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Original Research

Effects of Development Assistance for Health in Developing Countries

MONGBET Zounkifirou[1]
Faculty of Economics and Management, University of Yaounde II
Yaounde, Cameroon

TOURERE Zenabou
Department of Economics and management, University of Douala
Douala, Cameroon

Abstract

This article assesses the effects of international aid on the health sector in developing countries. We use estimation techniques such as Ordinary Least Squares (OLS), instrumental variables with fixed effects, and the dynamic panel approach. Using the data from various sources over the period 1990 to 2017 covering 126 developing countries, the initial results show that health aid contributes effectively and significantly to improved health outcomes in the developing countries at 1 and 5% of the significance thresholds. These results give the picture that the mobilization of the international community in favour of the health sector in the context of the MDGs through health aid has been more effective in achieving certain health goals from the 2000s onwards than before the Millennium Declaration. This study shows that it is in the interest of development partners, particularly those in the health sector, to significantly improve the survival and health of the populations of developing countries through health aid. It is recommended that development assistance policies be designed to take into consideration the existing institutional framework and how these resource flows interfere with, and therefore change, the incentive structure of recipient countries. The transfer of resources in the form of health aid to meet current needs must be complemented by other additional actions, such as education campaigns and infrastructure improvements, in order to achieve long-term improvement.

Keywords: Effects, development assistance for health, developing countries

[1] *Corresponding Author's Email: mongbetzounkifirou@yahoo.fr*

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Introduction

The coronavirus pandemic (COVID-19) has caused significant loss of life, disrupted livelihoods and undermined well-being worldwide. It exposed the weakness and vulnerabilities of health systems in developing countries and even those of the world's most powerful countries to a major health crisis. The crises in COVID_19 also have the negative impact that this can have on the achievement of the Sustainable Development Goal (SDG). Overall access to essential health services improved from 2000 to 2017, with the largest increase in low- and lower-middle-income countries. Against this background, it is urgent to take stock of the lessons learned and progress made in improving the health of populations and, above all, to identify and address the gaps that persist where progress has not been made. However, service coverage in low- and middle-income countries remains far below that of richer countries. Because of the severe shortfall in service coverage in low-resource countries, overall access to essential health services is still far below optimum.

To this end, multilateral and bilateral donors have decided to intensify their aid programs in general and to the health sector in particular. Thus, aid for health and population, after stagnating until the mid-1990s, has increased in recent years. From $8.6 billion in 1990 to $38.2 billion in 2017 (Figure 1).

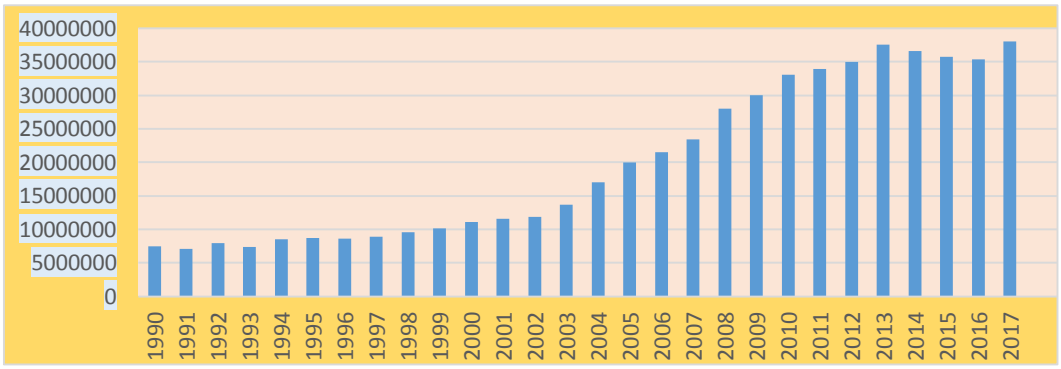

Figure 1. Evolution of aid to the health sector (in thousands of dollars in 2010)
Source: Authors' construction based on data from the IHME of 2020.

From the 2000s onwards, the health sector has been at the centre of the concerns of the entire international community with the definition and adoption of the MDGs. This led to the emergence of new donors, such as the Global Fund to Fight Tuberculosis, AIDS and Malaria, and, as a result, there has been a massive influx of external funding for the sector (OECD, 2020). The rest of this paper is organized around five sections. The second section reviews some previous work. The third section presents the methodology and data of the study. The fourth section presents the results and discussion. The penultimate section does the robustness check and, finally, the last section presents the conclusion and implications.

Literature review

The literature on the effects of foreign aid in general, and health in particular, can be divided into two main categories of studies: on the one hand, those that are based on the

assumption that aid is an important determinant of improved health and wellbeing of populations in recipient countries, and another group of studies that conclude that foreign aid does not help and may even harm human well-being (Chauvet & Guillaumont, 2008; Drabo & Ebeke, 2011) Studies in the first category argue that aid can contribute to improving a country's health status, either directly or through indirect channels (Toseef et al., 2019). Ndikumana & Pickbourn (2017) find that increased aid to the health sector reduces maternal mortality, Yogo & Mallaye (2015) find that health aid has reduced HIV prevalence and child mortality in Africa, and Gyimah-Brempong (2015), one of the first studies to document the impact of health aid in African countries, in particular, finds that health aid does indeed have a positive effect on a range of health outcomes. Bendavid et al. (2012) find that health aid is associated with higher life expectancy and lower under-five mortality rates, where they find that the association is strongest between 2000 and 2010, after implementation of the MDGs. Williamson (2008) found a negligible impact of health sector aid on a variety of health outcomes, including infant mortality, life expectancy and mortality rates. Mishra & Newhouse (2009) find no effect of overall aid on child mortality rates, but find that health specific aid does reduce child mortality. On the other hand, Piva & Dodd (2009) argue that large-scale projects and large amounts of donor aid for health have a greater impact on the health and health system of recipient countries because they are more likely to attract political attention, receive significant technical input and allow for economies of scale. Feeny & Ouattara (2013) further argue that aid leads to better health outcomes in poor countries by relaxing resource constraints and improving health service delivery. Wilson (2011) analyzed the relationship between foreign aid and mortality rates over time. His results show no effect of foreign aid to the health sector on mortality. He suggested that, despite the massive increase in the amount of aid received by developing countries, health sector aid tends to be directed more towards countries that are already experiencing a reduction in mortality, suggesting that such aid may follow success rather than cause it. Gomanee et al. (2005) found that total aid flows (as % GDP) do lead to overall levels of well-being as measured by the Human Development Index (HDI), although the effects are smaller for child mortality.

