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Bridging the Divide: Analyzing Child and Infant Mortality Disparities in Congo's Urban and Rural Areas

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Abstract:- This article presents an analysis of the differences in mortality among children under 5 years old according to their place of residence (rural or urban) in Congo and examines the hypothesis that these differences are merely manifestations of underlying economic status differences. Based on data from the Multiple Indicator Cluster Survey (MICS-5, 2014-2015), our findings refute the previously established hypothesis between child and juvenile mortality and wealth level. On the contrary, the significant contribution of malnutrition (10.07%) suggests that investments in community infrastructure could potentially play an important role in reducing child and juvenile mortality differences. Furthermore, if the two child groups were identical in terms of their characteristics, the child mortality gap would still be 0.047733, or 4.77% in favor of the urban environment. The corollary of these results suggests that in addition to strengthening maternal, infant, and juvenile health programs in rural areas, substantial efforts must also be made to improve household income.

Keywords:- *Infant and Child Mortality, Decomposition, Urban-Rural, Socioeconomic Characteristics, Congo.*

JEL classifications : J11, C25, R00, O55

I. INTRODUCTION

The right to health is a fundamental dimension of the 1948 Declaration of Human Rights and is the cornerstone of sustainable development, given its crucial importance in the formation of human capital. With this perspective, policymakers adopted the 2030 Agenda in September 2015, which, in its Sustainable Development Goal (SDG) 3, aims to ensure healthy lives and promote well-being for all at all ages by 2030.[1].

Since the pioneering work of Caldwell (1979a; 1979b) on the role of maternal education in child survival, the issue of infant and early childhood mortality has become a subject of intense analysis in social sciences. In particular, the analysis of the determinants of infant and juvenile mortality has led to numerous studies both theoretically and empirically. During the 1980s, most studies (Meegama, 1980; Mosley and Chen, 1984; Sastry, 1996) showed that infant and juvenile mortality was the direct result of a series of manifestations of a number of health and environmental factors interacting with each other. In this regard, Meegama (1980) identified three categories of causes of infant and juvenile deaths: (i) the first, inherent in a lack of assistance at the time of birth, (ii) the second composed of factors related to immaturity and congenital malformations of the child, and (iii) the third grouping neonatal infections related to the unhealthy environment. This thesis was taken up by Mosley and Chen (1984), and then by Kalipeni (1993), who provided a theoretical framework for explaining child survival in developing countries based on proximal determinants. By combining factors from social sciences (socioeconomic factors) and medicine (biological and nutritional variables), their approach suggests that disease is no longer the immediate cause of child mortality but the consequence of many mechanisms stemming from intermediate variables and socioeconomic determinants from which the whole process develops.

Despite the multidisciplinary nature of mortality studies, theoretical contributions from historical demography, medical humanities, social anthropology, and social sciences in general recognize the role of socioeconomic, cultural, and community factors in explaining child mortality. The debate on the explanatory factors of infant and juvenile mortality has evolved; currently, the discussion on mortality focuses on the underlying factors contributing to spatial or geographical disparities. In this regard, Sastry (1997), building on the premises established by Mosley and Chen (1984), estimated that although the availability of health services, sanitation infrastructure, and other social services is important for reducing mortality during early childhood, its interaction with individual, household, and community characteristics determines the level of observed gaps and real inequalities. The main idea of this argument is that determinants at each of these levels of operation within the general hierarchical structure are capable of influencing infant and juvenile

[1] SDG-3, among other things, calls for an end to preventable deaths of newborns and children under 5 years old, with all countries aiming to reduce neonatal mortality to at least 12 per 1,000 live births and under-5 mortality to at least 25 per 1,000 live births by 2030 (UN, 2015).

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mortality through the interactions of attributes at different levels.

In empirical literature, a series of studies have attributed the gaps in early childhood mortality in Developing Countries (DCs) to the urban bias, which indicates a disproportionate benefit obtained by an urban population in the allocation of public resources (Lipton, 1977; Redclift, 1984). Other works have attributed this differential to socioeconomic and community factors (Poel et al., 2009; Bocquier, et al., 2011; Mohanty 2011; Singh et al. 2011; Po and Subramanian 2011).

In the Congolese context, few studies have specifically examined the determinants of the differences in infant and juvenile mortality between rural and urban areas. The under-five mortality rate (U5MR), defined as the death of children from birth to the fifth (5th) anniversary (not included) per thousand live births, is considered politically as an indicator of the standard of living and socio-economic conditions of a country. A high U5MR for a country indicates unmet health needs, adverse environmental factors, and the poor health and socio-economic status of its population. According to a UNICEF report (2010), although substantial progress has been made in reducing the number of infant and juvenile deaths, children from poor or disadvantaged households remain disproportionately vulnerable in all regions of the developing world. Similarly, children born into the poorest 20% of households are almost twice as likely to die before the age of 5 as those born into the richest 20% (UNICEF, 2016).

In Congo, according to estimates from the Multiple Indicator Cluster Survey (MICS, 2014-2015) and the Demographic and Health Surveys (DHS) conducted respectively in 2005 and 2012, infant and juvenile mortality recorded a slight decrease between 2012 and 2015 (68‰ to 52.3‰ live births) compared to the sharp decrease observed between 2005 and 2012 (123‰ in 2005 to 68‰ in 2012). However, despite this decline, huge disparities in terms of gaps in infant and juvenile mortality remain significant between urban and rural areas. According to the MICS 2014-2015, the differential in infant and juvenile mortality was 38.2‰ in urban areas compared to 74.5‰ in rural areas. In other words, children are exposed to higher mortality risks in rural areas than their urban counterparts, regardless of the average level of mortality (MICS, 2014-2015). At the same time, the results of the survey on the availability and operational capacity of health services (SARA) conducted in 2018 highlight that the operational capacity of basic emergency obstetric and neonatal care services, assessed based on the availability of tracer elements grouped into 3 areas (staff and guidelines, equipment, medicines and products), is higher in urban health facilities (53%) compared to those in rural areas (43%). Regarding child vaccination, the analysis of the operational capacity score in the health facilities revealed that 73% of the tracer elements related to vaccination were available in urban health facilities compared to 60% in rural health facilities.

Examining the explanatory factors of the gap in infant and juvenile mortality between rural and urban areas is extremely important in the context of Congo, given that: (i) infant and juvenile mortality represents a major obstacle to achieving sustainable progress concerning every child's right to survive and thrive, and (ii) the major strategic objective displayed in the National Development Plan (NDP, 2018 – 2022) is to improve the health of the population throughout the territory.

This research aims to identify the main socioeconomic factors that explain the gap in infant and juvenile mortality between rural and urban areas in Congo. In this investigation, we argue that the household wealth index contributes to the gap between rural and urban areas in terms of infant and juvenile mortality. Referring to theoretical models on the disparity of child survival during early childhood, this hypothesis is based on the conceptual framework of the work of Mosley and Chen (1984) and Sastry (1996) in developing countries.

The rest of the research is presented as follows: Section 1 provides a brief review of the theoretical and empirical literature. The second deals with the methodology, data source, and estimation strategy applied to our case, while the third presents and discusses the results of the logistic regression model and the Fairlie decomposition (2005). Finally, the last section concludes with some implications for economic policies.

