highly skilled labour with unskilled labour being the reference group.

7. Marital status - This is also self-reported information in the NIDS data set, this will be transformed into a categorical variable of 0 married and 1 for unmarried with married being the reference group. Married women traditionally dedicate more time to household activities then labour market activities with men have better compensation (higher wage rate) than women.

Data Analysis

Data analysis will be done using STATA 14 software (Stata corp. Inc., college station, Texas, USA). Sample characteristics will be analysed using descriptive statistics. The panel regressions will use the fixed effect model as it will take into account omitted time invariant variables that influence the explanatory variables such as culture, NCD risk factors (unhealthy lifestyles, diet, etc.) (Williams, 2012). The fixed effect model takes into consideration the omitted variables (Ω) that affect independent variables over time and do not change (ibid). Time dummies will also be included to capture trends overtime with (λ_t) representing time fixed effects such as the 2008 global recession).

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Research Ethics

The study will utilise data that is already available in the public domain. The NIDS data is available from the University of Cape Town through the Southern Africa Labour and Development Research Unit (SALDRU). Every effort was made to remove personal identifier information from the publicly available NIDS dataset (names and contact details are kept separately from the public release data) (De Villiers et al. 2013). This research was submitted to Faculty of Health Research Ethics Committee (HREC) of the University of Cape Town (UCT).

Reporting and Implementation

The outcome this study is intended to contribute to South African public health and economic literature, inform policy makers. The outcomes will be available to the public on the University of Cape Town's website and a journal publication will be made available.

Part B: Literature review

Introduction

Global concern over the macro- and micro-economic vulnerability of developing nations to increased disease burden in general, and to Non-communicable diseases (NCDs) specifically, has been on the rise, finding expression in the recent Sustainable Development Goals (Mirelman et al., 2016). Developing countries are not only struggling with high levels of public debt, inequality, poverty and unemployment, but they also have these problems compounded by the prevalence of, and magnitude of the burden of NCDs. There are also high levels of pre-mature mortality from NCDs (ibid). In the age of fiscal austerity, public funding for managing NCDs is becoming increasingly inadequate and global NCDs funding interventions that recognise the developmental challenges that NCDs truly are, have also been impacted by austerity economics (Babones, 2013).

The economic effect of NCDs relates to loss of human capital and increased fiscal burden for social welfare payments for families that are left vulnerable after their breadwinners are affected by NCDs, (Jan et al., 2018). In as much as NCDs have macroeconomic impacts at the national, regional and local levels, they also have microeconomic effects at the household/individual level. This is in terms of reduced household/individual income due to loss of productivity, increased financial burden of out-of-pocket (OOP) expenditures on health, and general decline in the ability of the household to accumulate human capital, (Engelgau, Karan & Mahal, 2012).

Despite the increasing burden of NCDs, microeconomic evidence is sparse (Alam & Mahal, 2014; Mirelman et al., 2016). Mirelman et al. (2016) proposed an agenda for future research "to disentangle the mechanisms through which economic impacts from an NCD death occurs". Jaspers et al. (2014, p1) also argue that the impact of NCDs on "household expenditures and poverty indicators remain less well understood". Theoretically, it is expected that NCDs can affect income earning capability/capacity, productivity, wealth accumulation, economic growth, human capital accumulation, inequality and poverty (Alam & Mahal, 2014; Engelgau, Karan & Mahal, 2012; Mirelman et al., 2016). The discrepancies between theory and reality compel researchers to explore such theory by way of the scientific method to safe guard and enrich public health evidence on the microeconomic effects of NCDs.

The purpose of the review is to evaluate what others have found in their studies of the impact of NCDs, the methods they used, the data and variables they used. The review focuses on microeconomic effects of NCDs, as the study seeks to investigate microeconomic impacts of NCDs, relating to the labour market and household income, in South Africa. Thus, studies that focus on macroeconomic effects of NCDs are excluded from the review. As Alam and Mahal (2014) pointed out, studies focusing on the effects of NCDs on household welfare are only starting to emerge and are very few and limited in geographic extent. Jaspers et al. (2014 p 1) also urge: "Given the scarcity of information on specific regions, further research to estimate impact of NCDs on households and impoverishment in LMIC, especially the Middle Eastern, African and Latin American regions is required". This makes the present study an important contribution from a South African contextual perspective.

Background of South African Household income and Non-communicable diseases.

The 1996 directorate of chronic diseases, disability and geriatrics, 2006 national guidelines for NCD management and the WHO global action plan for prevention of NCDs 2013-2020 have prioritised NCDs as they cause a heavy economic burden on individuals, households and the country's economy. According to Bloom et al (2011) without any intervention NCDs will cost LMIC more than 7 trillion US dollars from then period of 2011 to 2025.

NCDs make it difficult for the poor to break the poverty cycle in South Africa in a context of previous structural discrimination that is remnant in the various markets in South Africa (Seekings, 2008; Maile, 2013). The quadruple burden of disease burdens the poor far more than the rich, in which case in South Africa this can be seen in the demographics of the population (Mayosi et al., 2012). Very little has changed in South Africa for the poor (ibid). They need to have a continuous source of income, either from the labour market or remittances. Their lives have simulated instruments of the economic work tools with a maturity date, entering the labour force young and healthy, exiting at old age permanently (those who are fortunate exit with some sort of grant (pension old age etc.)).

The problem of NCDs hinders' social and economic development whilst increasing household and individual impoverishment (Abegunde & Stanciole, 2006). The issue with NCDs in South Africa is further perpetuated by the epidemiological concentration of NCDs in the various

groups of the population especial the urban poor, now even worsening disparities (Mayosi et al., 2012). Those who live with NCDs are at risk of/ vulnerable to decreased productivity in the face of an inaccessible (availability, affordability, acceptability) health system among other things. This may lead to decrease in individual income, decreased labour force participation and others being impoverished (Abegunde & Stanciole, 2008). This adds to socially constructed health burdens, sometimes forcing others into the medical poverty trap. Against this backdrop NCDs have placed huge burden on the individuals and their households, where they continuously incur the fixed costs of NCD palliative or conservative care management. Even thou both have decreased baseline productivity and income earning potential, subjectively vulnerable to impoverishment and with limited labour market participation relative to the healthy; the poor have to spend a relatively larger proportion of their income to maintain their current state of health compared to their rich counterparts. Individuals and households have to readapt themselves and reprioritise intra and extra household labour activities such as labour substitution or re-allocation, they face a greater opportunity cost with decreased income earning potential and eventually deceasing their quality of life subjectively and socioeconomically.

Background of South African Labour market.

The South African labour market has transformed since 1994 but is still battling with high unemployment, high income inequality and skills shortage (Stats SA, 2014; Altman, 2007). The current unemployment rate stands at 26.7% with the broad definition including the discouraged being at 34% (Stats SA, 2017; DPRU, 2016) with an unknown number moving in and out of the labour market.

Overall trends or patterns highlighting the ins and outs of the labour market are not clear as those that are available have been masked by data collection methods and analysis techniques.

A simple example is how the financial services industry has been seen to be a labour absorbing industry for the past 2 decades with growths from 25% in 1994 to 45% in 2009 to 47.36% in 2014, Stats SA (2014). Many authors suggest the growth is overrepresented as labour brokers

or temporary employment agencies are classified under this banner (financial services) (DPRU, 2016; Cohen & Moodley, 2012; Bhorat et al., 2014; Bhorat et al., n.d.; Altman, 2007). The agencies reduce employee costs and liabilities for firms throughout the South African economy especially for labour intensive industries as they are subcontracted to provide temporary labour as needed. This was supported by the GEAR policies of 1996 under the flexible employment wage variation and barring of independent investigations with dissolution of the wages board. They distribute the various skilled and unskilled labour to the various industries. In conclusion through contextual investigations into the South Africa labour market influences are needed, hence the proposal to investigate the influence of NCDs on the South African Labour market using a nationally representative datasets such as NIDS.

According to Edwards (2001 & 2005), the labour market issue stems from the 80's where employment increased till 1984 (non-state employment 6.7 million) then slowly declined from 1988 (due to industry specific issues such as competition, demand shifts despite protectionism with GATT agreement post Uruguay round) to 1997 (non-state employment 6.05 million) and labour liberalisation was not the cause of job losses. Shifts within this period of labour force contraction consisted of 10% skilled workers and 22% non-skilled in 1988 and by 1997 18% skilled and 21% unskilled labour in the market. Job creation has been the main focus since before 1994, the General export incentive Scheme (GEIS) was implemented from 1990 to 1996. In 1994 the Reconstruction and Development Programme (RDP) advocating for increasing employment via economic growth, Growth Employment and Redistribution (GEAR)-liberalisation of labour and increasing wage flexibility/variation (1996), Accelerated and Shared Growth Initiative for South Africa (AsgiSA) in 1999 also encouraging labour flexibility and increasing skilled labour, New Growth Path (NGP) going in a slightly different direction via encouraging employment via the private sector (investing in labour absorbing industries) with labour market and wage regulations. The latest initiative is the National Development Plan (NDP) for 2030 which aimed to decrease unemployment to 14% by 2010 and to 6% by 2030 by creating jobs using SMME's and public works programmes.

According to the United Nations (2015), the South African working age population (16 years to 64years) grew by 8.5 million from 1980 to 2010 with only 58% participating in the labour market. According to Nattrass (1998), almost all household income in South Africa comes from labour market participation via wages and remittances. Based on comparative data from

1993, SA manufacturing wages were much higher in relation to productivity (SA ranked 7th in wages and 10th in income wages) (ibid). In November 2016 a national minimum wage of 20 Rands per hour was proposed. The minimum wage bill was in parliament (in April 2018) with an implementation date of May 2018 and to be phased in over a period of 2 years and will affect 45% of wage earners (6 million people) (OECD, 2017). This will affect mostly the private sector SMME's specifically outsourced services such as cleaners, security guards, primary agriculture and forestry, domestic workers and construction workers.

Within this labour-intensive labour market, there are limited studies in South Africa that try to tease out the economic consequences of living with NCDs at individual and household level, nor by gender.

1. Theoretical literature Review

Non-Communicable Diseases

Non-communicable diseases (NCDs), previously known as chronic diseases, are a group of diseases which tend to be of long duration and generally of slow progression. The main defining feature of NCDs is their non-infectious (non-transmissible) cause. The four main types of non-communicable diseases are cardiovascular diseases (like hypertension, heart attacks and stroke), cancer, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes; others include autoimmune diseases, chronic kidney diseases, osteoarthritis, osteoporosis, mental illnesses, Alzheimer's diseases and others.

They are as a result of a combination of genetic, physiological, environmental, lifestyle and behavioural factors. Since some of the risk factors are modifiable they are also considered to be preventable diseases (WHO, 2006). Other factors such as a person's income and social environment (also known as "social determinants of health") also increase the risk of developing NCDs (Scott & Schneider, n.d.). The World Health Report of 2002 from the WHO identified five main risk factors for non-communicable diseases; obesity, alcohol abuse, smoking, hypertension and raised cholesterol. The World Health Organisation (2018) postulates that if these risk factors were eliminated, approximately 80% of heart diseases,

strokes and type 2 diabetes' with 40% of cancers, could be prevented. Interventions targeting these risk factors are effective in reducing the prevalence of NCDs but do not receive the necessary attention as NCDs consequences/burden tend to be underestimated (Mirelman et al., 2016; WHO, 2006). NCDs affect all South African households directly or indirectly and the study investigates their association with labour market participation and household income.

Household Economic theory

Päivi Mattila-Wiro's (1999) review concluded that no particular economic theory is advanced enough to dominate household economics. Therefore, a number of theories listed below are considered to have influenced this study.

Traditional economic theory

Even though the assumptions do not always hold; Traditional economic theory assumes that people are rational, have perfect knowledge/information and have a well-ordered set of preferences. The household is seen as a single unitary unit that is self-sufficient and rational in behaviour, leading to the conclusion that the ill health of one member of the household will be seen/translated to ill health of the unit (household) with extrapolation into the greater economy (Jan et al., 2018). Traditional economic theory asks how good health can contribute to economic growth and stability. NCDs will affect the households' ability to sustain their income and participation in the labour market as a unit, should a member be burdened with an NCD. "A stable and resilient economy contributes to good health significantly" (Pelkowski & Berger, 2004, p 2) and good health contributes to economic growth; with the household being the starting point as it provides/supplies resources to the economy. Traditional economic theory gives a background into why the study will treat the household as a single economic unit and why if one member is affected by an NCD, everyone in the household is evidently affected.

