

Wayoro, Didier; Ndikumana, Léonce

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# DEPARTMENT OF ECONOMICS

## Working Paper

### **Impact of Development aid on infant mortality: Micro-level evidence from Côte d'Ivoire**

Didier Wayoro  
Léonce Ndikumana

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# **Impact of Development aid on infant mortality: Micro-level evidence from Côte d'Ivoire**

Didier Wayoro<sup>1</sup> and Léonce Ndikumana<sup>2</sup>

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## **Abstract**

The empirical literature has failed to reach consensus on the impact of aid on development outcomes based on aggregate cross-country analysis. This study follows the current trend in the literature on the effectiveness of aid to examine the impact of local-level aid on health outcomes. We combine data on World Bank's geo-located aid projects with three rounds of Demographic Health Surveys from Côte d'Ivoire and use difference-in-difference estimation techniques to explore the effects of aid on infant mortality. We find that proximity to development aid projects is associated with reduced infant mortality. Our results are robust to mother fixed-effects estimations as well as water and sanitation projects. The evidence suggests that access to prenatal and postnatal health care are possible mechanisms through which aid may affect infant mortality.

**Key words:** Aid, infant mortality, Côte d'Ivoire

**JEL Classification:** F35; I15; O55

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<sup>1</sup> Department of Economics, Indiana State University Terre Haute (corresponding author). This author is grateful for the Economics Department Chair's Joint Graduate Student Faculty Summer Research Award that helped to initiate the research on this topic that eventually culminated in this working paper.

<sup>2</sup> Department of Economics and Political Economy Research Institute, University of Massachusetts Amherst

## **1. Introduction**

Infant mortality rate is an important metric for assessing the effectiveness of a country health care system and level of development. However, despite significant commitments by the global community to reduce mortality among children through the 2000 Millennium Development Goals and the 2015 Sustainable Development Goals, 5.4 million children died before their fifth birthday in 2017 (UN IGME, 2018), most of which from preventable causes. Sub-Saharan Africa alone accounted for 50 per cent of these deaths, a rate that is estimated to reach 60 per cent by 2050 (UN IGME, 2018).

Building on recent surge in economic growth following many years of political instability, the Ivorian government adopted a National Development Plan (NDP) for the 2016-2020 period, with the stated goal of the country becoming an emerging economy by the year 2020. To support the country's efforts, international donors pledged \$15.4 billion in grants and loans (World Bank, 2017). However, while infant mortality rate has fallen in the country from 104 deaths per 1,000 live births in 1990 to 64 in 2017 (Figure 1), the rate is still far behind the Sustainable Development Goal 3 of reducing infant mortality rate to 25 deaths per 1,000 live births by 2030 (UN IGME, 2018).

The apparent disconnect between increases in international aid and the pace of social development progress has fueled the debate on the effectiveness of foreign aid in improving development outcomes such as health and education. The lack of agreement is partly due to the mismatch between instruments and outcomes, as well as differences in methodological approaches

employed in various studies. For example, a number of studies have used aggregate level of aid as instrument of development assistance and attempted to link it to aggregate outcomes such as economic growth in cross-country analyses. This approach makes it difficult to tease out the link between aid and growth, as many other factors unrelated to aid might influence growth (Odokonyero, Marty, Muhumuza, Alex, and Moses, 2018). Furthermore, aid interventions, for the most part, are delivered in the form of projects that respond to specific needs such as construction or improvement of roads or health care facilities, provision of anti-malaria mosquito nets, immunization campaigns, etc. Therefore, cross-country studies miss out on sectoral and project level information, which micro-level studies are better equipped to incorporate in the analysis (Kotsadam, Østby, Rustad, Tollefsen, and Urdal, 2018; Findley, Powell, Strandow, and Tanner, 2011).

In this vein, a number of recent studies have taken advantage of the availability of geo-located aid projects to assess their impact on development outcomes. Among them, Odokonyero et al. (2018) examine the impact of aid in Uganda using a difference-in-difference approach with panel fixed effects regressions applied to a combination of household surveys and geo-referenced subnational aid data. They find that aid reduces disease prevalence and the number of days of productive work lost because of illness. Based on similar data and methodology, Marty, Dolan, Leu, and Runfola (2017) show that aid at subnational level reduces malaria prevalence and improves healthcare quality in Nigeria while Kotsadam et al. (2018) reports that aid reduces infant mortality in that country.

This study follows the recent trend in the empirical literature by assessing the effects of aid at the subnational and sectorial level on infant mortality in Côte d'Ivoire. Unlike past cross-country

studies that used aggregate level of aid, this study takes advantage of the spatial and time variation in development projects and uses the difference-in-difference estimation technique to estimate the impact of aid on child wellbeing in Côte d'Ivoire. Additionally, because some areas in the country received aid projects while others did not, this approach can soundly account for possible estimation bias resulting from unobserved individual heterogeneity and time invariant individual characteristics as well as aid endogeneity (Odokonyero et al., 2018).