II. THEORETICAL AND EMPIRICAL LITERATURE REVIEW

This section revisits the theoretical and empirical literature on the determinants of the differential in child and infant mortality. In the first subsection, we briefly examine the theoretical frameworks for analyzing mortality during early childhood in sociodemographic literature. We will see that the understanding of disease risk and the outcome of the pathological process have evolved over time, initially focusing on biological and environmental factors, and subsequently on socioeconomic and demographic factors that act through immediate determinants.

In the second subsection, we address the empirical aspect by presenting studies on the disparities in child and infant mortality between urban and rural areas in developing countries, generally, and in sub-Saharan Africa, in particular. Finally, we highlight the originality of this work by focusing on methodological challenges and how the use of certain socioeconomic variables can influence the results of this analysis.

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A. Theoretical Frameworks for Analyzing the Determinants of Mortality During Early Childhood

The theoretical frameworks examined in this work are primarily based on microeconomic studies. This choice is justified by the individual nature of the data used in the analysis. Through this approach, we identify at the theoretical level: (i) factors associated with child and infant mortality that can account for the phenomenon of child and infant mortality in Congo and (ii) the theoretical model that could best lend itself to modeling under-five mortality rate (U5MR).

➢ *Sriniwasa Meegama's Theory (1980)*

Meegama (1980) is among the first authors who attempted to explain the phenomenon of mortality, particularly child deaths occurring before the fifth anniversary. His approach is more an expansion of the classical epidemiological model of infectious diseases than an integration of social science and medical science paradigms. According to Meegama (1980), the cause of death is just the final product of a series of manifestations of certain numbers of variables that interact with each other. He introduced a model that develops and articulates into three categories of causes of infant death. The first, inherent to a lack of assistance at the time of birth, includes diseases such as neonatal tetanus, postnatal asphyxia, and complications during childbirth. The second category consists of factors related to immaturity and congenital malformations of the child. The third category groups together neonatal infections and pathologies related to the unhealthy environment.

This model, therefore, assumes that the causes of death during early childhood are directly influenced by independent variables related to the child's sanitary and physical environment. These include factors such as: (i) climatic factors, (ii) the sanitation of the child's living environment and water quality, (iii) hygiene, food resources, and housing characteristics, and (iv) the mother's financial situation (Pace and Mastrorocco, 2002). The interest of Meegame's (1980) approach is to offer a synthetic vision of the biological determinants of child mortality by grouping together infectious diseases and identifying the primarily socio-economic causes responsible.

➢ *Mosley and Chen's Theory of Proximal Determinants (1984)*

Mosley and Chen (1984) developed "the model of proximal determinants of infant mortality". This approach, complemented by Kalipeni (1993), highlights a set of determinants or intermediate variables responsible for subsequent morbidity and mortality of infants and children. Specifically, Mosley and Chen (1984), and Kalipeni (1993) identify social, economic, biological, and environmental factors as responsible for reducing the proportion of survivors in any society. The originality of this model compared to Meegama's (1980) is that disease is not the fundamental and immediate determinant of child mortality. It is rather the consequence of many mechanisms that derive from several intermediate variables (such as maternal factors, environmental contamination, nutrient deficiencies, and individual disease control). The child's death is not simply the effect of the aggravation of a disease, but it is rather the last phase of a process, which groups together elements (variables) that interact reciprocally and are influenced by social and economic determinants.

Mosley and Chen (1984) thus identify a set of variables that have a direct effect on child mortality, even if they are directly influenced, on their side, by social, economic, and political factors. These determinants are grouped into five (05) categories of immediate determinants (maternal factors, environmental contamination, nutritional deficiencies, injuries, and individual health control), as illustrated in figure 1 (Moise et al., 2016).

However, although Mosley and Chen's (1984) framework is widely cited to explain the disparity in child mortality, several criticisms have been made. Indeed, Mosley and Chen (1984) focus more on individual decision-making and neglect geographical factors that also play a significant role in determining child health and, in particular, child and infant mortality. Moreover, the list of immediate determinants should be exhaustive, so that children's health will change if one or more determinants also change (Lemani, 2013). In addition, some determinants may not be included due to data availability and measurement difficulties.

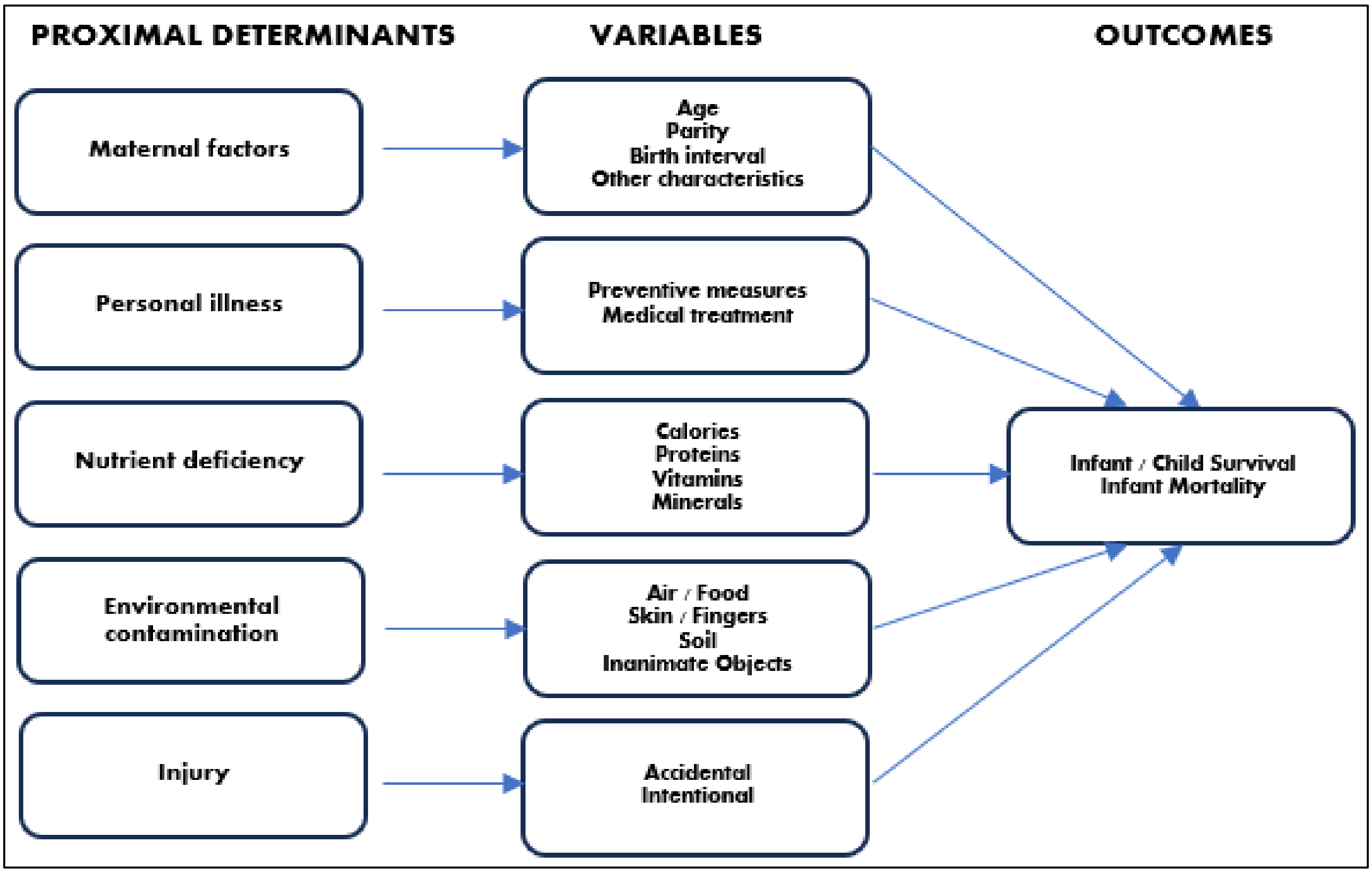

Fig 1 : Analytical Framework for the Study of Child Survival, Excerpted from Moise et al. (2016).

