Healthy Aid?

The (In)Effectiveness of Health-targeted Development Assistance

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Abstract

There is considerable theoretical debate over if and when development aid can be effective, but cross-sectional quantitative analyses have been relatively inconclusive. Using new comprehensive foreign aid data, we focus on development projects specifically designed to improve health of recipient country populations to see if these projects have positive impacts on the health sector. If health aid is effective, it should lead to measurable improvements in health indicators in recipient country populations. We hypothesize that health-targeted aid should improve infant and child mortality and life expectancy in recipient countries. To test the impact of health aid, we use robust GLS panel regressions to model the effects of bilateral and multilateral health aid on multiple health indicators in recipient countries from 1975 to 2000 using comprehensive aid data from the Project-Level Aid Database. This dataset includes CRS purpose codes for each project, allowing us to compare aid's performance with donor goals. Although health-targeted aid appears to be positively correlated with better health under certain conditions, our results suggest that it does not lead to robust increases in the health performance of the average recipient country.

[1] Draft prepared for the annual meeting of the International Studies Association, March 26-29, 2008 in San Francisco, California.

Understanding Foreign Aid

Although there has been a vast amount of research on the value and effectiveness of foreign aid there is still a lack of consensus among development scholars. The complexity of development makes it difficult to determine the impact of foreign aid in the web of political, economic, and social forces at work within developing countries. Due to these challenges, scholars disagree as to whether foreign aid produces positive results. The development literature encompasses two general opinions: (1) that foreign aid works under certain conditions, and (2) that foreign aid is ineffective under most circumstances. Before any consensus can be reached, however, more research must be conducted on the effects of different types of foreign aid in aid-recipient countries. We must better understand the sectoral effects of sector-targeted aid. Thus, we disaggregate aid flows to examine the effects of health-targeted aid and utilize a new comprehensive foreign aid database. We expect to see a positive relationship between health-targeted aid and improved health indicators in recipient countries. We hypothesize that health-targeted aid will decrease infant and child mortality and increase life expectancy.

Currently, most of the research on the effects of foreign aid has focused on the relationship between aggregate aid flows and various development indicators such as democracy, economic growth, GDP per capita, etc. However, in comparing aggregate foreign aid to such indicators the specific impacts of different types of aid are easily overlooked or lost. For example, many people believe that development aid to Africa over the past fifty years has been largely ineffective. Indeed, if one were to examine GDP per capita, economic growth, and democracy indicators in sub-Saharan Africa over the past several decades it might seem that all of the billions of dollars in aid money has been wasted. However, solely examining aggregate aid and general indicators of democracy and prosperity do not tell us the whole story. Even

Easterly admits that foreign aid has perhaps contributed to some improvements in Africa. As Easterly notes, "despite the zero-growth payoff to aid in Africa, there has been a fall in infant mortality and a rise in secondary enrollment in that most aid-intensive continent" (Easterly 2006, 177). Thus perhaps foreign aid in general or certain specific aid sectors actually have had a positive impact in sub-Saharan African countries. In this study we contribute to the current aid literature by attempting to capture the effects of aid in an individual aid sector. Specifically, we disaggregate total aid flows and instead look solely at aid flows in the health sector in relation to specific health indicators. We believe that a better understanding of the impact of aid in the health sector will be a valuable contribution to the ongoing debate on the effectiveness of foreign aid.

Additionally, we contribute to the current literature by utilizing a new database which contains the most comprehensive data to date on multilateral and bilateral foreign aid projects from 1970 to 2000. A joint project between Brigham Young University and the College of William and Mary, the Project-Level Aid (PLAID) database contains thousands of foreign aid loans and grants from multilateral donors, international financial institutions, OECD Development Assistance Committee (DAC) bilateral donors and non-DAC bilateral donors. For each loan or grant, the database includes the amount committed, donors and co-financing, project title, long description, and codes for health and environmental impact. The PLAID dataset is an improvement on the current OECD data on several fronts: PLAID contributes 10,868 more projects from multilateral donors than the OECD dataset, 46,230 more projects from international financial institutions, and 875 more projects from non-DAC bilateral donors. Furthermore, additional projects are continuously being added to the PLAID database.