Also, on an empirical level, a few works are of interest to us. Using data from 135 countries between 1975 and 2010, (Yousuf, 2012)examined the causality between health aid and child mortality rates. The results revealed that aid is statistically significant and has a positive effect on the selected health indicator. An increase in aid per capita resulted in a decrease in the number of deaths (per 1000 births) each year. Chauvet et al (2008) analysed the combined impact of aid and remittances on human capital development, including infant and child mortality rates. Using a panel of 109 developing countries and a quintile of 47 developing countries, their results indicate that health aid significantly improves health outcomes in the countries studied. Mishra & Newhouse (2007) used panel data to examine the effects of aid on selected health indicators. They find that total aid per capita and health aid per capita significantly reduce child mortality rates but have no statistically significant effect on life expectancy. Our study is based on the new approach to assessing the impact of international public aid at the sector level, in particular at the health sector level. Its theoretical underpinning is the "micro-Macro paradox". The term "Micro-Macro Paradox" was first introduced by Mosley (1986) and refers to one of the most controversial aid issues. Indeed, Mosely drew attention to an apparent paradox in the performance of international aid. Microeconomic data from

evaluations of aid-funded projects showed that a majority of projects were successful, while macroeconomic data from aid growth regressions showed disappointing results.

Methodology and data

This study examines the effectiveness of aid to the health sector in developing countries. Following the approach adopted by some previous work, our econometric strategy starts with a simple fixed-effect Ordinary Least Squares (OLS) regression techniques, Instrumental Variables (IV) and the Generalized Method of Moments (GMM). Our basic model is given by:

$$HealthOutcomes_{i,t} = \alpha + \beta DAH_{i,t} + \lambda X_{i,t} + \eta_i + \pi_t + \varepsilon_{i,t}$$

Where $HealthOutcomes_{it}$ indicates the variable to be explained. It should be noted that the per capita aid to the country's health sector i, $DAH_{i,t}$ is the main variable of interest, X_i is the set of explanatory variables in our model, ε_{it} is the residue of our model. Two main measures of health aid are used: DAH per capita, DAH/GDP ratio. The data for this variable are taken from the online database of the Institute of Health Metrics and Evaluation (IHME, 2020) of the University of Washington. For this thesis, these data cover 126 developing countries over the period 1990 to 2017[2]. Six main health measures are used here to denote overall health in each developing country. These include: Infant mortality, Tuberculosis prevalence; the burden of disease; the disability adjusted life years (DALYs). Measles immunization coverage rate, Malaria mortality rate, the crude death rate. The crude death rate All the data on these variables that we use to capture health indicators/outcomes are estimates developed by the United Nations Interagency Group (UNICEF, WHO, World Bank) and are mainly taken from the World Development Indicator database (WDI, 2019). Besides, we include many control variables in the model: medical density, which measures the proportion of doctors per 1000 inhabitants, the proportion of the urban population, population size, diphtheria, pertussis and tetanus (DTP) vaccination coverage, GDP per capita, population density, primary school completion rate for women. As Yogo and Mallaye (2015) show, we use GDP per capita to control for any effects of the economic cycle that cannot be accounted for by health aid. Data for these variables are mainly taken from the World Development Indicator database (WDI, 2019).

[2] These countries are contained in Table 8 in the Annex.

Table 1. Descriptive statistics of the variables

Variables	Observations	Average	Standard deviation	Minimum	Maximum
DAH par Capita	**3528**	**5.722**	**16.945**	**0**	**365.262**
Infant Mortality Rate	**3528**	**68.941**	**55.752**	**3.5**	**326.5**
HIV Prevalence	3528	2.030	4.573	0	28.4
Crude death rate	3528	9.121	4.128	2.883	41.359
Malaria prevalence	3528	6770.232	25467.89	0	311497
Prevalence Tuberculosis	3528	120.266	191.883	0	1280
ImmunisationDPT	3528	78.850	20.288	0	99
Immunization_Measles	3528	78.865	18.570	8	99
Burden of Disease (DALYs)	3528	0.472	0.155	0.092	0.788
Life expectancy	3528	64.205	9.262	26.172	79.914
GDP per capita	3528	3240.326	3202.289	0.0001	20512.94
Population	3528	4.04e+07	1.53e+08	9505	1.39e+09
Population Density	3528	106.660	164.261	1.405	1654.673
ContrôleCorruption	3528	-0.523	0.624	-1.868	1.592
Government Effectiveness	3528	-0.521	0.627	-2.445	1.337
Médical Density	3528	0.928	1.130	0.007	8.295
Health expenditure (% GDP)	**3528**	**5.559**	**2.334**	**1.025**	**25.475**
Female Primary School Completion Rate	3528	76.387	26.344	0	142.122
Female Fertility Rate	3528	3.842	1.641	1.085	8.606
Access to hygiene and sanitation	3528	38.455	37.595	0	100
The proportion of Urban Population	3528	45.981	20.852	5.416	100
per capita migrant remittances	3528	101.792	230.7078	0.002	3040.356

Source: Author's calculations based on data from WDI (2019) and IHME (2019).

