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Reducing children's malnutrition by increasing mothers' health insurance coverage: A focus on stunting and underweight across 32 sub-Saharan African countries

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Abstract

Despite the potential role of a mother's health insurance coverage in enhancing her children's health and well-being, research examining its impact on children's nutritional outcomes remains sparse. We examine the link between mothers' health insurance subscription and child malnutrition using data extracted from the Demographic and Health Surveys program across 32 sub-Saharan African countries on 109,019 children under the age of 5. We measure child stunting and underweight using height-for-age z-scores and weight-for-age z-scores, respectively. After addressing endogeneity, we found that mothers' health insurance subscription decreases child stunting and underweight. These results are robust to different approaches to addressing endogeneity and different measures of child stunting and underweight. The effect of mothers' health insurance subscription on stunting and underweight is more pronounced among girls than boys. These findings further demonstrate that mothers' health insurance subscription influences child stunting and underweight through maternal healthcare utilization and the provision of diversified diets to children.

Keywords: Health insurance, children health outcomes, stunting, underweight, dietary diversity, maternal healthcare utilization (MHU), sub-Saharan Africa (SSA)

JEL Codes: D14, G22, I12, I18

1. Introduction

In this study, we fill an essential research gap by providing answers to whether health insurance coverage contributes to children's nutritional outcomes. Despite combined efforts by global leaders to alleviate malnutrition, estimates from 2020 indicate that 22% (149.2 million) and 6.7% (45.4 million) of children under 5 years of age suffered from stunting and wasting, respectively (FAO et al., 2021). The prevalence of underweight children under age 5 in the same period was 12.6% globally (85.5 million). Although malnutrition is a global menace, children in Africa and Asia comprise over 90% of stunted children worldwide (UNICEF et al., 2020). While the prevalence of undernourishment in Africa was 21.0% in 2020, the rate was 24.1% in sub-Saharan Africa (SSA). This isolates SSA as the epicenter of malnutrition on the African continent. Malnutrition is associated with an increase in healthcare expenses as well as a decline in productivity and economic growth, which creates a vicious circle of poverty and disease (World Health Organization, 2014). Apart from potential mortality and disability, malnutrition may impair the physical and cognitive development of children along with bringing a higher risk of concomitant infections (Kandala et al., 2011; Wali et al., 2019). Climate variability and extremes, conflict, economic slowdowns and downturns (e.g., the COVID-19 pandemic), and the increasing cost of a healthy diet have been identified as the main drivers of increasing malnutrition levels and food insecurity (Development Initiatives, 2021; FAO et al., 2021).

To alleviate malnutrition and food insecurity across the globe and especially in SSA, transforming food systems to withstand the negative effects of the identified drivers has recently been emphasized (FAO et al., 2021). These policies aim at tackling the drivers by preventing violence by promoting peace, increasing or strengthening climatic and economic resilience, decreasing the cost of healthy food, addressing poverty and inequality, and ensuring a drift toward sustainable consumption habits (FAO et al., 2021). Among the many policies identified to alleviate malnutrition in developing countries, the potential role of social insurance in the form of health insurance, has received little consideration in the policy and research space. Although social insurance forms an important part of the social safety net, social assistance (i.e., cash transfers), and labor market programs have received more attention for their impact on poverty and inequality (Bryant, 2009; Pearson et al., 2016; Pellerano et al., 2016; van Ufford et al., 2016). This makes it imperative to analyze the effect of health insurance coverage on malnutrition for children under the age of 5 years in SSA.

Based on the extant literature, conceptual links can be drawn to explain the potential impact of health insurance coverage on malnutrition. First, increased health insurance coverage can reduce malnutrition in children (Aoun et al., 2015; De Silva & Sumarto, 2018) through mothers' increased utilization of prenatal and postnatal healthcare services (Ameyaw et al., 2017; Dixon et al., 2014). Second, the financial savings associated with health insurance (Garcia-Mandicó et al., 2021; Liu, 2016) can provide the financial resources required to either purchase healthy food or increase dietary diversity, which is known to improve child nutrition (Frempong & Annim, 2017). In spite of the nutritional benefits of health insurance, studies focusing on the link between health insurance and child malnutrition are limited.

Empirical studies in China (Peng & Conley, 2016) and Argentina (Nuñez et al., 2016) as well as other systematic reviews (Aderibigbe et al., 2018; Erlangga et al., 2019) have demonstrated that health insurance coverage improves children's nutritional outcomes. Other related studies have indicated that boys are more likely to be undernourished than girls because from conception, boys are more susceptible to illness than girls (Kraemer, 2000; Peng & Conley, 2016; Thurstans et al., 2020). These facts notwithstanding, empirical studies have not been undertaken in SSA and the potential channels in the association between health insurance coverage and child nutritional outcomes are yet to be empirically explored.

Despite the potential role of health insurance in reducing malnutrition among children, health insurance coverage among women in SSA is considerably low (Amu et al., 2021). This implies that the nutritional gains of health insurance will possibly elude many children in SSA due to its low coverage in the subregion. Most existing studies on health insurance have focused on its immediate effect on healthcare utilization without extending the analysis to intermediate outcomes such as malnutrition (Tilahun et al., 2018; Twum et al., 2018; Van Der Wielen et al., 2018; Wang et al., 2017; Yaya et al., 2019). Studies linking health insurance to other welfare outcomes often focus on single countries, which limits the links being examined (see e.g., Dixon et al., 2014; Dzakpasu et al., 2012; Kofinti et al., 2022; Yaya et al., 2019). The health insurance–welfare nexus is potentially endogenous, which may result in biased estimates if such endogeneity is not resolved (Fiestas Navarrete et al., 2019b; Hellinger & Wong, 2000b; Liang et al., 2004b), yet most extant studies have not addressed this methodological challenge.

Based on the gaps identified in the extant literature, we seek to answer the following research question: Does health insurance coverage influence children's nutritional outcomes? We do this by estimating the effect of mothers' health insurance subscription on stunting and underweight among children under the age of 5 years using child-level data across 32 countries compiled from the Demographic and Health Surveys (DHS) program. The gender and locational differences in the links between health insurance subscriptions and stunting and underweight are explored by estimating subsampled models for male–female and rural–urban children. We empirically examine whether mothers' health insurance subscription transmits to nutritional outcomes through the utilization of maternal healthcare services (e.g., trimester, antenatal, and postnatal) and the diversity of food consumed by children.

Our study makes the following contributions to the literature. First, we address the narrowed scope of previous studies by extending our study to include 32 countries in SSA, which helps to tell a more holistic story and offers policy capital regarding the health insurance–child nutrition nexus. Second, we provide empirical evidence of how health insurance coverage can be considered a viable policy tool in achieving Target 2.2 of the United Nation's (UN's) Sustainable Development Goals (SDGs), which seeks to end all forms of malnutrition by 2030. Third, we address one of the key methodological gaps in the literature by resolving the endogeneity associated with health insurance subscription using instrumental variable (IV) estimation in which the proportion of insured neighbors within a woman's locality is used as an instrument. Aside from the endogeneity-corrected results, additional quasi-experimental

approaches such as the propensity score matching (PSM) and Lewbel IV approaches are implemented as robustness checks.

