Effect of health insurance coverage on health care utilisation in Zambia

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Summary: Limited access to healthcare, particularly among low-income populations, hinders health outcomes in Zambia. Despite the existence of health insurance schemes, coverage remains low. This study investigates the impact of different types of health insurance on healthcare utilization in Zambia.

Utilizing data from the 2014 Zambia Household Health Expenditure and Utilization Survey, we employed propensity score matching and endogenous treatment effect models to estimate the effects of health insurance coverage on healthcare utilization. We disaggregated coverage into overall, public, and private insurance, and measured utilization through outpatient visits and admissions.

Our findings reveal that overall and private health insurance coverage significantly increase healthcare utilization across all measures. However, public health insurance coverage did not show a statistically significant impact at conventional levels.

In conclusion, this study highlights the low prevalence of health insurance coverage in Zambia and its positive association with healthcare utilization, particularly for overall and private schemes. This emphasizes the potential of expanding health insurance coverage, notably through the newly implemented National Health Insurance Scheme, to improve healthcare access and utilization in Zambia.

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I-Introduction :

Over the past ten years, nations have been advancing towards the achievement of Universal Health Coverage (UHC) through a range of strategies aimed at boosting healthcare utilization and enhancing outcomes for the general populace, as stated in WHO and World Bank's 2015 report. Many of these strategies specifically target vulnerable groups, including individuals living in poverty, mothers, children, older adults, and those residing in remote rural areas, as highlighted by Cotlear et al. in 2015. Health insurance programs play a pivotal role in realizing UHC objectives in numerous countries, as indicated by van der Wielen et al. in 2018. However, there is limited evidence regarding the effectiveness of these programs in improving healthcare access in low- and middle-income nations, as noted by WHO in 2017.

In the case of Zambia, despite the availability of health insurance schemes, healthcare utilization remains low. Hjortsberg and Mwikisa's argument in 2002 suggested that healthcare service usage in Zambia had declined even after the health reforms initiated in 1991, as evidenced by a sharp decrease in health facility visits. The Zambia Demographic Health Survey in 2018 estimated that healthcare utilization in the Zambian population is low, despite the country's high disease burden and improved income profile, as reported by the Central Statistical Office in 2018.

All in all, health insurance contributes to reducing healthcare costs, consequently fostering greater healthcare utilization and potentially leading to moral hazard. Escobar et al. in 2010 asserted that health insurance enhances access to healthcare services by making them financially accessible to people. Thus, from an economic standpoint, one would anticipate that individuals with health insurance coverage would utilize healthcare services more frequently, all other factors held constant, in accordance with the research of Andersen and Newman in 1973.

An important concern when examining the impact of health insurance coverage on utilization is the potential bias stemming from unobserved heterogeneity or selection issues, as acknowledged by various studies, including Jowett et al. in 2003, Deb et al. in 2006, Wagstaff and Lindelow in 2008, Wagstaff in 2010, Nguyen and Wang in 2013, and Lipton and Decker in 2015. This study aims to investigate the influence of health insurance coverage on utilization while taking into account endogeneity related to unobserved heterogeneity or selection problems.

II-Methods and Materials:

The data for this study were obtained from the Zambia Household Health Expenditure and Utilization Survey (ZHHEUS), which comprised approximately 12000 households and around 59500 individuals. Participants in the survey were asked to provide information regarding their enrollment in various health insurance schemes, including general insurance coverage, public insurance programs, and private health insurance, as detailed in the Ministry of Health's 2015 report. Additionally, an indicator was created to assess coverage by multiple insurance schemes.

The survey also collected data on healthcare utilization, encompassing outpatient visits, inpatient admissions, and the choice of healthcare providers. Outpatient service utilization was considered for the four weeks preceding the survey, while inpatient admissions were examined for the twelve months leading up to the survey, as specified in the Ministry of Health's 2015 report.

This paper employed two statistical models to estimate the impact of health insurance. Specifically, a doubly robust inverse-probability-weighted regression adjustment (IPWRA) model and an endogenous treatment effects regression model were utilized, employing the *etpoisson* STATA command.

