Impact of urban slum residence on coverage of maternal, neonatal and child health service indicators in the Greater Accra Region of Ghana: an ecological time-series analysis, 2018-2021

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Abstract

The Sustainable Development Goals (SDGs) 11 and 3 emphasize the need to eliminate slums, provide access to safe and affordable housing and basic services, and achieve universal coverage of maternal, neonatal, and child health (MNCH) services by 2030. Governments and development agencies have historically neglected the problems associated with living in urban slums across major capital cities in sub-Saharan Africa. Health policies and programs have tended to focus on people living in rural communities. This study assessed the trends and compared inequities in MNCH service utilization between slum and non-slum districts in the Greater Accra region of Ghana. The study analyzed data from 29 districts using monthly time-series data on MNCH service utilization between January 2018 and December 2021 obtained from the routine health management information system. Multivariable quantile regression models with robust standard errors were used to quantify the impact of urban slum residence on MNCH service utilization. We assessed the inequality of MNCH coverage indicators between slum and non-slum districts using the Gini Index with bootstrapped standard errors and the Generalized Lorenz curve. The rates of vaccination coverage and antenatal care (ANC) attendance have declined significantly in slum districts compared to the non-slum districts. However, skilled delivery and postnatal care were found to be higher in the urban slum areas compared to the non-urban slum areas. To achieve the target of the SDGs, the Government and other relevant stakeholders should prioritize the implementation of effective policies, programs, and interventions aimed at improving access to and utilization of ANC and immunization services among the urban slum dwellers.

Introduction

The 2030 Agenda includes 17 Sustainable Development Goals (SDGs). One of these goals, SDG 11 (“Make cities and human settlements inclusive, safe, resilient and sustainable”), has an explicit urban focus (1). Urbanization is an ongoing major global trend. According to the World Health Organization (WHO), more than 55% of the world’s total population resides in urban areas and this proportion is projected to increase to 68% by 2050 (2). In 2018, three times as many urban dwellers were estimated to live in less developed regions compared to more developed regions (3.2 billion versus 1.0 billion) (1). Although these projections can be used to positively influence urban development, challenges remain in addressing anticipated rapid urban population increases, particularly in LMICs.

The WHO asserts that most people living in urban areas still suffer from inadequate housing, transport, sanitation and waste management, poor air quality, lack of quality healthcare, limited access to social welfare services, and few economic opportunities (2).

While urbanization can enhance economic growth, poverty alleviation, and development, potential gains are largely dependent on its pattern and service delivery and infrastructure development keep pace with urban population increase. In many cases, the urban poor may not only lack the financial power to afford decent living conditions, but may also experience limited access to some essential health services, including maternal, neonatal and child health services (MNCH), job opportunities, and opportunities for social development (3). WHO has prioritized improving MNCH service utilization with the ultimate goal of achieving related SDGs but the lack of these services in urban slum areas may derail the gains made and may not be able to reduce maternal mortality to less than 70 per 100000 live births, reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births. Pregnant women who live in urban slums communities are at a high risk of maternal deaths with limited access to health facilities (4), and slum children have much poorer health outcomes, childhood illnesses, malnutrition and higher mortality than children in all other residential domains, including those in rural areas (5).

In general, people residing in large cities are better off in terms of their general well-being and have a greater choice of health services than their rural counterparts (6). However, these numbers conceal the disparities in most urban areas because the urban poor and their unmet needs are lost within per capita averages. Population based surveys often mask disparities in urban areas because sample sizes are too small to show disaggregation by wealth status or geographic location. The health and general well-being of poor people living in slum areas in capital cities in Africa have deteriorated as most government policies and other community-based interventions often overlook this population and focus on people living in rural communities (7). For instance, as people migrate, continuity of care such as antenatal care, facility-based deliveries, postnatal care and vaccination coverage suffers. There is also lack of health insurance, inadequate and poor accommodation, water and sanitation challenges (8).

There is a paucity of evidence of the impact of living in slums on health in sub-Saharan Africa (9). To the best of our knowledge, no study has quantified the impact of urban slum-based intercity inequalities on service utilization in sub-Saharan Africa using data from Routine Health Management Information Systems (RHMIS) that continuously capture utilization of health services and health status of urban slum dwellers in the capital city. Admittedly, a lot is known about intra-urban inequalities in Greater Accra, but there is much contextual knowledge to aid interpretation of findings from routine health systems data. To make informed decisions to improve the health of populations living in slum areas, it is essential to generate and track reliable estimates of MNCH outcomes and service utilization between slum and non-slum areas and further quantify the impact of living in urban slum districts on these selected outcomes and coverage indicators. This study aims to assess the impact of urban slum residence on the coverage of maternal, neonatal and child health service indicators (antenatal care, facility-based delivery, postnatal care and vaccination coverages) in the Greater Accra Region of Ghana.

