Research Report

Socioeconomic inequalities in the prevalence of double-burden malnutrition in South African households

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Abstract

This paper reviews the double-burden of malnutrition at the household-level, specifically mother-child double burden of malnutrition (MCDB) in South Africa. Nationally representative data from the National Income Dynamics Survey (NIDS) was used. All five waves of NIDS (2008-2017) were used for descriptive statistics and to quantify the extent of inequality in MCDB using Erreygers' Corrected Concentration Index. The most recent wave (wave 5, 2017) was used to determine the factors associated with inequality in MCDB using Wagstaff's decomposition analysis. The results confirm the existence of MCDB in South Africa and indicate that the prevalence of MCDB was the highest in the third wave of NIDS (2012). However, there has been no consistent increase or decrease in the prevalence of MCDB across waves. Inequality in MCDB was the highest in wave 2 (2010 – 2011), with MCDB being disproportionately concentrated amongst the poor. Wagstaff's decomposition analysis revealed that differences in the distribution of wealth was the biggest contributor to wealth-related inequality in MCDB. The findings of this study confirm the stated hypotheses, and suggest that inequality in MCDB is unfair and unjust. Addressing wealth inequality in the country may be a means to improving nutritional outcomes amongst vulnerable mothers and children. Policies aimed at addressing malnutrition should also target mothers, since mothers' health and socioeconomic status affect children's nutritional outcomes. Moreover, policies should not aggravate one form of malnutrition while attempting to address the other. Improving nutritional outcomes in the country may also be a means to impeding deleterious economic outcomes.

1. Introduction

The World Health Organisation (WHO) defines malnutrition as deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients (WHO, 2021). The WHO identifies two forms of malnutrition; undernutrition (which includes stunting, wasting, underweight and micronutrient deficiencies) and overnutrition (which includes overweight, obesity and diet-related non-communicable diseases). Historically, undernutrition and overnutrition have been viewed as mutually exclusive phenomena affecting distinct demographics. Undernutrition has been associated with poverty and food insecurity in low- and middle-income countries (LMICs), while overnutrition has been associated with wealth and indolence in high-income countries (HICs). As a result, undernutrition and overnutrition have often been researched an addressed separately (Wells, et al., 2020).

In recent years a global nutrition transition has taken place. This nutrition transition is characterised by increased consumption of calorie-dense processed foods which are high in sugar, salt, and fat; and a simultaneous decrease in the consumption of nutrient and fibre-rich foods (Sekiyama et al., 2015). Two other historic processes of change coincide with the nutrition transition namely, the demographic transition and the epidemiological transition. The demographic transition refers to a decline a fertility and mortality rates resulting from economic growth and industrialisation. The epidemiological transition refers to a decline in the prevalence of communicable diseases associated malnutrition, periodic famine, and inadequate sanitation coupled with a simultaneous rise in the prevalence of non-communicable diseases associated with urban-industrial lifestyles. The nutrition transition is closely related to the demographic and epidemiological transition. The combined outcome of all three transitions is observed in the changing nutritional outcomes such as average stature, body composition and morbidity (Popkin, 1993).

While these transitions occurred gradually in HICs, they have occurred at a more rapid pace in LMICs. Consequently, the prevalence of obesity and other diet-related non-communicable diseases have starkly increased in LMICs. However, undernutrition remains a problem in LMICs, and therefore the rise in overnutrition further burdens the public healthcare systems in these countries. This poses a threat to the health and economic stability of LMICs, which are already resource-constrained (Sekiyama, et al., 2015; Ghattas, et al., 2019; Oddo, et al., 2019;

Patel, et al., 2020). The coexistence of overnutrition and undernutrition is known as the double burden of malnutrition (DB).

DB can occur within populations, households, and individuals. Population-level DB refers to the coexistence of overnutrition and undernutrition within a region, country or community. At the population-level, undernutrition is usually observed amongst the poor and those of low socioeconomic status in rural areas and the urban poor, while those who are economically better off experience overnutrition. However, this disparity is currently shifting to the poor and others of low socioeconomic status. Household-level DB refers to the coexistence of overnourished and undernourished individuals within the same household, although overnutrition is most common amongst adults and undernutrition is most common amongst children. Individual-level DB refers to the exposure of both forms of malnutrition over the life-course (i.e., an association has been found between undernutrition in early life and increased risk of being obese or suffering from diet-related noncommunicable diseases in adulthood) or being overweight with micronutrient deficiency (Abdullah, 2015; Kosaka & Umzekazi, 2017; Ghattas, et al., 2019; Wells, et al., 2020).

The nutrition transition in South Africa is caharacterised by a complex set of factors . South Africa's history of Apartheid coupled with a high prevalence of HIV/AIDS have been associated with poor health outcomes amongst the African population (Kimani-Murage, 2013). Till this day, a large proprption of South African live in abject poverty, which increases their vulnerability to food insecutry, undernutrition, and infectuous diseases. The relationship between poverty, infectuous diseases, and malnutrituion is cyclical in nature, with poor living conditions and infectuous diseases exacerbating malnutrition (Tydeman-Edwards et al., 2018). Historically, poverty and undernutrtion have been associated with rural-residence among the African population in South Africa (Neves et al., 2013; Kepe & Tessaro, 2014). In recent years, South Africa has undergone a rapid economic and social transition, as well as urbanisation (Kok & Collinson, 2006). The co-occurance of the economic and social transition, coupled with urbanisation, have resulted in a rapid nutrtition transiton (Kimani-Murage, 2013). Like in other LMICs, the nutriton transition in South Africa has been associated with increased physical inactivity and increased consumption of processed foods which are high in fat, sugar and salt. Tydeman-Edwards et al. (2018) found that sugar was the most frequently consumed food item amongst study participants in the urban and rural Free State, with sugar being consumed approximately 60 times a month across areas of residence. Consequntly, there has been a rise in overweight/obesity in the adult population – particulalrly the female adult population in South Africa (Voster et al., 2005; Joubert et al., 2007). The presistent threat of undernutrition and infectous disease, as well as the more recent threat of overnutrition and other noncommunicable diseases, will hamper South Africa's progress towards achieveing Sustainable Development Goal 2 – which envisions the end of all forms of malnutrition by 2030 (IFPRI, 2016).

Limited research exists on the economic effects of DB. This is because existing economic models for nutriton have not successsfully harmonised the different long-term outcomes of chronic undernutriton and obesity. Moreover, due to a scarcity of data on contrasting form of malnutriton within the same population and the longstanding tradition of studying and addressing undernutriton and overnutrion in distinct silos, dthere are differences in the methodology employed by nutrtion economists to measure the economic effects of different types of malnutrion (Nugent, 2020). Thus, the economic consequences of overwiegt/obesity and stunting are often discussed separetly. The double-burden of malnutrition can affect the country's economy through at least three major categories of economic impact: (1) direct medical costs (2) productivity costs and (3) human capital accumulation (Hammond & Levine, 2010; Melaku et al., 2015).

The nutritional transition and consequent surge in overweight/obesity in LMICs has had an impact on direct medical spending within the health systems of LMICs. Obesity is associated with increased risk of hypertension, type 2 diabetes, coronary heart disease, arthritis, asthma, stroke, and hypercholesterolemia. Direct medical spending on such diseases can be expected to increase with an increase in obesity levels (Hammond & Levine, 2010). Stunting on the other hand is associated with increased morbidity and mortality from infections such as pneumonia and diarrhoea (Black et al., 2008). In the context of an already constrained fiscal space, further exacerbated by the impact of COVID-19, failure to address all form of malnutrition and their associated diseases could have a deleterious impact on healthcare spending in the country. With South Africa making progress towards Universal Health Coverage (UHC) through the implementation of the National Health Insurance (NHI) (Naidoo, 2012), some authors have argued that a pooled health insurance system may induce moral hazard by incentivising overweight and obesity since individuals themselves will not bear the full healthcare costs (Bhattacharya & Sood, 2006). Furthermore, stunting in childhood may predispose individuals to overweight/obesity and other non-communicable diseases later in life (Malik et al., 2018), impacting future medical costs.