Côte d'Ivoire is an interesting case study because of the availability of a rich set of household surveys covering the period of analysis. Furthermore, to the best of our knowledge, no previous study has examined the effects of local-level foreign aid on health outcomes in Côte d'Ivoire. As in Kotsadam et al. (2018), we find that proximity to aid project is associated with reduced infant mortality. We also find that prenatal and postnatal care, education and access to water and sanitation are possible mechanisms through which aid may affect infant mortality.

The rest of the paper is organized as follows. Section 2 gives a brief overview of the literature on the relationship between foreign aid and development outcomes. Section 3 describes the data and the empirical methodology. Section 4 presents the results and discusses possible transmission mechanisms, and section 5 concludes.

## **2. Literature Review**

The empirical literature has not reached a consensus on the effectiveness of foreign aid in developing countries (Doucouliagos and Paldam, 2009). This lack of agreement stems mostly from the different methodological approaches adopted in past studies. Some of them have conducted cross-country analysis to examine the aid-growth relationship. For instance, Burnside and Dollar

(2000) focus on the quality of economic policies and argue that foreign aid increases growth in developing countries implementing good fiscal, monetary, and trade policies. In contrast, using econometric techniques that account for the endogeneity of aid whereby foreign aid goes to countries that already have strong or poor economic performance, Rajan and Subramanian (2008) find no robust positive relationship between aid and growth, regardless of the geographical location or the type of aid provided. Recently, however, numerous studies have concluded that the impact of aid on growth depends on the country-specific context, whether aid is given directly to the government or a non-state actor such as NGOs, and on proximate determinants of growth such as physical capital accumulation and improvement in education and health outcomes (Juselius, Møller, and Tarp, 2014; Clemens, Radelet, Bhavnani, and Bazzi, 2012; Mekasha and Tarp, 2013; Arndt, Jones, and Tarp, 2015; Dietrich, 2011 )

Another approach considered in the aid effectiveness literature consists of disaggregating foreign aid by sector to assess its impact on sector-specific outcomes such as health and education. In this spirit, Mishra and Newhouse (2009) used a panel of 118 countries from 1973 to 2004 and found that health aid reduces infant mortality. Similarly, Ndikumana and Pickbourn (2017) provide evidence of an increase in access to water and sanitation services in Sub-Saharan Africa, especially in rural areas, as a result of targeted aid in these sectors. The evidence suggests that aid may help reduce urban-rural disparities in access to these services. In the same vein, Pickbourn and Ndikumana (2016), also find a significant decline in maternal mortality attributable to an increase in health aid in developing countries. In addition, Yogo and Mallaye (2015) reach the same conclusion regarding the effectiveness of targeted aid in 34 sub-Saharan African countries over the period 1990-2012. They find that health aid reduces HIV prevalence and child mortality.

Gyimah-Brempong (2015) also find evidence that supports the effectiveness of health aid in sub-Saharan Africa using six health outcomes.

One issue that complicates the analysis of the impact of aid on economic development is potential endogeneity of aid. It is possible that the relationship may run from development to aid. In this vein, Wilson (2011) argued that aid may simply be chasing success as the donors would like to have the best bang for their buck. Therefore, there is a temptation to allocate aid to countries and areas within countries that have a track record of demonstrated capacity to manage and absorb aid efficiently. If donors have a strong preference for good policy environment, then the aid-development relationship would run from health outcomes to aid. But an argument can also be made for a reverse causality. If indeed donors' mission is to promote development, then from an operational perspective, donors would allocate aid on the basis of needs. Thus, aid would go to countries and areas within a country exhibiting the lowest level of development or facing the highest levels of deprivation such as high infant mortality. Consequently, the relationship would run from aid to development or health outcomes. The two scenarios buttress the issue of the endogeneity of foreign aid.

In addition to the potential two-way relationship between development aid and health outcomes, other methodological concerns may potentially explain the inconclusive, and often biased results obtained in the aid effectiveness literature. Among them is the failure to account for the lagged effect of aid, sampling biases and the level of aggregation. For these reasons, even studies that attempted to identify the relationship between disease-specific aid and disease-specific outcomes have yielded conflicting results. For instance, Bendavid, Holmes, Bhattacharya, and Miller (2012) report that HIV-AIDS funding (PEPFAR) reduced HIV-specific mortality in Africa. And Hsiao



and Connor (2015) concur that HIV-specific and malaria-specific funding reduces HIV and malaria related mortality in developing countries. However, other studies have shown that donors' prioritization of HIV funding crowd-out or divert resources from other health concerns (Shiffman, 2008; Lordan, Tang, and Carmignani, 2011). Lu et al. (2010) go even further by arguing that health aid in general can be an incentive for governments to reduce their own health spending.