The remainder of this paper is organized as follows. Section 2 provides the conceptual link between mothers' health insurance subscription and child malnutrition and other theoretical considerations. Section 3 discusses the methodology, which includes the data sources, while the empirical model specification is presented in Section 4. Section 5 presents the results, while Section 6 concludes and provides recommendations.

2. Conceptual link between mothers' health insurance coverage and child malnutrition

Interventions aimed at universal health coverage, such as health insurance, have been proposed as an effective approach to addressing inequality in healthcare (Olugbenga, 2017). As a result, several countries in SSA have introduced health insurance schemes (Wang et al., 2014). In addition to serving as a pro-poor intervention, health insurance augments the prospect of achieving universal health coverage (Wang et al., 2017). In this section, we explore how mothers' health insurance coverage can potentially influence children's nutritional outcomes through maternal healthcare utilization (MHU), dietary diversity, and financial savings.

2.1. Maternal healthcare utilization

Health insurance provides a mechanism for women to access and utilize maternal healthcare services (Ameyaw et al., 2017; Amu et al., 2021; Bukari & Koomson, 2020; Dixon et al., 2014). This has a consequential effect on the health of their children. As advocated by the World Health Organization (WHO) (2017), every pregnant woman must have eight or more prenatal visits to a health center and be given iron and folic acid supplements for more than three months. During the same period, two tetanus injections, vitamins, calcium, and anti-malaria drugs should be accessed by the mother. This strengthens the mother's physical health and prepares her body for the delivery of a child with an adequate birth weight, given that children derive their nourishment completely from their mother during pregnancy. The National Institute of Health (2012) emphasized that babies born to mothers without prenatal care are three times more likely to be born with a low birth weight. Newborns with a low birth weight are not only susceptible to poor growth outcomes but are five times more likely to experience infant mortality than babies whose mothers received prenatal care.

Children who receive regular postnatal checks are likely to remain healthy given the opportunity for continuous monitoring and prescription of the most appropriate health promotion for maternal and newborn health, which has a far-reaching effect on the child's health outcomes (WHO, 2017). MHU directly leads to improved maternal health, awareness of nutritional practices, and health-promoting choices for mothers and their newborns. The birth weight of newborns is enhanced, which directly impacts their weight and height and therefore their nutritional scores. Lu et al. (2016) and Quimbo et al. (2011) empirically demonstrated that health insurance coverage is associated with a 14% and a 12% reduction in the probability of stunting in Rwanda and the Philippines, respectively.

2.2. Financial savings for dietary diversity

When households are overburdened with out-of-pocket healthcare expenditures, it may compromise their ability to achieve the standard level of dietary diversity. In India, where over 80% of healthcare costs are paid out of pocket, over 55 million people enter poverty within 1 year because of the costs associated with healthcare in the absence of health insurance (Finkelstein et al., 2012; Kumar, 2019). The financial burden of healthcare, as measured by out-of-pocket expenditures, relative to overall family income, is substantially greater for low-income families with children (Agency for Healthcare Research and Quality, 2006; Galbraith et al., 2005; Wherry et al., 2016). This financial burden may reduce the budget that families can allocate to diet and therefore attenuate their ability to attain the minimum dietary diversity (MDD) that will guarantee the overall health of their children. This theoretical link between dietary diversity and children's nutritional outcomes is rooted in UNICEF'S 2020 Framework, which builds on a 1990 conceptual work. It identifies diet as one of the immediate determinants of child nutrition. Diet is influenced by having sufficient food and adequate feeding and dietary practices, both of which support children's nutritional outcomes (UNICEF, 2021). Evidence from the United States indicates that insured persons are 35% less likely to incur out-of-pocket healthcare expenditures and about 40% less likely to skip bills or borrow money to settle medical costs (Finkelstein et al., 2012).

Leininger et al. (2010) noted that health insurance augments non-medical spending, particularly among low-income families. The Oregon Health Insurance Experiment revealed that enrollment in Medicaid contributed to 15% increase in Supplemental Nutrition Assistance Program participation (Baicker et al., 2013). Subsequently, the benefits of health insurance manifest in lower healthcare spending, leading to the retention of household resources that may subsequently be directed to investments in other aspects of children's well-being (Wherry et al., 2016). We, therefore, contend that adults with reduced out-of-pocket expenditures due to health insurance are generally likely to have money reserves for non-healthcare expenditures and be more likely to achieve better dietary diversity for their children relative to those who are not covered by health insurance.

The WHO recommends that children need the MDD of four out of seven food groups to experience the ideal growth and holistic development (WHO, 2008). Unfortunately, many children across the developing world do not meet this criterion (Khamis et al., 2019). Since dietary diversity constitutes a major requirement for children's growth, it is an essential indicator for assessing the eating habits, nutritional status, and overall health of children. Children's ability to meet the MDD is noted to protect against underweight and wasting (Ocampo-Guirindola et al., 2016).

Although Wemakor and Laari (2018) could not establish a positive association between dietary diversity and child health, several other empirical studies agree that a positive association exists between dietary diversity and child health, albeit with observable geographical and contextual variations (Aboagye et al., 2021; Frempong & Annim, 2017; Madzorera et al., 2021; Ocampo-Guirindola et al., 2016). It is worth noting that parents' ability to achieve the MDD for their children is partly linked to health insurance coverage such that the children of parents with health insurance are better positioned to have dietary diversity (Baicker et al., 2013).

2.3. Income effect

The prenatal and postnatal healthcare access enabled by health insurance coverage keeps a mother healthy enough to make labor force participation possible soon after birth, which may increase her available financial resources for providing a quality diet to her child (Hamid et al., 2011). Since health insurance may increase a mother's financial savings (Wherry et al., 2016), this can be channeled into durable assets or wealth accumulation. An increase in wealth may translate into increased consumption of the nutritious diet required to prevent stunting. Durable asset accumulation could be a risk-coping mechanism, which means that a household is able to smooth consumption during times of idiosyncratic economic shock to avoid the risk of food insecurity (Koomson et al., 2021), which is known to be a key driver of children's malnutrition. By inference, health insurance can affect children's nutritional status by means of the income effect that results from insurance coverage.