Overweight/obesity impact productivity through four levers; absenteeism (employees being absent from work as a result of health-related reasons), presenteeism (employees being less productive while at work as result of health-related reasons), premature mortality, and disability. This may also result in increased public expenditure on social grants and welfare loss in the health insurance market (Hammond & Levine, 2010). With regards to human capital development, stunting impacts children's cognitive, educational and behavioural outcomes. Stunting is a risk factor for impaired childhood development (Walker et al., 2011). Stunting affects children's school enrolment, performance, and grade progression. Stunted children are reported to be less likely to enrol in school or enrol late, achieve lower grades and have poorer cognitive ability compared to their non-stunted counterparts (Prendegrast & Humphrey, 2014). The culmination of all these factors impact human capital accumulation, and thereby a country's potential for economic growth.

The bulk of the literature on DB estimates the prevalence of DB within specific countries or regions. The purpose of this study is to evaluate the socioeconomic inequalities in household-level DB in South Africa by focusing specifically on maternal and child DB (MCDB).

2. Research Question

The research question of this study is to assess whether and to what extent MCDB is concentrated among specific wealth groups in South Africa. Should I find evidence of socioeconomic inequalities in MCDB in South Africa, the second research question is to establish the contribution of various factors (e.g., demographic, economic, health, lifestyle, etc.) to the socioeconomic inequalities in MCDB, and to interpret their relevance within the social determinants of health model and South African context. This research question will be addressed using the most recent and publicly available nationally representative data set which contains anthropometric data, namely NIDS. The Erreygers' corrected concentration index (CCI) will be used to measure inequalities and Wagstaff, Van Doorslaer and Watanabe's (2003) decomposition analysis will be used to assess the contributing factors to these inequalities.

3. Hypothesis

The thesis will set out to test two hypotheses:

Hypothesis 1: There are socioeconomic inequalities in MCDB in South Africa, concentrated among the socioeconomically disadvantaged.

Hypothesis 2: Various socioeconomic, demographic and lifestyle factors contribute to the inequalities. This supports the social determinants of health theory which purports that several non-medical factors influence health outcomes and health inequalities, and these non-medical factors are to some extent determined by an individual's socioeconomic position. These inequalities in health outcomes are therefore inherently unfair because they are generated by "unjust social arrangements" (Whitehead & Dahlgren: 2007: 3).

4. Literature Review

Studies from the database PubMed were reviewed for the purpose of this study. The earliest articles on MCDB were published in 1995, with most articles being published post 2000. From the studies reviewed, most were cross-sectional, using secondary data from the Demographic and Health Surveys of the respective countries and other nationally representative household surveys. Multivariate logistic regression was the most commonly used estimation strategy. There was inconsistency with regards to the definition and measurement of MCDB and age ranges. Throughout the literature, BMI was used as the indicator for overnutrition amongst adults. Most studies used stunting as the indicator of undernutrition amongst children, while others included wasting and underweight. The age ranges of children included in the studies also varied from 0-59 months, 6-59 months, 12-60 months, below 5 years, etc. Differences in the combination of overnourished mothers and undernourished children across studies and differences in the age categories considered and the definition of MCDB applied means that the studies are not comparable. The studies were mostly concerned with the prevalence of MCDB in African, Asian and Latin American Countries, and identifying the factors associated with MCDB within those countries.

Of all the studies, only one (Lee et al., 2012), used concentration indices to estimate the magnitude of MCDB inequality across economic groups in Guatemala. The results revealed that the prevalence of stunting was higher among poor households, however, maternal overnutrition was higher among richer households. Moreover, economic inequality in child stunting exceeded economic inequality in maternal overnutrition (CI = -0.22 and +0.14, respectively). The prevalence of MCDB was higher amongst poor and middle-class households than their richer counterparts. This is owed to the very high concentration of stunting among poorer households. MCDB was also more prevalent in rural areas and households with an indigenous mother.

The association between socioeconomic indicators and MCDB in the literature is heterogeneous. The risk factors associated with MCDB in the literature can be summarised into four categories: (1) biological/health environment (2) economic/food environment (3) physical/built environment, and (4) socio-cultural environment (Shrimpton & Rokx, 2012).

Biological/health environment

The thrifty phenotype hypothesis posits that undernourishment in utero predisposes individuals to non-communicable diseases such as obesity, hypertension, and diabetes later in life (Malik, et al., 2018). Through a process known as fetal programming, a fetus adapts to its environment (which is characterised by a lack of adequate nutrients) and anticipates the same environment when it is born. If an environment mismatch occurs (i.e., an individual finds themselves in a more food abundant environment), this increases their odds of developing non-communicable diseases. This is believed to be one of the drivers of MCDB in rapidly developing LMICs (Shrimpton & Rokx, 2012). Undernourishment in children is the result of low intake of nutrients and frequent infections such as diarrhoea, acute respiratory infections, and measles which cause poor absorption and or loss of nutrients consumed (Abdullah, 2015). This suggests that MCDB is more common in lower-income settings.

Maternal characteristics such stature, age, and age at first birth were among the factors associated with MCDB. In a study based in India, Patel, et al. (2020) find that mothers above the age of 35 displayed a greater risk of being overweight/obese and having an undernourished child. Moreover, increased age at first birth was found to protect against MCDB. Similarly, Oddo, et al. (2013) found that older age was found to be a predictor of MCDB. Maternal short stature was also a predictor of MCDB.

Economic and food environment

At the macro level, the economic status of a country informs its dietary and activity patterns, which in turn inform its public health concerns. In countries with a low Gross National Product (GNP), the prevalence of undernutrition is relatively high while the prevalence of overnutrition is low. In such countries, the double burden of malnutrition is most likely to occur in households with the resources required for an individual or individuals in that household to consume excess energy relative to expenditure and maintain a sedentary lifestyle. In contrast, in high GNP countries, the prevalence of overnutrition is relatively high while the prevalence of undernutrition is low. In very rare instances, there may be an undernourished individual in a household in a high GNP country. Differences in the nutritional status of individuals in low and high GNP contexts reflects that the energy density needs of individuals within the same household may vary. Therefore, individuals within the same household environment with the same genetic risk factors may have different lifestyle patterns related to external social, cultural, and physiological factors. While household DB can occur in all countries, it most commonly occurs in countries in the middle ranges of per capita GNP (Doak, et al., 2005).

Physical/built environment

The physical/built environment determines a key variable of energy expenditure, being physical activity. Today, most of the world's population resides in urban areas where the risk of overweight/obesity is greater. This is due to lifestyle changes associated with urban areas. Individuals in urban areas are becoming increasingly sedentary and dependent on store-bought food instead of growing and preparing food themselves. The advent of machinery has enhanced convenience; however, it has significantly reduced the physical activity urban-dwellers partake in (Shrimpton & Rokx, 2012). Roemling & Qaim (2013) add that urban environments are associated with greater food variety, particularly variety in processed, Western-style foods, and jobs which require lower levels of activity. As a result, overweight/obesity are likely to be most prevalent amongst the urban-employed.

Socio-cultural environment

Cultural perceptions about body size also influence individual's dietary and exercise habits. Okop, et al. (2016) found that being thin was undesirable amongst black South Africans in urban townships. Thin individuals were believed to be unhealthy and possible suffering form HIV/AIDS, TB or cancer. Morover, being overweight was associated with wealth and happiness as thin individuals were believed to be suffereing from physical or emotional stress or depression. Beliefs such as these sustain overweight/obesity in resource constrained communities. Moreover, some studies have suggested that in some cultures, a larger body size in women is considered more desirable (Holdsworth et al., 2004; Tateyama et al., 2018).