Biases in the empirical analysis of the impact of aid on development can also arise from mismatches between the intervention instrument (aid) and the target (development outcome indicators). Most aid is allocated to finance projects or programs at the sector level. These projects and programs are typically aimed at addressing particular development needs such as immunization, HIV prevention, water supply, education infrastructure, etc. For this reason, recent studies have taken advantage of the availability of aid data at the project level to undertake detailed analysis of the impact of aid on specific development outcomes. Using this framework, Dreher and Lohmann (2015) find a significant correlation between geo-coded World Bank aid projects and economic growth measured as regional nighttime light. Similarly, Civelli, Horowitz, and Teixeira (2018) link household surveys and geo-located aid disbursements and conclude that aid has a positive and significant effect on nightlight luminosity. Kotsadam et al. (2018) also merge geo-located aid data and households surveys in Nigeria and observe that proximity to subnational aid projects reduces infant mortality, and more so in rural and in predominantly Muslim areas. Their findings suggest that aid allocation may help reduce horizontal inequality. While they argue that wealth, access to work and education are potential mechanisms through which aid reduces infant mortality, they also recognize the need for more case studies on the effect of local-level foreign aid on development outcomes as well as for finding out the type of projects that work best. The present study follows this strand of the literature on aid effectiveness by examining the effect

of aid at the subnational level on child mortality in Côte d'Ivoire and by exploring possible mechanisms through which this effect may materialize.

### **3. Data and Methodology**

#### **3.1. Data**

The data used in this study to assess the effects of aid at the subnational level on infant mortality in Côte d'Ivoire come from two sources: the Aid Data project and the Demographic Health Surveys.

The Aid Data v1.4.2 is available online at the Research Lab at William & Mary, and it contains World Bank' aid projects at the district level. The aid projects covered in the dataset run from 1995 to 2014 with specific start and end dates, as well as GPS information on the exact location of each project. As described in Table 1, aid projects are in various sectors, including water and sanitation support, health, education, agriculture, government and civil society, banking and other services. Table 1 shows a total of 144 aid projects over the period 1995-2014. Some of the projects in health, agriculture, energy, education and banking take place in a single location while those in water and sanitation, other infrastructure and government and civil society appear in more than one location in the same district.

The survey data we use consist of the children samples of the three rounds of the DHS, namely 1994, 1998-1999 and 2011-2012. The datasets contain 3,998 observations in 246 clusters in the first round, 1,992 observations in 248 clusters in the second round and 7,776 observations in 352 clusters in the third round. Even though the surveys do not track the same individual over time, they are still representative of the children across the country. These surveys provide information

about the child, the mother, and household characteristics. Table 2 also shows that 30.9% of the children in our sample died before their first birthday.

As shown in Table 2, around 51 % of children live in poor households. Because the wealth index is not available for each survey round, we use assets available across the three surveys such as access to radio, TV, fridge, bicycle, motorcycle, car, toilet and finished floor. We constructed an asset index using the principal component analysis. The wealth quintiles range from 1 to 5, where 1 is the poorest quintile and 5 is the wealthiest. We code the wealth index as a binary variable – poor or not poor – so that poor households are those leaving in the lowest two quintiles.

An important advantage of using the three rounds of DHS surveys is that they contain the geolocalization of the clusters in which the children were born. This enables us to match the DHS data with the georeferenced aid data.

Figure 2 presents the distribution of aid projects (stars) and the DHS clusters (dots). It also shows the household clusters that are within a 25-km radius of an aid-funded project. According to the map, most of the aid projects took place in the southern and central parts of the country. The map in Figure 3 shows simultaneously infant mortality and aid project locations. The map illustrates substantial variations in infant mortality across the country. It also shows that many areas with the highest mortality rates hosted few projects or no projects at all.

### **3.2 Empirical Methodology**

To determine the effect of aid on infant mortality at the subnational level, we take advantage of the spatial-temporal nature of the dataset and use a difference-in-difference strategy (similar to Kotsadam et al., 2018). We specifically test whether the likelihood of a child dying before reaching

his/her first birthday is influenced by whether he/she was born in the vicinity of an aid project completed or implemented during the period 1995-2012. The information on aid projects is available for the period 1995-2014. However, since the child's year of birth in the surveys ranges from 1991 to 2012, we only consider aid projects falling in the 1995-2012 time period.

The empirical model is specified as a linear probability of a child dying before the first birthday. For a child  $i$  born in districts or departments  $j$  and cluster  $v$ , at time  $t$ , the model is specified as follows:

$$InfantMortality_{ijvt} = \beta_1(Aidproject50km_{jv} * BornduringAidproject_t) + \theta X_{ijvt} + \alpha_j + \delta_t + \lambda_{jt} + \varepsilon_{ijvt} \quad (1)$$

In the above equation, *InfantMortality* is a binary variable equal to 1 if the child died before his/her first birthday (12 months),  $X$  is a vector of child, mother, and household characteristics,  $\delta_t$  represents the birth-cohort fixed effects (year of birth fixed effects),  $\alpha_j$  stands for the district or province fixed effects, and  $\varepsilon_{ijvt}$  is a random error terms. *BornduringAidproject* is a binary variable for children exposed to implemented or completed aid projects (born between 1995 and 2012). *Aidproject50km<sub>jv</sub>* (or *Aidproject25km<sub>jv</sub>*) is a dummy variable taking the value 1 if the child lives in a cluster that is located within a 50km (or 25 km) radius from the project location. The term  $\lambda_{jt}$  represents province-year of birth effects (i.e., the interaction of year of birth dummies with province fixed effects) to capture pre-existing province-specific trends in cohort mortality. The vector of exogenous control variables  $X$  includes the gender of the child, child age, and multiple births and birth order.