3. Data and variable definitions

We use data from the DHS Program, which is an international household survey that provides data on multiple indicators for monitoring and evaluating impact in the areas of population, health, nutrition, wealth, and empowerment.[2] It employs a systematic sampling procedure and focuses on households and household members—particularly on women and children as well as fathers—and other household-level variables. The DHS consistently collects and monitors child health outcomes in a standardized and comparable way in developing countries and serves as one of the main data sources for measuring and tracking child health outcomes. We appended all available nationally representative and publicly available DHS surveys from 2006 to 2020. The DHS surveyed a total of 32 countries. The observations for each country were captured across different survey periods. For instance, the last survey year is registered by Eswatini in 2006, whereas the current survey period was recorded by Rwanda in 2020. We restricted our sample to children 0 to 59 months of age who provided data on anthropometric outcomes and whose mothers responded to the question on health insurance coverage. Our focus on children in this age group is based on recommendations by previous studies and because children under age 5 who experience stunting and underweight are at risk of not reaching their full physical and mental potential (Kandala et al., 2011; Wali et al., 2019). We sourced real per capita gross domestic product (GDP) data for each of the countries corresponding to the year of the survey from the World Development Indicators as a macro-level control variable. After cleaning the data, the final sample totaled 118,113 children aged 0 to 59 months in 104,121 households. Due to missing observations, our regression model with the highest level of observations included 109,019 children aged 0 to 59 months in 100,129 households.

3.1. Independent variable

The primary independent variable for this study is mothers' health insurance coverage or enrolment. This is a dichotomous variable that takes a value of 1 for mothers who subscribe to any health insurance scheme in their respective country and 0 for mothers who do not subscribe. This measure is in line with prior studies in the literature (Ameyaw et al., 2017; Van Der Wielen et al., 2018; Wang et al., 2017; Yaya et al., 2019).

[2] The DHS program is managed and funded by the United States Agency for International Development (USAID). Researchers have free access to DHS data (https://dhsprogram.com/data/available-datasets.cfm).

3.2. Outcome variables

We examined two child health outcomes which are stunting (using the height-for-age z-score, or the HAZ) and being underweight (using the weight-for-age z-score, or the WAZ). The z-scores for anthropometric measures were computed using the 2006 WHO Multicentre Growth Reference Study standards (Multicentre, WHO, 2006) following the literature (Imai et al., 2012; Jeong et al., 2018). Biologically extreme values (i.e., a HAZ < −6 or > 6 or a WAZ < −6 or > 5) were excluded based on the WHO cutoff values (WHO, 2006). A unit increase in either the HAZ or WAZ implies a decrease in the risk of being stunted or underweight, respectively. Based on this, we expect a positive association between mothers' insurance coverage and the HAZ and WAZ. We also recoded the HAZ and WAZ as binary indicators representing stunted and underweight children using the WHO's standardized cutoff of −2 standard deviations (SDs). We then reestimated the models using these indicator variables as the dependent variable to ensure consistency in our estimates.

4. Empirical model

Since our nutritional outcomes are both continuous variables, we employ the ordinary least squares (OLS) method to estimate the association between mothers' insurance coverage and children's nutritional outcomes as our baseline model. The HAZ and WAZ outcomes are estimated using the baseline model specified in Equation (1).

$$\boldsymbol{child\_health_{imhjt}} = \alpha + \beta MOTlNS_{mhjt} + CHILD'_{imhjt}\gamma + Mot'_{mhjt}\Psi + HH''_{hjt}\Gamma + CD''_{jt}\eta + \theta \ln \mathrm{GDP}_{jt} + \epsilon_{it} \quad (1)$$

Where $\boldsymbol{i, m, h\ and\ j}$ represent child-, mother-, household-, and country-level characteristics that influence the nutritional outcomes of the child, while t represents the survey period when data was collected. For every child, i, the vector, $\boldsymbol{child\_health}$, contains two health outcomes (i.e., the HAZ and WAZ). Each of these variables is estimated separately with the same set of control variables. $MOTlNS$ is a dummy variable representing mothers who subscribe to any health insurance scheme. The vector, $CHILD$**,** contains the following child-level variables: the child's gender, the child's age, the child's age squared, and if the child's size was average or large at birth. Mot' is a vector of the following maternal characteristics: if the mother is working, the mother's age, the mother's age squared, number of children born to the mother, if the mother has a tertiary education, if the mother is thin, the birth interval in months, if the mother's partner's occupation is agriculture, and if the mother is in the richest wealth quintile. $\boldsymbol{HH}$ is a vector of the following household characteristics: if household is located in a rural area and the number of household members. $\boldsymbol{CD}$ is a vector of country dummies used in the study. Finally, the *lnGDP* is the log of real GDP per capita for each of the countries corresponding to the year of the survey. These control variables were selected based on their identification as predictors of children's nutritional outcomes in earlier research (Erlangga et al., 2019; Nuñez et al., 2016; Peng & Conley, 2016).

4.1. Identification

The coefficient of $MOTlNS$ may be biased by possible endogeneity between child health outcomes and mothers' health insurance coverage. There may be measurement error in the

measures of the HAZ and WAZ outcomes coupled with the self-selectivity problem inherent in mothers' health insurance coverage (Fiestas Navarrete et al., 2019a; Hellinger & Wong, 2000a; Liang et al., 2004a). These problems could bias the estimated value of β if we do not address the endogeneity. We addressed the endogeneity problems using the IV technique by leveraging the approach employed by Lu et al. (2012) to construct a cluster health insurance prevalence rate in a woman's neighborhood as an instrument for an IV regression. We believe that this variable satisfies both the relevance and exclusion restriction conditions required for instrumental validity. Considering relevance, we argue that the cluster health insurance rate is positively associated with the likelihood that a mother subscribes to a health insurance policy. This is supported by Lu et al. (2012), who indicated that mothers' health insurance coverage depends to a great extent on information availability, which depends on neighboring mothers having also subscribed to a health insurance scheme. This way, mothers are able to interact and share their experiences about the benefits of health insurance coverage with their neighbors (Nuñez et al., 2016; Peng & Conley, 2016). Regarding the exclusion restriction, we do not expect the cluster health insurance prevalence rate to have a direct influence on child stunting or underweight unless it indirectly affects the child through the mother's health insurance coverage. We also do not expect an individual to have control over the neighborhood health insurance prevalence rate, which makes the instrument random. We then estimate the effect of mothers' health insurance coverage in a two-stage least squares (TSLS) model. In the first stage, Equation (2) is used to calculate $MOTlNS$ as a function of mothers' cluster health insurance prevalence rate ($MOT\_INSPREV$) and the control variables specified in Equation (1).

$$MOTINS_{mhjt} = \varphi + \delta MOT\_INSPREV_{mhjt} + CHILD'_{imhjt}\gamma + Mot'_{mhjt}\Psi + HH''_{hjt}\Gamma + CD''_{jt}\eta + \theta \ln GDP_{jt} + \epsilon_{it} \quad (2)$$

We estimate Equation (2) using the OLS model and predict $\widehat{MOTlNS}$. In the second stage, we replace $MOTlNS$ in Equation (1) with the prediction from Equation (2) and estimate health outcomes in Equation (3).

$$\boldsymbol{child\_health_{imhjt}} = \eta + \theta \widehat{MOTlN}_{mhjt} + \boldsymbol{CHILD_{imhjt}}'\boldsymbol{\Delta} + Mot'_{mhjt}\Lambda + HH''_{hjt}\rho + CD''_{jt}\upsilon + \Gamma \ln GDP_{jt} + \epsilon_{it} \quad (3)$$

A causal interpretation of θ requires $MOT\_INSPREV$ to be exogeneous in the child health outcomes equation.