Miscellaneous

Guevara-Romero, et al. (2021) propose two scenarios to explain the contradictory findings in the literature. The first scenario is that of an overweight/obese mother of high socioeconomic status. She is employed, earns a sufficient income, has a high level of educational attainment, and resides in a rural or urban area. The second scenario is that of an overweight/obese mother of low socioeconomic status. She is without work and therefore has limited or no source of income, she has a low level of educational attainment and resides in rural or urban area. In both scenarios the mother has un undernourished child. In the first scenario, the wealthier mother purchases large quantities of processed and packaged food with low nutritional value as she has little to no time to cook due to work and other obligations. In such a scenario, it is also likely that that the mother does not breastfeed her children and she spends most of her time in a seated position at work. This type of mother may reside in a rural or urban area; however, such mother is more likely to be found in urban areas. Thus, the existence of MCDB in such a context is the result of dietary and lifestyle factors specific to urban areas (e.g., high-fat, high-calorie diets; passive entertainment devices, mechanised labour devices, etc.). In the second scenario, despite not having sufficient financial resources to purchase large quantities of food like her wealthier counterpart, the poorer mother is also overweight/obese. Her excess weight may be the result biological factors (i.e., she may conserve fatty tissue despite not consuming enough calories). This scenario may occur in a rural or urban setting as such mothers may have migrated from rural areas to urban areas in search for employment opportunities.

5. Data & Methodology

5.1.Data Source:

This study will make use of the National Income Dynamics Study (NIDS). NIDS is a nationally representative household panel survey implemented by the Southern Africa Labour and Development Research Unit. There have been five iterations of NIDS since in inception in 2008, with an interval of 2-3 years between each iteration. NIDS provides information on how households survive positive and negative shocks such as job loss or the attainment of a new job. Moreover, the NIDS covers other themes such as household composition and structure; fertility and mortality; migration; labour market participation and economic activity; health and education; human capital formation; vulnerability and social capital (Brophy, et al., 2018).

All five waves of NIDS will be used to various extents. The five waves of NIDS will be used to conduct a trend analysis of how MCDB prevalence and inequality has changed in South Africa between 2008 and 2017. For this part of the analysis, each wave of NIDS will be treated as a cross-sectional survey. Secondly, the fifth wave of NIDS will be used to conduct a decomposition analysis of the factors contributing to the inequality in MCDB in South Africa. Given the systematic nature of inequality, it is unlikely that the factors contributing to inequality will have changed over the period of a decade. As such the analysis will be restricted to the most recent wave.

5.2.Feasibility of Study:

The NIDS dataset has generously been made available on the DataFirst website. This study will investigate the socioeconomic inequalities in the prevalence of MCDB. However, the theory from previous studies will be useful to explain the potential causes of the observed results. There are other studies that have used Erreyger's CCI and the Wagstaff et al. decomposition analysis to evaluate socioeconomic inequalities in health conditions and the contributing factors (Ataguba et al., 2016; Mutyambizi et al., 2019; Rossouw & Ross, 2021).

5.3.Ethical Approval:

Ethical approval for the data collections of Waves 1 to 5 of the NIDS was granted by the University of Cape Town's (UCT) Commerce Faculty Ethics in Research Committee on 12 December 2007. Additional ethical approval for Wave 5 was granted by UCT's Faculty of Health Sciences Human Research Ethics Committee on 19 December 2019. Only respondents who had signed two consent forms (one form which remains with the respondent and another which is returned to the NIDS office) were included in the dataset. For young adults (aged 15-17 years), a consent form was signed by the young adult's caregiver and an additional consent form was signed by the young adult themselves (DataFirst, 2021). To ensure the confidentiality of respondents, before acquiring access to the NIDS dataset, users must agree that they will not attempt to identify specific individuals from the data. The University of the Witwatersrand granted this study an ethical waiver given that this study makes use of NIDS as secondary data.

5.4. Measuring MCDB:

One of the challenges in MCDB literature is that of a lack of uniformity. There are no concrete indicators used across the literature when analysing MCDB, and therefore differences in MCDB prevalence across studies may be owed to differences in the measurement approached used. Moreover, this lack of uniformity compromises the comparability of studies. There exists a general consensus with regards to the definition and measurement of overnutrition in adults, however the classification of undernourished children is more heterogonous. Body Mass Index (BMI) is the most commonly used measure of adult overnutrition, although the use of BMI has been criticised for its inconsistent association with non-communicable disease risk across populations. An adult is classified as overweight/obese if their BMI $\geq$ 25.0 kg/m^2 (Fongar, et al., 2019; Wells, et al., 2020). There are five oft-used indicators of child nutrition, namely BMI-for-age Z-score (BAZ), weight-for-age Z-scores (WAZ), height-for-age Z-scores (HAZ), weight-for-height Z-scores (WHZ), and micronutrient deficiency (Fongar, et al., 2019).

Therefore, there are five measurements of MCDB in the literature (Fongar, et al., 2019; Guevara-Romero, et al., 2021):

1) When an adult is overweight/obese, and the child is underweight (BAZ < -2 SD)

2) When an adult is overweight/obese, and the child is underweight (WAZ < -2 SD)

3) When an adult is overweight/obese and the child is stunted (HAZ < -2 SD)

4) When an adult is overweight/obese and the child is wasted (WHZ < -2 SD)

5) When an adult is overweight/obese and the child is micronutrient deficient.

The NIDS dataset defines a child as an individual aged 0 to 14 years. The indicator for child undernutrition that is used in this study is stunting using HAZ as defined above. Stunting has been chosen because it captures long-term malnutrition and it has been linked to various poor health outcomes such as cognitive development (Casale & Desmond, 2015). A binary variable was created assigning a value of 1 when a child is stunted (HAZ < -2 SD) and the mother is overweight/obese (BMI ≥ 25.0 kg/m^2), and 0 otherwise.

5.5. Data description

5.5.1 Creating household pairs

The DB at the household level simply refers to the co-existence of an under-nourished and an over-nourished individual in the same household (Abdullah, 2015). However, the presence of an undernourished child and an overnourished mother is the most commonly used measure of household-level DB (Freire et al., 2014; Kroker-Lobos et al., 2014; Leroy et al., 2014; Ramirez-Zea et al., 2014). Moreover, of the existing permutations of MCDB, the combination of a stunted child and overweight/obese mother (sometimes referred to as SCOW) is the primary driver of DB at the household level, with other permutations having a prevalence of less than 1% in most countries (Popkin et al., 2020). Maternal health has been found to have a direct impact on children's health in that maternal malnutrition is often correlated with child malnutrition (Egal & Oldewage-Theron, 2014). Moreover, in the South Africa context, due to the low-rate of union formation (particularly amongst the African population) children are far more likely to reside with just their mother than their father. Therefore, women in South Africa bear the burden of responsibility for both financial and physical care of children. The lack of male-income support in many South African households means that a mother's socioeconomic, demographic and lifestyle characteristics are a determinant of her children's nutritional and other outcomes (e.g., educational outcomes) (Hatch & Posel, 2018), hence this analysis was restricted to mother-child pairs.

While this paper uses the term “mother child double burden of malnutrition” as it is referred to in the literature, the focus is on the primary female caregiver of the household. In the case of children, the sample was restricted to the eldest children in the household. The restriction of the sample to eldest children was motivated by results from a study by Yu et al. (2020), which found that there is an association between childhood thinness and having either siblings or a higher birth order. This suggest that poorer nutritional outcomes are more likely to be observed amongst eldest children. To create the primary female caregiver and eldest child variable, the following variables were used “household members relationship to household head”, “best gender” and “best age in years”.

To create the primary female caregiver variable, the personal identifiers for the relationship to household head in the household questionnaire (B3) were used. All female household heads or female partners of household heads aged 15 and above were assigned a value of 1 and taken to represent the mother/female caregiver. Pregnant women were excluded from the sample, as their pregnancy status could result in BMI estimates which are biased upwards. Once again, the personal identifiers for relationship to household head in the household questionnaire were used to create the eldest child variable. The eldest child (below the age of 15) of the household head was assigned a value of 1 and taken to represent the child. Only the eldest child of the household in the sample was included. Given that the household head was the female primary caregiver herself or her male partner, the relationship of the child to the female primary caregiver was either that of a biological child or step-child. For the remainder of the paper, the primary female caregiver will be referred to as a mother, in order to match the terminology used in the established literature. To match mothers and children in the same household, the household identifiers were used, and mother and children in the same household were coded with a value of 1, and the remaining households were coded with a value of 0.