Methods

Study area

This study is an ecological time series study across 29 districts in the Greater Accra Region (GAR) of Ghana between 2018 and 2021. Greater Accra is the capital region where Ghana's national capital Accra is located. The region has health facilities including teaching hospitals, regional hospitals, university hospitals, district hospitals, psychiatric hospitals, polyclinics, clinics, maternity homes, health centers, private health facilities, and community health post service. In this ecological study, the unit of observation is the population of children and women using health services across the 29 administrative districts. The GAR has a population of 5.5 million persons according to the 2021 population and housing census (10). The population of Ghana has not only grown but has also experienced rapid urbanization in the past several decades in Greater Accra and Ashanti regions. Today, more than half of the country's population resides in urban areas (11). According to the United Nations Habitat report, the proportion of the urban population living in slum households in Ghana is 30.4% as of 2018. Using 2010 National Population Census data and the UN-Habitat's definition of slums, the Accra Metropolitan Assembly identified 78 informal settlements and hotspots in Accra (12). According to the World Bank, approximately 37.4% of people who live in Ghana's urban regions live in slums (13).

Data source

The unit of analysis is the district where the facilities are located because of the difficulty of identifying catchment populations (unstable denominators) for individual facilities in urban areas. In addition, there was no data on population size at the sub-district level. We used the data from RHMIS, which routinely collects data on MNCH health outcomes and service utilization as clients interact with health services at health facilities or during outreach services. RHMIS is a comprehensive health management information system solution for the reporting and analysis needs of district health administrations and health facilities at every level. Healthcare workers at facilities collect the data and input aggregated reports via the District Health Information System (DHIS) database. The system receives data from Government and private health facilities and has been operational since 2012 but slum data from Ghana Statistical Service were available from 2018. We obtained monthly data on the indicators from RHMIS between 2018–2021 from the office of Policy, Planning, Monitoring and Evaluation Division of the Ghana Health Service and merged the data with slum information at the district level. The data from RHMIS can be summed from the health facility level to higher administrative areas like sub-districts, districts, regions up to the national level. The data on service utilization of antenatal care, skilled birth attendants, and postnatal care are monthly aggregates of women receiving maternal health services at different health facilities. The vaccination coverage indicators were aggregates of services provided at health facilities and through outreach programs provided by community health nurses.

Slum areas were identified by triangulating field survey, spatial and census data. The data on slum locations across the districts in Greater Accra were obtained from the synthesis of data obtained from the field in 2021. Also, Ghana Statistical Service slum delineated data for 2021, and a literature review of similar slum identification in Greater Accra using census, survey and remotely sensed and GPS located data were used (14, 15). The data on the population size and population projections for districts and sub-districts were obtained from the Ghana Statistical Service.

Health service coverage indicators

The primary service coverage measures include antenatal care (ANC) attendance, skilled delivery, postnatal care (PNC) attendance, and vaccination coverage for Bacillus Calmette-Guérin (BCG), Oral Polio, Measles, and Pentavalent 1 vaccine at the district level (Table 1).

Table 1
Health service coverage indicator definitions

Indicator	Definition	Numerator	Denominator	Source of denominator
BCG Coverage	The proportion of children under 1 year receiving BCG vaccine	Number of children under 1 year receiving the BCG vaccine in the period	Number of children under 1 year (estimated as 4% of the population)	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate
Oral Polio vaccination	The proportion of children under 1-year receiving oral polio (OPV1) vaccine	Number of children under 1 year receiving the OPV1 vaccine in the period	Number of children under 1 year (estimated as 4% of the population)	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate
Pentavalent vaccination	The proportion of children under 1 year receiving Penta1 vaccine	Number of children under 1 year receiving the Penta 1 vaccine in the period	Number of children under 1 year (estimated as 4% of the population)	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate
Measles-Rubella Coverage	The proportion of children under 1 year receiving Measles-Rubella Vaccine	Number of children under 1 year receiving the Measles-Rubella vaccine in the period	Number of children under 1 year (estimated as 4% of the population)	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate
Antenatal Care Coverage	The proportion of pregnant women receiving antenatal care during pregnancy (at least once).	Total number of antenatal registrants in a specified period	Total number of expected pregnancies of the catchment area within the specified period	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate
Skilled delivery	Percentage of deliveries conducted by skilled attendants (nurses and doctors).	The number of deliveries supervised by doctors or nurses in the specified period.	Number of expected pregnancies (estimated as 4% of the population)	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate
Postnatal coverage	The proportion of PNC registrants seen after delivery	Number of PNC registrants (within 48 hours)	Number of expected pregnancies (estimated as 4% of the population)	Ghana Statistical Service from the 2010 Population and Housing Census that adjust for monthly population growth rate

Measuring slums in Greater Accra Region

The primary exposure of interest was the number of slums in a district. The UN-Habitat 2004 defines a slum household as a group of individuals living under the same roof in an urban area who lack one or more of the following: 1. Durable housing of a permanent nature that protects against extreme climate conditions. 2. Sufficient living space which means not more than three people sharing the same room. 3. Easy access to safe water in sufficient amounts at an affordable price. 4. Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people. 5. Security of tenure that prevents forced evictions (1).