IPWRA model

IPWRA offers a hybrid approach to treatment effect estimation, merging the outcome modeling of regression adjustment (RA) with the weighted outcomes of inverse-probability weighting (IPW). RA employs sample means and a regression model to predict potential outcomes adjusted for relevant covariates (Cattaneo, 2010). IPW, in contrast, utilizes weighted means to differentiate the effects of the treatment from those of confounding variables (Imbens & Wooldridge, 2009). IPWRA's key benefit lies in requiring only one of the two models to be correctly specified (Imbens & Wooldridge, 2009). The initial step of IPWRA involves estimating the propensity score (treatment receipt probability) defined by Rosenbaum and Rubin (1983), as shown in equation (1) below.

$$P(x) = P(A_i = 1|x) = F\big(h(x)\big) = E(A_i|x) \quad (1)$$

where A_i is the treatment indicator for the treated group, x represents a vector of observed characteristics, and $F(.)$ is a cumulative distribution function. Following the works of Austin (2016), the inverse weights of the treated group are equal to 1 and the weights of the untreated group are defined as $\frac{\hat{p}(x)}{1-p(x)}$, where $\hat{p}(x)$ are the estimated propensity scores. Therefore, Ojo *et al.* (2021) define the propensity weight as:

$$w_i = A_i + (1 - A_i)\frac{\hat{p}(x)}{1-p(x)} \quad (2)$$

The ATT or ATE of the regression adjustment (RA) which is one of the components of IPWRA models is expressed as:

$$\tau_{RA} = n_Q^{-1} \sum_{i=1}^{n} A_i \left[r_Q(x, \delta_Q) \quad r_N(x, \delta_N) \right] \tag{3}$$

where n_Q is the treatment group sub-sample, r_Q is the regression model for the treated group (Q), and r_N is the regression model for the untreated (control) group (N) regressed on observed characteristics x_i and parameters estimates $\delta_i = (\alpha_i, \beta_i)$. IPWRA, a doubly-robust estimator that combines RAs in equation (2) and IPWs in equation (3) is then expressed as equation (4) below:

$$\tau_{IPWRA} - n_Q^{-1} \sum_{t=1}^{n} A_i \left[r_Q^*(x, \delta_Q^*) - r_N(x, \delta_N^*) \right] \tag{4}$$

where $\delta_Q^* = (\alpha_Q^*, \beta_Q^*)$.

Endogenous treatment-regression model: etpoisson

IPWRA estimators strive to eliminate treatment-outcome dependence by conditioning on covariates, effectively assuming these covariates eliminate the influence of unobserved confounders. However, this conditional independence assumption, while essential for IPWRA's validity, is inherently untestable. Despite meticulous research design, unobservable factors impacting both treatment assignment and potential outcomes (endogeneity) can create residual bias. Therefore, this paper additionally utilized the etpoisson model in STATA to mitigate the potential effects of endogeneity and provide a more robust analysis.

The endogenous treatment-regression model fit by the *etpoisson* STATA command uses a non-linear model for the outcome and the constrained normal distribution to model the deviation from the conditional independence assumption (Hackl, 2016). The *etpoisson* STATA command estimates the parameters of the Poisson regression model that includes an endogenous binary-treatment variable. For treatment t_j, z_j, and ϵ_j, the equation for the outcome y_i is given by:

$$E(y_j | x_j, t_j, \epsilon_j) = exp(x_j\beta + \delta t_j + \epsilon_j) \tag{5}$$

The treatment t_j is determined by

$$t_j = \begin{cases} 1, & \mathbf{w}_j\gamma + \mu_j > 0 \\ 0, & otherwise \end{cases} \tag{6}$$

Where x_j are the covariates used to model the outcome, $\mathbf{w}_j$ are the covariates used to model treatment assignment and the error terms ϵ_j and μ_j are bivariate normal with mean 0 and covariance matrix

$$\begin{bmatrix} \sigma^2 & \sigma\rho \\ \sigma\rho & 1 \end{bmatrix}$$

Conditional on ϵ_j, μ_j is normal with mean $\frac{\epsilon_j \rho}{\sigma}$ and variance $(1 - \sigma^2)$. The covariates x_j and $\mathbf{w}_j$ are uncorrelated to the error terms and t_j is the endogenous treatment indicator (Terza, 1998).