Results and discussion

In this sub-section, we present the results of the econometric estimates. The results from OLS estimates with fixed effects of the impact of health sector-specific aid on child mortality, HIV prevalence, tuberculosis prevalence, life expectancy, disease burden, malaria prevalence and measles immunizations are presented in Table 2 below. According to this table, health aid significantly worsens the prevalence of HIV and tuberculosis at 5% and 1% significance threshold respectively, while it has a negative and significant impact on child mortality, malaria prevalence and the burden of disease at 1% significance threshold for the first two variables and 10% for the burden of disease. Furthermore, health aid is significantly and positively correlated with the measles vaccination coverage rate and life expectancy at 1%, even if the associated elasticities are low. Thus, according to this table, a 1% increase in the amount of aid to be allocated to health is associated with a 1.1% drop in the infant mortality rate and a 0.2% 0.9% increase in life expectancy and vaccination coverage respectively. Besides, a 10% increase in the aid budget is accompanied by a 2.2% and 0.1% drop in the prevalence of tuberculosis and a 0.1% drop in the burden of disease.

However, as mentioned in the previous paragraphs, OLS estimates with fixed effects can suffer from several biases. To solve these problems, we proposed to use instrumental

variables and dynamic panel estimates. Table 3 opposite presents the results obtained from estimates using instrumental variables with fixed effects. These results are almost similar in terms of the sign of the parameters to those of OLS with fixed effects. Except that here, the sign of the valence of HIV becomes negative and significant at 1%. However, the sign for the prevalence of tuberculosis remains positive and statistically non-zero, meaning that health aid is not a good instrument for reducing the prevalence of tuberculosis. However, the values of the coefficients vary slightly.

Table 2: Impact of Development Assistance for on health outcomes/ fixed impact OLS

Variables	Dependent Variables						
	Infant Mortality	Prevalence of Tuberculosis	Prevalence of HIV	Burden Morbidity (DALYs)	Prevalence of Malaria	Life expectancy	Immunization_Measles
LogDAH per capita	-0.011*** (0.000)	0.011*** (0.000)	0.434** (0.030)	0.001* (0.086)	-0.022* (0.093)	0.002*** (0.000)	0.009*** (0.000)
LogGDP per capita	-0.201*** (0.000)	-0.154*** (0.000)	0.035 (0.888)	0.082*** (0.000)	-0.299*** (0.000)	0.006** (0.020)	-0.039*** (0.000)
LogPopulatiDensity	-0.644*** (0.000)	-0.297*** (0.000)	-0.298 (0.173)	0.395*** (0.000)	-0.151 (0.326)	0.169*** (0.000)	0.284*** (0.000)
LogMedicalDensity	-0.056*** (0.000)	-0.003 (0.832)	-1.202*** (0.003)	0.023*** (0.000)	0.032 (0.322)	0.008*** (0.000)	0.004 (0.571)
Female Primary School Completion Rate	-0.034** (0.046)	-0.062*** (0.000)	-0.142 (0.882)	0.081*** (0.000)	-0.0817 (0.275)	0.022*** (0.000)	0.177*** (0.000)
proportion of Urban Population	-0.140*** (0.001)	-0.490*** (0.000)	1.250* (0.065)	0.165*** (0.000)	-1.769*** (0.000)	0.153*** (0.000)	-0.0250 (0.469)
ControlCorruption	------	------	-1.221** (0.016)	------	------	0.025*** (0.000)	0.030* (0.056)
LogMigrant remittances per capita	-0.056*** (0.000)	-0.011* (0.053)	-0.201 (0.202)	-0.002*** (0.005)	-0.021* (0.081)	0.006*** (0.000)	0.016*** (0.000)
Female Fertility Rate	0.503 *** (0.000)	-0.042 (0.549)	-2.278** (0.044)	-0.119*** (0.000)	0.259 (0.134)	0.025*** (0.001)	-0.048* (0.084)
Health expenditure (% GDP)	-0.147*** (0.000)	0.015 (0.553)	------	0.002 (0.657)	------	0.013*** (0.002)	0.032** (0.040)
Access to hygiene and sanitation	------	------	------	------	0.236*** (0.006)	------	------
Constant	8298*** (0.000)	9.099*** (0.000)	-3.208 (0.585)	-30.768*** (0.000)	13.768*** (0.000)	2.739*** (0.000)	2.891*** (0.000)
Number of observations	3430	2263	3126	3430	1739	3430	2607
Number of Countries	126	126	117	126	100	126	126
R^2	0.412	0.285	0.228	0.246	0.236	0.254	0.130
Prob>F	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Source: Author's estimates. Note: The values in parentheses represent the P-Values of the individual student significance tests. ****P<0.01 or significance at 1%. **P<0.05; significance at 5%. *P<0.1; significance at 10%.*

Moreover, in both types of estimates, GDP per capita shows a statistically significant contribution, although it is more pronounced in the second specification. Note that we

have used GDP per capita to correct for potential endogeneity that might arise in the specifications. This correction leads to a higher revised coefficient in the second specification, confirming a notion in earlier studies that income has a strong and significant effect on health outcomes since higher income levels would translate into improved provision of public health infrastructures such as water and sanitation, better housing and nutrition, and better health facilities.

Thus, it can be said that in the regressions of instrumental variables (IV) and OLS with fixed effects, the coefficient of per capita health aid shows the correct sign but remains variable, from one technique to another; and also since the degrees of significance have also changed considerably in the estimation of IV.