➢ *Sastry's Analysis Framework (1996)*

Building on the premises established by Mosley and Chen (1984), Sastry's (1996) framework for interpreting child mortality provides a logical organization for the set of covariables likely to influence child survival at the level of: the individual (child or mother), the family (i.e., the household), and the community (contextual or geographical situation). The author argues that the actual outcome of child health largely depends on the interaction between community attributes (such as the community health system and infrastructure) and individual and household characteristics.

Sastry (1996) categorized the immediate determinants into three major categories: genetic, behavioral, and environmental. He argued that these determinants can intervene at three different levels: the child, the household, and the community; and that these three levels provide a logical organization for the variables likely to influence child and infant mortality. Emphasizing that a child resides within a family located in a community, he noted that children belonging to the same household are exposed to the same socio-economic and cultural situation of the household, on the one hand, and to the same infrastructure, climate, and physical environment of the community, on the other. As a result, children are exposed to the same diseases and conditions, which are transmitted within the community through normal contact.

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➢ *Form of Effect*

Table 1 Framework for Interpreting Factors Influencing Child Survival at Different Levels (Sastry, 1996)

Operating level	Genetics	Behavioral	Environment
Child	Idiosyncratic genetic factor	Behavior and care specific to children	
Family	Genetic factors are shared by all siblings	Parental competence, custody of children common to all siblings	Household environment
Community		Shared cultural preferences, values and influences	Infrastructure, climate, physical and pathological environment

B. Empirical findings on the determinants of child and infant mortality disparities

A vast body of literature has accumulated in recent years to analyze, from an empirical perspective, the disparities in infant mortality and/or mortality among children under five years of age. Our empirical review is based on studies following the framework established by Mosley and Chen (1984), which makes a clear distinction between the immediate determinants of child survival (mother's age at birth, parity, and birth intervals) and the socioeconomic determinants in developing countries[2]. These latter determinants, acting through immediate determinants, are grouped into three major categories of factors according to Sastry (1996): (i) individual factors, (ii) household factors, and (iii) community factors.

All these studies examine the differences between rural and urban areas using demographic and health variables and reveal the disadvantages of rural children in terms of mortality during early childhood. Moreover, these studies generally include information at the child level (such as sex and birth order), at the mother's level (such as birth spacing, age at birth, education, ethnicity) and at the household level (such as wealth index and access to clean water).

➢ *Proximal and Socio-Economic Determinants*

In the literature, numerous empirical contributions have helped to explain the determinants of infant and early childhood mortality disparities between rural and urban areas.

Sastry (1997) questions the factors explaining the observed differences in child survival according to the place of residence (rural or urban) in Brazil. Based on data from the 1986 Demographic and Health Survey, his results suggest that the urban advantage is attributable to better socioeconomic and behavioral characteristics at the individual/household level (especially maternal education) and the community.

Poel et al. (2009) examine infant and juvenile mortality inequality in six Francophone countries in Central and West Africa using Demographic and Health Survey (DHS) data[3]. To allow for an association between unobserved heterogeneity and observable characteristics at the household and community level, while identifying the contribution of the latter, they combine a probit model specified according to the Mundlak-Chamberlain approach and the Blinder-Oaxaca decomposition method (1973). Their results indicate that observed and unobserved household characteristics explain two-thirds of the total gap between rural and urban areas in terms of risks of mortality during early childhood. Moreover, among the observed characteristics, environmental factors (a safe source of drinking water, electricity, and the quality of housing materials) are the main contributors.

Previously, Poel et al. (2007)[4] noted in a study of 47 developing countries a significant urban advantage in terms of mortality during early childhood in about a third of the countries, in the absence of community variables that are potentially important factors of disparity. Similarly, they conclude that controlling for differences in household wealth reduces by 59% the median risk ratio between rural and urban areas in terms of mortality of children under five years old.

In the same vein, Saika et al. (2013) assess the role of socioeconomic factors and maternal and child health care (MCH) programs in explaining the gap between rural and urban areas in terms of infant and juvenile mortality in India over the last two decades. To this end, they use, on the one hand, binary logistic regression to analyze the association between socioeconomic factors and MCH program factors and child mortality, and on the other hand, the Fairlie decomposition technique (2005) to understand the relative contribution of different covariates to the gap between rural and urban areas in terms of infant and juvenile mortality. They conclude that the disparity in mortality between rural and urban areas during early childhood is attributable to the underlying disadvantage in terms of household wealth and maternal education, whereas breastfeeding and knowledge of oral rehydration solution contributed to reducing the gap. Moreover, the proportion of women using modern contraceptive methods and the percentage of fully

[2] Socio-economic determinants, on which social science research has devoted most of its work, are largely ignored by medical research. Similarly, immediate determinants encompassing indicators of various mechanisms producing stunting, diseases, and deaths, are more often analyzed in medical research and ignored in social sciences.

[3] Benin (2001), Central African Republic (CAR; 1995), Chad (2004), Guinea (1999), Mali (2001), and Niger (1998)

[4] The study by Poel et al. (2007) focuses on two types of mortality: infant mortality and mortality of children under 5 years old.

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vaccinated children in the community also contribute to widening the gap between rural and urban areas in terms of infant and juvenile mortality.

Using data from the 2011 Demographic and Health Survey (DHS-2011) of Nepal, Goli et al. (2015) study the determinants of ecological differences in infant and juvenile mortality using a Cox proportional hazard regression and a Blinder-Oaxaca type decomposition model. Their conclusions provide important insights into the issue of regional (ecological) disparities in infant and juvenile mortality. Moreover, the results of the Blinder-Oaxaca decomposition model reveal that the father's education, the household's economic status, place of residence, higher-order births with a reduced birth interval, and the mother's employment status contribute significantly to the differences in infant and juvenile mortality between ecological regions.

Adewuyi et al. (2017) examine the differences in infant mortality between rural and urban areas and the associated risk factors in Nigeria. Applying binary logistic regression by place of residence on the 2013 DHS data, the authors highlight those rural infants had higher mortality rates than their urban counterparts, and the probability of infant mortality is 1.45 times higher in rural residence compared to urban residence.

A recent study by Yaya et al. (2019) analyzes the factors explaining disparities between urban and rural areas in terms of mortality of children under 5 years old in 35 sub-Saharan African countries. Based on cross-sectional data from Demographic and Health Surveys (DHS), the authors apply binary logistic regression coupled with a Blinder-Oaxaca type decomposition. Their study shows significant differences between urban and rural areas for mortality of children under 5 years associated with biological and demographic, socioeconomic, and proximity factors. In the decomposition model, about 44.3% of the urban group and 74.7% of the rural group have under-5 mortality in sub-Saharan countries. The mother's age, her education, the use of newspapers, television, wealth index, the total number of live-born children, and the mother's age at first birth contributed to explaining the disparity between urban and rural areas in terms of mortality of children under 5 years old.