Grossmans theory

Becker's human capital theory was modified by Grossman in 1972 where the commodity of health is seen as a capital stock that yields healthy time but depreciates over time (Heckman, 2015). This capital stock can be augmented through health market inputs and time. Ignoring its underlying assumptions and conceptual limitations, it assumes that healthier people have

a lower rate of depreciation with a wider time horizon and are therefore more inclined to invest in themselves (hence the higher savings compared to the unhealthy). Based on Grossman's theory, poor health makes people value leisure time more (to be able to attend to themselves). Evidence shows that healthy people retire later than unhealthy people (Rodríguez-Sánchez & Cantarero-Prieto, 2017; Abegunde & Stanciole, 2008). But Goryakin and Suhrcke (2017), found that the unhealthy do not reduce their supply of labour hours in an effort to be able to meet their financial needs and at times provide slightly above average hours. Poor health significantly changes the time horizon for labour market participation for the unhealthy as they tend to retire earlier (Abegunde & Stanciole, 2008). Hence the WHO in 2001 and 2002 advocated for investments in health for developing nations using the human capital approach to support their reasoning (Bloom et al., 2011). A good health baseline for human capital allows for better education outcomes and contributing to a bigger more productive/efficient labour force. This intern allows for bigger retirement savings for the population as these are used as the main source of funds for investment by the state in developed countries. NCDs translate to wasted investments or less incentive to invest in people as the investment rewards yielded are below market value relative to international markets (Bertram et al., 2018; Nugent et al., 2018). Grossmans theory highlights the importance of health within the household and how various individauls view health as a commodity for investment in relation to limited time. This theory will have a barring on the studies results and open avenues for discussion.

Labour market participation:

The labour market is defined as a platform where suppliers of labour (individuals and households) interact/batter with consumers of labour (firms, households and individuals) for a variable medium of exchange.

Consumer theory

The consumer theory is also used to analyse the trade-off between labour and leisure time. Time becomes the constraining factor, as it is limited, so a trade-off is made between how much time to spend on labour (implicit in labour is the wage rate or income) and how much time is spent on leisure (NCD treatment and prevention). Pertaining to labour force participation (labour supply) there are two conflicting effects, the income effect and the

substitution effect (Parkin, 2010). The substitution effect states that poor health decreases productivity hence wages therefore people substitute low wages for more leisure time. The income effect states that poor health leads to low wages; therefore people work more to make up for the low wages (e.g. overtime shifts) (Goryakin & Suhrcke, 2017). The income effect dominates for low level employees as working longer hours equal more income to take home (ibid). This theory also opens avenues for discussion for the study's results as the complexity of individual and household time allocation is multifactorial.

2. Methodological literature Review

See Table 2 for methodology and data variable comparisons.

The review begins by looking at household income. Abegunde and Stanciole (2008) use the life standards measurement survey in Russia to investigate the impact of chronic diseases on households and individuals looking at how chronic illnesses affect labour income, healthcare and non-health care expenditure. Regarding healthcare expenditure the two step Hackman model was used to separate the context specific decision to incur health expenditure costs and the decision on the intensity of expenditure to be incurred. Regarding labour income an OLS regression with a fixed effect model was employed. Instrumental variable estimators were used to test for endogeneity in the estimates, employing the Hausman and Sargans test to discriminate between the fixed and random effect estimators. The study found that chronic illnesses were associated with higher household healthcare expenditures, with decreased labour supply therefore decreased income. The study found that household income decreases at a rate of 4.8% for every NCD found in the household with the probability of receiving transfer payments increasing by 2%. In 2011, Eaker et al. (2011) using a cohort study combining 3 data sets, in Sweden investigated the economic impact of breast cancer on individuals post diagnosis from 1993-2003. The study employed subgroup comparisons' using conditional logistic regression between pre and post diagnosis health welfare status, unconditional logistic regression was used to compare between the various stages of breast cancer. A Poisson regression model was used to account for other influential variables such

as working life, income and marital status. The study found a diagnosis of cancer had a negative influence on working capacity but no significant impact on income due social insurance policies and labour market regulations. In 2015, Jaspers et al. (2014) conducted a systemic review on the global economic impact of NCD on households the study found in some LMIC that NCDs decreased household income.

Pelkowski & Berger (2004) using a health and retirement survey data in the USA, investigated the impact of health on wages and labour supply. The study used longitudinal data with OLS regressions (log-wage and dummy variables for health status), a fixed effect model and Heckman model to correct for selection bias. The study concluded; a chronic health state increased unemployment by 6.3%, reduced labour supply measured in hours by 6.5% and reduced wages by 6.6%, at a 1% level of significance. Thirteen years later using the Spanish National Health Survey Data, Rodríguez-Sánchez & Cantarero-Prieto (2017) investigated the effects of Diabetes on the labour market relative to other chronic conditions/illnesses. The study utilises the Grossman model as a conceptual framework of departure. To estimate the effect of Diabetes on labour, the study used a Probit model with a dichotomous dependent variable (employed and unemployed), an ordered Probit for earnings and independent variables (age, gender, marital status, education and other lifestyle indicators). Using a Probit model with duration of unemployment as a proxy for number of work days lost, the study found a negative relationship with short term unemployment and a positive relationship for long-term unemployment ranging from 0.9 to 8.4 percentage points. The study concluded diabetes increases the probability of a low income and decreases the likely hood of lower high earnings. In Russia, Goryakin and Suhrcke (2017) also investigated self-assessed health status and labour market outcomes using longitudinal data. Using a binary dummy for log hours worked as a dependent variable the regression also included health dummies, socioeconomic variable dummies, time invariant factors and a time effect variable as independent variables. They applied an OLS regression and a fixed effect model. The study found that poor health perceptions, myocardial infarction, stroke, diabetes, liver disease and lung disease significantly reduced labour supply whilst controlling for other influential factors such as disability.

Arrossi et al. (2007) studied the socioeconomic impact of cervical cancer on patients and households using cross-sectional data from the living standards survey (patients interviewed

6 weeks after radiotherapy) in Argentina. Using a univariate and multivariate logistic regression the study found that cervical cancer patients are less likely to lose working hours or increase working hours for univariate results. For multivariate results they are more likely to lose family income. Huffman et al. (2011), investigated the economic impact of CVD in selected LMIC (Tanzania, Argentina, India and China). The study used a survey, of inpatients admitted for CVD in these 4 countries. The study used univariate and multivariate logistic regression models. The study found that work time (and working activities) was reduced by 70 up to 100% and household work time was reduced by 2 to 25%. Paalman et al. (2016) investigated employment benefits 10years post breast cancer diagnosis in the Netherlands using their cancer registry. Using a multivariate cox regression, the study found that relative to those without breast cancer those affected by breast cancer experienced a decline in employment and loss of income (the young patients had a higher risk of employment loss).

In south Africa Nwosu & Woolard (2015), investigated the impact of health (self-assessment of health state) on labour force participation using panel data from the NIDS for the first 3 waves. Using bivariate Probit model and a linear probability model the study found that better health is positively associated with labour force participation (health improvement is associated with an 11% increase in labour force participation). See table 2 for list of articles reviewed.

Conceptual Frameworks

Several conceptual frameworks that are considered to be essential/influential for the analysis of household income and labour force participation in an NCD burdened household are described briefly below.

Conceptual framework 1

Figure 2: Conceptual framework for the impact of NCDs on individual and households
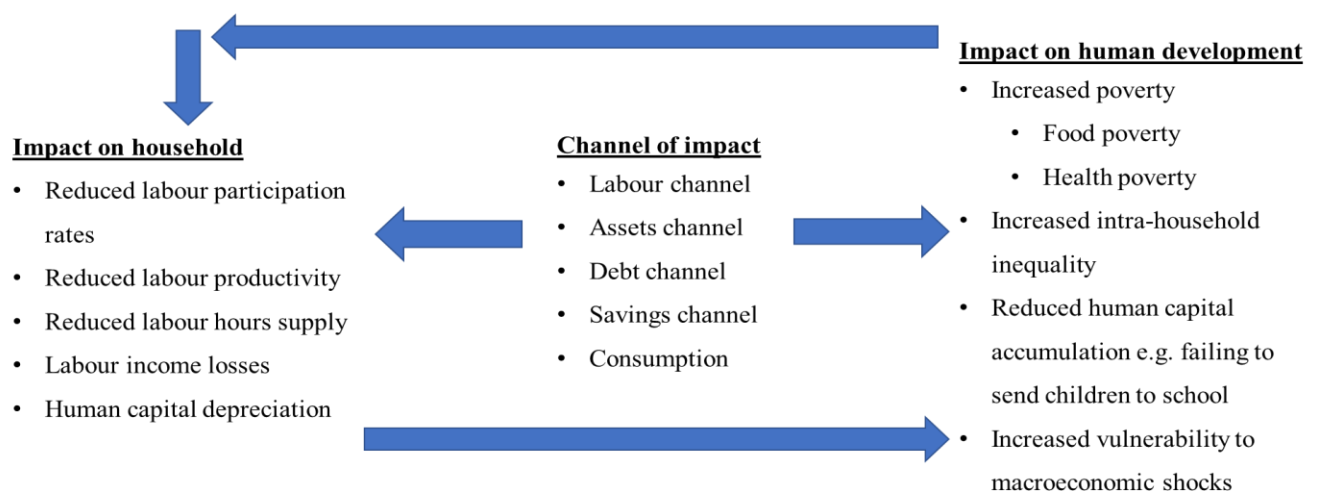
Source: Framework modified from McIntyre et al. 2006 for the analysis of economic impact of NCDs on individuals and households.

The primary mechanism through which an NCD impacts the household is the total amount of time supplied to the labour market by both the sick member and caring member or members. If the wage rate is assumed to be linearly related to the number of labour hours supplied, it can be shown that loss of extended hours of work time can easily lead to huge labour income losses (Becker 1965). Similarly, in households where self-employment is a source of income, then the right variable to think about is profit. The amount of profit a self-employed person who lives in a household that has a member suffering from an NCD is an outcome of the interaction of business success and the time that such a person can supply to the running of the business. Several observations follow from this simple heuristic. NCDs have unequal distributional and productivity effects in the household depending on whether it is a working/self-employed member or a non-working member of the family who is sick.

Figure 3: McIntyre et al.: Cost of Illness Approach; Simplified flow-chart of key issues relating to the economic consequences of illness.
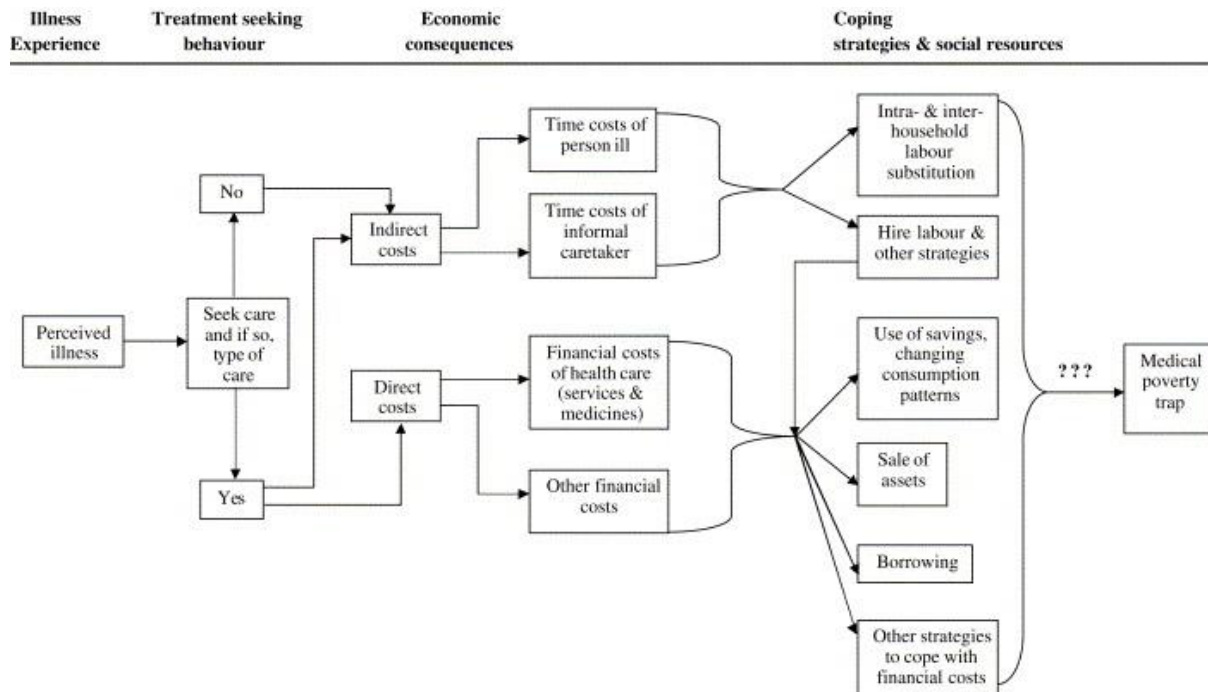

Source: McIntyre et al. 2006

Using a meta-theoretic approach, McIntyre et al. (2006) developed a conceptual framework in the study of the microeconomic effects of illness on household welfare. The model disaggregates economic effects of illness into direct and indirect costs as well as coping mechanisms of the affected households. The model postulates that increasing privatization of health care provision is associated with increased household vulnerability and poverty in general, especially amongst non-affluent households. Several authors have also found similar regressive effects of privatised health care; these include Alam and Mahal (2014); Buigut, Ettarh and Amendah (2015); Engelgau et al. (2012); Jaspers et al. (2014); Mirelman et al. (2016). Several transmission channels of the impact of illness on households are identified, not least savings channel, consumption channel, asset channel, debt channel, labour productivity channel, income channel as well as time reallocation channel with child labour aspects (Alam & Mahal, 2014; McIntyre et al., 2006). The savings channel manifests through dissaving to finance OOP expenditures. Sometimes, reallocation of funds from consumption

to medical expenditure must occur where there are no savings (Alam & Mahal, 2014). Other channels such as debt and asset channels have the long-term effect of undermining the sustainability of household livelihoods in the future because of household indebtedness and manipulative practices of loan sharks on the one hand, and asset stripping on the other. The interaction of medical cost and loss of income due to sickness are hypothesised to create a medical poverty trap, which has long run effects of sustaining the compromised economic and social vulnerability of the affected household or individuals (McIntyre et al., 2006). McIntyre et al.'s (2006) meta-analysis revealed that indirect costs of illness range between two to four times the size of direct costs. Like Alam and Mahal (2014), McIntyre et al. (2006) also found that private health care is regressive against female headed households.