In this study, we based the determination of slums in Greater Accra on the UN-Habitat definition of a slum. The slum areas were identified by triangulating three data sources: 1) evidence from literature based on the UN Habitat definition in the last two decades; 2) a listing of slums in Greater Accra from the Ghana Statistical Service (GSS); and 3) a field survey. From the literature, we extracted maps of Accra slums from two published manuscripts (14, 15). These Accra slum maps were digitized, georeferenced, and compared to establish the location of the slums in Accra. The list of slum locations (towns) obtained from the GSS was geocoded and mapped. Geocoding is the process of transforming place names or addresses to spatial data. These two data sources were overlaid to be sure that the borders matched and further validated the slum map based on this overlay through site visits. That is, the research team

validated the existence of slums in the locations identified in the literature and the list of slum locations obtained from the GSS through field visits.

The final judgment of the slum locations was decided by the team based on the UN-Habitat definition and took into consideration that not all slums are homogeneous and not all slum dwellers suffer from the same degree of deprivation. The degree of deprivation depends on how many of the five conditions that define slums are prevalent within a slum household. The final list of slums identified includes households that suffer from at least two shelter deprivations.

Districts were used as the unit of analysis in this study. The districts in Greater Accra were categorized into slum and non-slum districts. A district was designated as a slum if it intersects considerably (i.e., at least one-quarter or more of the households in the district) with the slum areas derived from the literature and UN-habitat definition. That is, the district must satisfy the intersect condition and or contain at least one town from the GSS list of slum towns. A district was designated a slum if it met one or both of the following conditions: 1) sufficient intersection with the slum areas derived from the literature and UN-habitat definition (i.e., at least one quarter or more of the households in the district, and 2) at least one town from the GSS list of towns. A total of 22 out of 29 districts in the Greater Accra region were classified as slum-districts and the remaining seven were considered non-slum districts (Fig. 1).

Statistical analysis

Descriptive summary measures such as median, 25th and 75th percentile, mean, standard deviation (SD), and the range were used to describe the service coverage measures of interest. In addition, time series tools were used to explore the distribution of the coverage measures and identified the underlying coverage trends between the urban slum and non-urban slum districts, seasonal patterns, and outliers.

Initial data exploration showed the coverage measures were heavily skewed. Therefore, we quantified the impact of living in urban slum districts on MNCH outcomes and service utilization using the quantile regression (least-absolute-value models, median absolute deviation and minimum $L1$-norm) models with a robust standard error. Furthermore, we adjusted for seasonality deviation, and linear time trends. The quantile regression is a natural extension of the ordinary least square (OLS) regression model that is used when the conditions of OLS regression are not met (i.e., linearity, homoscedasticity, independence, or normality). The quantile regression model equation for the τth quantile is given as follows:

$$Q_\tau(y_{ij}) = \beta_0(\tau) + \beta_1(\tau)slum + \beta_2(\tau)month + \beta_3(\tau)(year) + \beta_4(\tau)(facilities) + \beta_5(\tau)COVID + \beta_6(\tau)location + \beta_7 OPD + \beta_8 Pop + \varepsilon_{ij}(\tau), i = 1, \dots, n$$

Where y_{ij} is the ith month observation for the jth districts All the multivariable models adjusted for seasonality in month and year fixed effect, the impact of COVID-19 (a binary indicator indicating observations before and after the onset of COVID-19), total OPD attendance, number of health facilities in the district (a proxy for access), geographical location (urban or rural), and the monthly population size of the district where appropriate.

Assessment of equity

The WHO defines health equity as the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically, or geographically. In this study, inequalities in the coverage of MNCH services were measured and monitored and served as an indirect means of evaluating health inequity. We assessed the inequality of MNCH indicators between slum and non-slum districts using the Gini Index with bootstrapped standard errors and the Generalized Lorenz curve.

All statistical analyses were conducted using Stata MP version 17 (StataCorp LP, College Station, TX, USA) and a p-value less than 0.05 was considered statistically significant.

Results

Descriptive analysis

This study analyzed 1392 monthly time series data from 29 districts in the Greater Accra Region of Ghana (22 slum districts: 76% and 7 non-slum districts: 24%) between 2018–2021. The maximum number of slum locations per district was 6 (range: 0–6). This study analyzed data from 614 health facilities in the 29 districts that submit data on coverage indicators through the RHMIS. More than half of the health facilities are privately owned (54%, n = 332), Government facilities account for 42% (n = 255), Quasi-Government facilities including facilities owned by the Christian Health Association of Ghana account for 4% (n = 27) of the total facilities in Greater Accra. The distribution of health facilities is as follows: 22 districts with at least one slum account for about 76% of the total number of health facilities in Greater Accra.

Trend analysis of vaccination coverages between urban slum and non-urban slum districts

The trend analysis of vaccination coverage indicators showed that the median BCG, Pentavalent, Oral Polio and Measles vaccination coverages declined in the urban slum districts compared to the non-urban slum districts in the Greater Accra Region of Ghana between 2018–2021 (Fig. 2). We observed a difference in OPV coverage between slum and non-slum- districts between 2018 and 2019 but the coverage gap has decreased significantly between the districts from 2019 to 2021. Also, BCG coverage in non-slum districts was substantially higher and different from 2019 onwards.\

Trend analysis of antenatal care, skilled delivery and postnatal care coverage between slum and non-slum districts

The trend analysis of the coverage of antenatal care (ANC), skilled delivery, and postnatal care (PNC) attendance showed that the median coverages of the indicators have declined in the non-slum districts compared to the urban slum districts in the Greater Accra Region of Ghana from 2018 to 2021 (Fig. 3). ANC coverage appears to be declining in both slum and non-slum districts, but the decline appeared to be steeper in the slum districts compared to the non-slum districts over the same period. Although skilled birth attendance appears to be higher in the slum districts, the gains appear to be eroding, while skilled attendance at birth is increasing at a higher rate in the non-slum districts. PNC coverage has consistently been higher in the non-slum districts compared to slum districts and coverage appears to be increasing in both slum and non-slum districts.