- *Community-Level Determinants*

Differences in infant or juvenile mortality between rural and urban areas have also been the subject of empirical research at the community level. These studies have focused on the organization of the health system, the availability of health services and infrastructure, food supply, physical infrastructure (such as railways, roads, electricity, water, sewers), and political institutions.

Based on data from the 1988 Ghana Living Standards Survey, Lavy et al. (1996) observe significant disparities between urban and rural areas in terms of health infrastructure, which, according to them, mainly result from differences in the quality and accessibility of health services. Examining the survival and health status of children born in the ten years preceding the survey, they use non-parametric Kaplan-Meier methods to estimate risk functions, while Weibull models of the risk rate as a function of time measure the speed at which the risk rate changes. To this end, the authors find that infant and juvenile mortality rates are significantly higher in rural areas than in urban areas. In the same vein, a study by Balarajan et al. (2011) reveals similar significant results supporting this urban advantage in terms of health care facilities and mortality disparities compared to the rural environment in India.

Demombynes and Trommlerová (2012) questioned the substantial decline in infant and under-5 mortality recorded between 2003 and 2008 in Kenya. Applying a Blinder-Oaxaca type decomposition on data from the 2003 and 2008-2009 Demographic and Health Surveys (DHS), the authors show that the increased ownership of insecticide-treated bed nets in malaria-endemic areas or areas associated with high malaria prevalence explains 39% of the decline in post-neonatal mortality and 58% of the decline in child mortality. In contrast, the evolution of other factors used does not explain a substantial part of this decline. The unexplained part of the decline is associated with generalized trends such as the general improvement in living standards that occurred with economic growth.

In summary, empirical studies highlight that environmental, socioeconomic, and community factors condition the gaps in child and infant mortality at the spatial level. In this logic, we propose an evaluation of mortality disparities between urban and rural areas during early childhood in Congo, adopting an approach that takes into account potential selection bias.

C. Significance and Originality of the Research

Mortality inequalities among subpopulations have been extensively studied in recent years, with authors examining their significant link to educational level, household conditions (Sastry, 1997; Poel et al., 2009; Saika, 2013; Goli et al., 2015), and community characteristics (Lavy et al., 1996; Balarajan et al., 2011; Demombynes and Trommlerová, 2012), among others. In this regard, the literature suggests an association between urban and rural residence and the risk of child and infant mortality.

However, these analyses have focused on a variable of interest related to child and infant mortality, assessed using self-reported data from women aged 15 to 49 years who have given birth in the five (05) years preceding the survey period. It is important to note that the reliability of mortality estimates depends on the completeness with which child deaths are reported and recorded.[5]. Since the focus here is on child and infant mortality, information related to the number of births, the number of survivors, and the number of child deaths is of particular concern. Indeed, in the econometric literature, estimating an equation on a selectively obtained subsample from the population can lead to bias (Heckman,

[5] For example, underreporting and misreporting of deaths would lead to an underestimation of the IMR (Infant Mortality Rate).

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1979). Hence the importance of considering a potential selection bias in which only women who have given birth could be selected to be included and minimizing recall error[6].

In this perspective, this article contributes to the literature in two ways. Firstly, it integrates the approach of the two-step Heckman selection model, which is original because very few studies have taken into account this major methodological innovation, particularly in the context of Congo and Sub-Saharan African countries. Secondly, the study adopts Fairlie's (2005) estimation technique, which extends the Blinder-Oaxaca decomposition approach (1973), in contrast to the logistic regression methods usually used in most studies. In this way, we explicitly take into account the contribution of the explained component, as well as that of the unexplained component following Powers et al. (2011).

III. METHODOLOGY OF THE STUDY

We use econometric estimation to identify the explanatory factors of the urban-rural gap in child and infant mortality. To do this, we first present the theoretical model and estimation purposes. We then present the data source and justify the choice of variables used, before proceeding to the exploratory analysis of the various factors that may explain the difference in child and infant mortality between urban and rural areas. Finally, we perform a binary logistic regression model, coupled with a Blinder-Oaxaca type decomposition (1973) to explain the mortality disparities of children.

A. Theoretical Model and Estimation Purposes

➢ *Theoretical Model*

The model used in this research is based on Grossman's theoretical model (1972), which was initially designed for the analysis of the health production function at the microeconomic level. It is defined as follows:

$$S = f(X, M, E) \qquad (1.1)$$

S represents the health status of the population, X is a vector of socioeconomic variables, M represents the health system variables, and E represents the vector of environmental factors. To account for child and infant mortality, we adapt equation (1.1) by integrating the conceptual frameworks of Mosley and Chen (1984) and Sastry (1996). The conceptual core of their frameworks highlights the roles of factors that can influence child survival at the level of: the individual (child or mother), the family (i.e., the household), and the community (contextual or geographical situation). Thus, the mathematical equation is written as follows:

$$S = f(X, M, E) \qquad (1.2)$$

Where S represents child and infant mortality, which is an outcome variable.

➢ *Modèle à des fins d'estimation*

Before estimating the medical care production function using regression analysis, a functional form must be specified. Several common functional form assumptions have been used in the literature, including Cobb-Douglas, Translog, and Leontief.

In this study, we use the Cobb-Douglas production function due to its linear structure in logarithms. A Cobb-Douglas production function has certain advantages in terms of its simplicity of calculation and because it reduces the potential for multicollinearity due to the absence of interaction terms. Taking into account the functional form of Cobb-Douglas, equation (1.2) is then written as:

$$S = AX^{\alpha}M^{\beta}E^{\gamma} \qquad (1.3)$$

In empirical analyses, the list of variables may differ significantly due to data availability, cultural conditions, demography, and the environment of the country or countries studied. By taking logarithms on both sides of equation (1.3) and considering the selected variables (see following subsection), we obtain the following log-linear or constant elasticity model:

$$S = \beta_0 + \beta_1 deprt + \beta_2 expos2 + \beta_3 windx + \beta_4 watrm2 + \beta_5 nutri + \beta_6 sxenf + \beta_1 edmer + \beta_1 cnsro \qquad (1.4)$$

- *Decomposition of child and infant mortality in each residence or group setting*

Consider Y as a dichotomous variable characterizing the state of child and infant mortality. Thus, for an individual i, we define :

$$Y_{ij} = \begin{cases} 1 & si\ y_{ij} < z \\ & 0 \end{cases} \qquad (1.5)$$

$$y_{ij} = \begin{cases} 1 & if\ the\ child\ died\ before\ their\ fifth\ birthday \\ 0 & if\ the\ child\ is\ considered\ alive \end{cases} \qquad (1.5')$$

The groups $j = MU$ for urban households and MR for rural households. The probability for a child from household i to have died in group j is equal to :

$$P(Y_{ij} < Z) = P(y_{ij} = 1) = \Delta(X_{ij}\beta_j) \qquad (1.6)$$

Where X_{ij} denotes the vector of observed characteristics of household i in group j and Δ is the distribution function of the logit model.