Conceptual framework 3

Figure 4: Linkages between chronic illnesses and the economy: The Poverty Spiral
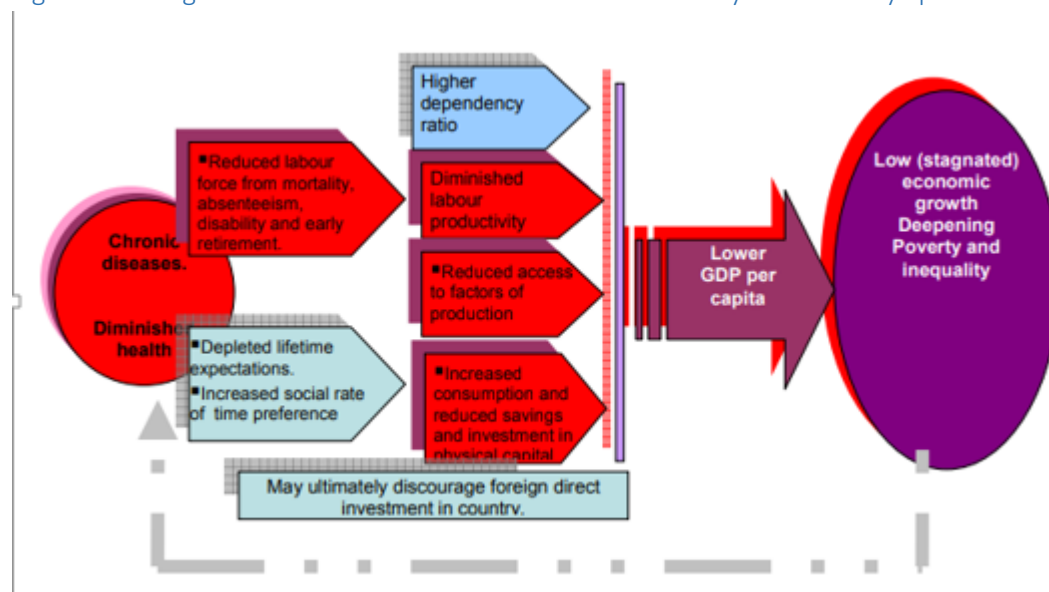
Source: Abegunde & Stanciole 2008

Abegunde & Stanciole's (2006) working paper at the WHO explored the economic consequences/cost of NCD mortality at a national level from 9 countries (Brazil, Canada, China, India, Nigeria, Pakistan, Russian Federation, the United Kingdom and Tanzania) demonstrating how these costs will increase if no intervention ensues and what the potential economic benefit would be if these interventions are able to control the burden of chronic

diseases. The framework establishes links between the NCDs and the macro-economy via individuals, households, the labour market and firms and eventually the national accounts. They find that chronic diseases affect an individual who lives in a household by decreasing the productivity of the household as a unit and allocating resources of the household to care for the NCD (increasing dependency). This further decreases the households' participation in the various markets (labour, financial and education) leading to low GDP per capita and low economic growth resulting in poverty and inequality.

Current Studies conceptual framework

The labour market is a platform or arena where the household sells off its labour for a wage or income. The consumer theory is also used to analyse the trade-off between labour and leisure time. Time becomes the constraining factor, as it is limited, so a trade-off is made between how much time is spent on labour (implicit in labour is the wage rate or income) and how much time is spent on leisure. Pertaining to labour force participation (labour supply) there are two conflicting effects, the income effect and the substitution effect (Robbins, 1997; Economica, 1997; Becker, 1965; Dickinson, 1999; Derobert, 2001). The substitution effect states that poor health decreases productivity hence wages therefore people substitute low wages for more leisure time (Zhang, Bansback & Anis, 2011). The income effect states that poor health leads to low wages therefore people work more to make up for the low wages (e.g. nurses overtime) (Suhrcke et al., 2007). The study's conceptual framework uses Abegunde and Stanciole's (2008) conceptual framework as a platform to build a new framework (Figure 1) that highlights the effect of NCDs on the economy starting at individual level, household level, the firm and eventually feeding into the macroeconomic arena. According to Abegunde and Stanciole (2006), there three common approaches to analysing the economic impact of NCDs; the cost of illness approach, the full-income method and the economic growth models (focusing on the impact on human capital or on labour supply). I limited the study to the latter.

At the individual level; Becker's human capital theory was modified by Grossman in 1972 where the commodity of health is seen as capital stock that yields healthy time but depreciates over time but can be augmented through health market inputs and time. Ignoring

its underlying assumptions and conceptual limitations, it assumes that young healthy people have a lower rate of depreciation with a wider time horizon and are therefore more inclined to invest in themselves (hence the higher savings compared to the unhealthy).

Grossmans Human capital theory advocates for investments in health stock. Health stock is a form of human capital that depreciates over time, NCD's increase the depreciation rate of this health stock. NCDs decrease the individuals' current productivity as seen in the study's conceptaul framework. NCD's also decrease one's ability to generate investment or health inputs into the health stock such as decreasing one's ability to exercise and generate income. This occurs against the backdrop of fixed costs/expenses therefore decreasing the individuals' disposable income.

Based on Grossman's theory, poor health causes people to value leisure time more (to be able to attend to themselves). This is supported by the fact that healthy people retire later than unhealthy people (whether they are more educated is still a debate). But Goryakin and Suhrcke (2017) found that the unhealthy do not reduce their supply of labour hours in an effort to be able to meet their financial needs and at times provide slightly above average hours. This change in labour supply is support by the income effect argument hence the conceptual framework allows for both increases and decreases in labour supply post NCD burden. But poor health does change the time horizon for labour market participation for the unhealthy as they tend to retire earlier (Chaker et al., 2015; Trevisan & Zantomio, 2016). Hence the WHO in 2001 and 2002 advocated for investments in health for developing nations using the human capital approach to support their reasoning.

A good health baseline for human capital allows for better education outcomes and contributing to a bigger more productive/efficient labour force. This intern allows for bigger retirement savings for the population as these are used as the main source of funds for investment by the state in developed countries. NCD translates in wasted investments or less incentive to invest in people as the investment is not worth the reward.

 The effect of NCDs on individual productivity is translated into changes in labour supply depending on circumstances, less disposable income available and decreased investment in health. This makes the individual more dependent on available support systems (e.g. family,

social security benefits etc.). As the individual is less productive the household as a functional unit also becomes less productive therefore having less disposable income with changes in labour supply, less investment and greater dependency on available support structures. As with the household the firm is affected by less productive individuals translating into a less efficient labour force with lower profit margins and less investment in labour force and a higher dependency on government interventions. This all leads to overall poor economic growth, increased poverty and inequality as depicted in figure 1.
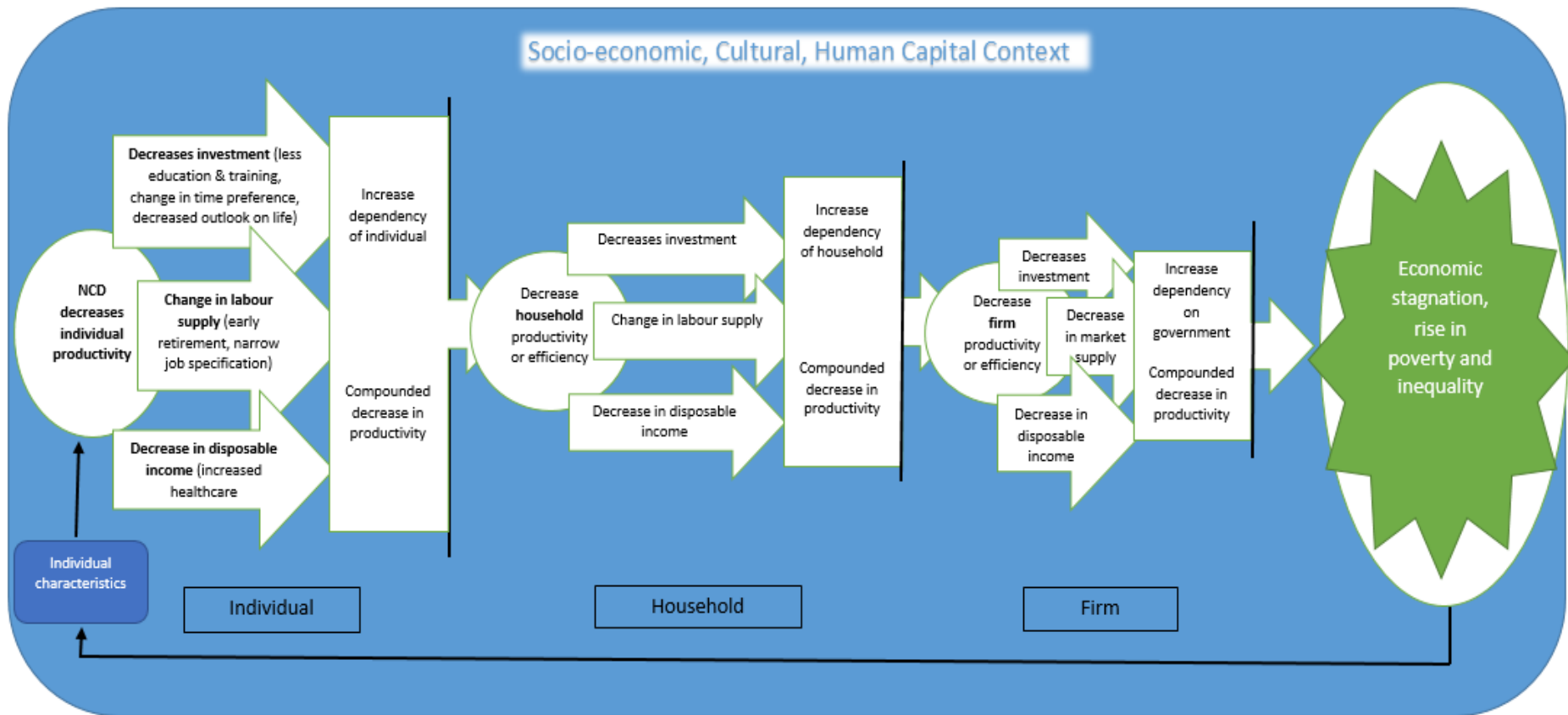
Figure 1: Study's conceptual framework

3. Empirical literature review

Non-Communicable Diseases, Labour and Household Income

There has been a heavy disease burden continuously on the urban poor communities from NCDs since the 2009 review (Mayosi et al., 2012) which is now compounded by infectious diseases in this population group. The Ministry of health in South Africa has set aside human resources to address both NCDs and CD under one permanent secretary within the Ministry; with global support a NCDs summit was held in 2011 (ibid). But the review still came to the conclusion that the detection, management and health outcomes of individuals with NCDs in South Africa was suboptimum. Cause of death statistics still earmarked NCDs as the leading cause of death in South Africa in that 10 year period (ibid). In India, Engelgau, Karan and Mahal (2012) found that disability secondary to NCDs can lead to a decrease in the working age population participating in the labour market, reduce productivity and lead to per capita GDP growth reduction. This findings are in relation to the fact that "40% of household expenditures for treating NCDs are financed by households that borrow or sell off assets," (Moreno & Hector, 2012). The disease burden of NCD in South Africa lies mainly on the working age population (Mayosi et al., 2012) therefore, it makes sense to investigate the effect NCDs have on the labour market, considering South Africa's economy relies heavily in the Services Industry for household income (Nattrass, 1998; Bhorat et al., n.d.; Bhorat et al., 2014).