As a robustness check, we use the sibling sample to control for mother fixed effects by estimating

the following equation:

$$InfantMortality_{ijvt} = \beta_2(Aidproject50km_{jv} * BornduringAidproject_t) + \theta X_{ijvt} + \partial_m + \delta_t + \lambda_{jt} + \varepsilon_{ijvt} \quad (2)$$

The goal here is to estimate the effects of aid on infant mortality by exploiting within-sibling variations. The model controls for observed and unobserved factors that might be correlated with both infant mortality and aid. We therefore include in the regression the term  $\partial_m$  which represents the characteristics of the mother that are constant across siblings such as mother's education, rural residency, ethnicity and religion. In the two models, the coefficients of interest,  $\beta_1$  and  $\beta_2$ , are expected to be negative, illustrating the benefits of being born within or near a location hosting an aid-funded project.

#### 4. Empirical Results

##### *Effects of Aid on infant mortality*

Table 3 presents the effects of the presence of an aid project on infant mortality in Côte d'Ivoire obtained from estimation of equations (1) and (2) using the difference-in-difference approach. The results presented in columns 1 and 2 show that proximity to aid projects is associated with reduced infant mortality. Children born within 50 km and 25 km of an aid-funded project implemented or completed over the 1995-2012 period faced a likelihood of dying before 12 months that is lower by 2.8 and 1.9 percentage points, respectively. The associated coefficients are statistically significant at 1%. These results are similar in direction and magnitudes to those of Kotsadam et al. (2018).

Columns 3 and 4 of Table 3 present the results with mother fixed effects; they are consistent with those obtained in columns 1 and 2. Being born in areas within 50 km and 25 km of aid-funded

projects is associated with infant mortality that is lower by 2.7 and 2.1 percentage points, respectively. In other words, the implementation of aid-funded projects is associated with a fall in infant mortality rate by 27 children per 1000 live births (column 3 – within 50km) and 21 children per 1000 live births (column 4 – within 25km), respectively; the coefficients are statistically significant at 1%. In addition, based on the average infant mortality rate in the sample as presented in the summary statistic in Table 2, the results in column 3 imply that the odds of dying before 1 year is 0.282 (lower than the sample average of 0.309) when a child was born within a 50km radius of an aid-funded project.

#### *Heterogeneity of the effects of aid on infant mortality*

Previous studies have shown that aid may have different effects depending on the targeted group (boys versus girls or wife versus husband) or the location (urban versus rural areas), with the assumption that the effect will be strongest for the most disadvantaged groups (Kotsadam et al., 2018). Using the mother fixed-effects estimation, we find that the triple interaction between proximity to aid-funded projects, the time of birth, and residency is not significant (Table 4, columns 1 and 2). A similar result is obtained for the triple interaction of proximity to aid-funded project, time of birth and gender (columns 3 and 4). Overall the results in Table 4 suggest that there are no statistically significant differences in the impact of aid on infant mortality along gender and rural vs. urban residency.

As further robustness check, we explore the linkages between infant mortality and aid measured at the sector level. Given the predominance of aid projects in the water and sanitation in the sample, we use this sector for illustration purposes. We re-estimate equations 1 and 2 by considering only aid projects in the water and sanitation sector. The results are presented in Table 5. They show that birth in proximity to aid-funded water and sanitation projects is associated with a reduction in infant mortality by about 2 percentage points, or a reduction of 20 child deaths out of 1,000 live births.

### *Controlling for endogenous migration*

We further explore the robustness of our results by examining the possibility that the effects of aid projects on infant mortality might be biased by endogenous migration. For instance, if children or their mothers moved from areas in proximity to aid projects to areas further away from aid projects areas, the treated children (those within 25 or 50 km from aid projects) will be mistakenly assigned to the control group (those far away from aid project) and vice versa if the displacement occurs from areas far from aid projects towards those closer to aid projects. Information about migration is only available in the 1994 and 2011-2012 DHS surveys. In the 1994 survey, women were asked whether they always lived in their current residence or not, and about the number of years they lived in their current place of residence. In the 2011-2012 DHS, the mothers were asked how many times they spent one or more nights away from their home in the 12 months preceding the survey. We define dummy variables for the propensity to migrate in the 1994 and 2011-2012 surveys and regress the migration status on proximity to aid projects, child, mother and other time-invariant variables.<sup>3</sup> The results in Table 6 show that proximity to aid projects has no effect on the

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<sup>3</sup> Previous studies such as La Mattina (2017) and Minoiu and Shemyakina (2014) used the migration history of households and defined a binary variable of migrant versus non-migrant (those who have lived continuously in their

propensity to migrate. This suggests that population migration is not a source of concern for the robustness of the results in this study.