Table 3: Impact of health aid on health outcomes/ Instrumental variable with fixed effects (IV)

Variables	Dependent Variables						
	Infant Mortality	Prevalence of Tuberculosis	Prevalence of HIV	BurdenMorbidity (DALYs)	Prevalence of Malaria	Life expectancy	Immunization_Measles
LogDAH per capita	-0.010*** (0.000)	0.012** (0.031)	-0.045*** (0.002)	0.010*** (0.000)	-0.025* (0.059)	0.010*** (0.000)	0.015*** (0.000)
LogGDP per capita	-0.246*** (0.000)	-0.145*** (0.000)	0.538*** (0.000	0.139*** (0.000)	-0.311*** (0.000)	0.038*** (0.000)	0.089 *** (0.000)
LogMedicalDensity	-0.051*** (0.000)	-0.010 (0.705)	-0.010 (0.899)	0.013*** (0.000)	0.025 (0.783)	0.006*** (0.004)	-0.018** (0.034)
Female Primary School Completion Rate	-0.024 (0.175)	-0.059* (0.000)	-0.607*** (0.000)	0.105*** (0.000)	-0.133* (0.058)	0.054*** (0.000)	0.185*** (0.000)
proportion of Urban Population	-0.226*** (0.000)	-0.489*** (0.000)	-1.319*** (0.000)	0.281*** (0.000)	-1.838*** (0.000)	0.211*** (0.000)	-0.022 (0.684)
ControlCorruption	-0.068*** (0.000)	-0.045* (0.062)	-0.298*** (0.000)	-0.014*** (0.001)	-0.015 (0.783)	0.010* (0.075)	0.027** (0.037)
LogMigrant remittances per capita	-0.052*** (0.000)	-0.012* (0.051)	-0.123*** (0.000)	-0.003** (0.016)	-0.021* (0.095)	0.005*** (0.000)	0.011*** (0.000)
Female Fertility Rate	0.387*** (0.000)	-0.026 (0.712)	0.313* (0.087)	-0.294*** (0.000)	0.355** (0.030)	-0.068*** (0.000)	-0.113*** (0.002)
LogPopulationDensity	-0.724*** (0.170)	-0.308*** (0.090)		----		----	0.333*** (0.000)
Health expenditure (% GDP)	-0.130*** (0.000)	0.025 (0.324)	0.065 (0.357)	0.016*** (0.001)	0.113** (0.038)	0.012*** (0.001)	0.010 (0.537)
Access to hygiene and sanitation	----	----	0.565	0.062*** (0.000)	0.245*** (0.004)	0.013** (0.036)	0.045** (0.049)
Constant	9.296*** (0.000)	8.998*** (0.000)	3.252*** (0.002)	-3.242 *** (0.000)	13.376*** (0.000)	2.856*** (0.000)	2.882*** (0.000)
Number of observations	3158	2255	2264	2264	1737	2264	2264
Number of Countries	126	126	126	126	100	126	126
R^2	0.396	0.293	0.31	0.839	0.244	0.490	0.426
Prob>F	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Source: Author's estimates. Note: The values in parentheses represent the P-Values of the individual student significance tests. ****P<0.01 or significance at 1%. **P<0.05; significance at 5%. *P<0.1; significance at 10%.*

As a result, we cannot conclude with certainty about the real impact of aid on health outcomes. To get a clear idea of the impact of health aid on health outcomes, we perform a dynamic panel specification. The use of this estimation technique confirms the presence of the expected effect of health aid on health outcomes. Table 4 presents the results of the dynamic panel specification of the impact of health aid on health outcomes. Indeed, according to the results of Hansen's test, the hypothesis of over-identification of restrictions cannot be rejected because the added value is greater than 10% of the significance threshold, in other words, the set of instruments chosen are valid. It can be argued that the difference in results in the first two estimates, although the aid coefficient is statistically significant, is since current aid per capita may indirectly influence health outcomes by influencing the other explanatory variables present. This could also reflect a positive correlation between unobserved factors in the selected health indicators and health aid and GDP per capita.

According to this new specification, health aid contributes effectively and significantly to improving health outcomes in the context of developing countries at 1 and 5% of the significance thresholds. Thus, a 1% increase in the volume of health aid is associated respectively with a 1% drop in the infant mortality rate 0.1% in the infant mortality rate and the burden of disease, an improvement in life expectancy of 78.9% and an increase in measles vaccination coverage of 1,4%, this result is to be compared with those of Feeny and Ouattara (2013) who looked at the impact of foreign aid in the health sector on two aspects of children's well-being, measles vaccination and DTP vaccination. They found that the relationship between health aid and these measures to promote children's health was positive and statistically significant. These results are thus in line with Yousuf (2012) findings that aid has a statistically significant and positive effect on child mortality rates, and that doubling aid leads to a reduction of about 1.3% in child mortality rates.

Finally, it concludes that for an average aid recipient country, doubling aid per capita results in a reduction of about 790 deaths per million live births in a given year. The same finding is made by Mishra and Newhouse (2009); their results suggest that child mortality could be reduced by 2% if health aid were doubled. They also suggested that, on average, an increase in health aid by a factor of 15 should reduce the child mortality rate by two-thirds by the MDGs, compared to its 1990 value. Overall, their findings suggest that health-specific aid improves health outcomes and should be scaled up to further increase human well-being. Moreover, a 5% increase in the aid budget translates into a 1% drop in the prevalence of tuberculosis, malaria and HIV by 6.5% respectively. Taken together, these results demonstrate that health aid is one of the major determinants of improved health outcomes in developing countries.

However, these results contrast with Williamson's (2008) findings that foreign aid is ineffective in improving overall health and is an ineffective human development tool. She shows that her results hold after controlling for reverse causality and are robust to the different specifications of the model used. Also, with Wilson (2011); Wilson examining the impact of foreign aid to the health sector on mortality rates over time and reported no effect. Furthermore, he notes that, despite the massive increase in the amount of aid received by developing countries, health sector aid tends to be directed more towards countries that are already experiencing mortality reduction, suggesting that such aid may follow success rather than cause it. Conversely, our findings corroborate those of Yogo

and Mallaye (2015) who found that health aid contributes to improved health outcomes in sub-Saharan African countries. For each additional unit of health aid, HIV prevalence falls by 8.3% and child mortality falls by 64% over 4 years. Also, Gyimah-Brempong (2015) for whom health aid has a statistically significant and positive impact on health outcomes in African countries, regardless of government effectiveness.