5.5.2. Creating the MCDB variable

Mothers’ weight and height measures were used to create their BMI measures. The NIDS provides three weight and height measures. In accordance with the NIDS practice used to calculate z-scores, the average of the first two measures were used, except in cases where the first two measure differed by more than 1 kg for weight and 1 cm for height. In these cases, the third weight and height measures were used (Brophy et al., 2018). WHO BMI cutoff points were used to categorise mothers’ weight status.

WHO classification	BMI (kg/m^2)
Underweight	<18.5
Normal	18.5 – 24.9
Overweight	≥25.0 – 29.9
Obese	≥30.0

To create the child stunting variable, z-scores were created using the ‘zscore06’ command in STATA. Similar to the practice used in the creation of BMI measures, the average of the first two weight and height measure was used, except when the measures differed by more than 1 kg or 1 cm. A “stunting” binary variable was created which coded children with a height-for-age z-score less than -2 as stunted, and children with a height-for-age z-score more than -2 as non-stunted.

The MCDB variable was created by assigning a value of 1 to all households with an overweight/obese mother and stunted eldest child pair. All other households were assigned a value of 0.

5.6. Measuring Socioeconomic Status: Wealth

In order to measure wealth-related inequalities in MCDB, a measure of wealth is required. Traditionally, monetary measures such as income and consumption expenditure have been used as measures of wealth or socioeconomic position (Howe, et al., 2008). However, the measurement of income and consumption expenditure are problematic, particularly in the LMIC context. Income and consumption expenditure are prone to fluctuations, especially during economic shocks. This is particularly important in LMICs, where consumption may have greater volatility and seasonality than in HICs. Respondents may also misreport their income or consumption expenditure. This may be due to a failure to recall such information accurately, or the desire not to accurately disclose income or certain types of consumption expenditure. Moreover, income measures may be unreliable in LMICs, where the informal sector has a stronger presence than in HICs (Howe, et al., 2008; Howe, et al., 2012).

Alternatively, an asset-based approach may be used as measure of wealth. This approach has been used by demographic studies such as the Demographic and Health Survey (DHS), which does not collect information on income or consumption expenditure, but rather creates wealth quintiles calculated on the basis of household assets and utility services. The rationale behind asset-based measures of wealth is that the more assets a household possess, the wealthier the household (Wittenberg and Leibbrandt, 2017). These assets were included in surveys because of their direct influence on health (e.g., television and radio ownership were indicators of households receiving public health messages) (Howe, et al., 2008). In the context of MCDB, television ownership may be of interest because of its influence on consumer preferences through the advertising of Western-style fast food outlets, as well as its association with passive leisure (Popkin, 2003; Shrimpton & Rokx, 2012). An asset-based measure of wealth will be employed in this paper. This NIDS does not provide wealth quintiles, and therefore asset indices were constructed using Multiple Correspondence Analysis (MCA). MCA is more appropriate for this study than Principal Component Analysis (PCA), as the former is designed for the analysis of categorical variables while the latter is designed for multivariate analysis of continuous variables. Moreover, PCA makes the assumption that indicator values are normally distributed while MCA makes fewer assumptions about the underlying distributions of indicator variables (Booysen, et al., 2008).

Following the methodology by Booysen et al. (2008), an asset index was created from a selection of variables from the NIDS survey. The STATA command 'mca' is used to construct the asset index. Table 5.6.1 presents the variables with the categories for each variable. The construction of the asset index was based on binary indicators for the 17 household durables. However, the resulting index may not be interpreted as a complete measure of well-being as it lacks other dimensions of well-being such as health, education and security. Two types of assets are contained in the constructed asset index namely communal, public assets versus private, income-associated assets. Therefore, it is more appropriate to consider the asset index a correlate of monetary poverty (Booysen, et al., 2008).

Table 5.6.1: **Variables used in the construction of the asset index**

Variable	Categories
Household durables	
Television	Owns a television Does not own a television
Satellite dish	Owns a satellite dish Does not won a satellite dish
Video player/DVD	Owns a DVD Does not own a DVD
Computer	Owns a computer Does not own a computer
Hi-fi stereo/CD player/MP3 player	Owns a Hi-fi stereo/CD player/MP3 player Does not own a Hi-fi stereo/CD player/MP3 player
Washing machine	Owns a washing machine Does not own a washing machine
Sewing/knitting machine	Owns a sewing/knitting machine Does not own a sewing/knitting machine
Camera	Owns a camera Does not own a camera
Microwave	Owns a microwave Does not own a microwave
Fridge	Owns a fridge Does not own a fridge
Electric stove	Owns an electric stove Does not own an electric stove
Motor vehicle	Owns a motor vehicle Does not own a motor vehicle
Motorcycle/scooter	Owns a motorcycle/scooter Does not own a motorcycle/scooter
Non-motorised boat	Owns a non-motorised boat Does not own a non-motorised boar
Flush toilet	Has access to a flush toilet Does not have access to a flush toilet
Piped water	Has access to piped water Does not have access piped water
Electricity	Has access electricity Does not have access to electricity

5.7.Independent Variables:

The independent variables that will be used in this study are based upon the risk factors associated with MCDB identified in the literature (Dieffenbach & Stein, 2012; Roemling & Qaim, 2013; Vaezghasemi et al, 2014. These include biological/health characteristics, economic characteristics, and household characteristics. These variables are described in more detail in Table 5.7.1.

Table 5.7.1: **Variables to be included in the analysis**

Category	Variable	Description
Biological/health characteristics	Maternal age	A categorical variable capturing the age of the mother
Economic characteristics	Mother's educational attainment	A categorical variable capturing the mother's highest level of education
	Mother's employment status	A categorical variable capturing the mother's employment status
	Household food expenditure per capita	A categorical variable capturing per capita food expenditure. Household food expenditure was divided by the number of persons in a household. The variable was then divided into five quintiles, with five being the highest expenditure category.
	Receipt of government grant	A binary variable capturing if anyone in the household was a recipient of a government grant
	Alcohol consumption	A binary variable capturing if anyone in the household spent money on beer/wine/spirits in the last 30 days
	Tobacco consumption	A binary variable capturing if anyone in the household spent money on cigarettes/tobacco in the last 30 days
	Marital status	A categorical variable capturing the mother's marital status
	Area of residence	A binary variable capturing if the household is based in aa urban/rural area. The variable is coded as 1 if the household resides in a rural area and as 0 if the household resides in an urban area.
	Household size	A categorical variable capturing the number of people residing the household.

5.8.Concentration Index:

The concentration index approach is used in Health Economics to evaluate the socioeconomic inequalities in health. It is derived from the Gini coefficient of income inequalities and requires that the health variable is on the same scale as income (Kjellsson & Gerdtham, 2011). In this study, the concentration index will be use measure the extent of inequality in MCDB over the distribution of wealth. The calculated index will take a value between -1 and 1. A negative value means that MCDB is disproportionately concentrated among the poor, and a positive value means that MCDB is disproportionately concentrated among the non-poor. A value of zero means that no income-related inequality exists in the prevalence of MCDB. The higher the concentration index, the higher the level of inequality (Wagstaff, 2005).

The Erreygers' corrected concentration index (CCI) will be used as opposed to the conventional concentration index. This is because the measures of MCDB used in this study are binary and bounded in nature (Wagstaff, 2005; Erreygers, 2009). The equation for Erreygers' CCI is as follows:

$$CCI_E = \frac{4\mu}{b-a} * C_s \qquad (1)$$

Where μ is the mean of the MCDB variable, b and a are its maximum and minimum values, respectively, and C_S is the standardised concentration index prior to Erreygers' correction (Erreygers, 2009; Wagstaff, 2009).