β_j represents the vectors of parameters to be estimated. From this formula, we derive the following two relationships: for children from urban households, the probability of being deceased is defined as follows :

[6] It is interesting to note that recall errors are likely to be more pronounced for children born further in the past than for those born more recently.

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$P(Y_{iMU} < Z) = P(y_{iMU} = 1) = \Delta(X_{iMU}\beta_{MU})$ (1.7)

For children from rural areas, the probability of being deceased is:
$P(Y_{iMR} < Z) = P(y_{iMR} = 1) = \Delta(X_{iMR}\beta_{MR})$ (1.6)

The proportion of deceased children in a group j can be estimated asymptotically without bias by the average predicted probability of death for individuals in that group. To this end, we have the following formulas :

$$P_{0j} = P(X_j, \beta_j) = \Delta(X_{ij}\hat{\beta}_j) = \frac{1}{n}\sum_{i=1}^{n_j}\Delta(X_{ij}\hat{\beta}_j)$$

The proportion of deceased children in the urban (respectively rural) environment is obtained by replacing $j = \{MU, MR\}$. To explain this gap and evaluate the contribution of each determining factor in explaining this gap, it is important to perform a decomposition.

- *Decomposition of mortality disparities using the Blinder-Oaxaca approac*

As we have seen previously, mortality disparities can be decomposed into two components: i) an explained component (denoted EXP) due to the difference in observable characteristics, and ii) the unexplained component (denoted $NEXP$) related to the difference in coefficients for the interest groups MR and MU.

$$EXP = \overline{\Delta(X_{MR}\hat{\beta}_{MR})} - \overline{\Delta(X_{MU}\hat{\beta}_{MR})}$$

$$NEXP = \overline{\Delta(X_{MU}\hat{\beta}_{MR})} - \overline{\Delta(X_{MU}\hat{\beta}_{MU})}$$

Thus, the poverty disparities between two interest groups can be decomposed as follows:

$$P_{0MR} - P_{0MU} = \overline{\Delta(X_{MR}\hat{\beta}_{MR})} - \overline{\Delta(X_{MU}\hat{\beta}_{MR})} + \overline{\Delta(X_{MU}\hat{\beta}_{MR})} - \overline{\Delta(X_{MU}\hat{\beta}_{MU})}$$

B. *Data Sources and Variables Used*

➢ *Data Source*

The data for this study come from the Multiple Indicator Cluster Survey (MICS-5) conducted from November 22, 2014, to February 28, 2015, by the National Institute of Statistics (INS) of Congo-Brazzaville. MICS-5 is a large-scale survey of a representative sample of 11,841 women of childbearing age (15 to 49 years) and 5,412 men (aged 15 to 54 years) in 12,811 households covering the twelve (12) departments of Congo.

The survey asked all women aged 15 to 49 years to provide a complete birth history of their children, including for each live birth, the sex, month and year of birth, survival status, and age at the time of the survey or age at death. The data on birth history allow for estimating under-five mortality rate (U5MNR).

For our study, the baseline sample consists of 9,234 children born in the last five years preceding the survey (i.e., between 2009 and 2010) for whom information was collected in the survey. This sample included 2,735 births (29.6%) in the urban area and 6,499 (70.3%) in the rural area.

➢ *Choice of Study Variables*

The dependent variable of this study is child and infant mortality, defined as mortality affecting children from birth up to the 5th anniversary (not included). It encompasses infant and juvenile mortality. For analyses, it was considered as a binary variable and classified as follows :

$$y_{ij} = \begin{cases} 1 & \textit{if the child died before their fifth birthday} \\ 0 & \textit{if the child is considered alive} \end{cases}$$

To study the disparities between rural and urban areas in terms of child and infant mortality and the factors affecting them, we will use related information on maternal and child health care (MCH). Several studies have highlighted the role of socioeconomic, demographic, and community variables in explaining mortality during early childhood in various countries (Mosley and Chen 1984; Sastry, 1996). Consequently, we use a number of socioeconomic, demographic, and maternal and child health care (MCH) variables in the MICS database.

- For socioeconomic variables, we include: household wealth index, mother's education level, religion, mother's exposure to media. In addition, the department of residence is another important determinant of child and infant mortality (Subramanian et al., 2006).

- As for demographic variables, we include: the child's sex, birth interval, mother's age at the child's birth, and malnutrition constructed from underweight and stunting. These variables have a significant association with child and infant mortality (Sastry, 1997; Poel et al., 2009; Adewuyi et al., 2017; Yaya et al., 2019).

- Regarding community variables related to MCH care, we include: the proportion of mothers aware of the existence of Oral Rehydration Solution (ORS). Indeed, in demographic literature, community-level variables are strongly dependent on mortality during early childhood (Saika et al., 2013; Lavy et al., 1996).

C. *Analysis Methods*

➢ *Descriptive Statistics Analysis*

The description of the sociodemographic and community characteristics of the sample selected for estimating the model explaining disparities in early childhood mortality is presented in Table 3 (appendix). This analysis reveals that nearly half of the selected children or our sample (49.39%) are female, while just over half (50.61%) are male. The proportion of rural women with secondary education or higher is lower (4.50%); 41.97% of

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rural women reported having received primary education, compared to 16.27% of urban women.

The majority of children living in rural areas (91.70%) belong to households classified in the two poorest quintiles, while the majority of children living in urban areas (47.17%) belong to households classified in the two richest quintiles.

As expected, the proportion of women exposed to the media is lower in rural areas (23.60%) than in urban areas (78.33%). The proportion of mothers aware of the existence of ORS is marginal among urban women compared to rural women. Indeed, only 3.63% of mothers reported being aware of it in rural areas, compared to 5.29% of mothers in urban areas. Overall, rural households with an underweight or stunted child represent 15.68 percentage points more than their urban counterparts.

During the survey period, a higher proportion of urban women (85.37%) reported having access to clean water meeting SDG standards, compared to only 38.12% of rural women. More than three-quarters of urban children are concentrated in Brazzaville (42.79%) and Pointe–Noire (32.32%), while rural children are more represented in Likouala (15.74%) and Kouilou (12.48%).

During the 2005–2015 period, the analysis of child and infant mortality stratified by wealth quintiles (from the Demographic and Health Surveys, DHS-2005 and DHS-2011) reveals that the proportion of children who died between birth and the fifth anniversary decreases quite regularly with an improvement in household wealth level (Figure 3). Furthermore, the risk of child and infant mortality recorded significant reductions in all wealth quintiles over the 2005–2015 period, going from a maximum of 135‰ for children from the poorest households in 2005 to a minimum of 34.2‰ for children from the richest households in 2015.