In addition to the TSLS estimations, this study applies the PSM method to address potential endogeneity as observed in other studies (Etwire et al., 2022; Gertler et al., 2016; Khandker et al., 2010; Koomson & Churchill, 2022; Koomson & Danquah, 2021). The treatment variable in this study is mothers' health insurance coverage, which is used to estimate the average treatment effect on the HAZ and WAZ. This technique produces an estimate to obtain the counterfactual effect of mothers' health insurance coverage on the two outcome variables. To subject our findings to sensitivity tests, we use five matching techniques, namely, nearest

neighbor (1), nearest neighbor (5), radius, kernel, and local linear regression matching methods. Finally, we exploit the Lewbel (2012) heteroscedastic-adjusted instrument method to ensure the robustness of the TSLS results, which have been deployed to address endogeneity in existing studies (Frempong et al., 2021; Koomson & Afoakwah, 2022 Koomson et al., 2021; Martey et al., 2022; Wooldridge, 2015). The Lewbel method is believed to produce consistent estimates.

4.2. Descriptive statistics

Table 1 summarizes the main variables and tests the differences between mothers who have health insurance and those who do not. We observe that only 8.1% of children have a mother who subscribes to health insurance. On average, fewer girls and fewer older children have a mother who subscribes to health insurance than children whose mothers do not subscribe to any health insurance. We find that the HAZ and WAZ of children are higher on average for mothers who have health insurance than those who do not have health insurance. As expected, we find that mothers who have health insurance utilize more maternal health services (additive indices for antenatal care visits in first trimester, attaining eight or more antenatal care visits, and making postnatal visits in the first 2 months of child's life). In addition, we determine that mothers who subscribe to health insurance provide more diverse foods out of the nine food groups to their children compared to mothers who do not.

Table 1. Descriptive statistics

Variable	Mothers who have health insurance coverage n = 109,019 (91.90%) Mean	Mothers who do not have health insurance coverage n = 8,828 (8.10%) Mean	Difference Mean Difference	$t < p$ Mean Difference
Child variables				
Height-for-age z-score (HAZ)	−1.280	−1.011	−0.269	0.000
Weight-for-age z-score (WAZ)	−0.843	−0.480	−0.363	0.000
Child is stunted (< −2 SD)	0.308	0.227	0.081	0.000
Child is underweight (< −2 SD)	0.157	0.079	0.079	0.000
Child is stunted or underweight	0.345	0.248	0.097	0.000
Mother has health insurance	0.000	1.000	−1.000	--
Child is female	0.496	0.488	0.008	0.135
Child's age	22.041	24.182	−2.142	0.000
Child's age squared	719.311	844.109	−124.798	0.000
Child's size is average or large at birth	0.837	0.839	−0.002	0.589
Dietary diversity consumed by child	2.273	2.489	−0.216	0.000
Mother variables				
Mother is working	0.607	0.700	−0.093	0.000
Mother's age	29.034	30.913	−1.879	0.000
Mother's age squared	895.253	1,002.442	−107.188	0.000
Number of children born to mother	3.713	3.271	0.442	0.000
Mother has a tertiary education	0.253	0.358	−0.105	0.000
Mother in a union/living with a man	0.849	0.844	0.005	0.218
Mother is thin	0.073	0.041	0.032	0.000
Birth interval in months	33.870	39.155	−5.285	0.000
Maternal healthcare utilization	0.788	1.122	−0.334	0.000
Partner's occupation is agriculture	0.278	0.120	0.158	0.000

Mother is in richest wealth quintile	0.332	0.487	−0.155	0.000
Household variables				
Household is rural	0.680	0.536	0.145	0.000
Number of household members	7.034	6.036	0.998	0.000
Macro variables				
GDP per capita	1,323.419	2,142.843	−819.424	0.000
Instruments				
Neighborhood health insurance prevalence rate	3.383	42.474	−39.091	0.000

Note: The sample for dietary diversity focuses on children under 24 months of age; SD = Standard Deviation.
t = t-statistic; p = p=value

4.3. Mothers' health insurance coverage and MHU

Figure 1 explores the relationship between mothers' health insurance coverage and MHU across the pooled sample for 32 countries. Figure 1A illustrates that insured mothers have 19.4 percentage points more antenatal visits within the first trimester of pregnancy than the uninsured. Similarly, Figure 1B depicts that insured mothers have at least eight, or 5.0 percentage points more, antenatal visits during pregnancy than their uninsured counterparts. In the same vein, Figure 1C shows that insured mothers have 9.0 percentage points more postnatal visits within the first 2 months of delivery than the uninsured.

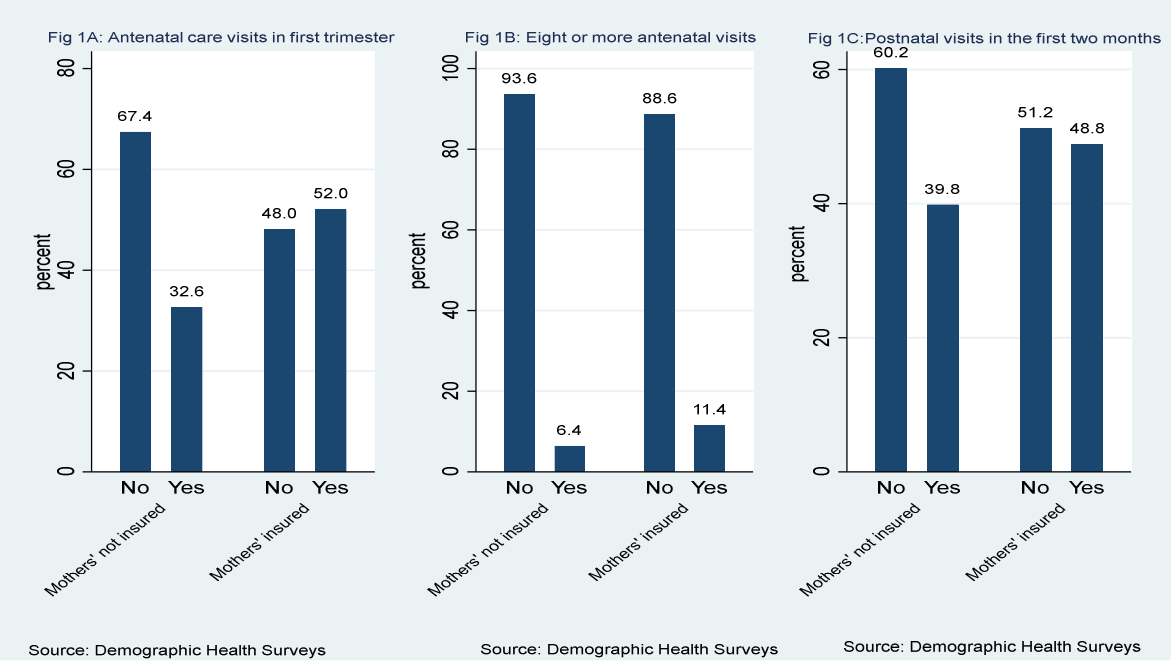

Figure 1. Mothers' health insurance coverage and maternal healthcare utilization (MHU)

4.4. Mothers' health insurance coverage and provision of diversified foods to children

Figure 2 explores the relationship between mothers' health insurance coverage and the consumption of diverse foods by their children. The left panel (Figure 2A) shows the countrywide distribution, whereas the right panel (Figure 2B), depicts the rural–urban perspectives. Based on figures in both panels, mothers' who subscribe to a health insurance

scheme provide more diversified foods to their children from the countrywide and rural–urban perspectives. A simple t-test of the difference of 0.22 units of a more diversified diet from the countrywide perspective between insured mothers' and their uninsured counterparts revealed a statistical significance of 1% (*see* Table 1).