The Stata command 'conindex' will be used in this analysis to derive concentration indices and their standard errors. It will also be used to graph a concentration curve that underlies the indices and test for differences in inequality across wealth quintiles.

5.9. Decomposition Analysis:

Wagstaff, Van Doorslaer, and Watanabe's decomposition method is applied to the Erreygers' CCI to explain to what extent inequality in MCDB is owed to wealth itself, and how much is owed to other socioeconomic, demographic, health, and lifestyle factors (Wagstaff, Van Doorslaer & Watanabe, 2003). The linear relationship between the MCDB measure *m* and the independent variables x_{ik} is as follows:

$$MCDB_{mi} = \beta_0 + \sum_{k=1}^{k} \beta_{k x_{ik}} + \varepsilon_{mi} \qquad (2)$$

Where MCDB is the measure *m* for individual *i*, $\beta_1, \beta_2 \ldots \beta_k$ are the coefficients, ε_{mi} is the error term and x_{ik} is the set of k socioeconomic, demographic, health and lifestyle factors for individual *i*. The linear model given the relationship between $MCDB_{mi}$ and x_{ik} in the equation above, the standard concentration index for $MCDB_m$, is written as follows:

$$C_s = \sum_{k=1}^{k} (\beta_k \overline{x_k}/\mu) C_k + \frac{2}{n} \sum_{i=1}^{n} \varepsilon_{mi} \, Ri_k/\mu \tag{3}$$

Where $\overline{x}_k$ is the mean of $x_{k,}$ μ is the mean $MCDB_m$, C_k is the concentration index for x_k. C_k will give the level of inequality in variable x_k. The latter term is the generalised concentration index of the error term, and can be rewritten as GC_E/μ.

When converted to suit an Erreygers' CCI, the equation above is expressed as follows:

$$CCI_E(MCDM_m) = 4(\sum_{k=1}^{k} \beta_k \, \bar{x}_k C(x_k) + GC_E) \tag{4}$$

Where $\beta_k\overline{x}_k$ is the elasticity of factor x_k to MCDB measure changes, C_k is the concertation index for x_k and GC_E the unexplained error term.

6. Results

6.1. Descriptive statistics

Table 6.1.1: **Weighted summary data by wave**

Variable	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	P-value
Maternal age						
15 – 19	0.93	0.55	1.70	1.11	0.52	0.000
20 – 29	14.82	12.52	16.38	14.47	15.46	
30 – 39	25.71	24.47	25.22	23.63	25.53	
40 – 49	23.41	24.66	22.30	23.10	21.26	
50 ≥	35.13	37.80	34.40	37.69	37.23	
Maternal marital status						
Married/cohabitating	58.94	57.29	50.42	49.35	48.65	0.000
Widowed	14.87	14.76	12.54	16.09	15.14	
Divorced/separated	5.33	4.11	4.17	4.70	4.89	
Never married	20.86	23.83	32.87	29.86	31.32	
Maternal educational attainment						
No schooling	14.51	12.33	9.90	8.69	7.43	0.000
Less than primary (Gr.0)	0.01	0.04	0.00	0.10	0.00	
Primary	24.06	22.23	18.69	18.34	15.62	
Secondary	56.62	59.68	65.80	66.64	69.61	
More than secondary	4.81	5.71	5.61	6.22	7.34	
Maternal employment status						
Not economically active	37.49	48.16	42.49	41.06	42.54	0.000
Unemployed	19.56	13.71	17.23	11.29	11.00	
Employed	42.95	38.13	40.28	47.65	46.45	
Area of residence						
Urban	63.50	63.52	66.57	66.10	68.84	0.000
Rural	36.50	36.48	33.43	33.90	31.16	
Household size						
≤3	45.20	40.48	46.70	49.06	51.83	0.000
4 – 6	40.63	42.04	38.34	37.09	36.18	
7 – 9	10.04	12.45	11.25	10.25	8.96	
≥ 10	4.13	5.03	3.71	3.60	3.03	
Government grant receipt status						
Grant recipient	53.82	53.95	55.08	56.31	52.39	0.000
Not grant recipient	46.18	46.05	44.92	43.69	47.61	

Table 6.1.1. reports the weighted summary characteristics of disaggregated by maternal characteristics and household characteristics for the restricted sample for each wave. The

statistical significance in the characteristics across waves were identified through the chi-square test (χ^2). Across each wave, the largest share of mothers belonged to the 50+ age category (Wave 1 = 35.31, Wave 2 = 37.80, Wave 3 = 34.40, Wave 4 = 37.69, Wave 5 = 37.23). Mothers in the 15 – 19 year age cohort represented the smallest share of mothers (Wave 1 = 0.93%, Wave 2 = 0.55%, Wave 3 = 1.70%, Wave 4 = 1.11%, Wave 5 = 0.52%). Married/cohabitating mothers represented the largest share of mothers across waves (Wave 1 = 58.94%, Wave 2 = 57.29%, Wave 3 = 50.42%, Wave 4 = 49.35%, Wave 5 = 48.65%), while widowed mothers represented the smallest share of mothers (Wave 1 = 14.82% Wave 2 = 14.76%, Wave 3 = 12.54%, Wave 4 = 16.09%, Wave 5 = 15.14%). In terms of educational attainment, the majority of mothers across waves had secondary education (Wave 1 = 56.62% Wave 2 = 59.68, Wave 3 = 65.80%, Wave 4 = 66.64%, Wave 5 = 69.61%). Mothers with less than primary education represented a very small share of mothers in waves 1, 2, and 4 (0.01%, 0.04%, and 0.10% respectively), and had no representation in waves 3 and 5.

The share of employed mothers was 42.95% in Wave 1, after which it declined in Wave 2 (38.13%) and rose above 40% again in the succeeding waves (Wave 3 = 40.28%, Wave 4 = 47.65%, Wave 5 = 46.45%). In terms of household characteristics; nearly two-thirds of mother-child pair resided in urban areas across each wave (Wave 1 = 63.50%, Wave 2 = 63.52%, Wave 3 = 66,57%, Wave 4 = 66,10%, Wave 5 = 68.84%). For each wave, excluding wave 2, households with three or less residents represented the largest share of households with mother-child pairs (Wave 1 = 45.20%, Wave 2 = 40.48%, Wave 3 = 46.70%, Wave 4 = 49.06%, Wave 5 = 51.83%). Lastly, more that half of mother-child pairs lived in a household with at least one government grant recipient (Wave 1 = 53.82%, Wave 2 =53.95%, Wave 3 = 55.08%, Wave 4 =56.31%, Wave 5 = 52.39%).

Table 6.1.2: **Prevalence of MCDB across waves**

Wave	Number of Observations	MCDB Prevalence	Std. Error	95% CI	
1	4 916	0.038	0.003	0.033	0.044
2	5 026	0.036	0.003	0.030	0.041
3	6 269	0.059	0.003	0.053	0.065
4	6 960	0.023	0.002	0.019	0.026
5	7 814	0.025	0.002	0.022	0.029

Table 6.1.2 reports the prevalence of MCDB across waves, reported as proportions. The results show that the prevalence of MCDB was statistically significantly highest in the third wave of NIDS (2012) at 5.9% and has declined since then. The lowest prevalence of MCDB was observed in the fourth wave (2014 – 2015) at 2.3%. In the most recent wave (2017), the prevalence of MCDB was at 2.5%.