Reverting to economic theory; economic theory predicts that the wage rate is function of the marginal productivity of labour and negotiation power of parties to the labour contract (Bartlett, 2006; Skidelsky & Craig, 2016). The marginal productivity of labour is itself a function of the human capital of the worker and the time worked insofar as labour supply can be measured in terms of the number of labour hours. This means that the wage is tied directly to the number of hours worked. The fewer hours one works, the less the wage income they receive, and the converse is true. Therefore, a health shock such as an NCD, assuming the patient is a working member of the household, leads to a reduction in the amount of labour hours supplied to the labour market. Since the wage rate is tied to the number of labour hours supplied, a reduction in the number of labour hours logically leads to erosion of both marginal and average productivity, and labour income. Alam and Mahal (2014) found that labour and

work participation loss rates, (therefore income losses) are very high in households with NCDs. For example, they found incomes to permanently decrease by 5% in households with NCDs. They found that individuals living with cancer lose between 2% and 3% of work time. The rates are even alarming for individuals living with heart disease and stroke, reducing labour participation by 27% and 73% respectively. Mwai and Muriithi (2016) found household income to be 26% lower in a household battling with an NCD than those battling with a communicable disease. Such a huge effect of NCDs could be attributed to loss of labour productivity for the sick member, to loss of labour productivity for care-giving members and to catastrophic expenditures associated with NCDs. Mukherjee and Koul (2014) found that the wage loss for the patient of coronary heart disease in India was 5% per year, while the partner to the sick person lost 1% of annual wage income because of lost productivity in caring for the sick partner. Chauhan and Aeri (2015) also find that patients suffering from cardiovascular heart diseases lose approximately 5% of their annual wage income.

Rodríguez-Sánchez and Cantarero-Prieto (2017) investigated the relationship between diabetes and employment outcomes in the Spanish labour market using national health survey data. They find that diabetic patients have higher unemployment rates and lower wage incomes relative to those who are non-diabetic. Even though the correlation between unemployment and being diabetic is not strong, they find that the effect of diabetes is "mediated by lifestyle factors and clinical and functional complications" such as gastric ulcers (Rodríguez-Sánchez & Cantarero-Prieto, 2017, p. 102). When they control for age and gender, their findings are mixed. Their Probit model results were not only insignificant for the effect of diabetes on unemployment, but also contradicted previous studies that concluded that diabetes reduced the probability of being employed. However, modelling the effects of diabetes on unemployment through an ordered logit model, they find significant effects of diabetes and that in the short-term having diabetes and being unemployed are negatively associated, but in the long-term they are positively associated. The results concluded that people with diabetes are 0.9 percentage points and 8.4 percentage points more likely to unemployment lasting between 1 and 2 years and more than two years, respectively, compared to those without diabetes. Furthermore, their model showed that other non-communicable diseases (e.g. arthritis, hypertension, stroke, chronic lung disease and obesity, asthma, heart attack) included in their model had significant effects on prolonged

unemployment. One limitation of the study was lack of clarity about controlling for interaction effects between diabetes and other non-communicable diseases, yet the conclusion drawn by the authors' points to the effects of diabetes on unemployment being mediated by other NCDs.

Goryakin and Suhrcke (2017) investigate the effects of chronically poor adult health, not necessarily NCD-related sicknesses, on labour supply in Russia. Their econometric findings, despite their intuition that Russia has substantial adult health problems, suggest that adult sickness does not significantly reduce the number of labour hours worked. However, a more nuanced finding is that the effect of chronic ill health on labour supply is substantial (Goryakin & Suhrcke, 2017, p. 361). The NCDs found to be significant were stroke, lung disease and heart disease. Interestingly, in their study, for all model specifications (OLS regression with a fixed effect model), they found diabetes to be statistically insignificant as well as having a positive relationship with labour supply, suggesting that having diabetes leads to supplying more labour. Methodologically, they measure labour supply by two variables, a dummy variable for working status and number of labour hours worked. Their study establishes unequal distribution of the burden of NCDs on urban (average of 69%) and rural communities as well as between men (average of 45%) and women. One reason for the urban bias in the labour supply response is because rural people are largely poor and tend to persist with work even if when they are chronically ill (ibid). Along the same line of reasoning, it is possible to deduce that the level of education mediates the effects of NCD-related sickness on labour supply, such that the more educated one becomes, the more likely that labour supply will be withdrawn (Alam & Mahal, 2014; Goryakin & Suhrcke, 2017; Rodríguez-Sánchez & Cantarero-Prieto, 2017).

Huffman et al. (2011) investigated the impact of cardiovascular diseases in Argentina, China, India, and Tanzania on labour supply and productivity. They found that in the absence of health insurance, the effects on productivity are negative. Productivity reduction from the countries in the study range from 70% to 100% across the income groups. There was considerably significant variation between the countries and the income strata for household effects (stopped or increased working due to NCD in household) on family members. This highlights contextual influences such as culture, economic developmental stage, legislation, type of employment etc. A large proportion of the low-income strata relative to the middle-

and high-income strata decreased working time (stopped working) in Argentina, China, and India but in Tanzania the inverse is true with the high-income strata decreasing their working more compared to the low- and middle-income strata. On the contrary a large proportion of the low-income strata relative to the middle- and high-income strata also increase working time (started working) in Tanzania, China, and India but in Argentina the inverse is true with the high-income strata decreasing their working more compared to the low- and middle-income strata. The study was unable to highlight the net effect of these changes within each country. They were also unable to truly attribute these changes solely to the effect of cardiovascular disease within the household.

Eaker et al. (2011) evaluated the state at which breast cancer would have adverse effects on labour supply and found that the effect of breast cancer on labour supply will begin to manifest three to five years after initial detection, decreasing labour supply. Again, this study brings out disease specific factors and contextual issues (such as labour protectionism and social security) that heavily influence labour force participation in Sweden. The study found after diagnosis, compared those without breast cancer, there was an increase in use of sickness benefits (decrease working time) and disability pension (stopped working) after 3years. After 5 years the increase in disability pension was more pronounced with less use of sickness benefits. This may be explained by the pathology/nature of breast cancer progression as remission is not guaranteed and re-mergence is common. According to the American Cancer Society only 62% of breast cancers are diagnosed in the first stage (1st stage has a 99% 5 year survival rate with appropriate treatment) with the rest having a minimum 5 year survival average at 90%, (Society, 2018). The study also found that the type of treatment the individual received had the largest impact on the results outcome. Arrossi et al. (2007), in a study on the effects of cervical cancer, found that households and individuals with cervical cancer had considerably reduced labour force participation in form of reduced working hours, work interruption and loss of productivity. This in turn induced loss of family income. The extent or severity of the effect of the cervical cancer on labour force and household income; the study was unable to measure/capture but in the final analysis they found that households ended up disposing of assets to mitigate the health-induced income shock, which further plunged them into poverty. Study methodology limitations are highlighted by the study.

Abegunde and Stanciole (2008) have investigated, the economic impact of chronic illnesses on households in Russia. Among many aspects, they found that there is significant loss of household income through reduced labour supply. The study found that household income reduces at a rate of 4.8% for every NCD in the household, attributing the result to the long-term impact of NCDs relative to non-chronic illnesses. This was supported by the fact that NCDs increased healthcare expenditure (with insured households spending more) and transfer payments into the household at a rate of 6.6% per NCD in the household. The study also found that NCDs decreased the number of work days done by the head of the household (this variable was measured as a proxy for productivity but due to its limitations productivity results were excluded from the study). Single headed households were found to have the lowest labour force participation with the highest healthcare expenditures (intuitively a decrease in household income).

Chorus and colleagues investigated labour force participation in patients with rheumatoid arthritis using a household survey in the Netherlands. The study found that rheumatoid arthritis disease duration of more than 6 years was negatively associated with labour force participation (Chorus et al., 2000). The study provided a snap shot using cross sectional data whilst controlling for confounding factors. But compared to the general population the labour force participation was only slightly lower. Therefore, more detailed research is needed to provide a robust conclusion.

To sum up the review and provoke thought so far, we look at Arnett (2016), who investigated healthy living supply-side interventions in the workplace that seek to reduce the effects of NCDs. She found that when properly designed and implemented, the benefits in terms of labour participation and productivity are enormous for both the employer and the employee. She found that the employee benefited through at least some of the following channels: reduced risk of cardiovascular disease, diabetes and cancer; high job satisfaction; increased worker income; lower household debt and lower long-term unemployment. For employers, the benefits were no less significant and the included, reduced productivity loss, reduced risk for short term disability, enhanced work performance, reduced health care spending and lower employee turnover rate.

A Summary of some of the literature reviewed is given in the table below.

Table 2: Empirical studies on the effect of NCDS on individual/household income, productivity and labour force participation:

Author(s)	Problem investigated	Method, variables and measurement, dataset	Findings
Pelkowski and Berger (2004)	Impact of health on wages, employment and labour supply in the United States	- Health and retirement survey data - Used OLS, Fixed Effects, applied Heckman correction	From the more robust Heckman correction, they found that - A permanent health condition (chronic) reduces wages by 6.6% (p<0.001) - A permanent health condition (chronic) reduces labour supply (in hours worked) by 6.5% - A permanent health condition (chronic) increases unemployment by 6.3%
Arossi et al. (2007)	Socioeconomic impact of cervical cancer on patients and their households in Argentina	- Univariate and multivariate logistic regression - Cross section data from self-administer questionnaires - Poverty status measured used poverty lines	Univariate results: - Person with cervical cancer 3.5 times more likely to experience income loss; 0.6 times less likely to lose work hours; 0.7 less likely to increases working hours; 3.1 times more to lose family income Multivariate results: 3.8 times more likely to lose family income
Abegunde and Stanciole (2008)	Economic impact of chronic health shocks on individuals and households in Russia	- Two-part Heckit (fixed effects-instrumental variable) model - Living standards Measurement Survey data	- Chronic illness reduced household income by 4.8% (p<0.001); practically zero and insignificant effect on productivity loss - Being overweight increased income by 6.6% (p<0.001), practically zero and insignificant effect on productivity loss
Eaker et al. (2011)	Relationship between breast cancer and income in Sweden	Matched cohort study	Did not find a statistically significant effect on income relative to those without breast cancer
Huffman et al. (2011)	Microeconomic impact of cardiovascular disease in LMICS	Used indicators of catastrophic spending	- In several LMICS work time was reduced by between 70% and 100% - Or work activities were severely limited by between 74% and 100% - Reduced household work time by between 2% and 25%
Jaspers et al. (2015)	Global effect of NCDs on household	- Meta-analytic literature study - Looked for studies that used	Found that NCDs increase the likelihood of a household falling into chronic poverty because of loss of income, loss of

		randomized controlled trials, systematic reviews, cohorts, case–control, cross-sectional, modelling and ecological studies • Looked at 6 NCDs: coronary heart disease, diabetes, lung disease etc.	productivity, because of catastrophic expenditures
Paalman et al. (2016)	Long term employment and social benefits situation of post-breast cancer diagnosis	• Multivariate Cox regression • Data from Netherlands cancer registry	• Those diagnosed experienced cumulative decline of both paid employment and social benefits relative to those without breast cancer (52% vs 46% respectively) • The risk of income loss increased for breast cancer survivors 5-7 year after diagnosis relative to non-breast cancer people
Mirelman et al. (2016)	NCDs and poverty in India	• Multinomial regression model • Census of vital statistics	• Households experiencing the burden of NCDs had a higher relative risk of being in poverty than those not experiencing the burden of NCDs
Goryakin & Suhrcke (2017)	Poor adult health and labour supply in Russia	• OLS and Individual level fixed effects • Data from Longitudinal Monitoring Survey—Higher School of Economics (RLMS-HSE) dataset	• In the Baseline model they find that diabetes and heart disease (but not MI, kidney disease, liver diseases, stroke, lung disease) significantly reduced labour supply • Two-part model only heart disease and lung disease had significant reductive effects on labour supply • In some sensitivity analysis MI and stroke were found to have significant negative effects on labour supply
Rodríguez-Sánchez & Cantarero-Prieto (2017)[1]	Labour market performance of diabetic people in Spain	• Probit model • Spanish National Health Survey data • Used duration of unemployment as proxy for number of work days lost which the dataset did not report • Short term employment	**Labour participation effects**: • Being diabetic was negatively associated with short term unemployment (not more than one year) – the effect was 0.7% to 6.2% points less likely to be unemployed. • but positively related to long term unemployment (more than one year) – the effect was 0.9% to 8.4% points more likely

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[1]

		reported as one year or less • Long term unemployment reported as more than one year	to be unemployed for prolonged period • Overweight people were more 0.2% to 1.4% points more likely to experience short term unemployment, but 0.2% to 1.9% point less likely to experience prolonged unemployment • Obese people were 0.2% to 2.6% points more likely to be unemployed in the short term but 0.4% to 3.5% less likely to experience prolonged unemployment • Current smokers were 0.3% to 3% less likely to experience short term unemployment but 0.4% to 4.1% points more likely to experience long term unemployment • Those with chronic lung diseases were 0.4% to 3.6% points less likely to experience short term unemployment but 0.5% to 4.9% more likely to experience long term unemployment • Ever smoking, arthritis, hypertension, cancer, cholesterol and back pain has no effect on duration of unemployment • Asthmatic people were 0.6% to 5.2% points less likely to experience short term unemployment but 0.8% to 7.1% points more likely to experience long term unemployment • Those with ulcers were 1% to 9.5% points less likely to experience short term unemployment but 1.4% to 12.8% more likely to experience long term unemployment • Heart attack was 0.8% to 7.6% points less likely to cause short term unemployment, but 1.1% to 10.2% more likely to cause long term unemployment • Stroke was 1.1% to 9.6% more likely to cause short term unemployment, but 1.4% to 12.9% points less likely to cause long term unemployment