Tableau 4: Impact of health aid on health outcomes / Generalized Method of Moments (GMM)

Variables	Dependent Variables						
	Infant Mortality	Prevalence of Tuberculosis	Prevalence of HIV	Burden Morbidity (DALYs)	Prevalence of Malaria	Life expectancy	Immunization Measles
$HealthOuc_{i,t-1}$	0.958*** (0.000)	0.991*** (0.000)	1.102*** (0.000)	0.922*** (0.000)	0.998*** (0.000)	0.898*** (0.000)	0.821*** (0.000)
LogDAH per capita	-0.010*** (0.000)	-0.010** (0.043)	-0.065** (0.020)	0.001*** (0.007)	-0.010** (0.038)	0.789*** (0.000)	0.014*** (0.007)
LogGDP per capita	-0.040*** (0.004)	0.016 (0.124)	-0.160** (0.049)	0.014*** (0.000)	0.010 (0.471)	0.715 (0.165)	-0.020 (0.107)
LogPopulationDensity	-0.011* (0.065)	0.003 (0.500)	------	0.001 (0.215)	0.010 (0.256)	0.348 (0.235)	0.019 (0.427)
LogMedicalDensity	0.003 (0.325)	-----	-0.058* (0.072)	------	------	-0.027 (0.848)	0.003 (0.637)
Female Primary School Completion Rate	-0.020** (0.042)	-0.088** (0.046)	-0.010 (0.973)	0.010 (0.249)	-0.024 (0.128)	1.493 (0.067)	0.071*** (0.002)
proportion of Urban Population	0.009 (0.321)	-0.010 (0.814)	-0.689*** (0.002)	------	-0.022* (0.071)	-1.024 (0.335)	-0.003 (0.909)
LogPopulation	0.004*** (0.003)	------	-----	------	------	-1.034** (0.017)	-0.041*** (0.001)
Immunisation DPT	-0.027*** (0.000)	0.033 (0.192)	-0.171 (0.283)	0.012* (0.053)	-0.038*** (0.008)	------	------
Female Fertility Rate	------	-0.018 (0.950)	0.337 (0.113)	-0.001 (0.592)	0.036 (0.195)	1.937* (0.058)	-0.002 (0.957)
Health expenditure (% GDP)	------	------	1.093*** (0.000)	-0.010** (0.045)	0.017 (0.493)	------	------
Government Effectiveness	------	-0.042** (0.044)	-0.275** (0.020)	-0.0001 (0.968)	------	------	------
Constante	0.738*** (0.000)	0.150 (0.330)	0.215 (0.830)	-0.113*** (0.000)	0.152 (0.225)	11.229 (0.249)	1.210*** (0.000)
Number of observations	2607	2119	2034	2252	1588	3283	3313
Number of countries	121	125	114	125	97	126	126
Numberof Instruments	32	48	39	24	47	19	28
AR(1)	0.082	0.054	0.075	0.037	0.076	0.001	0.000
AR(2)	0.186	0.160	0.305	0.102	0.364	0.337	0.706
P-value of the Hansen Over-identification Test	0.103	0.933	0.967	0.270	0.125	0.157	0.480

Source: Author's estimates. Note: The values in parentheses represent the P-Values of the individual student significance tests. ****P<0.01 or significance at 1%. **P<0.05; significance at 5%. *P<0.1; significance at 10%.*

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Impacts of health aid during the MDGs period

Intending to reduce poverty and promote sustainable development in developing countries, the UN General Assembly adopted several resolutions in September 2000. One of these resulted in eight so-called Millennium Development Goals (MDGs). Between 2000 and 2015, the MDGs provided the framework for global development efforts transforming the field now known as global health. Of the eight MDGs, three are specifically related to health, including Goal 4 on child mortality, Goal 5 on maternal health and Goal 6 on combating human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), malaria and other killer diseases such as tuberculosis (TB) and polio. All 189 Member States, including developing countries, have ratified the resolution. Member States also agreed to reduce child mortality by two-thirds, maternal mortality rates by three-quarters and to roll back HIV/AIDS and other major diseases by 2015.

Table 5: Impact of health aid on health outcomes in the context of the DGs/Generalized Method of Moments (GMM) (2000-2017)