Table 6.1.3: **Prevalence of MCDB (wave 5)**

Variable	Non-MCDB	MCDB	P-value
Maternal age			
15 – 19	0.55% 41	0.00% 0	0.000
20 – 29	15.78% 1 173	13.43% 26	
30 – 39	24.68% 1 834	49.12% 94	
40 – 49	21.10% 1 568	23.99% 46	
≥ 50	37.90% 2 817	13.45% 26	
Maternal marital status			
Married/cohabitating	47.97% 3 555	57.69% 111	0.000
Widowed	15.39% 1 140	5.51% 11	
Divorced/separated	4.92% 365	6.77% 13	
Never married	31.72 2 351	30.02% 58	
Educational attainment			
No schooling	7.43% 551	2.17% 4	0.000
Primary	15.87% 1 176	12.75% 25	
Secondary	69.43% 5 143	81.94% 158	

More than secondary	7.27% 538	3.13% 6	
Employment status			
Not economically active	43.39% 3 114	32.23% 62	0.003
Unemployed	10.89% 780	16.42% 32	
Employed	45.62% 3 266	51.35% 99	
Area of residence			
Urban	68.59% 5 098	61.45% 118	0.612
Rural	31.41% 2 335	38.55 74	
Household size			
≤ 3	52.49% 3 901	25.92% 50	0.000
4 – 6	35.50% 2 639	59.18% 114	
7 – 9	9.04% 672	9.19% 18	
≥ 10	2.97% 220	5.71% 11	
Government grant receipt status			
Recipient of grant	52.55% 3 902	66.15% 127	0.000
Not recipient of grant	47.45% 3 524	33.85% 65	

Table 6.1.3 reports the percentage (first row) and the absolute number (second row) of households with and without MCDB disaggregated by maternal and household characteristics for wave 5 only (2017). The statistical significance in the characteristics between pairs with MCDB and pairs without MCDB were identified using the chi-square test (χ^2). The distribution of maternal age across pairs with MCDB and those without MCDB is statistically significant (p-value = 0.000). While maternal age amongst households with MCDB is concentrated amongst the middle age categories in pairs without MCDB maternal age is concentrated among the upper end of the maternal age distribution. For instance, amongst pairs with MCDB 49.12% of mothers belonged to the 30 -39 age category, while for pairs without MCDB 37.90% of mothers belonged to the 50+ age category.

The distribution of marital status across pairs with MCDB and those without MCDB is statistically significant (p-value = 0.000). Mothers who were married/cohabitating largest representation amongst pairs both with MCDB (57.69%) and households without MCDB (47.97%). This is possibly because this group constitutes a larger share of the sampled population than mothers who are widowed, divorced/separated, or have never been married. Similar to being married, mothers with secondary education were the most likely to live in households both affected by MCDB and not affected by MCDB. It appears that education is on average higher in households with MCDB. 81.94% of pairs with MCDB had mothers with secondary education, while this percentage is lower at 69.43% for pairs without MCDB. However, primary schooling is higher among mothers in pairs with MCDB (15.87%) than mothers in pairs with MCDB (12.75%). These differences are statistically significant according to the chi-square tests.

With regards to employment status, mothers who were employed represented the largest share of mothers in pairs both with MCDB (51.35%) and without MCDB (45.62%). Being unemployed, was the least likely employment status for mothers belonging to pairs both with MCDB (16.42%) and without MCDB (10.89%). These differences are statistically significant (p-value = 0.003). The difference in the percentage of households with MCDB and without MCDB residing in rural areas was not large, with 61.45% of households with MCDB being located in an urban area, and 68.59% of households without MCDB being located in an urban area. However, the geographical distribution of households with and without MCDB was not statistically significant (p-value = 0.612).

The distribution of households with MCDB and those without MCDB is statistically significant (p-value = 0.000). Household size amongst households with MCDB was concentrated amongst households with 4 – 6 residents (59.18%), while household size amongst households without MCDB was concentrated amongst smaller households. Households with 3 or less residents and 4 – 6 residents represented 52.49% and 35.50% of households without MCDB, respectively. The government grant receipt status of households with MCDB and households without MCDB was statistically significant (p-value = 0.000). A positive government grant receipt status (i.e., having at least one household member who receives a government grant was higher amongst households with MCDB. 66.15% of households with MCDB had at least one government grant recipient, while this percentage is lower at 52.55% for household without MCDB.

6.2. Erreygers' Corrected Concentration Index and Concentration Curve

Table 6.2.1: **Erreygers' Corrected Concentration Index for all Waves**

Wave of NIDS	No. of obs.	Index value	Std. error	p-value
Wave 1	4 693	-0.0082	0.0061	0.1818
Wave 2	4 940	-0.0231	0.0061	0.0002
Wave 3	6 066	-0.0206	0.0067	0.0023
Wave 4	6 834	-0.0082	0.0042	0.0500
Wave 5	7 624	-0.0091	0.0040	0.0215

Table 6.2.1 reports Erreygers' Corrected Concentration Index for every wave of NIDS. The index value captures the magnitude and direction of inequality in MCDB. A larger index value indicates higher inequality in MCDB. A negative (positive) index value indicates that MCDB is disproportionately concentrated amongst the poor (rich). The results show there is no clear trend in inequality in MCDB across the waves. Inequality in MCDB has varied across waves, peaking in the 2nd wave of NIDS (2010 – 2011). The index value for the second wave is -0. 0231, and it is statistically different from 0 (p-value = 0.002). Inequality in MCDB was the lowest in the 1st (2008) and fourth wave (2014 – 2015), with an index value of -0.0082 for both waves. However, the results are not statistically significant for the first wave. Across all waves

the index value was negative, indicating the inequality in MCDB was disproportionately concentrated amongst the poor.

Figure 6.2.1: **Concentration curve for NIDS Wave 5 (2017)**

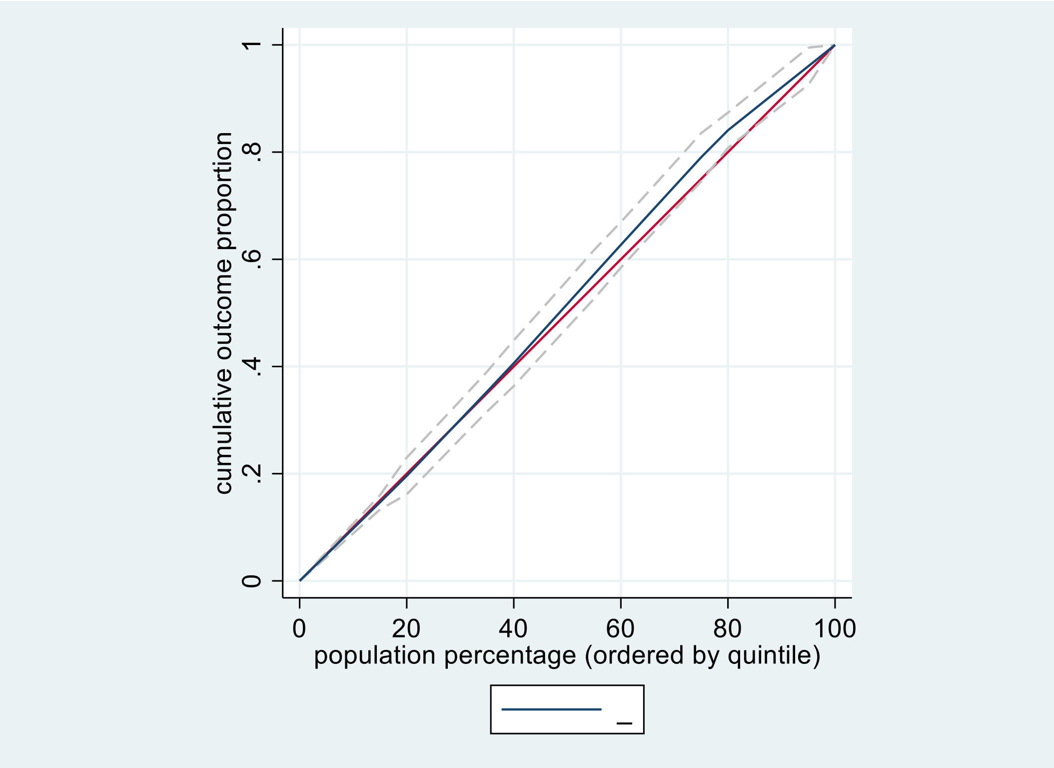

Figure 6.2.1 illustrated the concentration curve for wave 5 only. The concentration curve is derived from the concentration curve is derived from the concentration index. If the concentration lies on the 45-degree line of equality, this indicates that there is no inequality in the distribution of MCB across socioeconomic status. However, if the curve lies above (below) the 45-degree line of equality, MCDB is concentrated amongst the poor (rich). In figure 6.2.1, the concentration curve lies above the line of equality, and therefore MCDB is disproportionately concentrated amongst the poor. However, these results are to be interpreted with caution as the confidence intervals of the concentration curve are rather wide, which suggests the socio-economic gradient is non-linear (i.e., there may not be a clear step-wise increase in the prevalence of MCBD with decreasing socioeconomic status).