Impact of urban slums on health service coverage

The study found a statistically significant association between vaccination and health service coverages and living in urban slum districts in the capital city. The results from the quantile regression with robust standard error (Table 2) showed that a unit increase in the number of slums per district was associated with 4.3 percentage point (pp) reduction in the BCG vaccination coverage [95% CI:-5.87, -2.79; $p < 0.001$], and 2.5 pp reduction in pentavalent vaccination [95% CI: -3.86,-1.14; $p < 0.001$], a 3.3 pp reduction in measles vaccination [95% CI: -4.68, -1.93; $p < 0.01$], 5.4 pp reduction in Oral Polio vaccination [95% CI: [-6.87, -3.99; $p < 0.01$] and 2.6 pp reduction in ANC attendance [95% CI: [-4.35, -0.89; $p < 0.01$]. However, skilled delivery and PNC visits appear to have increased in the slum districts compared to the non-slum districts, 1.64 [0.50, 2.78] and 2.60 [2.06, 3.15], respectively.

Table 2: Impact of urban slum residence on maternal, neonatal, and child health service utilization in the Greater Region of Ghana

	Quantile regression modeling: reporting median impact estimates and corresponding confidence interval
service coverage measures	
BCG	-4.33 [-5.87, -2.79]***
Pentavalent	-2.50 [-3.86,-1.14]***
Measles vaccination	-3.31 [-4.68, -1.93]***
OPV	-5.43 [-6.87, -3.99]***
ANC attendance	-2.62 [-4.35, -0.89]**
Skilled delivery	1.64 [0.50, 2.78]**
PNC	2.60 [2.06, 3.15]***

Abbreviations: RR: Adjusted Incidence Rate Ratio, BCG: Bacille Calmette-Guérin, OPV: Oral Polio Vaccination, ANC: Antenatal Care, PNC: Postnatal Care, CI: Confidence Interval, p-value notations: ***p<0.001, **p<0.01, *p<0.05. Note: All the multivariable models adjusted for seasonality in month and year fixed effect, the impact of COVID-19, total OPD attendance, number of health facilities in the district (a proxy for access), geographical location, and the population size of the district where appropriate.

Inequity analysis of coverage indicators between slum and non-slum districts

The concentration index ranges between 0 and 1, and inequality in access to health service utilization increased with an increasing Gini index. A value of “0” meant there was a completely equal distribution of service utilization, whereas a value of “1” referred to the extreme situation of one group of people having complete access to health service utilization, and all the rest having no access at all (maximum inequality). Inequality in BCG vaccination, Measles vaccination, Oral Polio Vaccination, Pentavalent vaccination, Antenatal care, and Skilled Birth Attendance was higher in slum districts compared to the non-slum districts. Inequality in PNC was however lower in slum districts compared to the non-slum districts (Table 3, Figure 4).

Table 3: Inequality analysis of coverage indicators between slum and non-slum districts

	Slum status	
	Non-slum districts	Slum districts
Indicators	Gini Index [95% CI]	Gini Index [95% CI]
BCG vaccination	0.117 [0.107-0.127]	0.262 [0.246-0.278]
Measles vaccination	0.110 [0.099-0.122]	0.157 [0.147-0.167]
Oral Polio Vaccination	0.118 [0.110-0.127]	0.193 [0.180-0.207]
Pentavalent vaccination	0.117 [0.109-0.126]	0.185 [0.173-0.197]
Antenatal care	0.135 [0.124-0.146]	0.263 [0.247-0.280]
Skilled Birth Attendance	0.260 [0.242-0.278]	0.334 [0.315-0.352]
Postnatal care	0.143 [0.131-0.155]	0.115 [0.105-0.125]

Note: The Gini Index is a measure between zero (perfect equality) and one (maximum inequality) which in our case summarizes the degree of inequality in health service utilization between slum and non-slum districts in the Greater Accra region of Ghana between 2018-2021. A Gini index of zero indicates that everyone in the district has the same access, so there is perfect equality across the population. A Gini index of one lies on the other extreme and indicates that only one individual from the whole population has all the

access, everyone else has no access. Numbers closer to zero indicate less inequality, and the closer the Gini index is to one, the more unequal coverage is within the population considered.

Discussion

This study quantified the impact of living in slum districts on MNCH service coverage and explored the trend of these services between slum and non-slum districts over 4 years (2018-2021). Our findings showed that living in urban slum areas correlates with lower vaccination coverage and ANC attendance. However, the study revealed that people living in urban slums are more likely to report higher coverage of skilled delivery and postnatal care which may be attributed to the intense outreached programs carried out by Government community health nurses and other NGOs on the need to have skilled delivery at birth. In addition, hospitals with high caseload may be in slum areas where women from outside slums travel to seek the aforementioned services.