Variables	Dependent Variables						
	Crude death rate	Prevalence of Tuberculosis	Prevalence of HIV	Infant Mortality	Prevalence of Malaria	Life expectancy	Immunization Measles
$HealthOuc_{i,t-1}$	0.984*** **(0.000)**	0.997*** **(0.000)**	1.034*** **(0.000)**	0.929*** **(0.000)**	1.076*** **(0.000)**	0.901*** **(0.000)**	0.885*** **(0.000)**
LogDAH per capita	**-0.042*** (0.000)**	**-0.045** (0.033)**	**-0.217*** (0.006)**	**-0.015*** (0.001)**	**-0.059*** (0.000)**	**0.010*** (0.000)**	**0.010** (0.031)**
LogGDP per capita	-0.010 **(0.**778)**	-0.045 **(0.190)**	0.184 **(0.274)**	-0.051* (0.062)	0.180** (0.010)	0.002 (0.575)	-0.004 **(0.248)**
LogPopulationDensity	-0.018 (0.476)	----	-0.117** **(0.029)**	-0.033* (0.073)	-0.128** (0.011)	0.003 (0.471)	-0.016 **(0.137)**
LogMedicalDensity	0.049 (0.152)	----	-0.080** **(0.049)**	-0.054*** **(0.002)**	-0.039 (0.250)	0.010*** **(0.000)**	----
Female Primary School Completion Rate	-0.206 *** **(0.005)**	0.059 (0.645)	0.287 **(0.612)**	0.017 (0.603)	0.063 (0.234)	0.001 (0.733)	-0.041 **(0.165)**
proportion of Urban Population	0.021 **(0.**359)**	-0.095 (0.402)	-0.873** **(0.012)**	0.122** **(0.044)**	-0.248 (0.182)	-0.010 (0.583)	-0.002 **(0.953)**
ControlCorruption	----	----	-0.143 **(0.782)**	----	----	----	----
LogPopulation	-0.023*** (0.009)	----	0.082 **(0.190)**	-0.034*** **(0.003)**	----	0.001 (0.520)	----
LogMigrant remittances per capita	0.036*** (0.000)	----	0.110** **(0.027)**	----	----	----	----
Immunisation DPT	0.145* (0.053)	0.257 **(0.349)**	-0.053 **(0.900)**	0.001 (0.930)	0.053 (0.213)	0.019*** **(0.001)**	----
Female Fertility Rate	-0.334** (0.021)	0.124 (0.497)	0.208 (0.544)	-0.091** (0.041)	-0.351*** **(0.001)**	0.013*** **(0.006)**	-0.079 **(0.265)**
Health expenditure (% GDP)	-0.098** (0.030)	----	-0.083 (0.610)	----	----	0.010 (0.275)	----
Access to hygiene and sanitation	0.017 (0.839)	0.130 (0.434)	0.168 (0.601)	-0.018 (0.287)	----	----	-0.021 **(0.556)**
Government Effectiveness	-0.036 (0.452)	-0.141* (0.082)	-0.205 (0.575)	-0.028 (0.168)	0.057 (0.394)	-0.004 (0.401)	0.047* (0.060)
Constante	1.191*	-1.369	-1.604	0.869**	-0.386	0.291***	0.993***

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Variables	Dependent Variables						
	Crude death rate	Prevalence of Tuberculosis	Prevalence of HIV	Infant Mortality	Prevalence of Malaria	Life expectancy	Immunization Measles
	(0.072)	(0.355)	(0.447)	(0.022)	(0.575)	**(0.006)**	**(0.006)**
Number of observations	1335	1869	1688	1896	1612	2125	1346
Number of countries	97	125	113	115	99	125	98
Numberof Instruments	52	18	36	50	40	27	41
AR(1)	**0.080**	**0.046**	**0.044**	**0.080**	**0.076**	**0.001**	**0.001**
AR(2)	0.119	0.152	0.539	0.105	0.450	0.954	0.221
P-value of the Hansen Over-identification Test.	**0.255**	**0.371**	**0.860**	**0.939**	**0.383**	**0.536**	**0.778**

Source: Author's estimates. Note: The values in parentheses represent the P-Values of the individual student significance tests. ****P<0.01 or significance at 1%. **P<0.05; significance at 5%. *P<0.1; significance at 10%.*

The MDGs have both reflected and helped to shape a normative health aid agenda. In the field of global health, the role of governments is widely seen as having diminished. However, an appreciation of the role of the MDGs in the conceptualization of global health is particularly relevant at a time when the world is in the transition to the MDGs' successor, the Sustainable Development Goals (SDGs). The influence, impact and importance of the health related MDGs have not been fully explored in their entirety. To this end, to understand the future of global health and how actors in the field of development and health aid, in general, can engage in shaping the sector, it would be useful to have a clearer picture of the role that aid has played in the past, particularly during the implementation of the MDGs (Marten et al., 2018). Thus, to assess the impact of aid specifically earmarked for the health sector, we are making new estimates, this time considering a new time horizon. Our study now covers the period 2000-2015. Table 5 below presents the results of our estimates.

Our findings confirm a coherent picture of the international community's increased commitment to the health sector within the framework of the MDGs over the period 2000-2015. It should be recalled that this commitment has been translated at the operational level by a massive influx of aid; but also by the design of specialized global health financing programs, including vertical and horizontal programs. These results show that health aid has potentially had many positive effects on the health of populations in developing countries, and this is reflected in child mortality and the prevalences of HIV, tuberculosis and malaria being inversely proportional to aid, while life expectancy and vaccination against diseases are positively correlated, but at low intensities. On the other hand, we found that aid has only had beneficial effects on crude mortality rates, in short on the overall health of people in developing regions since the beginning of the millennium.

As shown by Toseef et al. (2019), our results suggest that since the adoption of the UN MDGs in 2000, health aid to developing countries has been only modestly effective in improving some measures of population health in recipient countries. Specifically, these benefits have mainly concerned HIV prevalence, child mortality, tuberculosis and malaria prevalences, overall mortality, and to a lesser extent life expectancy and immunizations coverage. For example, a 1% increase in the volume of aid resulted in a 21.7% decrease in HIV prevalence, compared to 5.9% for malaria, 1.5% for child mortality and 4.2% for

overall mortality. Taken together, our results provide sufficient evidence that health aid has been more or less successful in improving health outcomes.

Robustness checks

Limiting ourselves to the above results could lead us to wrongly conclude from the consistency of the estimators. To ensure the relevance of our results, we use two robustness checks. First, we modify the length of the unit periods in our time frame to a minimum of four years. This is done by averaging over 4 years all data related to the study variables. In this new horizon of analysis where we obtain a reduced number of periods of Seven (7), we test the robustness of the key equation using the Generalized Moments Method. Second, we replace the variable the Logarithm of **Health Aid per capita** by that of **Health Aid as a percentage of GDP**. Tables 6 and 7 in appendix present the results of estimates.