			Income effect:
			• All NCDs that were significant in the labour force participation model (except ulcers and diabetes) were insignificant in the income model, but all that were insignificant in the labour force participation model are significant in the income model at all levels of income categories • Diabetes was found to increase the probability of earning lower levels of income e.g. below 1850 euros and reduces the likelihood of earning high incomes such as 1851 to 3450 euros. •
Nwosu and Woolard (2015)	Effect of self-assessed health (SAH) outcomes on labour force participation	• Instrumental variables-linear probability model • 1st and 3rd waves of NIDS dataset	• A 1% increase in self-assessed health, led to a 0.22% increase in the probability of participating in the labour force.
(Nwosu & Woolard, 2017)	Effects of self-assessed health outcomes of labour force participation	• Fixed effects regression • Pooled OLS regression • NIDS dataset all four waves	• Self-assessed health outcomes had significant and positive effects on labour force participation. Wide differences between fixed effects and pooled OLS coefficients of SAH
(Nwosu, 2018)	Relationship between mental and physical health (depression, hypertension, diabetes and tuberculosis) and employment	• Fixed effects, random effects and pooled OLS regressions, NIDS datasets	• Marginal increases in depression and diabetes incidence were found to lead to 4% - 6% decrease in employment. A marginal increase in tuberculosis incidence was found to lead to 12%- 13% decrease in employment. • These effects were not because there were no job market opportunities but rather increased economic inactivity of patients
(Adjaye-Gbewonyo, Kawachi, Subramanian, & Avendano, 2018)	Does district level inequality in South Africa affects risk factors that increase the prevalence of cardiovascular disease	• Fixed effects regression model • NIDS dataset • District level Gini coefficient data	• No evidence found linking inequality to increased incidence of cardiovascular disease
		•	•

Relevant available South African literature

Micro-level studies on the impact of NCDs on household income and labour force participation are scanty, but macro-level analysis shows that the loss of national output due to heart disease, stroke and diabetes and the resulting absenteeism between 2006 and 2015 was no less than US$1.88 billion in cumulative terms (Sheik et al., 2016). Nwosu and Woolard (2015) investigate the relationship between health and labour force participation using the first and third waves of the NIDS datasets and found that good health was a good predictor of active labour force participation. They found that if one got successfully treated, their labour force participation persisted for at least four years. Nwosu and Woolard (2017) extend the argument in Nwosu and Woolard by including all the four waves of the NIDS dataset to test the relationship between self-assessed health and labour force participation. They find a positive and significant effect of self-assessed health (on a Likert scale running from poor to excellent health) on labour force participation and that there is a gender bias in favour of men in this empirical relationship. They found that ill-health reduced labour force participation by between 20% and 30%. In their argument, they lament "relatively scant literature on the impact of health on the labour market in South Africa" (Nwosu & Woolard, 2015, p. 1). The present study builds on this conviction of the lack of current research on the impact on NCDs on labour market outcomes in South Africa. There is considerable scope to keep unravelling the relationship between labour market outcomes and NCDs.

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Non-communicable diseases and economic outcomes in South Africa
ORIGINAL RESEARCH ARTICLE   .

Part C: Journal Manuscript

CONTENTS

Non-communicable diseases and economic outcomes in South Africa: a cohort study for the period of 2008-2018

. **Odwa Mfolozi**[1] .

Abstract

Background: The total number of people living with non-communicable diseases in South Africa currently is unknown even though non-communicable diseases (NCDs) was accountable for 60% of the top ten causes of death in South Africa for the year 2015. In 2016, according to Stats SA, non-communicable diseases were accountable for 57.4% of all deaths in South Africa. In 2011 they were accountable for 23% of years of life lost and 33% of disability adjusted life years. Government total expenditure is also unknown but it is estimated at more than one billion rands per annum for low to middle income countries such as South Africa. NCDs negatively impact the labour market by decreasing labour productivity, increasing employee turnover and early retraction from the labour market. This further decreases individual and household income especially for the urban poor who carry the heaviest non-communicable disease burden in South Africa and contributes to the medical poverty trap as well as, worsening income inequality in South Africa.

Author: Odwa Mfolozi

Email: ormfolozi@yahoo.com

1.   Health Economics Unit, School of Public Health and Family Medicine, Faculty of Health Sciences, University of Cape Town

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Objective: This dissertation investigates the association between non-communicable diseases and labour market participation (LFP) and the effect it has on household income (HHI).

Methods: Using the longitudinal data from the National Income Dynamics Study (NIDS) with information on labour force participation, household income and diseases such as high blood pressure, diabetes, cancer, chronic lung disease, heart problems, stroke, arthritis; were used for analysis. The analysis used the 2008 (wave1), 2012 (wave 3) and 2016 (wave 5) data sets from the NIDS. The analysis is restricted to the population aged 18 years to 65years. The Study examines these associations using logistic and linear regression models for NCDs exposed households and non NCDs exposed households, comparing the two for differences and the effect observed on labour force participation and household Income. The control variables include location, age, race, gender, marital status and level of education. The NCDs are treated as exposure variables with labour Force Participation (LFP) and House Hold Income (HHI) being outcome variables. The study is guided by a conceptual framework that views the household as a unitary function.

Results: LFP: Based on the regression results, as a group NCDs show a negative relationship with labour force participation as a non-significant decrease but individually it depends on the type of NCD an individual is exposed to. Cancer, stroke and heart attacks are negatively associated with labour force participation. Asthma, diabetes and hypertension are positively associated with labour

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force participation. When an individual suffers from one NCD the relationship/association depends on the type of NCD, If and when an individual is burdened by a second or third NCD (Co-morbidities) the relationship with LFP tends to be positive (an increase in LFP). HHI: Counterintuitively as a group NCDs is associated positively with household income; a significant increase of 15% at 5 % level of significance. However, individually, hypertension, cancer, asthma, heart problems and stroke have a negative relationship (a decrease) with household income except Diabetes. Objectively there is insufficient evidence to conclude that NCDs decrease household income via decreasing labour force participation indirectly contributing to poverty in South Africa, as majority of household income comes from wages and remittances. Individually almost all NCDs (with Cancer and Hypertension having significant results) decrease household income but as a group increase household income. This requires further investigation into the NCD burdened household dynamics in South Africa.

Conclusion: Therefore, as recommended by the WHO; individual specific interventions will be more effective than population-based interventions to alleviate the ripple effects of the non-communicable disease burden in low to middle income countries (LMIC). Universal Health Care and up scaled prioritisation at Primary Health Care level is needed as NCDs accounted for half the global burden of disease but only received 2% of international donations compared to human immune-deficiency virus (HIV/AIDS) that accounted for 4% of the global burden of disease receiving 29% of international donations and grants.

INTRODUCTION

Background

According to the WHO, in 2018, 71% (41million) of all reported deaths globally were due to non-communicable diseases (NCDs), compared to 28 years (1990) before; where they accounted for 47% of deaths globally. 85% of NCD-related deaths occur in low to middle income countries (LMIC). The four leading NCDs (accounting for 80% of NCD related deaths) identified or attributed to these

deaths were cardiovascular diseases (17.7 million deaths), cancers (8.8 million deaths), diabetes (1.6 million deaths) and respiratory diseases (including asthma and chronic obstructive pulmonary disease (3.9 million deaths)) with their burden rising rapidly among lower income countries and populations. Even though with the current Sustainable Developmental Goals (SDG) 2030 target of reducing NCD death by third, NCD disease burden measured in Disability Adjusted Life Years (DALYs) was projected to increase from 33% in 2002 to 45% by 2030 but this has been revised to 57% with the highest incidence going to be in LMIC (Kristensen, 2009), with 85% of deaths due to NCDs already occurring in LMIC (Meyrowitsch and Bygbjerg, 2006). NCDs have been associated with epidemiological transitions due to urbanization, globalization and modernization resulting in unhealthy lifestyles, poor social habits and dietary changes (Meyrowitsch and Bygbjerg, 2006; WHO, 2018).

Non-communicable diseases place a huge economic burden on households and individuals. This is evident in the maintenance or control measures of these diseases (treatment costs, time, lifestyle & diet change), rescue measures (seeking interventions-GP, hospitalisation, transportation) and disability or permanent lifestyle changes for the household (opportunity costs, death of a breadwinner). According to Bloom, Cafiero, Jane-Llopis, et al. (2011), it is estimated that NCDs will cost the global market more than 50 trillion US dollars between the years 2011 and 2025.

In the context of a global population of seven billion people with 80% living in LMIC; NCDs comprise of 49% of the estimated 1.5 billion DALY's that form the overall global burden of disease (Meyrowitsch and Bygbjerg, 2006). According to Mahal, Karan and Engelgau (2010a), in 2004 India spent 3.3 % of its Gross Domestic Product (GDP) in out of pocket payments for healthcare, with NCDs accounting for 47% of the expenditure. The economic benefit (using DALY's) of reducing NCD mortality in Russia from 2008 to 2025 at rate of 4.6% per year would save Russia 3.6 to 4.8% of its GDP (measured using 2002 Russian GDP) (Suhrcke, McKee *et al.,* 2006). According to Kankeu *et al.* (2013), due to lack of financial protection in a number of LMICs, financial costs of NCDs are borne by the households rather than the governments. Therefore, financial protection is necessary but not enough (Abuosi *et al.,* 2016). This heavy burden on the household can

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lead to adverse economic outcomes such as impoverishment, early retraction from the labour market with limited ability to generate income, (Suhrcke, McKee et al., 2006). Impoverishment due to NCD is 50% greater when compared to Communicable Diseases, (Ngugi, 2014). Adverse economic consequences of NCDs are more pronounced (both at micro and macro level) in LMIC with poor access (availability, affordability and acceptability) to healthcare, (Suhrcke, Nugent et al., 2006). According to Bloom et al. (2012) without any intervention NCDs will cost LMIC more than 7 trillion US dollars from 2011 to 2025. Despite the well-known link between health and economic development, low-middle-income countries have paid very little attention to this relationship. This lack of attention or prioritisation is not justifiable. Better health increases labour supply and productivity, indirectly income. There is vast amount of evidence that health is a major contributor to economic growth, (Suhrcke, McKee et al, 2006).

South African Health System Context
South Africa with a population of 57million people, at a growth rate of 1.3%, has 38.3% of its population being vulnerable to NCD's (those between ages 30 and 70 years) with a probability of dying from an NCD being 27%, (WHO, 2014). The total number of people living with NCDs in South Africa is unknown, but estimates based on death rates highlight the severity of the situation. Together, as a group, NCDs are the leading cause of death in South Africa, followed by infectious diseases. But individually Tuberculosis (TB) and HIV/AIDS are responsible for most deaths (29,1%) followed by cerebrovascular disease (7,5%) and lower respiratory infections (4,9%), (Pillay-van Wyk et al., 2016), with Ischaemic heart disease, stroke, diabetes mellitus, and Chronic Obstructive Pulmonary Disease (COPD) accounting for 6.6%, 6.5%, 2.6%, and 2.5% of all deaths respectively, (Elloker et al., 2012).

In South Africa, in 1996, with a new government in place; a directorate of chronic diseases, disability and genetics was established in an attempt to control and prevent NCDs. The body contributed to new policy and legislation such as the Tobacco Products Controls Act amendment, Liquor Act 59 of 2003, advertising restrictions and tax levies (such as the recent alcohol and sugar tax). In 2006 the national Department of Health introduced standard treatment guidelines for management of NCDs; with a shift

from an acute care to a chronic healthcare model with complimentary interventions such as CHIPS (community health intervention programme). In 2011 the National Planning Commission recognised the poor state of healthcare in the country and were aware of their insight shortcomings in the subject matter hence they invited the general public to contribute to possible solutions to the healthcare problem. But all of these have not worked as the prevalence of NCD's among South Africans has continued to increase (Mayosi et al., 2009, 2012). South Africa suffers from a quadruple burden of disease (high prevalence of communicable, non-communicable diseases, increasing levels of trauma with high maternal and child mortality), especially among the urban poor population (Mayosi et al., 2009, 2012). In South Africa, the burden of NCDs increased from accounting for approximately 29% of all deaths in 2008 to accounting for 38,9% of all deaths and 16% of disability-adjusted life years in 2012; with this burden varying between the various age and population groups (Elloker et al., 2012). But according to the 2nd South African National Burden of Disease (SA NBD) Study non-communicable diseases accounted for 43.4% of all deaths in 2012 (Nojilana MPH et al., no date). In 2010 more than 36% of these deaths occurred before the age of 60 years (Nojilana et al., 2016).