For instance, the Ridge and Korle-Bu teaching hospitals are among the two most advanced health facilities in Ghana, and they are surrounded with slum communities. Since these are high end facilities, most cases are transferred from other health facilities to the Ridge and Korle-Bu teaching hospitals. The lower vaccination coverage may be attributed to socio-cultural factors (16, 17) and other misconception associated vaccine hesitancy and lower ANC attendance since most of these childhood vaccinations campaigns are emphasized during ANC(18).

The equity assessment showed that inequalities in BCG vaccination, measles vaccination, oral polio vaccination, pentavalent vaccination, antenatal care, and skilled birth attendance were higher in slum districts compared to the non-slum districts. Our analysis showed that most of the advanced Government health facilities such as the Ridge and Korle-Bu teaching hospitals which are all national health insurance (NHI) accredited health facilities in Greater Accra region are located within slum communities and access may largely not be a problem.

Although there are a larger number of private health facilities in slum areas as well as non-slum areas in the capital city, access to these private health facilities may be lower among urban slum dwellers compared to non-urban slum dwellers. This could be attributed to urban-slum dwellers being poor and may not be able to afford services at private facilities especially when not all private health facilities accept NHI due to the delay in the reimbursement of funds. Vaccine acceptability and uptake have decreased in recent years, both in children and adult immunization programs, with serious consequences for public health(19). Decreases in vaccination rates have contributed to the increased prevalence of preventable childhood deaths and the reappearance of previously eradicated diseases such as polio and measles (20).

Conversations on social media platforms, print, and electronic media have raised concerns about the safety of vaccines among the general population, including myths, conspiracy theories, misinformation, disinformation, and rumours about the effectiveness and side effects of vaccines in preventive programs. Such rumours promote fear, and neglect and set back the progress made in addressing issues of vaccine hesitancy. In addition, urban slum areas by definition generally lack basic infrastructure and resilient health systems necessary to sustain vaccination campaigns geared towards demystifying the myth associated with vaccination(21). Slums are the geospatial manifestations of urban poverty, social neglect, and inappropriate and inadequate government policies. These factors are largely associated with poor health outcomes and service utilization(22). There is the need for further studies to be conducted to determine factors influencing low vaccination coverage and ANC attendance in urban slum areas.

Limitations

Although the impact of COVID was accounted for in the regression models, we still believe that overall impact of COVID-19 on the disruption of the provision of essential health services including maternal, neonatal and child health outcomes cannot be underestimated and the pandemic had the potential to affect the pattern of health coverage between 2020 and 2021(23, 24).
Secondly, the analysis of data should have been conducted at the sub-district level, as the slum-impact variance could be higher at the lower levels compared to the district levels. However, our study could not analyze the sub-district level as there were no reliable sub-district population size estimates to generate a reliable denominator for the unbiased estimation of service coverage measures. The binary designation of districts as containing slums could suffer ecological fallacy as the proportion of slum in each district differs. Also, the secondary data used to define slum areas might be out-of-date considering the rapid urbanization in capital cities. Current population census micro-data and gridded population estimates can be used to improve the detection of slums within districts; however, data were not available at the time of the study.

Furthermore, the analysis does not control for “by passing” i.e., women living in non-slum areas accessing health services in slum areas and vice versa and cross-district border use of services (25) Finally, RHMIS data tend to fluctuate and contain reporting errors. Therefore, fluctuations in service utilization should be interpreted with caution. Also, at the time of conceptualization and analysis, Ghana’s 2021 population and housing census were not yet available, so projections based on the 2010 census were used.

Conclusion

Slum districts in the capital cities have lower childhood vaccination coverages and antenatal care but high facility-based deliveries and postnatal care coverage. Accordingly, we advocate for a shift in the intensity of Government policy implementation and intervention aimed at improving health service utilization among urban slum dwellers with special focus on childhood immunization and ANC attendance. Interventions geared towards increasing vaccine uptake should be a major government priority.

Declarations

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Ethics declarations

This study obtained ethical approval from the Ethics Committee of the Faculty of Environmental and Life Sciences, University of Southampton (Ethics approval ID: 60948.A1).