Table 6 shows that our main variable of interest, health aid, has retained the same statistically significant sign. But that the impact of aid on Life Expectancy has now become very small even though the associated coefficient has remained statistically significant, albeit positive. However, the impact of GDP per capita on child mortality becomes insignificant, so that it is even positively correlated with overall mortality. This implies for aid that when the unit period is reduced, this has led to a relative attenuation of the impact of aid on health outcomes, while the variation in the GDP coefficient can be explained by the fact that with longer periods, GDP may have a greater influence on health outcomes.

Table 6: Robustness checks results Impact of health aid on health outcomes / Generalised Method of Moments (GMM) (average of 4 years)

Variables	Dependent Variables					
	Infant Mortality	Prevalence of Tuberculosis	Prevalence of HIV	Crude death rate	Life expectancy	Immunization Measles
$HealthOuc_{i,t-1}$	0.851*** (0.000)	0.731*** (0.000)	0.921*** (0.000)	0.992*** (0.000)	0.870*** (0.000)	0.100*** (0.002)
LogDAH per capita	-0.036*** (0.004)	-0.353*** (0.005)	-0.079*** (0.009)	-0.022*** (0.000)	0.002** (0.015)	0.017*** (0.000)
LogGDP per capita	-0.038 (0.410)	-0.729*** (0.002)	-0.233** (0.049)	0.023** (0.016)	0.010*** (0.002)	0.029* (0.076)
LogPopulationDensity	-0.036 (0.183)	-0.481** (0.039)	---	-0.012 (0.343)	0.010 (0.111)	-0.0002 (0.982)
LogMedicalDensity	-0.102** (0.034)	0.149 (0.405)	0.054 (0.393)	0.017*** (0.004)	-0.010*** (0.000)	0.015 (0.372)
Female Primary School Completion Rate	-0.045 (0.529)	0. 295 (0.539)	0.104 (0.571)	-0.002 (0.856)	-0.005 (0.260)	0.084*** (0.008)
proportion of Urban Population	0.092 (0.323)	0.202 (0.693)	0.188 (0.419)	-0.070*** (0.000)	-0.004 (0.365)	-0.087** (0.013)
ControlCorruption	-0.083 (0.340)	0.118 (0.683)	-0.027 (0.857)	-0.015 (0.380)	0.010*** (0.003)	-0.022 (0.510)

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Variables	Dependent Variables					
	Infant Mortality	Prevalence of Tuberculosis	Prevalence of HIV	Crude death rate	Life expectancy	Immunization Measles
LogPopulation	-0.105*** (0.000)	---	---	-0.011* (0.065)	0.002* (0.088)	0.010 (0.107)
LogMigrant remittances per capita	0.036** (0.011)	-0.024 (0.630)	---	0.011*** (0.002)	---	---
Immunisation DPT	-0.068 (0.589)	0.100 (0.840)	-0.045 (0.673)	-0.101*** (0.001)	0.024*** (0.000)	0.641*** (0.000)
Female Fertility Rate	0.026 (0.869)	0.010 (0.950)	-0.102 (0.747)	-0.069** (0.044)	-0.034*** (0.000)	-0.031 (0.616)
Health expenditure (% GDP)	-0.335*** (0.000)	-0.633** (0.038)	---	0.065*** (0.000)	---	-0.024 (0.182)
Access to hygiene and sanitation	0.018 (0.214)	-0.452 (0.453)	-0.178*** (0.000)	-0.010* (0.095)	0.010*** (0.004)	-0.016* (0.052)
Government Effectiveness	0.146** (0.021)	0.094 (0.779)	0.153 (0.439)	-0.019 (0.155)	-0.017*** (0.000)	0.059** (0.037)
Constante	2.791*** (0.000)	10.244*** (0.007)	1.771 (0.264)	0.532*** (0.006)	0.399*** (0.000)	1.023*** (0.000)
Number of observations	550	496	539	448	448	550
Number of countries	112	124	109	94	94	112
Numberof Instruments	54	32	46	69	69	62
AR(1)	0.019	0.036	0.093	0.034	0.007	0.003
AR(2)	0.387	0.477	0.969	0.169	0.635	0.807
P-value of the Hansen Over-identification Test.	0.735	0.129	0.809	0.692	0.373	0.284

Source: Author's estimates. Note: The values in parentheses represent the P-Values of the individual student significance tests. ****P<0.01 or significance at 1%. **P<0.05; significance at 5%. *P<0.1; significance at 10%.*

On the other hand, when we replace aid per capita with aid as a proportion of GDP, we do not get a change in our results, which remain much more consistent. Table 7 presents the results of the panel estimates. In the six specifications for all the variables to be explained, health aid remains significantly and positively associated with health outcomes.

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Table 7: Robustness test results: Impact of health aid on health outcomes / Generalised Method Moments (GMM) (after replacement of per capita health aid by health aid as a percentage of GDP)