In the IPWRA and etpoisson STATA command models, two indicators were utilized to assess health services usage, based on the survey's questions: (1) the cumulative number of outpatient visits and (2) the total admissions count. These indicators, both quantified at the individual level, were tally variables. The analysis also considered the binary variable of health insurance membership, distinguishing between individuals enrolled in a health insurance scheme and those who were not. Health insurance was categorized into three types: overall, public (government medical scheme), and private. The linkage between each healthcare facility's usage and the type of insurance was examined. Additionally, several control variables were factored in, including age, gender, marital status, expenditure, health status, education, employment, and residence location.

III- Results and discussion :

This paper investigates the impact of health insurance on healthcare utilization, focusing on both outpatient visits and hospital admissions. We employ Inverse Probability Weighting Regression Adjustment (IPWRA) to estimate the causal effect of insurance on healthcare utilization. To

address potential endogeneity concerns, we additionally utilize the etpoisson STATA command model and assess its results for evidence of endogeneity. The validity and unbiasedness of the IPWRA estimates are ultimately confirmed by the absence of endogeneity in the endogenous treatment effects models.

Impact of health insurance coverage on the total number of outpatient visits

Table 1 presents the findings of our analysis on how health insurance coverage affects the total number of outpatient visits. We use two different regression methods: Instrumental Variables with Propensity Score Weighting (IPWRA) and extended Poisson regression (etpoisson).

The first column shows the estimated coefficients from the IPWRA regressions, while the third column presents the marginal effects from the etpoisson regressions. These marginal effects tell us how much the average number of outpatient visits changes for a given increase in health insurance coverage.

The second column displays the p-values of the over-identification tests in the IPWRA model. These tests help us assess whether the covariates are balanced in the model. A p-value less than 0.05 indicates unbalanced covariates, which could bias the results.

Finally, the fourth column shows the p-values of the etpoisson Wald test. This test checks for the presence of endogeneity, meaning whether the unobserved factors influencing insurance coverage also affect the number of outpatient visits. A p-value less than 0.05 suggests a significant correlation between these unobserved factors, implying that the estimated coefficients may not be causal.

Overall, Table 1 provides a comprehensive picture of the relationship between health insurance and outpatient visits, accounting for potential biases and endogeneity concerns.

The total number of outpatient visits:

Table 1 reveals a statistically significant endogeneity issue in the overall coverage model. The Wald test's p-value falls below 5%, indicating a non-random relationship between the treatment variable (health insurance coverage) and the error term. Consequently, the etpoisson STATA model in the third column provides the accurate and unbiased estimates of health insurance's impact.

On average, a treated individual with overall coverage would make 0.018 more outpatient visits compared to someone without coverage. This marginal effect of the Average Treatment Effect on the Treated (ATET) is statistically significant ($p < 0.1$). Ignoring endogeneity would have overestimated the true impact of health insurance on total outpatient visits by 0.001.

The total number of public outpatient visits:

Due to the presence of endogeneity signaled by the public coverage model (p-value < 0.05), the etpoisson STATA command estimator provides the most accurate results for assessing the impact of public health insurance on the total number of public outpatient visits. The estimated average treatment effect on the treated (ATET) obtained from the etpoisson model is -0.006, which is statistically insignificant at conventional levels. Therefore, we can conclude that public health insurance coverage does not have a statistically significant effect on outpatient visits to public health facilities.

The total number of private outpatient visits:

For private health insurance coverage, the model estimated using the etpoisson command in STATA produces a p-value greater than 0.05. This means we cannot reject the null hypothesis that there is no correlation between treatment errors and outcome errors. The estimated p-value is 0.223. Therefore, the reliable and accurate estimates of the impact of private health insurance coverage on the total number of private outpatient visits are those presented in the first column of Table 1, obtained using the IPWRA method. The IPWRA estimator reports an average treatment effect on

the treated (ATET) of 0.039 ($p < 0.01$). This suggests that an average individual with private health insurance coverage would make 0.039 more outpatient visits to a private health facility compared to someone without insurance. All p-values from the overidentification tests are greater than 0.05, indicating that the covariates are well-balanced in the IPWRA models.

Table 1 Impact of health insurance coverage on the number of outpatient visits

	IPWRA (β)	Overidentification test	Etpoisson (β)	Wald test
OVERALL COVERAGE				
ATET	0.019**	0.495	0.018*	0.003
PUBLIC COVERAGE				
ATET	-0.0004	0.402	-0.006	0.000
PRIVATE COVERAGE				
ATET	0.039***	0.077	0.045***	0.223

Notes: Significance level *** p<0.01, ** p<0.05, * p<0.1. The outcome models were adjusted for age, age squared, gender, marital status, religion, education, place of residence, health status, presence of chronic illness and employment status. The treatment models were balanced by age, age squared, gender, marital status, education, place of residence, health status, presence of chronic illness and employment status.