6.3.Wagstaff Decomposition Analysis

Table 6.3.1: **Wagstaff decomposition analysis (wave 5)**

Variable	Elasticity	CI	Absolute contribution	% Contribution	% Aggregate Contribution
Wealth quintile					91.1649856
Quintile 1	(reference)	(reference)	(reference)	(reference)	
Quintile 2	.00124883	-.35474664	-.00044302	4.385807	
Quintile 3	.00104474	-.14947955	-.00015617	1.5460413	
Quintile 4	.00331249	.18786352	.0006223	-6.1606467	
Quintile 5	-.01137039	.81191804	-.00923182	91.393784	
Area of residence					
Urban	(reference)	(reference)	(reference)	(reference)	
Rural	.00595676	-.43921464	-.0026163	25.90096	
Food expenditure quintile					-0.54564568
Food quintile 1	(reference)	(reference)	(reference)	(reference)	
Food quintile 2	.00234985	-.14096643	-.00033125	3.2793259	
Food quintile 3	.00132909	-.05356045	-.00007119	.70473614	
Food quintile 4	.00663345	.01329257	.00008818	-.87292622	
Food quintile 5	.00089952	.41063581	.00036938	-3.6567815	
Cigarette/tobacco					
Not purchased	(reference)	(reference)	(reference)	(reference)	
Purchased	.00223067	.08317898	.00018555	-1.8368716	
Alcohol					
Not purchased	(reference)	(reference)	(reference)	(reference)	
Purchased	-.00348266	.18541459	-.00064574	6.3927012	
Government grant receipt status					
No grant recipient	(reference)	(reference)	(reference)	(reference)	
Grant recipient	.01366084	-.35535217	-.00485441	48.057965	
Household size					18.8318983
3≤	-.10041712	.00676481	-.0006793	6.7250034	
4-6	-.02663659	.05918198	-.00157641	15.606202	
7-9	-.00841232	-.04201818	.00035347	-3.4993071	
≥10	0	-.02392861	0	0	
Mother's age					4.5920864
15-19	0	-.00917815	0	0	
20-29	.01921511	-.11239341	-.00215965	21.380252	
30-39	.04746938	.00531956	.00025252	-2.4998756	
40-49	.02280443	.06328953	.00144328	-14.28829	

≥50	0	.05296247	0	0	
Mother's employment status					-12.56418516
Not economically active	-.00959317	-.12725228	.00122075	-12.085282	
Unemployed	-.00075525	-.06405099	.00004837	-.47890316	
Employed	0	.19130327	0	0	
Mother's marital status					-57.2135378
Married/cohabitating	.01874393	.29220667	.0054771	-54.222537	
Widowed	-.00111962	-.07041605	.00007884	-.7804973	
Divorced/separated	.00506268	.04410434	.00022329	-2.2105035	
Never married	0	-.26589496	0	0	
Residual				-22.780356	
Total				100.0	

Table 6.3.1 reports the results of the decomposition analysis of MCDB for wave 5. The columns display the elasticity, concentration index, absolute contribution, percentage contribution for each determinant of MCDB, and aggregate contributions of multiple categorical variables. The elasticity reflects the sensitivity of MCDB to changes in the covariates. Positive elasticities mean that mother-child pairs with this characteristic are more likely to be affected by MCDB (i.e., the child is stunted, and the mother is overweight/obese). Wealth quintiles, with the exception of quintile 5 have positive elasticities. This indicates that these quintiles are more likely to be affected by MCDB – that is to say, mother-child pairs in the less wealthy quintiles are more likely to be affected by MCDB than mother-child pairs in the wealthiest quintile. Moreover, mother-child pairs from household in which cigarettes/tobacco were consumed in the month preceding the survey and households with at least one government grant recipient were more likely to be affected by MCDB. Furthermore, mother-child pairs for which the mother was married/cohabitating or divorced were also more likely to experience MCDB.

For each of the determinants of MCDB, Erreygers' Corrected Concentration Index across wealth quintiles is calculated and reported in the column labelled CI. A positive index value indicates that that the determinant has a pro-rich distribution (i.e., the determinant is disproportionately distributed amongst the rich), and a negative index value indicates that the determinant is disproportionately distributed amongst the poor. Factors such as cigarette/tobacco consumption, alcohol consumption, a smaller household size (6 or less residents), older mothers (aged 30 and above), being employed and marital status (married/cohabitating and divorced/separated) have a positive concentration index value. This indicates that these factors are concentrated amongst the rich. Factors such as larger household size (7 or more residents), younger mothers (15 – 29 years), employment status (not economically active and unemployed), and marital status (widowed and never married) have negative concentration and are therefore concentrated amongst the poor.

The absolute and percentage contributions of the explanatory variables are also estimated. A positive absolute contribution means that inequality in MCDB would decrease if that variable were equally distributed across socioeconomic status, and a negative absolute contribution means that inequality in MCDB would increase if that variable were equally distributed across socioeconomic status. Percentage contributions indicate that an increase in inequality of an explanatory variable will increase the degree of inequality in MCDB. Similarly, a decrease in inequality of an explanatory variable will decrease the degree inequality in MCDB.

Inequality in MCDB was largely explained by wealth status (91.16%). Other factors that made significant contributions to inequality in MCDB are grant receipt status (48.06%). Grant receipt status had a negative absolute contribution, indicating that inequality in MCDB would increase in grant receipt status were equally distributed across socioeconomic status. Household size made a 18.30% absolute contribution to inequality in MCDB. If the negative absolute contributions of having households with less than 6 residents were to fall way (i.e., socioeconomic status were equalised across household size), inequality in MCDB would increase.

Factors that had positive absolute contributions include wealth quintile (being in quintile 4 relative to wealth quintile 1), food expenditure per capita quintiles (being in food expenditure quintile 3 and quintile 5 relative to quintile 1), household size (7 – 9 residents), maternal age (30 - 39 years and 40 - 49 years), maternal employment status (not economically active and employment status) and marital status (married/cohabitating, widowed, and divorced/separated). That means that if the middle and highest wealth quintile of food expenditure were equally distributed across socioeconomic status, inequality in MCDB would decrease. Furthermore, if living in a household with 7 – 9 residents, maternal age of 30 -49 years, mothers being unemployed or not economically active, and being either married/cohabitating, widowed, or divorced/separated were equally distributed across socioeconomic status, inequality in MCDB would decrease.

The factors included in the analysis explain 122,78% of overall inequality in MCDB. The residual term, which is the difference between the concentration index and the sum of all factor contributions, indicates that there are some unobserved characteristics which contribute to inequality in MCDB. These unexplained determinants contributed to -22.78% of inequality in MCDB.

7. Discussion

The study finds evidence of the existence of the double burden of malnutrition in South African households, which in this study has been defined as the co-existence of a stunted child and an overweight/obese mother. The results of the descriptive analysis indicate that the prevalence of MCDB was highest in the third wave of NIDS (2012), with MCDB being prevalent amongst 5.9% of mother-child pairs. The lowest prevalence of MCDB was recorded in the subsequent wave of NIDS, wave 4 (2014 – 2015) at 2.3% amongst mother-child pairs. The prevalence of MCDB rose slightly between the fourth and the fifth wave, reaching a prevalence rate of 2.5% in wave 5 (2017). Although these prevalence rates may not seem alarming, the double burden of malnutrition is an emerging policy concern as it can have deleterious effects on the country's health spending as discussed in the introduction. Similar to the results of this research paper, a relatively low prevalence rates of MCDB (defined as a stunted child and overweight/obese mother) have been observed in Bangladesh (4%) and India (6%). A slightly higher prevalence rate was observed in Indonesia (11%) (Oddo, 2012; Patel et al., 2020). Another study in Ethiopia found that the prevalence of an overweight/obese adult and stunted child was the most prevalent form of DB in Addis Ababa, affecting 9% of households (Bliznashka et al., 2021).