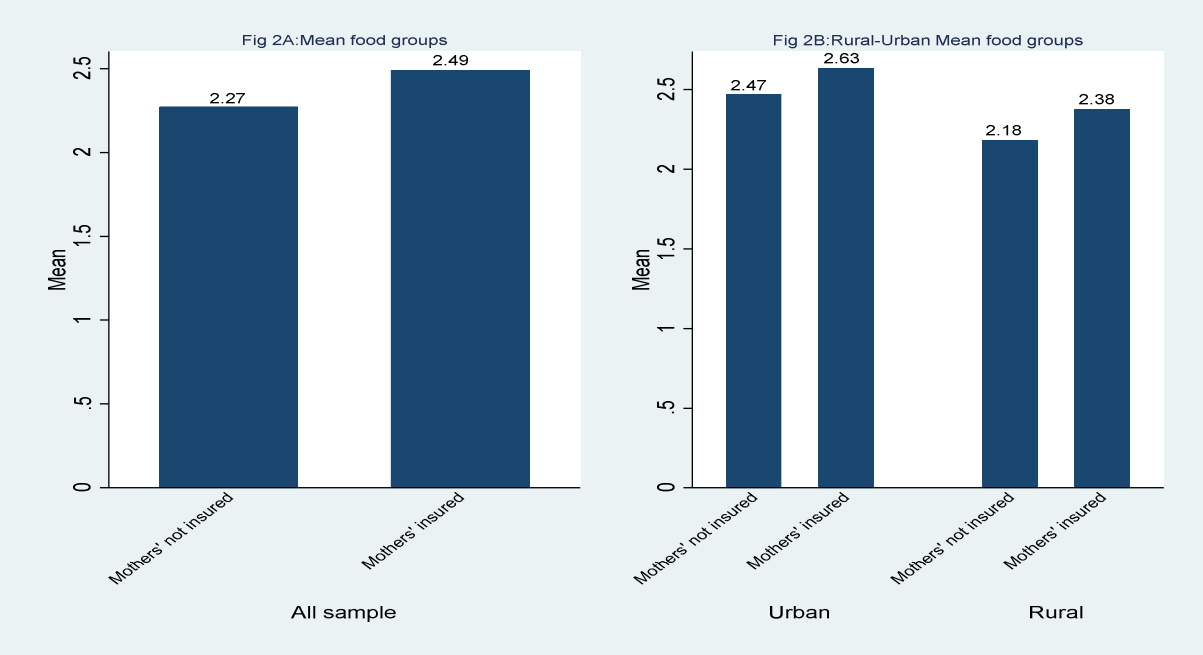

Figure 2. Mothers' health insurance coverage and the provision of diversified foods to children under 2 years of age.

4.5. Correlation between mothers' health insurance coverage and the HAZ and WAZ

Figure 3 displays the relationship between maternal health insurance coverage (orange ball) and the HAZ (blue map color) and the WAZ (green map color) across all 32 countries covered in this study. The size of the ball represents the rate of maternal health insurance coverage in a country while the intensity of the color of the map depicts the national average HAZ and WAZ scores. We observe that countries with a greater maternal health insurance coverage rate on average exhibit higher HAZ and WAZ scores (i.e., their children are less at risk). While Figure 3 indicates that maternal health insurance is associated with a lower risk of stunting and underweight among children under age 5, we are unable to conclude because there are other important variables that influence the HAZ and WAZ aside from health insurance coverage. In Section 5, we estimate multiple regressions that include covariates and employ endogeneity-correcting models to assist us in asserting causality.

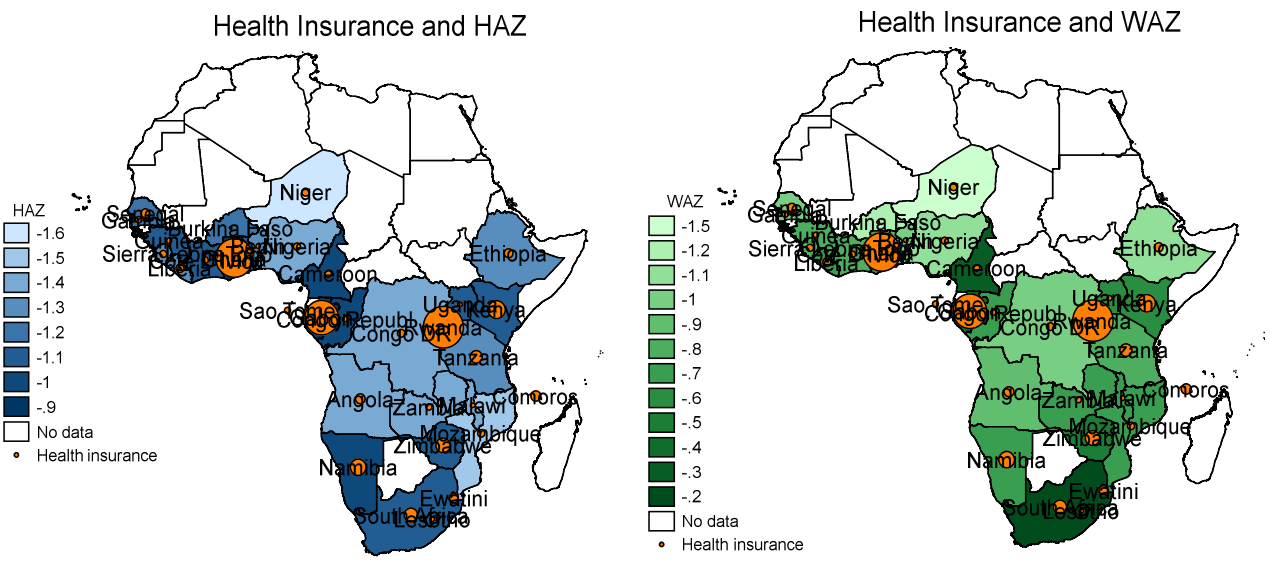

Figure 3. Correlation between mothers' health insurance coverage and the HAZ and WAZ

Source: Authors' own construction using DHS data.