Impact of health insurance coverage on the total number of admissions

Table 2 presents the outcomes of IPWRA and *etpoisson* STATA command regressions, illustrating the influence of health insurance coverage on the total number of admissions. Additionally, the table displays the probability values for the overidentifying test of the IPWRA model and the Wald tests for the *etpoisson* STATA command regressions, with results provided for overall, public, and private health insurance schemes.

The total number of admissions:

Table 2 illustrates the consistency of the IPWRA estimates, as indicated by the absence of endogeneity in the *etpoisson* STATA command models. The ATET for the IPWRA model is 0.019, with a significance level of $p < 0.01$. Consequently, individuals covered by a health insurance scheme are admitted approximately 0.02 times more frequently than if they had no insurance coverage, on average.

The total number of public admissions:

In Table 2, the Wald test's probability value exceeds 0.05 within the public health insurance coverage model. Consequently, the ATET (0.005) for the IPWRA estimator in the first column of Table 2 is both accurate and consistent, despite its positive and non-significant nature. Consequently, when accounting for the endogeneity of the treatment variable, it can be concluded that public health coverage does not have a significant impact on the overall number of admissions at public health facilities.

The total number of private admissions:

Since the Wald test probability value in Table 2 exceeds 0.05, the IPWRA estimator provides a consistent result regarding the impact of private health insurance coverage on admission numbers. The model does not raise concerns about endogeneity. The ATE for the individual IPWRA model is 0.011 ($p < 0.05$). This suggests that, on average, individuals in the treated population are admitted to private health facilities approximately 0.011 times more frequently when they have private health insurance. Table 2.13 indicates that all covariates in the IPWRA models exhibit good balance, as evidenced by the probability values of the overidentification tests in the second column, which are all below 0.05.

Table 2 Impact of health insurance coverage on the number of admissions

	IPWRA (β)	Overidentification test	Etpoisson (β)	Wald test
OVERALL COVERAGE				
ATET	0.019***	0.495	0.039***	0.162
PUBLIC COVERAGE				
ATET	0.005	0.302	-0.258	0.028
PRIVATE COVERAGE				
ATET	0.011**	0.691	0.015***	0.295

Notes: Significance level *** p<0.01, ** p<0.05, * p<0.1. The outcome models were adjusted for age, age squared, gender, marital status, religion, education, place of residence, health status, presence of chronic illness and employment status. The treatment models were balanced by age, age squared, adult, gender, marital status, religion, education, place of residence, health status, presence of chronic illness and employment status.

Utilizing treatment effects models for impact assessment, this study demonstrates that the overall expansion of health insurance coverage in Zambia had a notably favorable impact on two key utilization measures: the total count of outpatient visits and the total count of admissions. This observation held true even after accounting for the endogeneity within the models. These findings validate existing evidence indicating that an increase in health insurance coverage correlates with heightened utilization of healthcare services. It is unsurprising that individuals who are members of health insurance schemes would make greater use of these services, given that membership explicitly grants them access to healthcare services. This outcome may be attributed to adverse selection and moral hazard effects that may arise when initiating or expanding health insurance coverage (Erlangga, 2019). The upsurge in utilization could potentially signal the presence of moral hazard (Ataguba and Goudge, 2012). Importantly, this positive relationship between health insurance and healthcare utilization has also been reported in prior studies (Robyn et al., 2012; Levine et al., 2016b; Lu et al., 2012; Blanchet et al., 2012; Hassan et al., 2013; Chin et al., 2012; Nguyen and Wang, 2013).

Impact of public health insurance on public health care utilisation

The presence of public health insurance coverage was determined to have an insignificant impact on the utilization of public health care services. This lack of significance can be attributed to the limited prevalence of public health insurance programs. These programs were nearly absent prior to the establishment of the National Social Health Insurance Schemes, indicating that they would not have had a noteworthy influence on health care utilization.