An important feature of the PLAID database is that each project is classified by a sector-specific purpose code which allows us to isolate aid given to specific sectors. Thus, all multilateral projects – whether loans or grants – are included in the dataset and coded consistently with the CRS-coded bilateral projects in the OECD-DAC database. These purpose codes are employed by the Creditor Reporting Service (CRS) of the OECD to classify projects reported by members of the DAC in its monitoring of developing countries' debt. For the purpose of this paper we disaggregate total foreign aid by isolating projects with health-specific CRS codes. We hope that this new and improved dataset will enable us to get a more accurate picture of the effects of health-targeted aid on health indicators in aid recipient countries. Understanding the effectiveness of health aid will in turn contribute to the overall debate on the value of foreign aid.

The Debate on Foreign Aid and its Effectiveness

Despite the vast amounts of foreign aid research conducted during the past several decades, there still remains a lack of consensus among development scholars on whether it promotes growth. Aid optimists at development institutions like the World Bank justify further aid projects and programs in developing countries with findings that aid leads to growth in "good" policy environments (Burnside and Dollar, 2000; 2004). However, others are skeptical of these claims and have challenged the reliability of those results. Many critics argue that development aid is ineffective, and some even claim it undercuts economic and political development in recipient countries (Bräutigam and Knack, 2004; Knack, 2001). We contribute to this ongoing debate by addressing the gap in quantitative analysis of aid effectiveness in specific sectors (Sarah Bermeo, 2006). In this study we disaggregate total aid flows in order to compare health-targeted aid projects and recipient country health indicators. A better understanding of the results of health-

targeted aid will be a valuable tool in evaluating the effects of development assistance in general.

Many scholars argue that foreign aid is largely ineffective. Peter Boone claims aid does not decrease poverty. He argues that aid money allows increased government consumption, which is too often directed toward the wealthy elite rather than to programs that benefit the poor (Boone 1996, 322). Others agree that the fungibility of development aid allows recipient governments to divert those funds away from the donors' desired targets (Pack and Pack, 1993; Burnside and Dollar, 2000; Collier and Dollar, 2002). In addition, the frequent lack of coordination among donors may make aid less effective or even detrimental if projects overlap or conflict with each other (van de Walle, 1999; Buse and Gwin, 1998). Some scholars go so far as to argue that aid may even have negative returns; too much aid may make domestic governments dependent on outside assistance and weaken both their accountability and legitimacy (Bräutigam and Knack, 2004; Knack, 2001).

Perhaps the most influential critic of the foreign aid regime is William Easterly, who describes aid agencies as the "cartel of good intentions" (2002) and claims that the bulk of their efforts are ineffective. He argues that the lack of coordination between aid agencies leads to duplicative projects, and that agencies focus on highly visible initiatives and frameworks rather than those based on sound economic principles. Also, millions of dollars of aid have been squandered in countries where corrupt leaders or bad policies prevent the money from delivering the expected services. However, Easterly's criticism focuses on the current structures of and relationships among development organizations, not the premise that foreign aid can reduce poverty through economic growth. He cautions against unjustified optimism, but writes that some aid can be effective some of the time (2003).

Most aid advocates concede that its effects depend somewhat on the recipient countries'

international and domestic environments. Selectivity and conditionality, recent focuses in the development world, are based on Burnside and Dollar's findings that aid is only associated with growth in countries which have sound fiscal, monetary, and trade policies (2000, 2002). With these policies in place, increased government spending financed by foreign aid can stimulate growth and reduce poverty. Pumping money into countries with restrictive economic policies does not have beneficial effects because there is no way to translate increased funds into economic growth. Many other researchers have reached similar conclusions (Collier and Dollar, 2002; Guillaumont and Chauvet, 2001). They also acknowledge that direct donor oversight and coordination with recipient governments are necessary to ensure the money is spent on growth-promoting programs, rather than being funneled into pet projects that have little effect on poverty. Mosley and Suleiman (2007) argue that stable and predictable development assistance is necessary for governments to plan and use those funds efficiently.

Another group of researchers provides empirical evidence suggesting that weak policies and institutions do not dilute the effectiveness of aid, but that aid projects lift people out of poverty despite differences in government or economic policies. These scholars argue that factors in recipient countries such as per capita income, income equity, poverty rates, and good governance do not have significant effects on the results of foreign aid projects (Croghan, Beatty, and Ron, 2006; Asra et al., 2005; Dalgaard, Hansen, and Tarp, 2001, 2004). Others like White refute the fungibility and negative returns criticisms, claiming that donors use foreign aid as both an incentive for reform and as a reward for "strengthen[ing] institutions and policies so that services can be effectively delivered" (1998).