5. Results

5.1. Baseline results

Table 2 reports the baseline estimates for the link between mothers' health insurance coverage and children's standardized HAZ and WAZ. While Columns 1 and 2 do not control for country fixed effects, Columns 3 and 4 control for country fixed effects for the respective outcome variables. In Column 1, we observe that mothers' health insurance coverage is associated with an increase in the HAZ by 0.014 units. In Column 2, mothers' health insurance coverage is associated with an increase in the WAZ by 0.021 units. In Columns 3 and 4, mothers' health insurance coverage is associated with increases of 0.011 and 0.012 units in the HAZ and WAZ, respectively. It can be observed that the estimates with country fixed effects (Columns 3 and 4) are less than those without country fixed effects (Columns 1 and 2). This is expected given that country fixed effects attenuate the explanatory power of health insurance. Nonetheless, these results indicate that mothers' health insurance coverage improves children's health outcomes by decreasing the risk of stunting and underweight situations among children under age 5. The values of the coefficient signify that mothers' health insurance coverage positively influences the HAZ and WAZ, which implies a reduction in the stunting and underweight situation of children.

The results of the control variables provide interesting insights (see Table A1). We find that girls record higher average nutritional scores than boys, while children's age exhibits a U-shaped relationship with nutritional outcomes. Children's size at birth is positively associated with their nutritional score. We observe that nutritional scores tend to be higher for children whose mothers are employed, have a tertiary education, are in a union/living with a man, and are in the richest wealth quintile. On the contrary, nutritional outcomes are lower for children whose mothers are thin, live in rural areas, or have a partner who is in agriculture.

Unlike children's age, mother's age exhibits an inverted U-shaped relationship with children's nutritional outcomes. The number of children born to a mother and household size are generally associated with a decrease in children's nutritional scores, while an increase in real GDP per capita enhances children's nutritional outcomes. Since OLS estimates can be biased in the presence of endogeneity, we address this issue by estimating a TSLS model and present the results in Section 5.2.

Table 2. Effects of mothers' health insurance coverage on children's HAZ and WAZ (OLS results)

Variable	(1) HAZ	(2) WAZ	(3) HAZ	(4) WAZ
Mother has health insurance	0.014***	0.021***	0.011***	0.012***
	(0.002)	(0.001)	(0.002)	(0.002)
Child characteristics	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes
Number of observations	109,019	109,019	109,019	109,019
R-Squared	0.125	0.108	0.137	0.140

Robust standard errors appear in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; OLS = Ordinary Least Squares; HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score.

5.2. Endogeneity-corrected results

In this section, we report the TSLS results that address the endogeneity associated with health insurance coverage. We estimate our TSLS regressions using the neighborhood health insurance prevalence rate among mothers as an instrument (see Table 3). As expected, the first-stage results indicate that an increase in the neighborhood health insurance prevalence rate is positively linked to mothers' health insurance uptake (Columns 1–4). Given that the F-statistics across all models are greater than the threshold of 10, we infer that our instrument does not have a weak relationship with mothers' health insurance coverage (Stock & Yogo, 2002). It is evident in Table 3 that the endogeneity of mothers' insurance coverage causes a downward bias in our baseline estimates in Columns 2 and 3. In Columns 1 and 2, mothers' health insurance coverage increases children's HAZ and WAZ by 0.015 and 0.032 units, respectively. Columns 3 and 4 also reveal an increase in the HAZ and WAZ by 0.018 and 0.014 units, respectively. The findings in Columns 3 and 4, after controlling for country fixed effects, indicate that insurance coverage has a relatively greater influence on the HAZ than on the WAZ. This holds promise for health insurance-malnutrition policy discourse given the pronounced effects of maternal health insurance coverage on children's long-term nutritional outcomes (i.e., the HAZ) compared to their short-term nutritional outcomes (i.e., the WAZ). The values of the coefficients signify that mothers' health insurance coverage has a positive influence on the HAZ and WAZ. Therefore, mothers' health insurance coverage reduces child stunting and underweight. The possible inference to be drawn from this outcome is that mothers who subscribe to health insurance are afforded a mechanism for accessing and utilizing maternal healthcare services (Ameyaw et al., 2017; Dixon et al., 2014) thereby enhancing the

health of their children and decreasing the chance of a low birth weight, which can impede their growth (Abrokwah, 2017; Bosomprah et al., 2015; Wherry et al., 2016). In addition, mothers covered by health insurance experience a significant reduction in their out-of-pocket healthcare expenditures, which engenders their ability to provide the required dietary diversity to their children (Finkelstein et al., 2012).

Table 3. Effects of mothers' health insurance coverage on the HAZ and WAZ among children (IV results)

	(1)	(2)	(3)	(4)
Variable	HAZ	WAZ	HAZ	WAZ
Mother has health insurance	0.015***	0.032***	0.018***	0.014**
	(0.002)	(0.002)	(0.006)	(0.005)
Child characteristics	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes
Kleibergen–Paap rk LM statistic	5950.536	5950.536	2579.878	2579.878
	(0.001)	(0.001)	(0.001)	(0.001)
Kleibergen–Paap rk Wald F statistic	18000	18000	4428.190	4428.190
First Stage				
Neighborhood health insurance prevalence rate	0.006***	0.010***	0.006***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	109,019	109,019	109,019	109,019
R-Squared	0.125	0.108	0.137	0.139

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01; IV = Instrumental Variable; HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score.

5.3. Gendered and locational results

In this subsection, we report the results for the boy–girl subsamples (Table 4) and for rural–urban children (Table 5) to reveal any latent gender or locational heterogeneity associated with mothers' health insurance coverage and children's HAZ and WAZ outcomes. The analysis in this section is central to the UN's SDG objective to "leave no one behind," a mandate that is designed to encourage researchers to engage in disaggregated analysis (Koomson et al., 2021; World Health Organization, 2016). Table 4 presents the TSLS estimates for boys and girls, respectively, in Columns 1 and 2 for the HAZ and for the WAZ in Columns 3 and 4. In Columns 1 and 2, mothers' health insurance coverage is associated with a 0.17- and 0.020-unit increase in the HAZ for boys and girls, respectively. In Columns 3 and 4, mothers' health insurance coverage is associated with a 0.023- and 0.025-unit increase in the WAZ for boys and girls, respectively. Comparing the estimates for Columns 1–4 indicates that the HAZ and WAZ for girls are affected more by mothers' health insurance coverage than boys. Since boys are more susceptible to sickness and more likely to be undernourished than girls (Kraemer, 2000; Thurstans et al., 2020), this implies that the savings generated by maternal health insurance coverage, which is used to increase food consumption, can reinforce the gender difference in nutritional scores by enhancing the HAZ and WAZ more for girls than for boys.