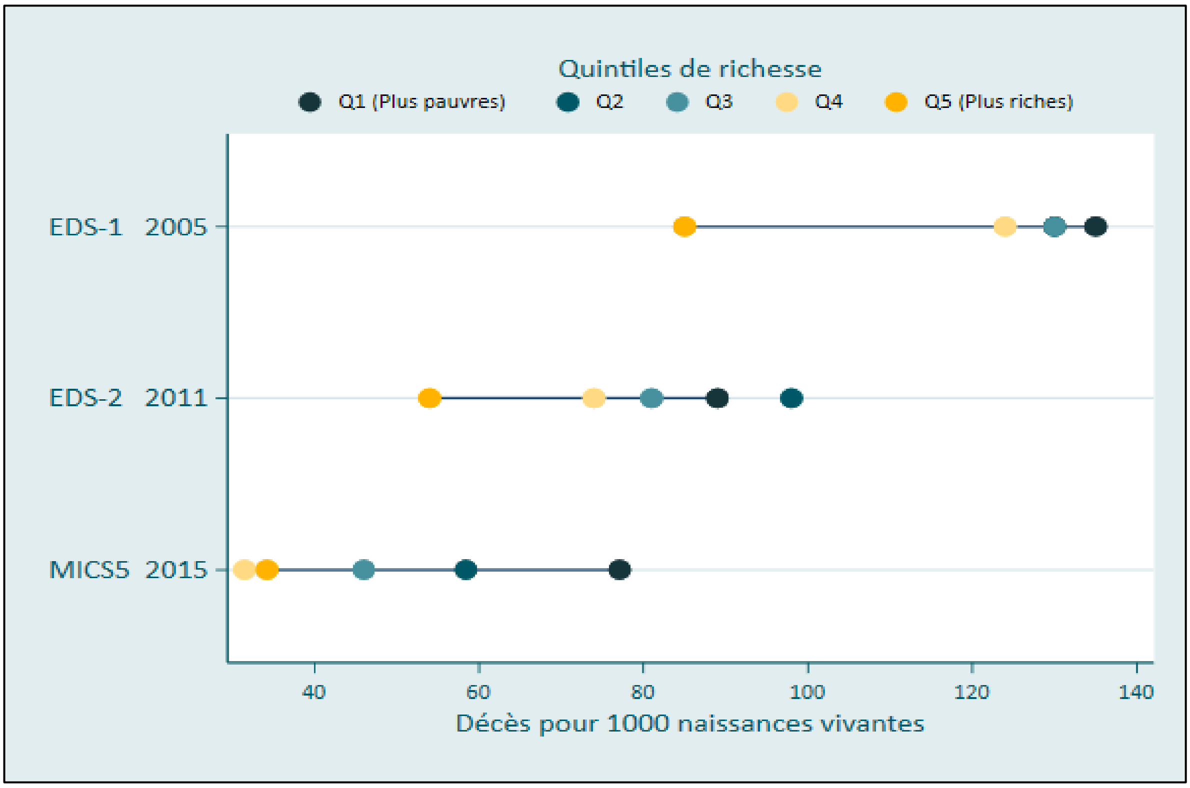

Fig 3 : Child and Infant Mortality by Wealth Quintiles, 2005 – 2015.

➢ *Econometric Estimation Strategy*

Our data presents a significant number of missing values. To improve our logistic model, we chose to combine certain modalities and consider missing values as additional modalities.

Before estimating the logistic regression model, a Pearson's Chi-squared test was carried out to examine the existing link between the variable of interest (child and infant mortality) and other explanatory variables. We group certain modalities of variables to comply with the condition of application of the test[7]. Overall, the results of the Chi-squared test show that the department of residence seems to have an influence on mortality during early childhood in both urban and rural environments at the 1% threshold. However, child and infant mortality seems more associated, in the rural environment, with malnutrition, religion, mother's exposure to the media, household wealth quintile, and mother's ethnic group (see Table 2 – Appendix).

[7] One of the essential conditions for application requires that the theoretical frequencies be greater than or equal to 5.

We use the Heckman selection model approach to account for a potential selection bias where only women who had a child under 5 years of age during the collection period could be selected for inclusion in the sample. In the first step, we estimate a probit and calculate the inverse Mills ratio variable, and the estimation of the equation of interest with the inclusion of the inverse Mills ratio variable in the second step. The dependent variable of the selection equation is child and infant mortality, and the independent variables are individual characteristics, notably religion, mother's education level, and mother's knowledge of the existence of ORS.

The calculated Mills ratio was then added to the response equation to estimate determinants and decompositions. Global decompositions were calculated to determine the contribution of the explained component, as well as that of the unexplained component plus the contribution of the interaction to the gap in the outcome. In addition, detailed decompositions were calculated to determine the contribution of each independent variable to the explained and unexplained decompositions, as described by Yun (2004) and Yun et al. (2006). Following the methods of Yun (2004) and Yun et al. (2006), detailed decomposition analyses focused on two types of decomposition: explained and unexplained.

IV. PRESENTATION AND INTERPRETATION OF RESULTS

The estimation of the logistic regression allowed us to obtain the odds ratios (OR). In all cases, the analysis of the estimates is set at the 5% significance threshold.

Considering the results of the logistic regression models estimated in the entire sample, rural and urban environments, the likelihood ratio test leads to the rejection of the null hypothesis (H0) according to which no variable influences the probability of survival or death of a child under 5 years. A p-value lower than 0.05 indicates that the model is globally significant at the 5% threshold. Therefore, at least one variable is significant in explaining child and infant mortality in Congo.

D. Rural, Urban, and National Determinants in Child and Infant Mortality

We perform a binary logistic regression analysis to examine factors associated with mortality of children under 5 years old in Congo and in both urban and rural environments. Similarly, Table 4 presents the ORs associated with the binary logistic regression related to the determinants of mortality during early childhood in the complete sample, as well as the results broken down by living environment.

The results indicate that in the rural environment, the wealth index is significantly and negatively associated with the probability of dying in children under 5 years old in both rural, urban environments, and the entire sample. Indeed, children living in a household of medium or rich living standard have significantly lower risks of dying compared to those whose living standard is poor. In other words, the risk of dying for a child decreases as the economic level of the household rises. However, the very rich living standard has a surprisingly significant positive influence on child and infant mortality, in the rural environment, with an OR of 3.697. This spurious result is mainly explained by the small sample size of households in this category in the rural environment, as evidenced by Table 4 (see appendix). Consequently, this could not provide robust results in the analysis of this modality.

In the rural environment and across the country, child malnutrition is significantly and negatively associated with child and infant mortality. Children who show no signs of malnutrition have a lower risk of dying than malnourished children.

A negative association is observed between mother's exposure to mass media and the probability of dying in children under 5 years old – children with mothers exposed to the media have significantly less risk (0.399) of dying than their peers whose mothers are not exposed to the media.

The department of residence has a significant link with child and infant mortality. Nationally, children residing in the Plateaux department (0.526) and Pointe-Noire (0.273) have less risk of dying during early childhood than their counterparts living in the Bouenza department. Conversely, children living in the Lékoumou department have 1.5 times more risk of dying than those residing in the Bouenza department.

At the community level, having access to clean water meeting SDG standards has a significant impact on the probability of a child dying. In the complete sample and in the rural sample model, children living in households with access to clean water according to SDG standards have respectively 2 and 3 times more risk of dying than their peers living in a household without such access. This result, contrary to the literature, is also explained by the reduced sample size broken down by living environment.

Moreover, the significance of the inverse Mills ratio at the 5% threshold, as illustrated in Table 4, introduced in the estimation of the binary logistic regression at the second stage, translates into a proven selection bias in the choice of mothers concerned by the study and justifies its significant presence in the modeling.

E. Socioeconomic Determinants of the Gap between Rural and Urban Areas in Child and Infant Mortality

Table 1 presents the detailed breakdown of the gap between rural and urban areas in terms of under-5 mortality, based on explanatory variables. A positive contribution (as seen in the 8th or last column) of a variable indicates that it contributes to widening the mortality gap between rural and urban areas, while a negative contribution shows that it reduces this gap. The results show that the entire difference (100%) in child mortality between rural and urban areas is explained by differences in the coefficients of the studied variables. This means that even if the socioeconomic characteristics of both groups of children were identical, the mortality gap would still persist at 4.77% (0.047733), in favor of urban areas.