This debate is presently inconclusive because of the limited availability of data. Some studies appear to support the hypothesis that foreign aid causes growth under certain conditions

(Burnside and Dollar, 2000), but others offer evidence to the contrary by including more observations or re-specifying the model (Easterly, Levine, and Roodman, 2003). So far, most of these analyses have focused on the relationship between aggregate aid flows and general indicators such as democracy and economic growth. However, in comparing aggregate aid to such indicators the direct impacts of projects in specific sectors are easily overlooked or lost. If a country receives foreign assistance but experiences no economic growth, one might conclude that the aid was ineffective or even detrimental. However, it is misguided to judge all aid against economic growth (for example) when much of it is allocated towards specific goals or objectives that may not translate into economic growth in the short or medium-term (i.e. projects that promote education, health, environmental protection, etc.).

Clemens, Radelet, and Bhavnani's recent analysis of short-term aid represents one of the first attempts to quantitatively study the effects of a specific aid type (Clemens, Radelet, and Bhavnani 2004). In their study Clemens et al. isolate short-term aid (infrastructure, agriculture, industry, and other sectors which promote short-term growth) from humanitarian and long-term aid (which they posit has little or no effect on growth in the short-term). Interestingly, they find that short-term aid is positively correlated with short-term economic growth.

If foreign aid is effective, aid projects will correlate with their stated purposes. Therefore, evaluations of aggregate aid measured against economic performance may be missing the mark. Following the lead of Clemens et al., we argue that analyzing sector-specific outcomes provides a much better picture of whether aid projects achieve their intended purposes. In this study we disaggregate aid data to explore the relationship between health-targeted aid and health indicators in recipient countries. If this type of development assistance is effective, we would expect that mortality rates should be lower and life expectancies longer when a country receives

more health aid.

Until recently, this kind of research has been precluded by the lack of available data on health in developing countries and health-targeted foreign aid projects. Researchers such as Jackson and Mills (2007) have emphasized the need for "timely, reliable and complete information on financial resources" of countries' health systems to improve both coordination and effectiveness of aid projects. In addition, the lack of comprehensive data on the purpose and amount of aid projects limits research on development assistance because it is not clear where all the money is going and why. Without this knowledge, researchers cannot perform large-sample quantitative tests to determine whether aid projects are associated with improvements in the sectors they are directed toward.

There has, therefore, been little quantitative research done on the effects of health-targeted foreign aid. However, certain qualitative studies have offered some insight on the impact that health aid may have in developing countries. In their case studies of four developing countries, Croghan, Beatty, and Ron argue that health interventions, foreign aid, and technical assistance led to improvements in infant mortality rates, irrespective of factors such as economic development, good governance, and quality health care systems (Croghan, Beatty, and Ron 2006). In fact, Croghan et al. find that developing countries like Bangladesh and Ecuador achieved positive health outcomes *in spite* of poor governance, lack of health infrastructure, and low levels of economic development. Although confined only to case studies of four countries, Croghan et al.'s research presents encouraging results on the impact that health-targeted development assistance can have in developing countries.

Even William Easterly concedes that foreign aid most likely contributed to positive health outcomes such as the significant reduction in infant mortality rates in sub-Saharan Africa

during the past several decades (Easterly 2006). Despite his overall skepticism of the effectiveness of foreign aid in general, Easterly posits that perhaps "aid even works on average in some sectors, such as health, education, and water and sanitation" (Easterly 2006). The purpose of our study is precisely to answer this question. We hope that our quantitative analysis of health-targeted development assistance will contribute to the work of Croghan et al., Easterly, and other scholars in determining whether or not health-targeted aid is an effective means of promoting health in the developing world.

If Croghan et al. and other scholars are correct in their assessment of health-targeted aid, these findings should greatly inform the current debate on foreign aid allocation. Unfortunately, despite the recent focus on health issues in the development community, health-targeted aid seemingly remains a second priority. According to Landis MacKellar, HIV/AIDS and infectious disease are the only two sectors in which development assistance for health increased from 1993 to 2003 (MacKellar 2005). MacKellar shows that basic health care, health education, reproductive health, family planning, basic nutrition, and other health interventions actually decreased as a percentage share of total development assistance during this ten year period.