Variables	Variables Dépendantes					
	Infant Mortality	Prevalence of Tuberculosis	Prevalence of HIV	Crude death rate	Life expectancy	Immunization Measles
$HealthOuc_{i,t-1}$	0.845*** (0.000)	0.734*** (0.000)	0.921*** (0.000)	1.044*** (0.000)	0.911*** (0.000)	0.139*** (0.000)
Log DAH per capita	-0.031*** (0.005)	-0.368*** (0.004)	-0.079*** (0.009)	-0.020*** (0.000)	0.004*** (0.000)	0.015*** (0.008)
Log GDP per capita	-0.092** (0.012)	-1.079*** (0.000)	-0.309** (0.012)	-0.041*** (0.003)	0.010*** (0.003)	0.046* (0.084)
Log Population Density	-0.010 (0.763)	-0.476** (0.042)	0.055 (0.384)	-0.028** (0.047)	0.003 (0.461)	-0.038 (0.175)
Log Medical Density	-0.096** (0.013)	0.151 (0.565)	---	0.010 (0.107)	-0.011*** (0.000)	0.010 (0.512)
Female Primary School Completion Rate	0.092 (0.192)	0.349 (0.469)	0.108 (0.557)	0.011 (0.527)	-0.015** (0.012)	0.061** (0.014)
proportion of Urban Population	0.149 (0.148)	0.174 (0.735)	0.183 (0.432)	-0.017 (0.461)	-0.001 (0.751)	-0.018 (0.441)
ControlCorruption	-0.141* (0.050)	0.130 (0.654)	-0.028 (0.853)	0.068*** (0.003)	0.004 (0.383)	---
Log Population	-0.079*** (0.000)	---	---	-0.026*** (0.000)	0.010*** (0.002)	---
Log Migrant remittances per capita	---	-0.019 (0.692)	---	0.026*** (0.000)	-0.003*** (0.000)	---
Immunisation DPT	0.010 (0.764)	0.142 (0.775)	-0.047 (0.663)	-0.232*** (0.000)	0.033*** (0.000)	0.745*** (0.000)
Female Fertility Rate	0.174 (0.205)	0.084 (0.904)	-0.095 (0.761)	-0.182*** (0.000)	-0.045*** (0.000)	0.083 (0.392)
Health expenditure (% GDP)	-0.355*** (0.000)	-0.628** (0.040)	---	---	---	-0.019 (0.573)
Access to hygiene and sanitation	0.011 (0.388)	-0.473 (0.430)	-0.178*** (0.000)	0.010 (0.494)	0.002 (0.190)	-0.016 (0.170)
Government Effectiveness	0.184*** (0.002)	0.084 (0.802)	0.152 (0.441)	-0.063*** (0.001)	-0.004 (0.305)	0.080** (0.017)
Constante	1.498** (0.019)	9.682** (0.012)	1.746 (0.270)	1.300*** (0.000)	0.294*** (0.000)	0.257 (0.591)
Number of observations	545	496	539	448	448	621
Number of countries	112	124	109	94	94	121
Number of Instruments	56	33	46	55	69	33
AR (1)	0.005	0.029	0.093	0.027	0.001	0.015
AR (2)	0.762	0.661	0.965	0.254	0.400	0.496
P-value of the Hansen Over-identification Test.	0.401	0.235	0.810	0.645	0.485	0.918

Source: Author's estimates. Note: The values in parentheses represent the P-Values of the individual student significance tests. ****P<0.01 or significance at 1%. **P<0.05; significance at 5%. *P<0.1; significance at 10%.*

Health aid has the right sign and has a significant impact on infant mortality, tuberculosis prevalence, HIV prevalence, mortality, life expectancy and vaccination coverage, but remains insignificant. GDP contributes significantly to improving health outcomes. Health expenditure does indeed play an important role in improving these

health indicators, particularly child mortality and tuberculosis prevalence. We can conclude that our results are robust. So aid to the health sector is effectively improving health in developing countries.

Conclusion and implications

The objective of this article is to review the effectiveness of aid to the health sector on health outcomes in developing countries. We have used several health indicators including infant mortality rate, HIV, tuberculosis and malaria prevalence, crude mortality rate, disease burden, measles immunizations coverage and life expectancy, among others. It can be seen that aid specifically targeted at the health sector positively and significantly affects health outcomes in developing countries. However, the results sometimes depend on variables such as GDP per capita, female primary school completion rate, government effectiveness and many others. These results should be compared with those of Gyimah-Brempong (2015) and also, Yogo and Mallaye (2015), while the contrast with those of Williamson (2008).

Furthermore, our results provide the picture that health aid has played an important role in mobilizing the international community to support the health sector in the context of the MDGs, and has had an overall positive impact in improving health outcomes. Indeed, the results suggest that since the adoption of the UN MDGs in 2000, health aid to developing countries has been only modestly effective in improving some measures of population health in recipient countries. Specifically, these benefits have mainly concerned HIV prevalence, child mortality, tuberculosis and malaria prevalences, overall mortality, and to a lesser extent life expectancy and immunizations coverage confirming the work of Toseef et al (2019).

Finally, our results are robust to the change in the length of unit periods in our time to a minimum of four years, and to the replacement of the per capita health aid variable by health aid as a percentage of GDP. Indeed, all international agendas have always given pride of place to health in developing countries. This has materialized in the MDGs and, more recently, in the Sustainable Development Goals (SDGs), which have a target date of 2030. Furthermore, our findings suggest that focusing aid on the health sector could be beneficial and that the current donor focus on health could be well placed. One of the major recommendations of this work is that to achieve SDG 3 of the 2030 agenda, it is in the interest of development partners, particularly those in the field of health, to considerably improve the survival and health of populations in developing countries. Given the low allocation of national budgets to the health sector in these countries, increased international aid would undoubtedly contribute to improving the performance of their health systems. This would allow the implementation of other important vaccines, such as rotavirus vaccines, which have become a high priority issue; the control of certain neglected tropical, the communicable and non-communicable diseases. Also, our results highlight many other channels through which governments in developing countries are performing their health systems. These include: improving governance and the quality of institutions, macroeconomic stabilization and improving the quality of health spending.

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Appendix

List of Countries of the sample

Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Burkina Faso, Burundi, CHAD, Cambodia, Cameroon, Central African Republic, Chile, China, Colombia, Comoros, Congo, Costa Rica, Cote d'Ivoire, Cuba, Democratic Republic of the Congo, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Federated States of Micronesia, Fiji, Gabon, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordania, Kazakhstan, Kenya, Kyrgyzstan, Laos, Lebanon, Lesotho, Liberia, Libya, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Samoa, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Thailand, The Gambia, Timor Leste, Togo, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

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