Several variables significantly contribute to this mortality gap. The department of residence (Niari, Sangha), mothers' exposure to media, and access to SDG-compliant drinking water are among the factors that play a crucial role in explaining the average gap in coefficients between urban and rural areas. For example, the results reveal that differences in access to clean water explain 10.07% of the under-5 mortality gap between rural and urban areas. If the level of access to clean water in rural households reached that of urban households, the mortality gap would be reduced by 0.4764 percentage points. This finding is consistent with existing literature, which underscores the importance of community infrastructure in reducing health inequalities (Poel et al., 2009; Saika et al., 2013).

Moreover, the results show that geographic differences, such as the place of residence in certain departments (mainly Niari and Sangha), account for a significant portion of the mortality gap. Children living in some rural departments face higher mortality risks before the age of 5 than their urban counterparts due to disparities in health infrastructure and access to services. This trend aligns with the findings of Mosley and Chen (1984) and Sastry (1996), who highlight the role of geographic and community determinants in child mortality.

Mothers' exposure to media also plays an important role in reducing the mortality gap. Children whose mothers have access to media face lower mortality risks compared to those whose mothers do not. The media serve as a crucial vehicle for disseminating essential information on maternal and child health, such as the importance of hygiene, vaccination, and prenatal and postnatal care (Singh et al., 2011). This emphasizes the need for integrating large-scale awareness programs into public health policies, particularly in rural areas where access to information is limited.

These findings are in line with the conclusions of several studies on child mortality. Balarajan et al. (2011) and Poel et al. (2009) have demonstrated that differences in access to health infrastructure and clean water are major drivers of inequality between rural and urban areas. Similarly, Goli et al. (2015) revealed that factors such as income levels, maternal education, and access to infrastructure play a critical role in reducing child mortality. However, our results show that improving socioeconomic characteristics alone is insufficient to eliminate the mortality gap. The differences in how these characteristics influence mortality in each setting (i.e., the coefficients) are far more important in explaining the total gap. This underscores the importance of local contexts, infrastructure, and rural-specific health policies to mitigate these disparities.

Table 2 : *Results of the Model Estimations for Decomposition of Disparities*

Decomposition Results — Number of obs = 9271

High outcome group: area==1 --- Low outcome group: area==0

u5mnr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]	Pct.
E	.00043882	.0068525	0.06	0.949	-.012992	.01387	-.92786
C	-.047733	.0083322	-5.73	0.000	-.064064	-.031401	100.93
R	-.047294	.0047644	-9.93	0.000	-.056632	-.037956	

Due to Difference in Characteristics (E)

u5mnr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]	Pct.
deprt1	.0026618	.13577	0.02	0.984	-.26345	.26878	-5.6282
deprt8	.0049229	.25041	0.02	0.984	-.48589	.49573	-10.409
deprt12	.0022814	.11596	0.02	0.984	-.22499	.22956	-4.8238
expos2	.0034563	.17614	0.02	0.984	-.34178	.34869	-7.3082
windx	.0042673	.19169	0.02	0.982	-.37145	.37998	-9.023
watrm2	-.0032864	.16756	-0.02	0.984	-.33171	.32514	6.949
nutri	-.002638	.13454	-0.02	0.984	-.26634	.26106	5.5779
sxenf	-7.4783e-06	.00041761	-0.02	0.986	-.00082599	.00081103	.015812
edmer1	-.00065586	.035216	-0.02	0.985	-.069679	.068367	1.3868
edmer2	-.0030543	.15678	-0.02	0.984	-.31035	.30424	6.4582
cnsro2	.00094843	.048323	0.02	0.984	-.093765	.095662	-2.0054
mills	-.0084572	.43133	-0.02	0.984	-.85386	.83694	17.882

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Due to Difference in Coefficients (C)

u5mnr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]	Pct.
deprt1	-.0030776	.002874	-1.07	0.284	-.0087105	.0025554	6.5073
deprt8	.0029462	.001077	2.74	0.006	.00083524	.0050572	-6.2296
deprt12	.0021228	.00099265	2.14	0.032	.00017725	.0040684	-4.4886
expos2	.0016151	.00077647	2.08	0.038	.000093202	.003137	-3.415
windx	.013474	.0088735	1.52	0.129	-.0039183	.030866	-28.49
watrm2	-.004764	.0021222	-2.24	0.025	-.0089236	-.00060447	10.073
nutri	-.00043026	.003622	-0.12	0.905	-.0075294	.0066689	.90975
sxenf	-.002046	.016617	-0.12	0.902	-.034615	.030523	4.3262
edmer1	.0014688	.0038744	0.38	0.705	-.0061251	.0090626	-3.1056
edmer2	.0040916	.007045	0.58	0.561	-.0097165	.0179	-8.6515
cnsro2	-.03008	.022595	-1.33	0.183	-.074366	.014206	63.602
mills	.099386	.10507	0.95	0.344	-.10654	.30531	-210.15
_cons	-.13244	.11505	-1.15	0.250	-.35794	.093064	280.03

Source: Author, based on Stata

V. DISCUSSION AND ECONOMIC POLICY IMPLICATION

Our findings have significant implications for policy. Firstly, the persistence of considerable disparities between rural and urban areas in terms of child and infant mortality suggests that social and health policies are not achieving sustainable progress in maternal, neonatal, and infant health for all population groups. The results indicate that in addition to strengthening maternal and infant health programs in rural areas, substantial efforts must also be made to improve household wealth. However, political actions aimed at improving the health of the rural population should not be carried out at the expense of other disadvantaged groups.

To further reduce the gap in child and infant mortality, it is crucial to prioritize rural infrastructure improvements, particularly regarding access to clean water and healthcare services. Investments in community infrastructure have a direct impact on rural living conditions, and public health campaigns, especially through media channels, should be bolstered in rural areas where information is less accessible. These actions are key to addressing the root causes of mortality disparities.

Furthermore, to address disparities between urban and rural areas in child health, it is important not only to introduce a health and social protection system but also to ensure equality and equity in these child protection systems. Our analysis demonstrated that the gap between rural and urban areas in terms of child and infant mortality in Congo is primarily explained by differences in the distribution of effects (or coefficients) of mortality determinants during early childhood, and not by differences in household characteristics. Therefore, interventions must also be tailored to local specificities, recognizing the geographic and social contexts that influence child health outcomes in different departments.

The department of residence, mother's exposure to the media, and access to clean water compliant with SDG standards contributed significantly to the gap. Geographic disparities, particularly in departments like Niari and Sangha, explain a large portion of the mortality gap. Thus, a territorial approach is necessary to ensure that healthcare policies and infrastructure meet the specific needs of rural populations.

At the household level, within the framework of Mosley and Chen (1984), the immediate determinants of child and infant mortality – which, in this paper, consist mainly of community and individual factors, such as mother's exposure to media, malnutrition, and department of residence – are strongly and systematically linked to the gap in child and infant mortality. This is consistent with previous research (e.g., Manda 1999; Sastry 1996). Our results emphasize that access to sanitation and clean water is limited first by community infrastructure and then by the household's ability to connect to this infrastructure. The significant contribution of malnutrition (10.07%) reinforces the idea that investments in rural infrastructure should be coupled with programs helping households fully benefit from these improvements.