Jeremy Shiffman is also critical of foreign aid donors' health interventions and initiatives. Shiffman finds that donor funding for various communicable diseases does not closely correlate with the burden of each disease (Shiffman 2006). Shiffman contends that health assistance must be increased and that donors must provide a more "balanced allocation" of current resources for health interventions. We thus believe that a quantitative analysis of health-targeted foreign aid and its effects on health in developing countries is timely and relevant to the current debate. With the current emphasis on health in the UN Millennium Development Goals and the development community in general, understanding the effectiveness and impact of health aid is

of utmost importance.

Hypothesis and Data

When donors fund health-targeted aid projects, their goal is to improve health in recipient country populations, whether indirectly with budget assistance for government health ministries or directly through projects on the ground. Thus, if aid can be linked to improvements in the health of developing country populations, it can be considered effective. There are numerous pathways by which aid-funded projects can lead to increased health in recipient countries, of which we mention just a few. Building health infrastructure and training medical workers results in better quality and increased accessibility of medical care. By increasing the number of trained medical staff and providing more hospitals and clinics with better supplies, these projects allow for more people to receive better medical care, thus extending life expectancy and decreasing mortality rates. Additionally, immunizations and other preventative programs such as neonatal care, nutritional programs, and medicine distribution reduce susceptibility to disease, thereby resulting in a healthier population.

Health-targeted development aid should cause an improvement in health indicators in recipient countries because the projects it funds are beneficial to health. We hypothesize that health-targeted aid will have significant negative effects on mortality and positive effects on life expectancy. We analyze its results by modeling its effect on developing countries' infant mortality rates, under-five mortality rates, and life expectancy at birth.

In order to test our hypothesis that health-targeted foreign aid improves the health of recipient country populations, we created a panel dataset containing observations for all non-OECD countries every five years from 1975 to 2000. Because data on both economic and health indicators are unavailable for some countries and years, our dataset included all 164 countries for

which these indicators were reported during at least one of the five-year periods of our study. We obtained measurements of recipient country populations' health from the World Development Indicators published each year by the World Bank.[2] We used countries' infant mortality rate (IMR) to define their health status, but we also included their under-five mortality rate and life expectancy at birth for additional models to ensure robustness. These three health indicators are consistently utilized in both medical and social science research as valid measures of a population's overall health because they reflect many important factors such as quality of medical care, prevalence of disease, nutrition, and maternal health. None of the distributions of these variables were skewed enough to justify transforming them with natural logarithms.

We used data from PLAID to obtain the values of health-targeted aid, our independent variable. Our dataset included the value of all bilateral or multilateral loans or grants in the database given from 1970 to 1999 with CRS purpose codes in the health sector.[3] Because aid-funded health projects take time to implement and thus do not have immediate effects, we measured health indicators against the total health aid (converted to US 2000 dollars) each country received during the previous five-year period. For example, the total amount of health aid Albania received from 1990 to 1994 was compared with the observations of Albania's health indicators in 1995. We believe this more accurately represented the correlation between aid and health outcomes because measuring health outcomes a few years after aid was given allowed time for aid-funded projects to be implemented. Finally, we transformed the aid totals by taking their natural logarithms in order to obtain a more linear relationship for our models and to interpret aid's effects on health indicators in terms of percentages.

Our models included controls for the most important factors affecting public health in

[2] Available online at www.worldbank.org.
[3] See the appendix for a list and descriptions of the CRS purpose codes

order to more fully isolate the effects of health-targeted aid. The most important of these is per capita GDP, which we used as reported by the International Monetary Fund (IMF) in constant 2000 United States dollars, adjusted for purchasing power parity.[4] We transformed this variable by taking its natural logarithm to produce a more linear relationship between it and health indicators. GDP is an essential control because countries with higher living standards have better health indicators than poorer countries. In fact, GDP alone predicted over half of the variation in health among recipient countries. Wealthier countries should have overall better living conditions, more people should be able to afford healthcare, and the treatment they receive should be higher quality than in poorer countries. We also included population data from the IMF. At a given economic level, it should require more resources for states with high populations to improve health rates because they have to provide services to more people.