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Figures

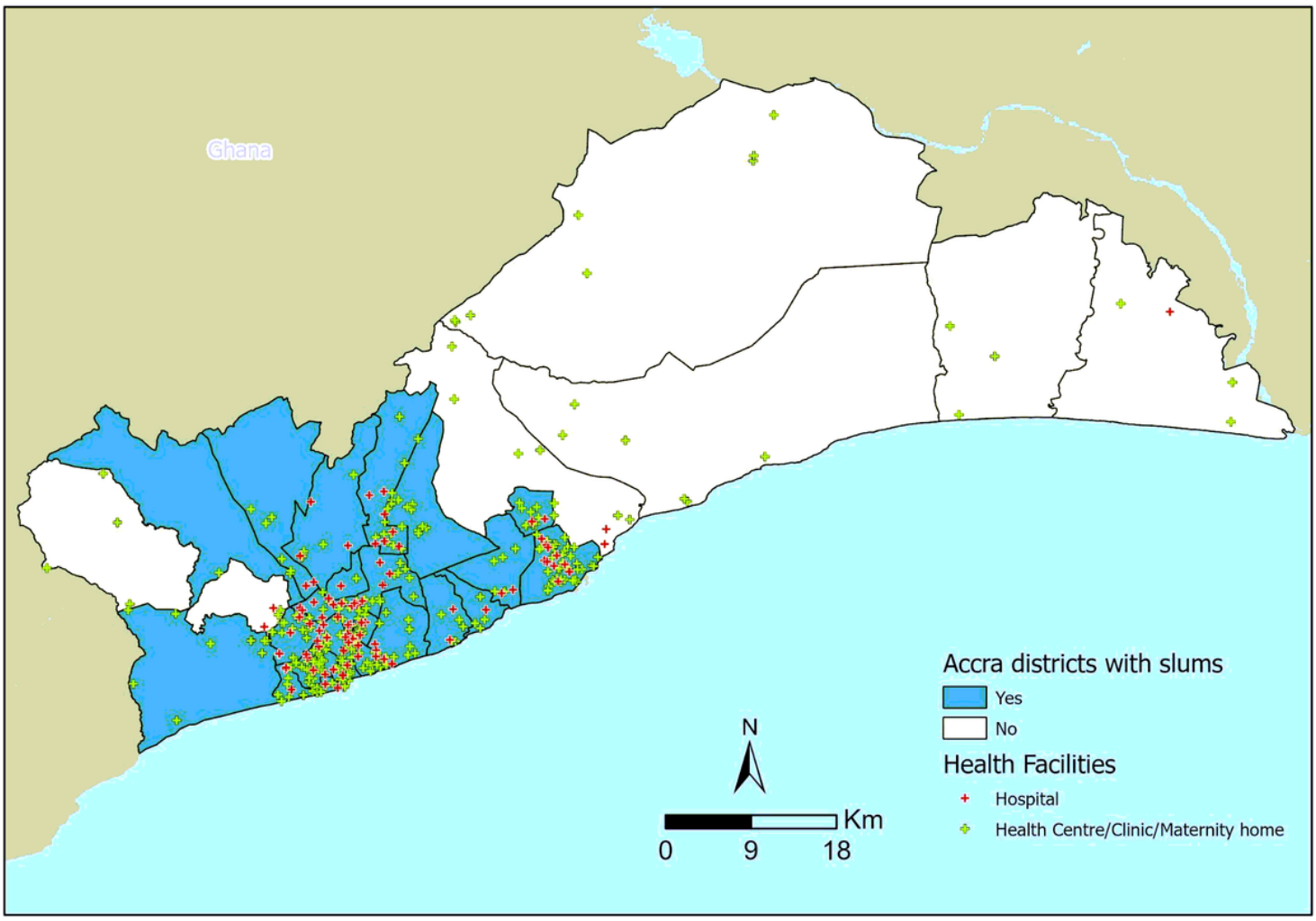

Figure 1

Districts within Greater Accra Region with slums/no slums and type of health facilities.