This study also revealed that there is inequality in the distribution of MCDB. Across all waves of the NIDS, MCDB was concentrated amongst the poorest households, with inequality in MCDB being the highest in the second wave (2010 – 2011). However, there was no clear trend in inequality in MCDB (i.e. it cannot be concluded that inequality in MCDB has increased or decreased consistently over time). This study also revealed some of the socioeconomic, lifestyle and biological factors which contributed to inequality in MCDB. Inequality in wealth (measured by asset possession) was the most important factor in determining wealth-related inequality in MCDB amongst mother-child pairs. This finding, coupled with the consistent concentration of MCDB amongst the poor, confirm both hypotheses of this paper; 1) socioeconomic inequalities in MCDB in South Africa are concentrated amongst the poor, and 2) there are non-medical factors which determine an individual's health status. These non-medical factors are informed by an individual's socioeconomic status, and therefore inequality in health outcomes (in this case MCDB) is inherently unjust and unfair.

Wealth disparities create differences in other health determinants such as food consumption and access to other health-enhancing goods and services (Gu et al., 2019). Although the 5 waves of NIDS included in the study follow participants over a short period of time (2008 –

2017), the consistent concentration of MCDB amongst the poor may provide evidence for the thrifty phenotype hypothesis. It may be possible that individuals who were undernourished children in earlier life are now overweight/obese in adulthood. Furthermore, these results indicate the potential for improving maternal and child health outcomes by reducing wealth inequality. A study by Von Fintel (2021), also using NIDS data, observed worse health outcomes for children living in poor households compared to those of their counterparts living in non-poor households. Moreover, they also found that children living in chronic poverty (i.e., children who were poor over the most three most recent waves of NIDS) had worse health outcomes than those who lived in poor households for only one wave of NIDS. With increasing unemployment and widening inequality as a result of COVID-19, it is likely that more children are living in chronically poor households. This suggest that the health outcomes of these children will continue to deteriorate and have a long-lasting impact. Contrary to the results of this paper, Patel et al. (2020) found that MCDB was highest in households with mothers of higher socioeconomic status.

The concentration of MCDB amongst the poor can be explained using the social determinants of health model, which posits that health is produced by the following factors: biological factors, behavioural factors, socio-cultural factors, living and working conditions, and structural factors (Scott et al., 2017). There are multiple factors which constrain an individual's ability to make health-enhancing choices. Price, for instance, is an important determinant of the individual's food purchasing choices. Poverty is often associated with rationing and food insecurity. This may lead individuals to opt for food items which are processed and have little nutritional value because they are cheaper and have a longer shelf life. Furthermore, spatial segregation and the inability to afford travel costs influences an individual's access to gyms, health facilities, grocery stores, etc., and thereby further constrains their ability to make health-enhancing decisions. Cultural perception about body size (e.g., fatness/thinness being considered as more or less desirable) coupled with unhealthy social norms (e.g., excessive alcohol or tobacco consumption) also play a role in informing health outcomes.

The results also revealed which factors are concentrated amongst the poor and the rich. Unsurprisingly, belonging to a larger household (7 or more members), having a young mother (below 30 years), having a mother who is unemployed or not economically active, and a mother who is widowed or has never been married were concentrated among the poor. The consumption of cigarettes and alcohol, residing in a smaller household (less than 7 members) having a mother who is older (above 30 years), having a mother who is employed, and having a mother who is married/cohabitating or divorced were concentrated among the rich. Over and above wealth inequality, other factors which contributed to inequality in MCDB were government grant receipt status, food expenditure per capita, maternal employment status, and maternal marital status. With the exception of grant receipt status, if the afore mentioned explanatory variables were equally distributed across wealth status, inequality in MCDB would decrease. However, inferences drawn from the grant receipt status must be interpreted with caution, as the paper uses the grant receipt status of the household rather than that of the mother (who generally is in control of the grant resource).

Policies have already been implemented to address stunting and overweight/obesity as distinct phenomena. For example, in 1994 the South African government introduced the School Nutritional Programme which provides school children with meals in an effort to combat undernutrition amongst school-aged children (Modjadji & Madiba, 2019). And in 2017, a 20% tax on sugar-sweetened beverages to offset the increased intake of added sugars and thus decrease the prevalence of overweight/obesity (Benade & Essop 2017). There is a need for policies and measures which address overnutrition and undernutrition (and their contributing factors such as poverty and inequality) simultaneously. Addressing DB is complex as the risk factors for the contrasting forms of malnutrition are different (Kimani-Murage et al., 2011), which may make it difficult for a single intervention to address both forms of malnutrition

Given that the emergence of MCDB is fairly recent, and the policy environment for actions and strategies targeted at combating MCDB is fairly untapped, the WHO in 2017 published a set of “double-duty actions” (DDAs) to tackle MCDB (WHO, 2017). The core tenet of DDAs is that policies aimed at addressing malnutrition need to be careful not the aggravate one form of malnutrition, while trying to combat another (Menon & Penalvo). DDAs include interventions such as the promotion of exclusive breastfeeding, market regulations, and maternal nutrition and antenatal care programs. An example of one such intervention was a behavioural intervention in Indonesia which targeted the behaviour of mothers by providing them nutrition education and home visits or printed education resources, in conjunction with government-funded food supplementation programs. Slight improvements were observed in the primary outcome measures of undernourished children such as weight. Despite improvements being observed in physical activity, fruit and vegetable consumption and the ability of mothers to provide children with growth-promoting animal protein in the education group, these did not translate to significant improvements measures of overnutrition such as BMI (Mahmudiono et al., 2018). These results underscore the complexity of addressing contrasting forms of malnutrition within the same household. Many interventions have proven to be successful in reducing undernutrition, however lower efficacy is observed when it comes to addressing overnutrition (Nugent et al., 2020). A study in Indonesia and Bangladesh found that currently breastfeeding was a protector against MCDB (Oddo, 2012). Exclusive breastfeeding therefore needs to be encouraged amongst new mothers.

Other possible interventions to combat MCDB include poverty reduction measures such as food subsidies. Research suggests that there is a positive relationship between healthy nutrient-rich food and household income (Menon & Penalvo, 2018). Such research validates the results of this research, which found that wealth status was the largest and most significant determinant of inequality in MCDB. In a country like South Africa where poverty and inequality are rife, poverty reduction measures would enable households of lower socioeconomic status greater access to healthier food options. This is because households of lower socioeconomic status are more likely to be in food desserts (i.e. locations where people have limited access to healthy and affordable foods) and therefore end up having to pay more (e.g. transport costs) in order to access healthy food or resort to cheaper and more convenient processed food (Milan et al., 2015).

8. Conclusion

This study assesses the extent of socioeconomic inequality in MCDB in South Africa and uses Wagstaff's decomposition analysis to decompose the factors which contribute to inequality in MCDB. The results how that inequality in MCDB discriminates against the poor. This study also provides evidence that wealth is the biggest contributor to inequality in MCDB. This study therefore provides justification for measures that will reduce poverty and overall inequality in South Africa, as a means to improve nutritional outcomes in the country by enabling poorer individuals to make better decisions regarding their health. Investing in the nutrition of the population of South Africa could have positive long-term economic benefits for the country by virtue of a reduction in the burden of disease and thereby reduced health expenditure, increased productivity, and improved human capital accumulation. Therefore, greater policy effort needs to be directed towards improving maternal and child nutritional outcomes.

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