In conclusion, this analysis demonstrates that disparities in infant mortality between rural and urban areas are largely due to differences in how socioeconomic and community variables influence child health outcomes. Improving infrastructure alone is not enough. Public policies must address not only household characteristics but also broader environmental and infrastructural conditions that affect rural households' ability to care for their children. Unfavorable environmental conditions contribute significantly to the mortality gap and are driven by both inadequate community-level infrastructure and the inability of households to use available services.

Thus, policies must focus on integrating infrastructure investments with targeted assistance for households to fully leverage these improvements, ensuring equitable progress in maternal and child health outcomes. By addressing the dual challenges of community infrastructure and household-level needs, policymakers can work to close the gap in child mortality between rural and urban areas.

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APPENDICES

Table 2: *Chi-square test*

Variables	Chi-square test statistics		Test probability (p-value)	
	Rural	*Urban*	*Rural*	*Urban*
Mother's education	3,412	3,2533	0,332	0,516
Department	49,312	22,249	0,000***	0,000***
Child's gender	0,226	0,029	0,634	0,864
Malnutrition	15,340	0,447	0,000***	0,504
Religion	3,780	16,380	0,706	0,012**
Media exposure	8,028	1,063	0,005***	0,303
Wealth quintile	22,290	4,849	0,000***	0,303
Ethnic group	20,231	2,958	0,003***	0,814
Availability of drinking water	9,742	0,0566	0,002	0,812

*** p<0.01, ** p<0.05, * p<0.1
Source : Author

Table 3: *Descriptive statistics*

Variable	Rural		Urban	
	N	%	N	%
Mother's education				
No	974	14,92	137	5,00
Primary	2740	41,97	446	16,27
Secondare1	2521	38,61	1384	50,49
Secondary2 or higher	294	4,50	772	28,16
ND	-	-	2	0,07
Department				
Kouilou	815	12,48	-	-
Niari	428	6,55	325	11,86
Lekoumou	695	10,64	-	-
Bouenza	539	8,25	141	5,14
Pool	592	9,07	-	-
Plateaux	730	11,18	-	-
Cuvette	701	10,74	-	-
Cuvette Ouest	617	9,45	-	-
Sangha	385	5,90	216	7,88
Likouala	1028	15,74	-	-
Brazzaville	-	-	1173	42,79
Pointe-Noire	-	-	886	32,32
Child's gender				
Men	3295	50,46	1397	50,97
Woman	3235	49,54	1344	49,03
Malnutrition				
Yes	2889	46,13	792	30,45
No	3374	53,87	1809	69,55
Television exposure				
No	4989	76,40	594	21,67
Yes	1541	23,60	2147	78,33
Wealth quintile				
Poorest	4247	65,04	3	0,11
Second	1741	26,66	628	22,91
Middle	389	5,96	817	29,81
Fourth	133	2,04	690	25,17
Richest	20	0,31	603	22,00
Availability of drinking water				
No	4041	61,88	401	14,63
Yes	2489	38,12	2340	85,37

Source : Author

Table 4: *Odds-ratio results for the logistic regression model*

	(1)	(2)	(3)
VARIABLES	Model 1: Rural	Model 2: Urban	Model 3: Set
Infant and child mortality			
Department			
Bouenza	*Ref.*		
Brazzaville	--	2.957	0.718
		(2.196)	(0.188)
Cuvette	0.748	--	0.876
	(0.176)		(0.200)
Cuvette-ouest	0.821	--	0.981
	(0.190)		(0.222)
Kouilou	1.035	--	1.196
	(0.208)		(0.236)
Lekoumou	1.343	--	1.560**
	(0.266)		(0.304)
Likouala	0.934	--	1.131
	(0.200)		(0.235)
Niari	0.683	4.295*	0.889
	(0.180)	(3.243)	(0.196)
Plateaux	0.460***	--	0.526***
	(0.115)		(0.130)
Pointe Noire	--	1.160	0.273***
		(0.892)	(0.0905)
Pool	0.714	--	0.825
	(0.166)		(0.190)
Sangha	0.986	5.573**	1.108
Media exposure			
No	*Ref.*		
Yes	0.399*	1.020	0.521
	(0.214)	(0.619)	(0.218)
Household wealth index			
Poorer	*Ref.*		
Poor	0.919	0.799	0.895
	(0.103)	(0.289)	(0.0950)
Medium	0.427***	0.642	0.549***
	(0.122)	(0.213)	(0.106)
Rich	0.272**	0.490**	0.430***
	(0.163)	(0.176)	(0.122)
Richer	3.697**		1.009
Safe drinking water (MDG standards)			
No	*Ref.*		
Yes	3.183***	--	2.948***
	(1.086)		(0.993)
Malnutrition			
Yes	*Ref.*		
No	0.740***	0.960	0.771***
	(0.0709)	(0.233)	(0.0682)
Child's gender			
Men	*Ref.*		
Woman	1.048	1.017	1.052
	(0.0975)	(0.223)	(0.0898)
Mother's education			
No	*Ref.*		
Primary	1.075	1.007	1.066
	(0.148)	(0.532)	(0.142)

	(1)	(2)	(3)
VARIABLES	Model 1: Rural	Model 2: Urban	Model 3: Set
Secondary 1	1.212	0.787	1.151
	(0.200)	(0.438)	(0.179)
Secondary 2 or more	1.750	0.395	1.220
	(0.623)	(0.323)	(0.370)
Knowledge of ORS existence			
Yes	*Ref.*		
No	1.208	0.744	1.030
	(0.345)	(0.315)	(0.242)
Mills-ratio	0.213**	2.875	0.294**
	(0.144)	(4.853)	(0.180)
Constant	0.942	0.00434	0.498
	(1.293)	(0.0149)	(0.623)
Comments	6,448	2,615	9,166
se Eform in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Source : Author

Table 5 : *List of codes (or codification) of the departments of Congo*

Department of residence	**Name**
deprt1	Bouenza
deprt2	Brazzaville
deprt3	Cuvette
deprt4	Cuvette-Ouest
deprt5	Kouilou
deprt6	Lekoumou
deprt7	Likouala
deprt8	Niari
deprt9	Plateaux
deprt10	Pointe-Noire
deprt11	Pool
deprt12	Sangha

Source : Author

Table 6 : *Dictionary of Model Variables*

Variable	**Long Description of the Variable**
expos2	Mother’s exposure to media (1=Yes, 0 otherwise)
windx	Wealth index quintile (1=Poorest, 2=Second, 3=Middle, 4=Fourth, 5=Richest)
watrm2	Does the household have access to SDG-compliant drinking water ? (1=Yes, 0 otherwise)
nutri	Household individual malnutrition (1=Yes, 0 otherwise)
sxenf	Child’s gender (1=Male, 2=Female)
Homme	1=Yes, 0 otherwise
Femme	1=Yes, 0 otherwise
edmer	Mother’s education

edmer1	1=Mother with no education, 0 otherwise
edmer2	1=Mother with primary education, 0 otherwise
cnsro2	Knowledge of the existence of oral rehydration solution (1=Yes, 0 otherwise)
mills	Mills inverse ratio

Source : Author