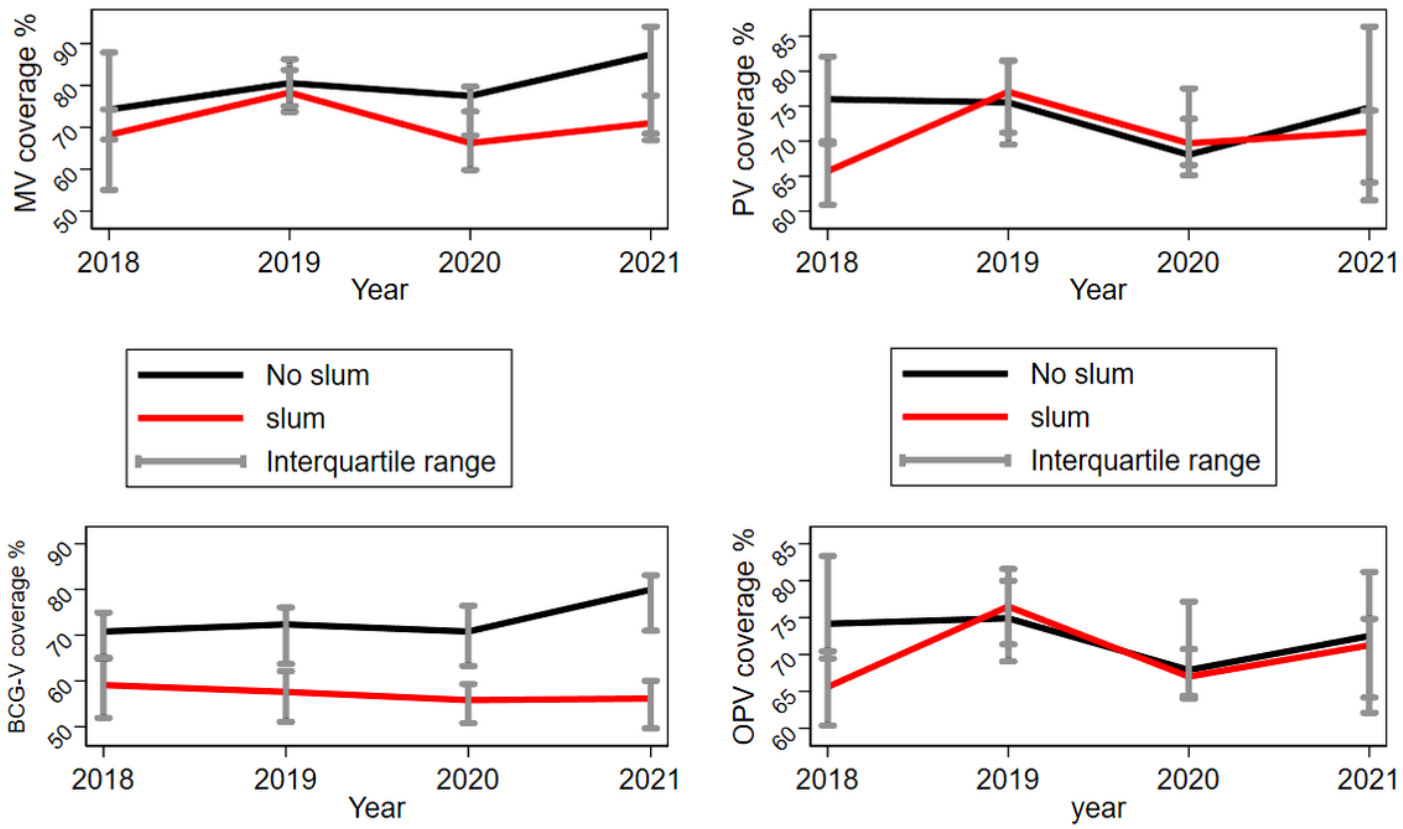

Figure 2

Trend analysis of vaccination coverage between slum and non-slum districts from 2018-2021.

Panel a)-MV: Measles vaccination; Panel b)-PV: Pentavalent vaccination; Panel c)-BCG-V: Bacille Calmette-Guérin vaccination; Panel d)-OPV: Oral Polio vaccination