Table 4. Gendered effects of mothers' health insurance coverage on the HAZ and WAZ (IV results)

	(1) HAZ	(2) HAZ	(3) WAZ	(4) WAZ
Variable	Boys	Girls	Boys	Girls
Mother has health insurance	0.017*	0.020**	0.023***	0.025***
	(0.009)	(0.009)	(0.005)	(0.005)
Child characteristics	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Kleibergen–Paap rk LM statistic	1359.687	1221.496	1276.725	1145.900
	(0.001)	(0.001)	(0.001)	(0.001)
Kleibergen–Paap rk Wald F statistic	2393.771	2041.495	2651.460	2235.626
First Stage				
Neighborhood health insurance prevalence rate	0.006***	0.008***	0.006***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	55037	53982	55037	53982
R-Squared	0.133	0.136	0.136	0.141

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01; IV = Instrumental Variable; HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score.

Table 5 presents the TSLS estimates for urban and rural children. In Column 1, mothers' health insurance coverage is associated with a 0.04-unit increase in the HAZ for urban children. However, the effect of mothers' health insurance coverage on the HAZ for rural children yielded an insignificant estimate. In Columns 3 and 4, mothers' health insurance coverage is associated with a 0.014- and 0.025-unit increase in the WAZ for urban and rural children, respectively. Comparing the estimates for Columns 1–4 indicate mixed results. Regarding the HAZ, urban children are more affected by their mothers' health insurance coverage whereas rural children are more affected in terms of their WAZ.

Table 5. Locational effects of mothers' health insurance coverage on children's HAZ and WAZ (IV results)

	(1) HAZ	(2) HAZ	(3) WAZ	(4) WAZ
Variable	Urban	Rural	Urban	Rural
Mother has health insurance	0.041***	0.003	0.014***	0.025***
	(0.011)	(0.008)	(0.006)	(0.005)
Child characteristics	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Kleibergen–Paap rk LM statistic	1079.524	1310.061	1080.357	1212.060

	(0.001)	(0.001)	(0.001)	(0.001)
Kleibergen–Paap rk Wald F statistic	3787.201	2519.456	1900.382	2699.156
Neighborhood health insurance prevalence rate	0.005***	0.006***	0.007***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	36119	72900	36119	72900
R-Squared	0.117	0.135	0.122	0.133

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01; IV = Instrumental Variable; HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score.

5.4. Robustness check and sensitivity to cutoff

In this subsection, several sensitivity checks are performed to test the robustness of our estimates. First, we assess the robustness of our standard TSLS estimates using PSM. The PSM results provide a robustness check of the relationship between mothers' health insurance coverage and children's HAZ and WAZ. As depicted in Table 6, we exploit several matching techniques—nearest neighbor, radius, and kernel regression matching methods—to ensure robustness in the findings. Across all matching techniques, the average treatment effect on the treated for the effect of mothers' health insurance coverage indicates that the effect ranges from 0.027 to 0.060 units. This implies that children whose mother subscribes to health insurance record higher average HAZ and WAZ scores. The PSM results are consistent with our baseline and TSLS estimates and provide an important basis for inferring that mothers' health insurance coverage improves children's HAZ and WAZ, regardless of an endogeneity-correcting method being applied.

Secondly, we test whether the coefficients of mothers' health insurance are sensitive to the standard cutoffs for stunting and underweight using the HAZ and WAZ, respectively in Table 7. We use the standard cutoff of children having less than −2 SD of HAZ or WAZ to measure stunted and underweight children, respectively. We further obtain a measure for children who are either stunted or underweight, which indicates a double burden of malnutrition. Columns 1 and 2 show the effect of mothers' health insurance coverage on stunting and underweight while Column 3 reports the results of either stunting or underweight. Columns 1 and 2 indicate that mothers' health insurance coverage is associated with a decrease in the probability of stunting and underweight by 6.8 and 4.3 percentage points, respectively. In Column 3, we see that mothers' health insurance coverage is associated with a 6.7-percentage-point decrease in the probability of being stunted or underweight. Overall, the results from the measures that use the standard cutoffs presented in Columns 1 and 2 and those that combine the two are both consistent with our findings indicating that our results are robust to the different conceptualizations used to identify malnourished children.

In line with previous studies, we use the Lewbel approach, which leverages both internal and external instruments, to address endogeneity. In Table A2 (Columns 1–4), we report the results from the Lewbel TSLS method, which concur with the significantly positive effect of mothers' health insurance coverage on child stunting and underweight after combining our neighborhood health insurance prevalence rate instrument with internally generated instruments. This signifies that the role of maternal health insurance coverage in improving children's nutrition is consistently established, regardless of the endogeneity-correcting method applied.

Table 6. Propensity score matching using different matching methods

Matching Technique	HAZ	WAZ
1–Nearest neighbor (one-to-one)	0.048***	0.060***
	(0.015)	(0.012)
5–Nearest neighbor	0.028***	0.046***
	(0.007)	(0.006)
Radius	0.027***	0.036***
	(0.002)	(0.001)
Kernel	0.028***	0.037***
	(0.002)	(0.001)
Local linear regression	0.031***	0.038***
	(0.015)	(0.012)
Number of observations	109,019	109,019

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01;
HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score.

Table 7. Effects of mothers' health insurance coverage on stunted and underweight children (IV results)

	(1) Stunted	(2) Underweight	(3) Stunted or Underweight
Mother has health insurance	−0.068***	−0.043***	−0.067***
	(0.019)	(0.014)	(0.020)
Child characteristics	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Kleibergen–Paap rk LM statistic	2579.878	2579.878	2579.878
	(0.001)	(0.001)	(0.001)
Kleibergen–Paap rk Wald F statistic	4428.190	4428.190	4428.190
Neighborhood health insurance prevalence rate	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)
Number of observations	109019	109019	109019
R-Squared	0.094	0.071	0.093

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01;
IV = Instrumental Variable; GDP = Gross Domestic Product.

5.5. Potential channel analysis

Several potential channels through which mothers' health insurance coverage can influence child stunting and underweight were discussed in Section 2. Drawing from the many potential channels, we employ a two-step process as previously used by Alesina and Zhuravskaya (2011) and Koomson and Churchill (2021) to assess the potential mediating role of MHU (additive index of antenatal care visits in first trimester, eight or more antenatal care visits, and postnatal visits in the first 2 months of life) and dietary diversity (number of food groups consumed by the child). In the first step, we confirm that mothers' health insurance coverage is significantly associated with MHU and diversity of diets consumed by their children (see Table 8). The results reported in Columns 1 and 2 show that mothers' health insurance coverage is positively

associated with MHU and dietary diversity, which is consistent with the literature (Kofinti et al., 2022; Wang et al., 2017; Yaya et al., 2019).