The DHS datasets also provide information on those who lived in their current place of residence when the surveys were conducted. We experiment by restricting the sample to individuals who lived in the current place of residence at the time of the survey. As shown in Table 7, the results are robust: proximity to aid projects is still associated with reduced infant mortality.

### *Transmission mechanisms*

The results presented thus far suggest that aid at project level is associated with a reduction in infant mortality. The results show no differential impact of either gender or rural-vs-urban residency of the household on the aid-infant mortality linkages. To further explore the mechanisms by which aid may affect infant mortality, we estimate the effects of proximity to aid-funded projects on variables that are likely to affect the child's survival such as vaccination, the mother's education, wealth, and access to postnatal and prenatal care. The results obtained using the difference-in-difference approach are presented in Table 8. They show that birth in proximity of aid projects increases the likelihood for the child to be vaccinated (columns 1-4). More specifically, there is a positive and statistically significant association (at 1%) between proximity to aid project and BCG and Measles vaccinations.

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current place of residence since before or at the start of the shock (proximity to aid project) and estimated separately their models for the full population and the sub-sample of non-migrants and tested whether the effect of the shock on child health is statistically different by migration status. This approach could not be implemented in this study because the information on mothers who lived continuously in the current residence since before aid projects (1995) was not available.



In addition, proximity to aid projects reduces the likelihood of a child to live in a poor household while mothers' probability of being educated is increased by proximity to aid-funded projects (columns 5 and 6). The results in columns 7 and 8 suggest a positive association between the presence of aid projects and the number of prenatal visits as well as the likelihood of the child being delivered at the hospital, which is expected to improve the odds of the child's survival. The results suggest that changes in mothers' health seeking behavior and access to vaccination may serve as channels through which aid influences infant mortality.

## **5. Conclusion**

This study sought to examine the impact of development aid on infant mortality in Côte d'Ivoire by merging local level aid and three rounds of DHS surveys. Using geographical information available in the datasets and the difference-in-difference estimation method, we found that proximity to aid projects is associated with significantly reduced infant mortality. The results are robust to different estimation techniques, control for mother-fixed effects, as well as possible endogenous migration. The findings corroborate those of Kotsadam et al. (2018) for the case of Nigeria. However, the results show no heterogeneity of the effect of aid on child health by gender or rural-versus urban residency. The study also suggests that aid-funded water and sanitation projects may reduce the likelihood of a child dying before his/her first birthday. Furthermore, access to prenatal care and immunization are possible transmission channels through which aid improves child welfare.

This study did not address how government-sponsored health campaigns might contribute to the improvement of child welfare, or the possible complementarity between foreign aid delivered in the forms of projects and local initiatives. In addition, some projects might have an immediate

impact while others might take a longer time to have an impact in the economy. We also did not consider other factors that might explain the high rate of infant mortality such as resistance to vaccination due to local customs. All of these are potential avenues for future research.