In a general household survey of 2002 to 2008; Ataguba (2011), found NCD's to be evenly distributed across the socio-economic groups in South Africa as a result of changing prevalence trends. NCDs decrease one's quality of life and expected/potential life span whilst contributing to the medical poverty trap. In South Africa where the economy and the labour markets are anchored by the services industry and unskilled labour (Bhorat et al., 2014), this can have adverse economic outcomes for the long run unless precautionary measures are taken (Bertoldi, 2014; Bhorat et al., (n.d.); DPRU, 2016)). Individuals never regain their pre-NCD productivity levels despite treatment (Ngugi, 2014). This reduction in labour productivity often leads to early retirement, (Lumsdaine and Mitchell, 1999; Quinn, 1990). From a general perspective, Nwosu (2015) found that there was a significant relationship between labour participation and health outcomes in South Africa using the NIDS dataset. They found that ill-health reduced labour force participation by between 20% and 30%.

A number of studies have investigated the effect of health on labour markets using various diseases as

tracers (Pan American Health Organisation, 2011). However, there is limited evidence on the labour market impact of NCDs as a group of diseases, and existing evidence tends to come from developed countries on single diseases. Secondly, majority of the studies rely on cross-sectional data, limiting the possibilities to account for unobserved independent individual characteristics (Holm, Jæger and Pedersen, 2009). This study adds to the body of literature on the economic burden of NCDs on the household economics in a developing country, South Africa, where there is dearth of literature with regards to this topic. The study uses nationally representative panel data to investigate the household economic effects of NCDs as a group looking at how the number of NCDs and each NCD in a household affects labour force participation (LFP) and household income.

METHODOLOGY

3.1.1 Conceptual framework

The labour market is a platform where the household sells off its labour for a wage or income. The study's conceptual framework uses Abegunde and Stanciole's conceptual framework as a platform to build a new framework (Figure 1) that highlights the effect of NCDs on the economy starting at individual level and then household level.

At the individual level; based on Becker's human capital theory, it assumes that young healthy people have a lower rate of depreciation with a wider time horizon and are therefore more inclined to invest in themselves (hence the higher savings compared to the unhealthy). NCDs increase the depreciation rate of this health stock and decrease the individuals' current productivity. NCDs also decrease one's ability to generate investment or health inputs into the health stock such as decreasing one's ability to exercise and generate income. This occurs against the backdrop of fixed costs/expenses therefore decreasing the individuals' disposable income. Goryakin & Suhrcke (2017), found that the unhealthy do not reduce their supply of labour hours in an effort to be able to meet their financial needs and at times provide slightly above average hours. This change in labour supply is supported by the income effect argument hence the conceptual framework allows for both increases and decreases in labour supply post NCD burden. But poor health does change the time horizon for labour market participation for the unhealthy as they tend to retire

earlier (Chaker et al., 2015; Trevisan & Zantomio, 2016). Hence the WHO in 2001 and 2002 advocated for investments in health for developing nations using the human capital approach to support their reasoning.

The effect of NCDs on individual productivity is translated into changes in labour supply depending on circumstances, less disposable income available and decreased investment in health. This makes the individual more dependent on available support systems (e.g. family, social security benefits etc.). As the individual is less productive the household as a functional unit also becomes less productive therefore having less disposable income with changes in labour supply, less investment and greater dependency on available support structures. As with the household the firm is affected by less productive individuals translating into a less efficient labour force with lower profit margins and less investment in labour force and a higher dependency on government interventions. This all leads to overall poor economic growth, increased poverty and inequality as depicted in figure 1. NCDs translate into wasted investments or less incentive to invest in people as the investment is not worth the reward.
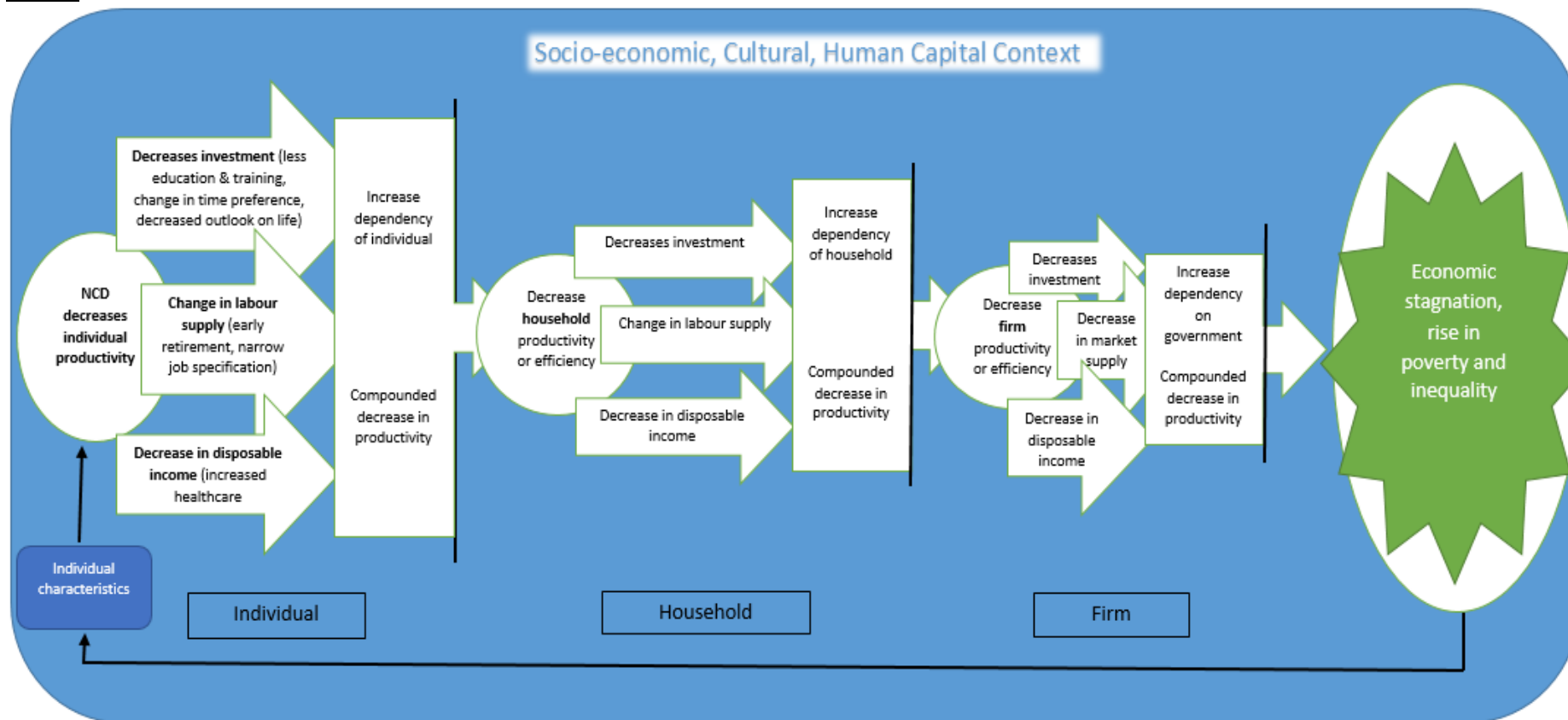
Figure 1

Figure 1: Paper's Conceptual framework

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Data source

The study utilised data collected by the School of Economics at the University of Cape Town as an initiative of the South African government (South African Presidency) via Southern Africa Labour and Development Research Unit and Department of Planning Monitoring and Evaluation. Using the National Income Dynamics study (NIDS) to "track and understand the shifting face of poverty" over a period of 8 years from wave1 in 2008 to wave 5 in 2018. The NIDS is a data set consists of five waves, but the study uses wave 1, 3 and 5, the first wave was conducted in 2008 and consists of 7300 South African households and 28000 individuals, with an average attrition rate of 16% between the waves. This master sample was stratified into 53 districts with 3000 Primary Sampling Units (PSU) and NIDS used 400 of these (a random selection of PSU within each strata (subset) of the master sample), spread across the 9 provinces of South Africa (48% of Households are in rural areas while 52% are in urban areas).

Model specification

The study examined the association of self-reported NCD status on economic outcomes of individuals and households using labour force participation and household income as indicators respectively, applying a fixed effects model to control for unobserved personal characteristics that could bias the estimates. For each regression, NCDs were included as a group and as individual diseases.

Labour force participation; (equation 1) used a logistic regression to estimate the odds of a certain event occurring by transforming the dependent variable into a logit using the maximum likelihood estimation (Gujarati 2004).

Logit model (LFP) $yit^* = \alpha + \Omega + \beta_1 NCD_{it} + \ldots + \beta_k x_{k,it} + \lambda_t + \mu_{it}$------------------------*eqn 1*

Where: y_{it}=*labour force participation of individual I at time t (a binary variable)*

α= *constant*

Ω=*fixed effect (Individual fixed effect)*

NCD_{it}= *a binary variable taking a value of 1 at time t if the respondent reports having any type of NCD (diabetes mellitus, cancers, chronic obstructive airway diseases, Asthma, Hypertension, heart diseases, stroke, osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases)*

x_{it}= *independent variables (Age,Race,Sex,Education,Occupation,income ,labour force participation)*

λ_t = *time fixed effect*

μ_{it}= *error term*

Household income; (equation 2) used the ordinary least squares (OLS) regression estimation to identify the association using the least squares estimation method to estimate unknown response parameters, Gujarati (2004), as the outcome variable was a continuous variable. The outcome variable was transformed to a log variable.

OLS model (HHI) $ln Y_{ht} = \alpha + \Omega_i + \beta_1 NCD_{ht} + \ldots + \beta_k x_{k,ht} + \lambda_t + \mu_{ht}$------------*eqn 2*

Where: . $ln Y_{ht}$= *log of household income (h) at time (t)*

α= *constant*

Ω_i=*fixed effect (household fixed effect)*

NCD_{ht}= *a binary indicator (1. binary variable taking a value of 1 at time t if the respondent reports having any type of NCD (diabetes mellitus, cancers, chronic respiratory illness (chronic obstructive airway diseases, Asthma), cardiovascular illness (Hypertension, heart diseases, stroke), osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases) as a combined indicator and 2; binary variable taking a value of 1 for independent NCD.*

$x_{k.ht}$= *independent variables (Age,Race,Sex,Education,Occupation,Labour force participation)*

λ_t = *time fixed effect*

μ= *error term*

See appendix 1 for variable description (**Table 3**)

Data Analysis

Data analysis was done using STATA 14 software (Stata corp. Inc., college station, Texas, USA). Sample characteristics where analysed using descriptive statistics. The panel regressions were fixed effect models as they took into account omitted time invariant variables that influence the explanatory variables such as culture, NCD risk factors (unhealthy lifestyles, diet, etc.)etc., (Williams, 2012). The fixed effect model takes into consideration the omitted variables (Ω) that affect independent variables over time and do not change, (Williams, 2012). Time dummies were also included

to capture trends overtime with (λ_t) representing time fixed effects such as the 2008 global recession.