In the second step, we separately include MHU and dietary diversity as covariates in the HAZ and WAZ models and report the results in Table 9. To provide stronger grounds for the estimate comparison, we reestimate the baseline model without the potential maternal health variable to guarantee that all estimates are generated from the same sample. Panels A and B present the results for the HAZ and WAZ, respectively. Concerning the HAZ model, the reestimated coefficient from the baseline model is presented in Column 1, whereas the MHU mediation model is presented in Column 2. For MHU to qualify as a potential mediator, the coefficient of mothers' health insurance coverage must diminish in size or become statistically insignificant when it is added as a covariate to the HAZ model. This is the case in Column 2 where the inclusion of MHU in the model reduces the magnitude of the coefficient of mothers' health insurance coverage compared to our baseline model (see Colum 1). This observation implies that MHU is an important channel through which mothers' health insurance coverage influences the HAZ.

Concerning the mediating role of dietary diversity in the HAZ model, the reestimated coefficient from the baseline and mediating models are presented in Columns 3 and 4. Given that the food groups consumed by children focus on children under 2 years of age, we reestimated the baseline model in Column 3 to assess the comparability of our sample. This is the case in Column 4 where the inclusion of dietary diversity in the model reduced the magnitude of the coefficient of mothers' health insurance coverage compared to our baseline model (see Colum 3). This observation implies that the consumption of diversified diets by children is an important channel through which mothers' health insurance coverage influences the HAZ. Scrutinizing the reduction in the magnitude of mothers' health insurance coverage resulting from its inclusion in MHU and dietary diversity, the decline accruing to both mediating variables is the same in absolute terms (i.e., 0.001). This implies that both mediating variables are equally important in influencing the HAZ.

Using the same approach in the WAZ models, MHU is identified as a potential channel through which health insurance coverage affects the WAZ, but the same result was not found for dietary diversity.

Table 8. Effect of Mothers' health insurance coverage on MHU and dietary diversity (IV results)

	(1) Maternal healthcare utilization	(2) Food diversity
Mother has health insurance	0.268***	0.352***
	(0.047)	(0.137)
Child characteristics	Yes	Yes
Maternal characteristics	Yes	Yes
Household characteristics	Yes	Yes
Log of GDP per capita	Yes	Yes
Time fixed effects	Yes	Yes
Country fixed effects	Yes	Yes

Kleibergen–Paap rk LM statistic	1149.253	600.096
	(0.001)	(0.001)
Kleibergen–Paap rk Wald F statistic	1480.474	796.349
First Stage		
Neighborhood health insurance prevalence rate	0.005***	0.005***
	(0.001)	(0.001)
Number of observations	109019	56538
R-Squared	0.215	0.396

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01; IV = Instrumental Variable; GDP = Gross Domestic Product; HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score.

Table 9. Effect of MHU and dietary diversity on HAZ and WAZ (potential channels)

	(1)	(2)	(3)	(4)
	Mediator: MHU		Mediator: Food diversity	
	HAZ	HAZ	HAZ	HAZ
	Baseline		Baseline*	
Panel A: HAZ model				
Mother has health insurance	0.011***	0.010***	0.007**	0.006**
	(0.002)	(0.002)	(0.003)	(0.003)
MHU		0.006***		
		(0.001)		
				0.004***
Dietary diversity				(0.001)
Child characteristics	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Number of observations	109019	109019	56538	56538
R-Squared	0.137	0.137	0.129	0.131
Panel B: WAZ model				
Mother has health insurance	0.012***	0.011***	0.011***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)
MHU		0.004***		
		(0.001)		
				0.002***
Dietary diversity				(0.001)
Child characteristics	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes
Log of GDP per capita	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Number of observations	109019	109019	56538	56538
R-Squared	0.139	0.139	0.142	0.143

Robust standard errors appear in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01; MHU = Maternal Healthcare Utilization; HAZ = Height-for-age z-score; WAZ = Weight-for-age z-score; GDP = Gross Domestic Product.

6. Conclusion

This paper examines the effect of mothers' health insurance coverage on child stunting and underweight in developing countries. This study is underscored by the observation that the growth of children is influenced by the privileges and resources available to their mothers, which includes access to formal healthcare utilization. This holds particularly in the case of developing countries, where women face barriers to formal healthcare utilization. This paper posits that mothers who are covered by health insurance will be able to utilize maternal healthcare, which will reduce the incidence of stunting and underweight among children in developing countries. The cross-country nature of this study provides a compelling setting for examining the relationship between mothers' health insurance coverage and child stunting and underweight in developing countries.

We adopt a transnational approach by combining household surveys of the DHS from 32 countries. The paper corrected the potential endogeneity between mothers' health insurance coverage and child malnutrition outcomes (i.e., stunting and underweight). We found that mothers' health insurance coverage improves children's health outcomes in developing countries by decreasing their risk of stunting and underweight. These results are robust to other alternative quasi-experimental approaches such as PSM and the Lewbel TSLS method. They are also consistently established when a different standard cutoff is used to identify stunted and underweight children. Gender- and location-wise, the results consistently indicate decreasing malnutrition among girls more than boys, whereas the locational analysis reveals mixed outcomes. Additional analyses show that reducing the incidence of stunting and underweight could be attributed to increased MHU among mothers and an increase in the consumption of diversified diets by children. In summary, these results indicate that promoting health insurance coverage among women during their reproductive lives could have malnutrition-reducing effects on their children.

Beyond the overwhelming evidence in support of the positive association between maternal health insurance coverage and children's nutritional outcomes that is established in this paper, these findings have several implications for policy and practice. First, designing policies with a conscious attempt to enhance health insurance coverage may play a vital role in enhancing healthcare utilization among parents and children. Second, promoting health insurance ownership may increase dietary diversity, which remains a strategic policy target throughout many countries due to its associated health benefits. Third, increased maternal health insurance coverage may help achieve the UN's SDG 3—"to ensure health and well-being for all, at every stage of life" (United Nations, n.d.). Specifically, it can aid in the achievement of SDG Target 3.1, which seeks to reduce the global maternal mortality ratio to less than 70 deaths per 100,000 live births by 2030 because health insurance ownership increases MHU. Increased healthcare utilization among mothers and children can also help achieve SDG Target 3.2—ending preventable deaths of newborns and children under the age of 5 years. Fourth, the financial savings associated with maternal health insurance ownership can assist in the achievement of SDG 2—ending hunger, achieving food security, and improving nutrition. This is because the associated financial savings may provide the resources required to enhance food consumption, even for vulnerable households. Based on these findings, we encourage that increased health insurance coverage, especially among mothers, should be promoted across all countries in SSA. Countries that have already instituted maternal health insurance policies should target universal coverage by enacting laws for compulsory enrollment or by embarking on sensitization campaigns that inform mothers of the health and financial benefits of being covered by an insurance scheme. Nations that are yet to design or implement a national health insurance scheme should make every effort to do so. A conscious effort should be made to remove

bottlenecks such as bureaucratic arrangements that discourage people from enrolling in health insurance schemes.

A key limitation of this study concerns the potential channels that we explored empirically. Despite several potential channels that are discussed in the literature, we were only able to test the roles of MHU and dietary diversity due to data limitations. Future studies may explore the potential roles of the other channels if the relevant data become available.

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