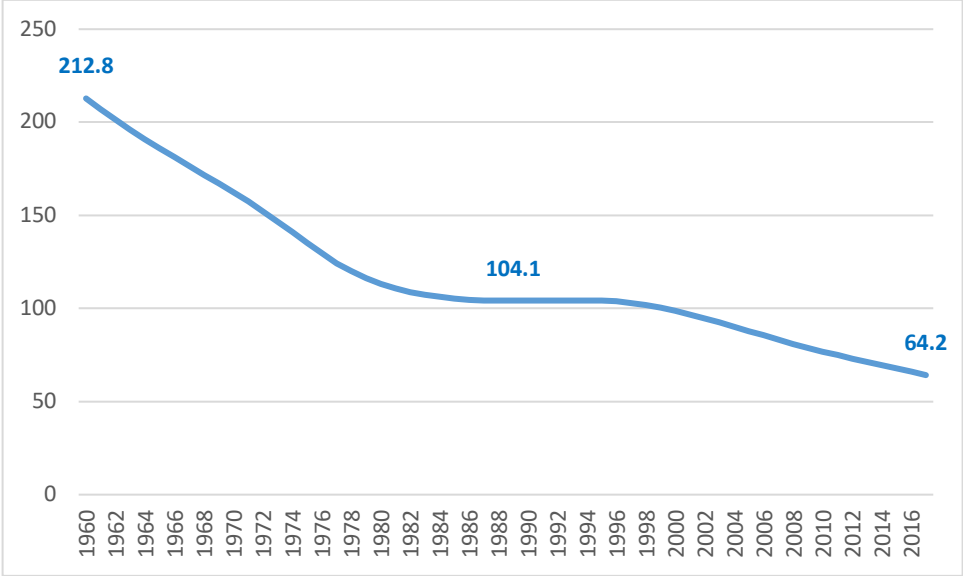
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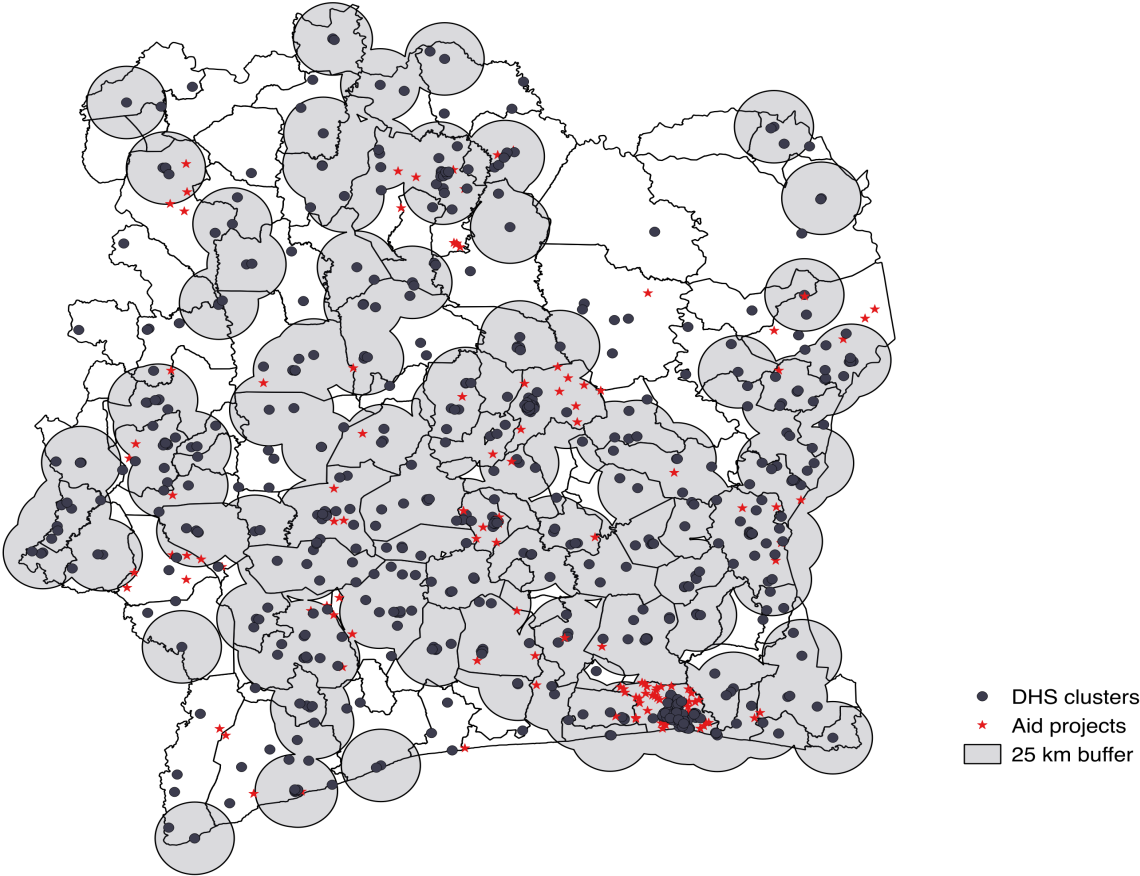


Figure 1: Trend of infant mortality rate (per 1,000 live births) in Côte d'Ivoire