RESULTS

Descriptive Statistics

The study sample has an average long-term unemployment at 62%, which is similar with that of Stats SA; people in long-term unemployment increased by 9, 4 percentage points from 59, 4% in 2008 to 68, 8% in 2018, (Stats SA, 2018). See table 5: urban areas have the highest population density in absolute numbers followed by traditional areas, then farms (53.15%, 39.56%, and 7.29% respectively). Based on study sample location variable, NCD prevalence is similar despite the variation in population density, with urban areas (25.36%), farms (22.24%) and traditional areas (20.76%). The traditional areas have the highest concentration of people unemployed (48.21%) followed by urban areas (46.87%) and farms (4.92%). Age groups: the youth (18-35) is the largest group forming 46% of the total sample. This followed by adults (36-50) (25%) the elders (50-65) (19%) and old age (10%). Employment and unemployment follow a similar distribution. However, NCD prevalence is more concentrated among the old age category (57%) followed by the elders (47%) then adults (23%) and lastly the youth (6%). Sample distribution based on race, the largest group is the black followed by the coloured then white and lastly Indian/Asian population groups
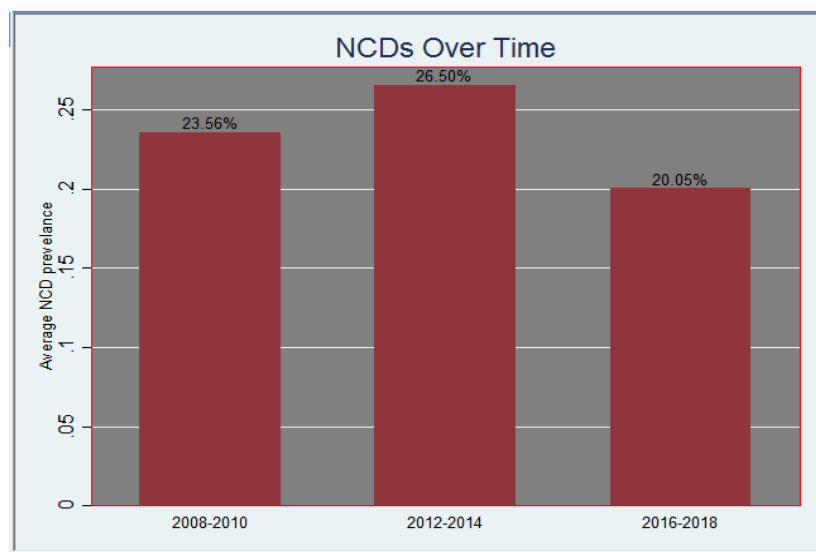
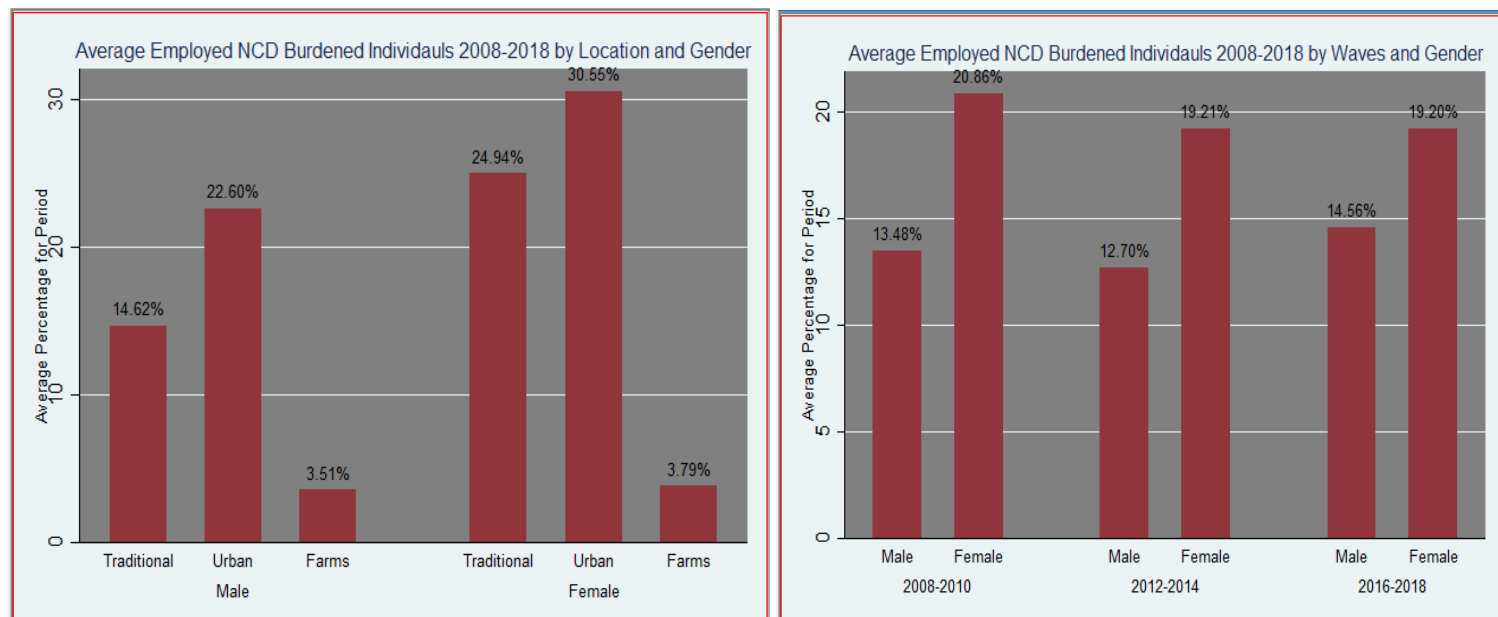(78%, 14%, 6% and 2% respectively). But NCD prevalence is more concentrated among the white population group (39%) followed by the coloured population group (32%), followed by the Indian/Asian population group (29%) and lastly the black population group (21%).

Figure 5.1

Source: NIDS Data 2018

Table 3   Non-Communicable Diseases Distribution in NIDS Data Set from 2008 to 2018

Wave	Total	NCD	No-NCD	1 NCD	2 NCDs	>3 NCDs	Cancer	Stroke	heart attack	Hypertension	Asthma	Diabetes
2008/10	13,651	3,216 (23.56%)	10,435 (76.44%)	2,419 (17.72%)	668 (4.89%)	129 (0.94%)	89 (28.53%)	140 (32.63%)	461 (40.37%)	2,401 (33.66%)	493 (36.28%)	584 (32.00%)
2012/14	12,686	3,362 (26.50%)	9,324 (73.50%)	2,402 (18.93%)	776 (6.12%)	184 (1.45%)	90 (28.85%)	168 (39.16%)	424 (37.13%)	2,653 (37.19%)	503 (37.01%)	705 (38.63%)
2016/18	13,425	2,691 (20.04%)	10,734 (79.96%)	2,037 (15.17%)	525 (3.91%)	129 (0.96%)	133 (42.63%)	121 (28.21%)	257 (22.50%)	2,080 (29.16%)	363 (26.71%)	536 (29.37%)
Total		9,269 (23.31%)	30,493 (76.69%)	6,858 (17.25 %)	1,969 (4.95%)	442 (1.11%)	312	429	1,142	7,134	1,359	1,825

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Figure 5.2

Source: Authors calculation from NIDS dataset using STATA 14 software

NCD prevalence varies in a non-uniform manner for period 2008 to 2018. NCDs on average (throughout the waves 2008-2018) are concentrated/highest among those that live in urban areas (25%), the unemployed (26%), the female sex (28%), the white population group (38%), the old age category (57%) and those that did not receive any form of education(42%) see figure 5.1 and 5.2.. In wave 1 24% of the sample population had NCDs and of the 24%, 35% was employed. In wave 3 27% of the sample population had NCDs with 32% having employment. Wave 5 had 34% of the 20% of people with NCDs being employed. Employment distribution follows population density distribution patterns. Throughout the waves people living in urban areas have the highest employment rate, ranging from 17% to 16% and 19% from wave 1 to 5 showing increases in employment. Farm locations provide the least employment at a 2% average decreasing from 3%. Traditional areas of living also show a decrease in employment from 14% in wave 1 to 12% in wave 5. On average in absolute terms more women are employed in all three locations categories and throughout the 5 waves (2008-2018) compared to men. However, an increasing trend can be observed for males (figure5.1 and 5.2).

Co-morbidity (having more than one NCD) follows similar trends as above except for population groups; where the Indian/Asian population group shows the highest NCD Co-morbidity concentration (3% for 3 or more NCDs and 11% for 2 NCDs), see

table 5. Individually hypertension has the highest burden (in absolute numbers) in all 3 waves followed by diabetes, then asthma, followed by heart attacks, strokes and lastly cancers, (see table 3).

Regression Results:
LFP: Based on the regression results, as a group NCDs show a negative relationship with labour force participation (log odds: exp (-0.0208281) CI: -.1589802 .117324). When an individual suffers from one NCD the relationship with labour force depends on the type of NCD. While Cancer, Stroke and heart attacks independently have a negative relationship with labour force participation; Asthma, Diabetes and Hypertension are positively associated with labour force participation. Specifically, having cancer significantly decreases the likelihood of being employed (log odds: exp (0.71) [CI: -.1316563 -.1082086]). (**See Table 6).**

HHI: NCDs as a group have a significant positive relationship with household income (Coeff: 0.15 [CI: 0.0012676-0.0294682]). However individually, all NCDs showed a negative association with household income except Diabetes. Cancer and Hypertension were significant at 5% and 10% significance levels with coefficients of -.0636711 and -.0156711 respectively. Diabetes

is associated with a non-significant increase in household income.

See **Table 6.**

DISCUSSION

The aim of the study was to examine the association of NCDs with an individuals' ability to participate in the labour market and the impoverishing effects of NCDs on the general households' disposable income. The study expected to find similar results to D. Abegunde & Stanciole, (2006) where NCDs in Russia decrease Labour Force Participation and decrease Household Income.

Household income and labour supply issues are more complex and seem to be dependent on social context and household dynamics. This is evident from the heterogeneity in results about household income from Jaspers et al. (2014) systemic review and Goryakin & Suhrcke (2017) who noticed that men decrease labour supply when women are sick but women increase labour supply when men are sick. Suhrcke also noted that in the presence NCDs those who live in rural areas where less likely to stop working compared to those that live in the urban areas. The current study's results were also heterogeneous with all individual NCDs, except Diabetes, being associated with a decrease in household income similar to what other authors such as what Ngugi (2014), Mwai and Muriithi (2016) and Engelgau, Karan and Mahal (2012) found in LMIC (that NCDs decrease household income). But as a group (and Diabetes individually) the study found NCDs to be associated with an increase in household income. As a group the association is significant at 10% level of significance, which is an unexpected finding/result.

The results of this current study lie on the premise that almost all household income in South Africa comes from labour force participation and remittances; as noted by Nattras (1998) in the analysis of the South African labour market. The study found that as an individual is affected by an NCD, one increases/decreases his/her participation in the labour market depending on the type of NCD. Cancer, stroke and heart attacks decrease LFP, this finding is expected due to the very nature of these diseases. Jaspers et al., (2014); Paalman et al., (2016); Eaker et al., (2011) and (McKevitt et al., (2011) also had similar findings based on individual

NCDs. Hypertension, Diabetes and Asthma were associated with an increase in LFP. The only study that supported this finding was done in Russia by Goryakin & Suhrcke (2017) where individuals increased their LFP in order to increase income to finance the costs of illness. But as a group the study found NCDs to be associated with a decrease in LFP. Though the finding was nonsignificant, this was similar to Abengunde & Stanciole's findings.

The descriptive results confirm the concentration of NCDs is among the urban non-educated females as previously identified by Mayosi et al (2009). This vulnerable group has a high incident of infectious diseases such as TB and HIV/AIDS (UNAIDS 2018). Whilst in South Africa, opportunities in the labour market for females are opening up, high unemployment (mainly due to skills mismatch) has prevented a significant change in labour market participation for this group (urban females), (Bhorat *et al.*, no date), hence the increasing employment trend for males. The literature on household income especially in South Africa is sparse and needs more investigation. The prevalence of NCDs from sample data (18 to 65years) is high with an average prevalence of 23% from 2008 to 2018, but HIV having a prevalence average of 18% (UNAIDS Data 2018; age 15 to 49years) (UNAIDS 2018) is prioritised in funding and policy, currently spending 2 billion a month on ARVS with the world's largest procurement programme, with the new National Strategic Plan of the South African National AIDS Council forecasting expenditures of over 207 billion Rands in the next five years. NCDs fall under the pool of general healthcare services under the constraints of recent budget cuts (*South African National HIV Prevalence , Incidence and Behaviour Survey , 2012*, 2012).

LIMITATIONS

One of our limitations is that the NCD status of an individual is based on self-reported information. This can be a serious overlook for the study, as a large part of the South African population is illiterate, and their subjective assessment of health may differ from those of their more affluent/educated counterparts. According to Jones et al. (2013), self-reported assessments are prone to measurement errors. This has resulted in some authors using objective measures (also considered objective subjective measures by Nwosu (2015)) but this also carries the burden of under-estimating the

true nature of the illness (NCD) or being impossible to obtain such information due to costs. Nwosu (2015), recommends the use of self-reported data variables for public health and economic related studies. NIDS is constantly correcting and adjusting the data set for inconsistences such as those identified in wave 2 relating labour and unemployment identified by Cichello, Leibbrandt and Woolard in 2012, when comparing it to other data sets such as the Stats SA data of the same period.

CONCLUSION

Objectively there is insufficient evidence to conclude that NCDs decrease household income via decreasing labour force participation indirectly contributing to poverty in South Africa, as majority of household income comes from wages and remittances. Based on the study's findings: individually almost all NCDs (with Cancer and Hypertension having significant results) decrease household income but as a group increase household income. Therefor this requires further investigation into the NCD burdened household dynamics in South Africa

Commitment from the South African government and other interest groups provide a basis for relevant policy to address the multifaceted problem of NCDs through prevention, enhancing healthy lifestyles, access to quality health care especially at household and Primary Health Care level. This will be in line with the sustainable developmental goals of reducing poverty, providing good health and living, while providing decent work and economic growth in spirit of global and local partnerships. This will also be in line with the African union agenda 2063 of building a prosperous Africa beginning with a healthy population and workforce.