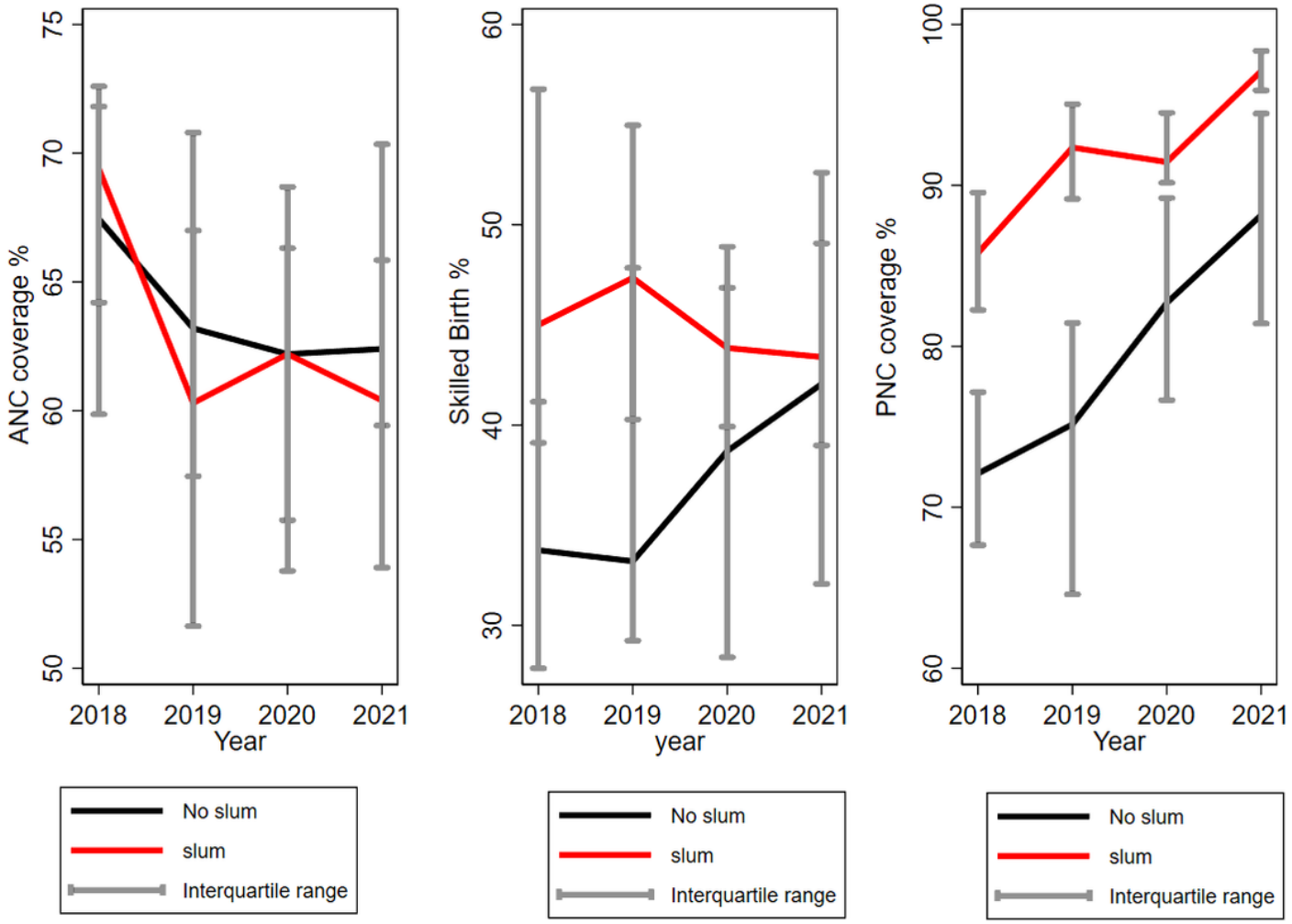

Figure 3

Trend analysis of antenatal care, skilled delivery, and postnatal care coverages between slum and non-slum districts from 2018-2021. Abbreviations: ANC: antenatal care, PNC: postnatal care.

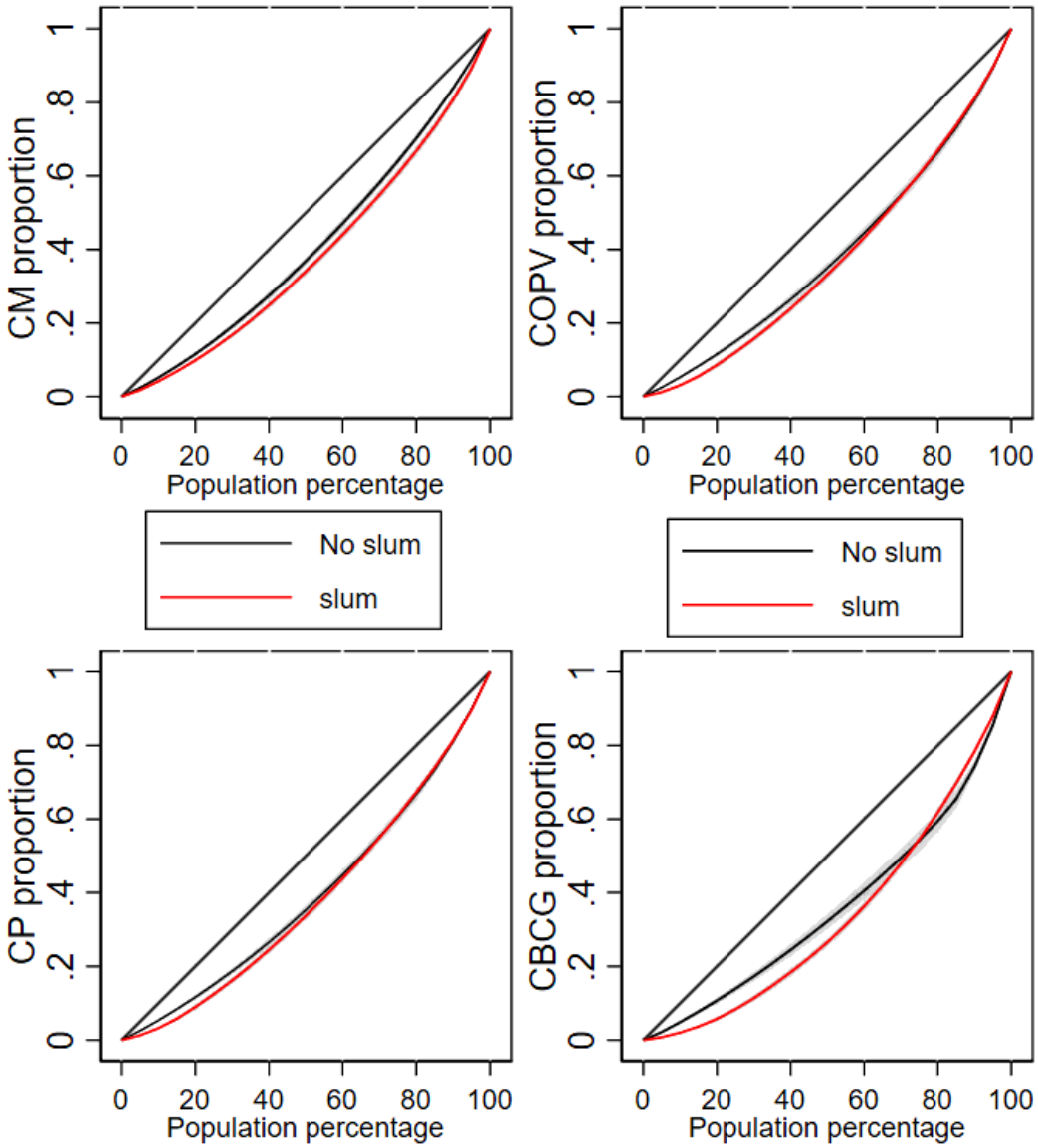

Figure 4

Health inequity assessment using generalized Lorenz curve: Note: CM: Cumulative Measles, CP: Cumulative Pentavalent, COPV: Cumulative Oral Polio Vaccination, CBCG: Cumulative Bacillus Calmette-Guérin