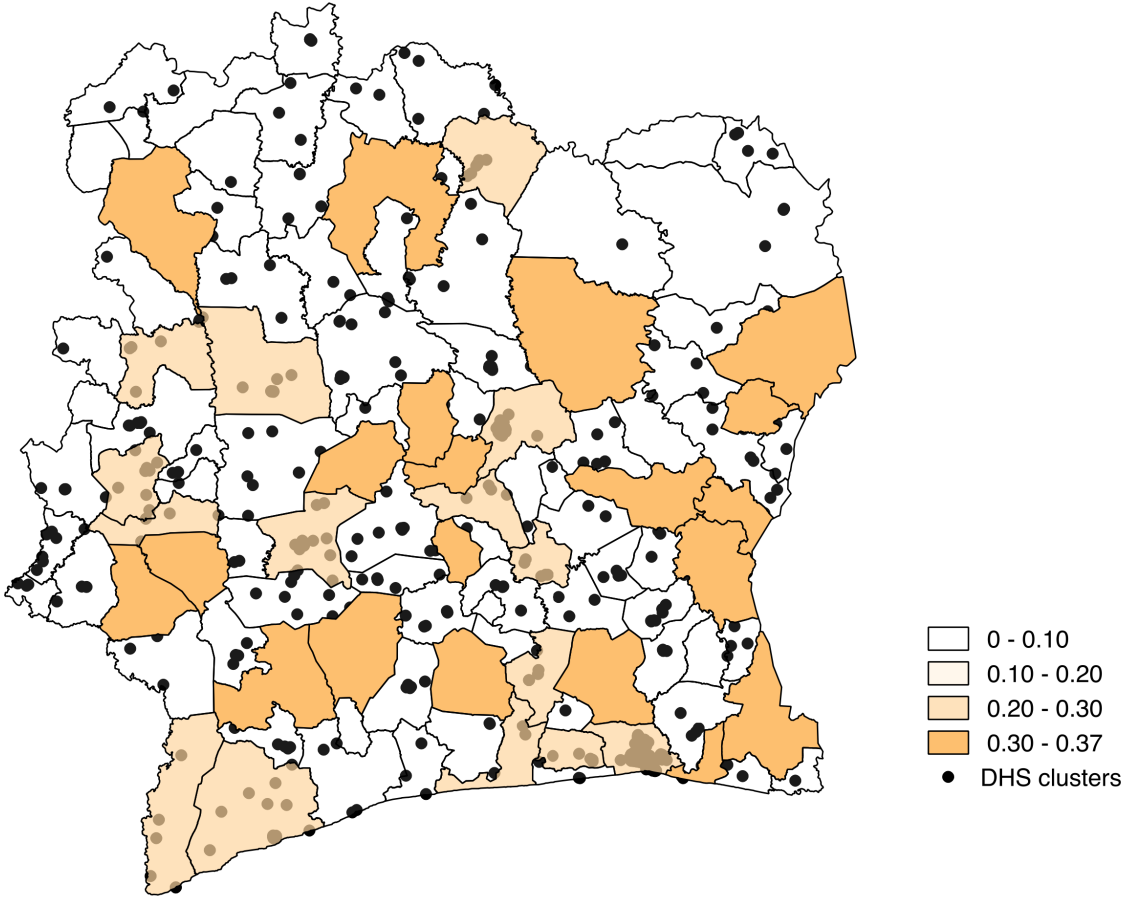
Source: constructed by the authors using data from the World Development Indicators database

**Figure 2:** Aid projects and DHS Clusters distribution



Notes: constructed by the authors using QGIS 2.3  
Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS, and Aid Data v1.4.2

**Figure 3:** Infant mortality rate based on the three DHS surveys



Notes: constructed by the authors using QGIS 2.3  
 Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS.

**Table 1: Types and locations of aid projects (1995-2014)**

Type of projects	Numbers of projects	Number of locations
Health	12	12
Agriculture	13	13
Government and civil society	10	4
Banking and financial services	1	1
Education	5	5
Energy generation and supply	8	8
Water and sanitation	76	11
Other social infrastructure and services	19	14

Source: Authors' calculation using Aid Data v1.4.2



**Table 2:** Summary statistics

	Mean	Max	Min	St. Dev.	Obs
Infant mortality (=1 if died before 12 months)	0.309	1	0	0.462	13766
Aid projects within 50 km (=1 if yes)	0.674	1	0	0.469	13766
Aid projects within 25 km (=1 if yes)	0.432	1	0	0.495	13766
Rural (=1 if yes)	0.612	1	0	0.487	13766
Child lives in poor household (=1 if yes)	0.510	1	0	0.500	10551
Child vaccinated (=1 if yes)	0.720	1	0	0.449	3905
Child vaccinated against BCG (=1 if yes)	0.780	1	0	0.415	12446
Child vaccinated against Measles (=1 if yes)	0.526	1	0	0.499	12351
Mother has some education (=1 if yes)	0.337	1	0	0.473	13766
Child born during aid project (=1 if yes)	0.687	1	0	0.464	13766
Child is from multiple births (=1 if yes)	0.041	1	0	0.199	13766
Child birth order number	3.658	15	1	2.449	13766
Child age in years	1.623	4	0	1.338	12485
Child is male (=1 if yes)	0.504	1	0	0.500	13766
<b><i>Ethnic groups</i></b>					
Akan	0.273	1	0	0.446	13748
Krou	0.087	1	0	0.281	13748
North Mande	0.148	1	0	0.355	13748
South Mande	0.090	1	0	0.286	13748
Voltaiques	0.167	1	0	0.373	13748
others	0.236	1	0	0.424	13748
<b><i>Religion</i></b>					
Christian	0.360	1	0	0.480	13741
Muslim	0.432	1	0	0.495	13741
Others	0.208	1	0	0.406	13741

**Table 3: Effects of aid projects on infant mortality**

	(1)	(2)	(3)	(4)
Aid project 50km*born during Aid project	-0.028*** (0.007)		-0.027*** (0.009)	
Aid project 25km*born during Aid project		-0.019*** (0.005)		-0.021*** (0.006)
Province fixed effects	Yes	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes
Mother fixed effects	No	No	Yes	Yes
Observations	12284	12284	8786	8786
R-squared	0.851	0.851	0.854	0.854

Notes: The dependent variable is infant mortality. Robust standards errors are in parentheses, clustered at the DHS cluster level. All regressions include province specific trends, year of birth fixed effects, child controls (gender, child age, multiple births dummy and birth order fixed effect). Mother's time invariant characteristics used in the mother fixed effects regressions are mother's education, rural residency, ethnicity and religion.

Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS, and Aid Data v1.4.2

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

**Table 4: Effects of aid projects on infant mortality for different groups**

	(1)	(2)	(3)	(4)
Aid project 50km*born during Aid project	-0.022** (0.010)		-0.028*** (0.009)	
Aid project 50km*born during Aid project*Rural		-0.006 (0.009)		
Aid project 50km*born during Aid project*Male			0.002 (0.008)	
Aid project 25km*born during Aid project		-0.017** (0.008)		-0.023*** (0.008)
Aid project 25km*born during Aid project*Rural		-0.005 (0.009)		
Aid project 25km*born during Aid project*Male				0.006 (0.008)
Region fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Regions specific trends	Yes	Yes	Yes	Yes
Mother fixed effects	Yes	Yes	Yes	Yes
Observations	8786	8786	8786	8786
R-squared	0.854	0.854	0.854	0.854

Notes: The dependent variable is infant mortality. Robust standards errors are in parentheses, clustered at the DHS cluster level. All regressions include province specific trends, year of birth fixed effects, child controls (gender, child age, multiple births dummy and birth order fixed effect), mother controls (education, rural residency, ethnicity and religion). Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS, and Aid Data v1.4.2

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

**Table 5: Effects of water and sanitation aid projects on infant mortality**

	(1)	(2)	(3)	(4)
Aid project 50km*born during Aid project	-0.018*** (0.006)		-0.020*** (0.007)	
Aid project 25km*born during Aid project		-0.020*** (0.005)		-0.020*** (0.006)
Province fixed effects	Yes	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes
Mother fixed effects	No	No	Yes	Yes
Observations	12284	12284	8786	8786
R-squared	0.851	0.851	0.854	0.854

Notes: The dependent variable is infant mortality. Robust standards errors are in parentheses, clustered at the DHS cluster level. All regressions include province specific trends, year of birth fixed effects, child controls (gender, child age, multiple births dummy and birth order fixed effect). Mother's time invariant characteristics used in the mother fixed effects regressions are mother's education, rural residency, ethnicity and religion.

Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS, and Aid Data v1.4.2

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

**Table 6: Effects of aid projects on migration**

	1994 DHS		2011-2012 DHS	
	(1)	(2)	(3)	(4)
Aid project 50km		-0.015 (0.015)		0.003 (0.021)
Aid project 25km	-0.009 (0.012)		0.004 (0.017)	
Child controls	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes
Observations	12246	12246	12246	12246
R-squared	0.237	0.237	0.487	0.487

Notes: The dependant variable is the propensity to migrate (a dummy variable for population displacement). Robust standards errors are in parentheses, clustered at the DHS cluster level. All regressions include year of birth fixed effects, region fixed effect, child controls (gender, child age, multiple births dummy and birth order fixed effect), mother controls (education, rural residency, ethnicity and religion).

Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS, and Aid Data v1.4.2

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

**Table 7: Effects of aid projects on infant mortality using residence at the time of the survey**

	(1)	(2)	(3)	(4)
Aid project 50km*born during Aid project	-0.029*** (0.007)		-0.027*** (0.009)	
Aid project 25km*born during Aid project		-0.020*** (0.005)		-0.021*** (0.006)
Province fixed effects	Yes	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes
Mother fixed effects	No	No	Yes	Yes
Observations	11751	11751	8545	8545
R-squared	0.850	0.850	0.854	0.854

Notes: The dependent variable is infant mortality. Robust standards errors are in parentheses, clustered at the DHS cluster level. All regressions include province specific trends, year of birth fixed effects, child controls (gender, child age, multiple births dummy and birth order fixed effect). Mother's time invariant characteristics used in the mother fixed effects regressions are mother's education, rural residency, ethnicity and religion.

Data sources: 1994, 1998-1999 and 2011-2012 editions of the Côte d'Ivoire DHS, and Aid Data v1.4.2

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

**Table 8: Effects of aid projects on other variables of interest (mediating factors)**

	Vac. (1)	BCG (2)	Measles (3)	Polio (4)	Poor (5)	Mother ed. (6)	Prenatal visits (7)	Hospital delivery (8)
Aid project 25km*born during Aid project	0.028 (0.023)	0.102*** (0.020)	0.064*** (0.020)	0.009 (0.015)	-0.258*** (0.048)	0.061*** (0.021)	0.598*** (0.106)	0.106*** (0.032)
Regions fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regions specific trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3848	12245	12151	12252	9414	12284	10290	12284
R-squared	0.344	0.159	0.304	0.197	0.333	0.125	0.169	0.174

Notes: Robust standards errors are in parentheses, clustered at the DHS cluster level. All regressions include province specific trends, year of birth fixed effects, child controls (gender, child age, multiple births dummy and birth order fixed effect).

Data sources: 1994, 1998-1999 and 2011-2012 Côte d'Ivoire DHS, and Aid Data v1.4.2

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%