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Table 4

Measurement of Variables

Exposure variable:	
Non-communicable disease/s	A self-reported health status and condition from the adult questionnaire for each primary sample member and continuous sample member above the age 18. All NCDs will be categorized into 1 for exposure and 0 for non-exposure and are included as a dummy (group variable), a categorical variable with 1 NCD, 2NCDs and 3 NCDs and as independent individual NCDs. Non-communicable diseases are defined as a group of idiopathic non-transmittable long-term illnesses. These include diabetes mellitus, cancers, chronic respiratory illness (chronic obstructive airway diseases, Asthma), cardiovascular illness (Hypertension, heart diseases, stroke), osteoporosis, Alzheimer's disease, cataracts and chronic kidney diseases. These NCDs will be considered as an exposure that affects one's ability to earn and participate in the labour market
Outcome variables:	
Labour force participation	Labour market participation- A self-reported voluntary engagement in the labour market in return for an income/profit. Each individual is categorized into one of two mutually exclusive categories, employed (formal or self-employed) and unemployed. This was classified as a binary categorical dependent variable identified as 1 if employed or 0 unemployed.
Income	Household Income- In the data set, total household income is a continuous variable that will be an outcome of an OLS regression subject to the various explanatory variables to visualise the association between NCDs and income in South Africa for the period. This was logged so it follows a normal or near normal distribution for a linear regression analysis using ordinary least squares.
Independent Variables:	Area of residence –This is a categorical variable from the household questionnaire and will be transformed into a dummy variable with 1 for urban location and 0 for rural location.
	Age – This is captured as a continuous variable and used as a continuous and squared transformation variable. Only individuals above the age of 18 are considered in the study.
	Race – Self reported from adult questionnaire. This is a categorical variable that is captured as best race coded as 1 for African, 2 for coloured, 3 for Asian/Indian and 4 for white population groups. This variable will be treated as a categorical variable with white population group as the reference group.
	Sex – Sex was captured as a categorical variable and transformed into a dummy variable with 1 for male and 0 for female.
	Education - self reported categorical variable coded in numeric values as best education from the adult questionnaire. This variable is transformed into a categorical variable with primary schooling (1), high schooling (2), tertiary schooling (3) and no schooling (0), with no schooling being the reference group.
	Marital status - This is also self-reported information in the NIDS data set, this is transformed into a categorical variable of 0 married and 1 for unmarried with married being the reference group.

Table 5		Non-Communicable Diseases Distribution in NIDS Data Set From 2008 to 2018							
		Total	**No NCD**	**Non-Communicable Diseases**	**One NCD**	**Two NCDs**	**Three NCDs**	**Employed (Out of total sample)**	**Unemployed (Out of total sample)**
Location	**Traditional**	15,730 (39.56%)	12,465 (79.24%)	3,265 (20.76%)	2,473 (15.72%)	665 (4.23%)	127 (0.81%)	4,658 (27.73%)	11,072 (48.21%)
	Urban	21,132 (53.15%)	15,773 (74.64%)	5,359 (25.36%)	3,889 (18.40%)	1,187 (5.62%)	283 (1.34%)	10,369 (61.73%)	10,763 (46.87%)
	Farms	2,900 (7.29%)	2,255 (77.76%)	645 (22.24%)	496 (17.10%)	117 (4.03%)	32 (1.10%)	1,771 (10.54%)	1,129 (4.92%)
Age	**Youth (18-34)**	18,400 (46.28%)	17,176 (93.35 %)	1,224 (6.65%)	1,125 (6.11%)	88 (0.48%)	11 (0.06%)	7,257 (43.20%)	11,143 (48.52%)
	Adults (35-49)	9,910 (24.92%)	7,656 (77.26%)	2,254 (22.74 %)	1,826 (18.43%)	361 (3.64%)	67 (0.68%)	5,971 (35.55%)	3,939 (17.15%)
	Elders (50-65)	7,545 (18.98%)	3,986 (52.83 %)	3,559 (47.17%)	2,429 (32.19%)	900 (11.93%)	230 (3.05%)	3,169 (18.87%)	4,376 (19.06%)
	Old age (66-100)	3,907 (9.83%)	1,675 (42.87 %)	2,232 (57.13%)	1,478 (37.83%)	620 (15.87%)	134 (3.43%)	401 (2.39%)	3,506 (15.27%)
Gender	**Female**	23,567 (59.27%)	16,942 (71.89%)	6,625 (28.11%)	4,831 (20.50%)	1,461 (6.20%)	333 (1.41%)	8,334 (49.61%)	5,233 (66.33%)
	Male	16,195 (40.73%)	13,551 (83.67%)	2,644 (16.33%)	2,027 (3.14%)	508 (3.14%)	109 (0.67%)	8,464 (50.39%)	7,731 (33.67%)
	Black	31,090 (78.19%)	24,707 (79.47%)	6,383 (20.53%)	4,828 (15.53%)	1,293 (4.16%)	262 (0.84%)	12,181 (72.51%)	18,909 (82.34)

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Race	Coloured	5,729 (14.41%)	3,924 (68.49%)	1,805 (31.51%)	1,309 (22.85%)	395 (6.89%)	101 (1.76%)	2,989 (17.79)	2,740 (11.93%)
	Indian/Asian	652 (1.64%)	461 (70.71%)	191 (29.29%)	98 (15.03%)	73 (11.20%)	20 (3.07%)	308 (1.83%)	344 (1.50%)
	White	2,291 (5.76%)	1,401 (61.15%)	890 (38.85%)	623 (27.19%)	208 (9.08%)	59 (2.58%)	1,320 (7.86%)	971 (4.23%)
Employment Status	Employed	16,798 (42.25%)	13,515 (80.46%)	3,283 (19.54%)	2,633 (5.67%)	559 (3.33%)	91 (0.54%)	16,798 (100%)	0
	Unemployed	22,964 (57.75%)	16,978 (73.93%)	5,986 (26.07%)	4,225 (18.40%)	1,410 (6.14%)	351 (1.53%)	0	22,964 (100%)
Education	None	4,522 (11.37%)	2,632 (58.20%)	1,890 (41.80%)	1,384 (30.61%)	415 (9.18%)	91 (2.01%)	1,174 (6.99%)	3,348 (14.58%)
	Basic Ed	29,111 (73.21%)	22,971 (78.91%)	6,140 (21.09%)	4,553 (15.64%)	1,293 (4.44%)	294 (1.01%)	11,438 (68.09%)	17,673 (76.96%)
	Higher Ed	4,981 (12.53%)	4,034 (80.99%)	947 (19.01%)	705 (14.15%)	199 (4.00%)	43 (0.86%)	3,272 (19.48%)	1,709 (7.44%)
	Tertiary Ed	1,148 (2.89%)	856 (74.56%)	292 (25.44%)	216 (18.82%)	62 (5.40%)	14 (1.22%)	914 (5.44%)	234 (1.02%)
Study sample average from wave 1 to 5 (2008-2018)	1. African | 79.21%	2. Coloured | 14.18%	3. Asian/Indian | 1.54%	4. White | 5.08%					
South African population of 57,398,421 million in 2018	1. African | 79.4%	2. Coloured | 8.8%	3. Asian/Indian | 2.6%	4. White | 9.2%					

*(Out of total sample) includes those with NCDs and those without NCDs

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<div align="center">Table 6: Regression Results</div>

Exposure Variable |	Labour Force Participation Coef. (Std error)	[95% Conf. Interval]		Household Income Coef. (Std error)	[95% Conf. Interval]	
NCD group						
NCD Group	-.0208281 (.07049)	-.1589802	.117324	.0153679** (0. 00719)	.0012676	.0294682
NCD individual						
Cancer	-.7123856 ** (0.30825)	-1.316563	-.1082086	-.0636711** (0.02951)	-.1215156	-.0058265
Stroke	-.440656 (0.28475)	-.9987694	.1174574	-.0193805 (0.02472)	-.067837	.029076
Heart Attack	-.0829469 (0.15539)	-.3875207	.2216269	-.0097418 (0.01517)	-.0394825	.0199988
Asthma	.0230129 (0.17023)	-.3106383	.3566641	-.0231614 (0.01600)	-.0545405	.0082176
Diabetes	.1687131 (0.14820)	-.1217626	.4591888	.0023188 (0.01414)	-.0254012	.0300389
Hypertension	.0292492 (0.07952)	-.1266229	.1851214	-.0156711*** (0.00805)	-.0314492	.000107

<div align="center">* Significant at 1% level of significance | **Significant at 5% level of significance | ***Only Significant at 10% level of significance</div>

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Author Contribution

I **Odwa Mfolozi**, hereby declare that the work in this paper is based on my original work (except where acknowledgments indicate otherwise) as part my MPH (Health Economics) dissertation/thesis and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. This work was supervised by Dr Olufunke Alaba at the health economics Unit at the University of Cape Town. I have empowered the University of Cape Town to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Ethical compliance and standards

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Part D: Policy Brief

Non-communicable diseases and economic outcomes in South Africa: a cohort study for the period of 2008-2018

Health Economics Unit
*School of Public Health & Family Medicine
University of Cape Town*

Source: This policy brief is based on a journal article titled "**Non-communicable diseases and economic outcomes in South Africa: a cohort study for the period of 2008-2018**" not yet published (2019).

Authors: The research was conducted by Odwa Mfolozi and Olufunke Alaba (Health Economics Unit, University of Cape Town).

For more information about this policy brief:
Please email Odwa Mfolozi (ormfolozi@yahoo.com).

HEU Policy Briefs present summarised research findings and key policy recommendations on important health care policy issues in South Africa.

Policy brief on "analysing individual and household economic outcomes in South Africa by examining the effect of Non-Communicable Diseases (NCDs) on household income (HHI) and labour market participation (LFP)."

Key findings

1) On average, 23.3% of the South African population suffers from at least one NCD.
2) NCDs are concentrated among those that did not receive any form of education, those that live in urban areas, the unemployed, the female sex, the white population group and old age.
3) Cancer, Stroke and heart attacks have negative association labour force participation whilst hypertension, diabetes and asthma have a positive association with labour force participation.
4) All NCDs except Diabetes have a negative association with household income.

Introduction

South Africa suffers from a quadruple burden of disease (high prevalence of communicable, non-communicable diseases, increasing levels of trauma with high maternal and child mortality), especially among the urban poor population. The prevalence of NCDs among South Africans has continued to increase with this burden accounting for approximately 29% of all deaths in 2008 to accounting for 38, 9% of all deaths in 2012 and 16% of disability-adjusted life years in 2012. Impoverishment related to NCDs is 50% greater when compared to Communicable Diseases. According to, (Nattrass, 1998), Almost all household income in South Africa comes from labour market participation via wages and remittances. The financial costs of NCDs are borne by the Households rather than the governments. This can be seen in the maintenance or control measures of these diseases via treatment costs, time, lifestyle & diet changes; rescue measures such as seeking interventions (Doctor Consultations, hospitalisation, transportation) and disability or permanent lifestyle changes for the household through opportunity costs or death of a breadwinner. Adverse economic consequences of NCDs are more pronounced (both at micro and macro level) in Low to Middle Income Countries (LMIC) such as South Africa with poor access (availability, affordability and acceptability) to healthcare.

The objective of the study was to examine the association between non-communicable diseases and labour market participation and the effect it has on household income.

Part D: Policy Brief

Research Methods

The study utilised data from the National Income Dynamics study (NIDS) to "track and understand the shifting face of poverty", over period of 10 years from 2008 to 2018. Data analysis was done using STATA 14 software via panel regression models capturing changes in trends with fixed effects models accounting for omitted time invariant variables that influence the final results such as culture and NCD risk factors (unhealthy lifestyles, diet, etc.).

Key findings

In the period of 2008-2018, 23.3% of the South African population on average suffers from a least one Non-Communicable Disease. Those that are affected the most are those that live in urban areas , of the female sex, the unemployed, of the white population group, with no basic education (without Matric) and of old age. NCDs as a group is associated with a negative effect on labour force participation with Stroke, Heart attacks and Cancer contributing to the negative association individually. Hypertension, Asthma and Diabetes were found to have a positive association with labour force participation. As a group NCDs were found to have a positive relationship with household income but individually all NCDs except Diabetes had a negative effect on household income.

Policy recommendations

- These results provide some justification for Health system reform with NCD prioritisation, particularly if the economic impact on individuals and households is to be mitigated in South Africa. Given that South Africa's formal social support system is limited, South Africa's health system reform needs a policy that focuses on addressing the health needs of the poor whilst ensuring that the burden of financing those health services does not rest heavily on poor households. Healthy lifestyle interventions and prevention, Equity in financing and resource allocation must be the pillars of the new reform to prevent worsening the existing disparities. Physical and financial barriers to service access must be addressed to achieve equity.
- NPO and Private sector regulation and restriction is imperative. Thou in the short run are beneficial, these private entities are established mainly as profit making or product marketing or market penetration instruments for the long run, in the South African economy. They give off benefits such as employment, short term economic growth, improve quality and competition within health service provision but erode and fragment the health system with skewed resource allocation (technology, human and financial), distribution and equity (both financing and Access) of services. And sometimes completely exclude the poor and ignore the people's needs in their long-term plans.
- The researchers hope these findings will add impetus to commitments to Capacity building for sustainable heath service equity.

The Health Economics Unit is part of the School of Public Health & Family Medicine at the University of Cape Town. Email: info-heu@uct.ac.za

www.heu-uct.org.za

Appendix:

Instruction to Authors link

https://www.springer.com/journal/40258/submission-guidelines#Instructions%20for%20Authors