We also employed the Polity Index[5] as a control for democracy because we expect that more democratic countries are more accountable and have greater incentives to ensure their citizens receive basic health care. Polity scores reflect the presence or lack of democratic institutions in a given country, a score of -10 representing pure autocracy and 10 representing pure democracy. The Polity Index accounts for political competition, constraints on the executive, selection of the executive, and other variables that measure democratic and autocratic traits of each country's political system. Negative Polity scores represent countries which are more autocratic and positive scores indicate that a country is somewhat democratic, with larger scores indicating more democratic countries.

Similarly, we control for transparency as reported by the International Country Risk Guide (ICRG)[6] in an effort to account for fungibility. The ICRG value indicates the probability

[4] Available online at. http://www.imf.org/external/data.htm#data.
[5] Available online at www.cidcm.umd.edu/polity.
[6] Available online at www.prsgroup.com.

that government officials will take or demand bribes in exchange for special favors. ICRG scores range from 0 (highly corrupt) to 6 (highly transparent). We expect that governments with higher levels of transparency would be less likely to divert aid money for unintended purposes. Thus aid should be more effective in transparent countries than in corrupt ones where officials are more likely to divert received funds to themselves or pet government projects, rather than spending them for the purpose the donor intended.

Clean water and improved sanitation are significant influences on reducing the prevalence of disease, but these factors are not directly addressed by health-sector aid projects so they do not create endogeneity problems in the models. We included the percentages of countries' populations which had access to safe drinking water and improved sanitation facilities in our database to ensure our regression results were not driven by these factors. During the analysis, we only employed access to sanitation as a control because it was highly correlated with and had similar effects to the clean water variable.

While we used the clean water and sanitation access variables reported in the World Bank's Development Indicators, their coverage was quite sparse across countries. Those countries with missing data were most likely those with less access to safe water and sanitation; this skewed data could contribute to heteroskedasticity in our regressions. Also, the number of missing observations for these controls greatly reduced the sample size for models including sanitation.

Finally, we also included a dummy variable for Sub-Saharan Africa. This dummy accounted for the significantly lower health of countries in that category due to regional factors such as climate and disease prevalence.

We recognize that our research on health aid is subject to certain limitations. Perhaps most importantly, we are constrained by the lack of comprehensive data on foreign aid flows to developing countries. Although the PLAID dataset offers an improvement on multilateral and international financial institution aid data, it does not yet include all of the bilateral aid data that is contained in the OECD dataset. Furthermore, PLAID does not yet include foreign aid data from non-traditional, or "non-DAC" donor countries, with the exception of 875 projects from the People's Republic of China. Another limitation is that the PLAID dataset does not include private-sector aid from non-governmental organizations and other humanitarian groups. We therefore acknowledge that we are presently unable to account for all foreign aid flows to developing countries.

Additionally, we recognize that our data may be biased by the aid donors who report their foreign aid-giving activities. It is possible that some of the aid data is inaccurate or misrepresented by donor countries or multilateral donors in the project descriptions. Similarly, the PLAID dataset reports foreign aid commitments and not actual disbursements; thus we are unsure whether all of the reported aid is actually delivered. Another issue is the problem of fungibility—whether or not governments actually allocate aid for its intended purposes. By controlling for transparency (and thus corruption) we attempt to partially account for fungibility; however, we realize that aid may not always reach its intended objective. Thus, since we are uncertain as to how much aid is actually disbursed by donors and if it is allocated to its specified purpose by recipient governments, our analysis rests on the assumption that aid is reaching its intended targets.

Similarly, we are limited by the sparseness of health data in certain developing countries. Although we attempted to amalgamate the most comprehensive dataset of health indicators

(including mortality rates, under-five mortality rates, and life expectancy from a variety of sources), there were inevitably certain countries for which we could find only partial data or no data at all. Due to this lack of complete data on foreign aid and health indicators, our regression analysis offers only a partial representation of the reality on the ground in developing countries. Our predictions were more prone to error for cases with higher mortality rates and lower life expectancies. Thus we believe there may be additional variables we do not control for that affects health in the least healthy countries in our sample. We partially address this issue by employing a robust random-effects model.