Impact of private health insurance on private health care utilisation

The findings also affirmed that having private health insurance had a favorable impact on all private healthcare utilization measures. This implies that private insurance still plays a vital role in enhancing access to healthcare services in Zambia. Since out-of-pocket expenditures on healthcare services remain a prevalent method of financing healthcare in private facilities within the country, the adoption of private health insurance could offer households a means to avoid financial burdens associated with substantial out-of-pocket costs. Consequently, promoting the use of private health insurance is advisable to alleviate the financial strains faced by patients intending to seek care at private healthcare facilities. Encouraging private health insurance plans could, therefore, provide access to financial protection that is currently lacking in the country. These findings align with previous studies conducted by Shmueli and Savage (2014), Rivera-Hernandez et al. (2016), and Abougergi et al. (2019).

However, despite its limited prevalence in Zambia, private health insurance coverage is susceptible to market failures stemming from moral hazards and adverse selection, as noted by Wu et al. (2020). These factors may also explain the positive impact observed on healthcare utilization. Moral hazard may result in patients seeking excessive levels of care, and physicians prescribing unnecessarily expensive treatments and medications, as discussed by Arrow (2001). Insurance companies address moral hazards through deductibles and copayments, potentially exposing

insured individuals to limited financial protection. Additionally, insurers may lack accurate information about the health status of policyholders, leading to adverse selection. These factors may constrain the ability of private health insurance to adhere to the principles of universal health coverage. According to Zhang et al. (2020), the expansion of private health insurance could contribute to the ongoing rapid rise in healthcare expenditures, lead to fragmentation of the healthcare system, and exacerbate social inequality by further widening the gap in healthcare utilization between different socioeconomic groups. Nevertheless, Nyman (2004) emphasizes that moral hazard is not always inefficient from a welfare perspective.

In summary, this study has identified positive effects of health insurance coverage on healthcare service utilization, a trend observed for both overall and private health insurance coverage. However, the impact was not statistically significant for public health insurance coverage. This lack of significance can be attributed to the low prevalence of public health insurance schemes or the possibility of subpar service quality and limited healthcare infrastructure at these facilities. If enrollees perceive contracted providers to offer inadequate or substandard care, they may delay seeking treatment, potentially affecting their health. Consequently, the lack of a significant effect on utilization for public health insurance schemes may be attributed to the poor quality of services provided by public healthcare service providers, as discussed by Robyn et al. (2012) and Erlangga et al. (2019).

This paper acknowledges the concerns raised by economists such as Wagstaff and Yu (2007), who assert that when evaluating the impact of health insurance, it is insufficient to merely assert that health insurance positively influences healthcare service utilization. Health insurance can also incentivize excessive use of healthcare services. Economic theory suggests that improvements in access must be weighed against potential welfare losses stemming from both demand-side and supply-side moral hazards, as highlighted by Escobar et al. (2010). In this study, we have cautiously assumed that the observed positive impact of health insurance coverage on healthcare service utilization can be considered a welfare gain, given the significant access challenges prevalent in Zambia. The Zambian Ministry of Health (2019) explains that the Zambian population, particularly the most vulnerable groups, tends to face severe access constraints, leading to underutilization rather than overutilization of healthcare services. Consequently, concerns related to potential moral hazards are less likely to be problematic in this study. Any additional care resulting from health insurance is presumed to be necessary, beneficial, and advantageous for the population.

IV- Conclusion:

This paper underscores the significance of offering health insurance coverage, recognizing the positive influence of both overall and private insurance on healthcare utilization. In the absence of health insurance, out-of-pocket expenses have the potential to push households into poverty. There is currently a consensus that public funding is necessary to address disparities and attain Universal Health Coverage (UHC) by extending insurance coverage to marginalized populations, thus eliminating their financial barriers to essential healthcare services. Furthermore, the government has the opportunity to enhance funding for healthcare service provision and elevate the quality of care. This is especially pertinent because public coverage has shown limited effects on healthcare utilization outcomes. To enhance the quality of care, particularly at public healthcare facilities, the government can intensify its oversight of healthcare facilities, advocate for patient-centered care, broaden service offerings at healthcare facilities, and incentivize healthcare workers through both financial and non-financial means. Additionally, the government can embark on initiatives such as constructing more hospitals and clinics, expanding and upgrading road networks, and recruiting more skilled personnel to improve the doctor-patient ratio, particularly in rural regions.

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