Testing and Results

We analyzed the effect of health-targeted foreign aid on recipient countries' health indicators using robust GLS panel regressions, clustering by country to calculate heteroskedasticity-consistent standard errors. We employed random-effects methods because we believed that variables omitted in our regressions such as climate and disease prevalence varied both between countries and across time. This was justifiable because the coefficients thus generated did not differ substantially from those in fixed-effects models. By estimating the effects of health-targeted aid both on the three health indicators discussed above and the changes in those indicators over five-year periods, we generated descriptions not only of health aid's effects on recipient countries' general health, but also its influence on changes in mortality and life expectancy.

Table 1 shows the results of the regressions employing IMR as the dependent variable. In the models with the greatest predictive power, aid had a statistically significant negative effect on IMR, supporting our hypothesis that aid improves health. Controls for GDP, democracy, and Sub-Saharan Africa were also always significant, with GDP and Sub-Saharan Africa both

exhibiting the expected large negative and positive effects, respectively, on IMR. We dropped population from the model for parsimony because although it was usually significant, it did not contribute to the regression's predictive power.

Adding sanitation and transparency separately to the model decreased the substantive significance of aid's health effect. This may be because health aid has a smaller effect in countries with initially lower mortality rates, which are associated with higher transparency and better sanitation infrastructure. Without controlling for transparency or sanitation, a two percent increase in health aid was associated with over a four and one-half percent decrease in infant mortality. This was reduced to a one and one half percent decrease when either transparency or sanitation was part of the regression. Still, this effect is substantively significant for countries receiving low to moderate amounts of health aid.

We then incorporated an interaction between aid and transparency to create a more accurate model of aid's effects on health and account for a possible spurious relationship between aid and health. This interaction was significant and negative, demonstrating that aid still decreased infant mortality, but its substantive effect was much smaller than aid's alone. We would expect to see this because aid is less effective if government officials divert project funds and prevent them from reaching their intended targets.

Aid's effects on infant and child mortality may depend on the interaction between democracy, transparency, and sanitation, which may approximate a measure of good governance by incorporating political freedoms, governmental effectiveness, and provision of basic infrastructure. If this is true, our findings lend support to Bräutigam and Knack's (2004) claim that aid is more effective under "good" governments. Aid's significance in these models indicates that health-targeted aid projects may cause reduced infant mortality in recipient

countries.

Table 2 reports the results of the regressions predicting under-five mortality, on which health-targeted aid also has a significant negative effect in most cases. GDP and the Sub-Saharan African dummy had very large, statistically significant effects on child mortality, much higher than for infant mortality. Aid was significant controlling additionally for democracy and transparency, with a one percent increase leading to a one and a quarter percent decrease in child mortality. Similarly to the IMR model however, controlling for transparency considerably decreased the size of aid's health effect without removing its statistical significance. In a regression controlling for democracy but not transparency, a one percent increase in aid had led to a four percent decrease in child mortality. When an interaction term for democracy and transparency was included, the model was almost identical.

Just as in the IMR model, when we included the interaction between aid and transparency aid's effect was reduced but retained its statistical significance. It is possible that aid's smaller effect when interacted with transparency could be due to a spurious relationship between aid and health when corruption is unaccounted for. Both health aid allocations and the effectiveness of the aid received in decreasing mortality may depend upon the relationship between political systems, transparency, and government provision of basic services.[7] Our results suggest that countries with better overall governance – meaning free systems, high transparency, and high provision of infrastructure – both receive more aid than other countries and also use these outside funds more efficiently to improve their citizens' health.

We next examined the influence of health aid on life expectancy. Health projects should

[7] Burnside and Dollar 2004 and Bermeo 2006 both find that less-corrupt countries receive more aid, in keeping with development circles' emphasis on selectivity.

not necessarily have a significant independent effect on this measure after only five years, because life expectancy is an inherently sticky indicator which changes gradually over long periods of time. Also, we do not expect health aid to significantly increase the life expectancy of members of older generations who lived most of their lives prior to aid-funded improvements in public health. Because of this, we did not expect aid projects to affect life expectancy much in the short-term, but rather expect that its effects would work through the intervening variable of aid-induced changes in child mortality. In fact, lagged child mortality explains over seventy percent of the variation in life expectancy.

Thus unsurprisingly, Table 3 displays regression results that health aid had a smaller impact on life expectancy than on other health indicators and did not always meet the 0.05 threshold for statistical significance. However, it still had a significant positive, though small, effect on life expectancy in some cases. Controlling for GDP, the regional dummy, and democracy, aid increases by one percent were associated with one-quarter percent improvements in life expectancy. Alternatively, including sanitation and transparency in the model led to a 0.14 percent improvement for each one percent increase in aid. These results suggest that health-targeted aid can improve the health of older people in recipient countries as well as those who benefit from projects during their developing years.

As in each of the previously-discussed regressions, GDP and the sub-Saharan Africa dummy always demonstrated statistical and substantive significance. Together, they accounted for almost all of the model's predictive power. In addition to these controls, both sanitation and democracy had statistically significant influences on life expectancy in separate regressions. While the model including Polity indicates that people live longer in democracies, the substantive change in life expectancy as countries become more democratic is not strong

controlling for other variables. Democracy became insignificant when sanitation and transparency were included in the model.

In models for each of these indicators, other controls such as access to clean water, war, and population were significant in some circumstances and not in others. When population and war were statistically significant, they did not improve the model's predictions enough to justify their inclusion. Access to clean water proved significant but was left out of the models because of its overlapping effects with sanitation availability.

We also analyzed health-targeted aid's effect on the change in recipient countries' IMR and under-five mortality rates each five years. By examining the change in health indicators over a five year period, we effectively accounted for previous health situations and focused on the health improvements we expect to see as a result of aid. However, the coefficients for health aid in most of these models had the opposite sign of that which we expected. Our models of changes in health indicators were not nearly as accurate in their predictions as those describing the health indicators discussed above.

In most regressions on IMR differences, aid was significant but had a positive effect on IMR change along with GDP, democracy, and sanitation, indicating that these variables were associated with larger increases in child mortality. This is contrary to the expectation that these variables would be associated with negative changes in IMR because of their extremely strong positive impact on IMR in earlier models. Although transparency was dropped from the models because of its lack of statistical significance, it also appeared to affect changes in health in the opposite direction than in earlier models. War was significant and had the expected positive effect on infant mortality, but it was miniscule. Transparency was never significant, so we never included it in the models.

As shown in Table 4, including a five-year lag of IMR in the model doubled its predictive power. Not only was previous IMR a significant factor on health outcomes five years later, but its addition to the regression also changed the signs of GDP and democracy, indicating that they slowed the increase in infant mortality when previous health conditions were accounted for. Countries with higher previous IMRs experienced bigger IMR decreases (or smaller increases) than countries which had lower IMR before. On the other hand, aid's modeled effect remained significant and positive, even when controlling for war. The fact that the model of IMR differences produced contradictory results for aid highlights the difficulty of modeling differences. There may be some omitted variable which would change the sign of aid in the difference models.

Aid, GDP, and democracy similarly had significant effects and initially positive signs in regressions analyzing the change in under-five mortality. In models for which health aid was significant, its coefficient ranged from 0.08 to 0.79. Sanitation also appeared to cause larger increases in child mortality and when it was added to this basic model, the predictive power increased but aid became extremely insignificant. Transparency was insignificant, and so were all interactions between democracy, transparency, and sanitation. War was statistically significant but had a negligible effect.

A five-year lag of health indicators was also the largest influence on the model of under-five mortality (see Table 5). For every increase of previous under-five mortality by one, the change in this health indicator over the five-year period became more negative by 0.16. Controlling for lagged under-five mortality also made the signs of GDP and democracy become negative as expected. The significant effect of lagged under-five mortality both on the effects of other controls and on changes in health indicates that a country's prior health status may be the

largest influence on changes in health. Previous health rates even changed the effect of the sub-Saharan dummy, which became twice to three times as large as before. It appears that previously healthier countries experience less health progress than those with poor health, suggesting that health aid may be more effective in countries with greater room for improvement.

Conclusion

In conclusion, results for our statistical analysis of health aid were varied; aid appeared to improve overall health indicators in some cases but seemed to have the opposite influence on changes in health status over five-year periods. Although this is perhaps partially because countries with declining health received more health aid, aid's lack of significance in some statistical models does not allow us to confidently reject the null hypothesis that aid has no effect on the changes in recipient country populations' health status from 1970 to 1999.

A few similarities between models allow us to make some tentative conclusions concerning the effectiveness of health-targeted aid. First, aid's effect becomes smaller when interacted with a measure of transparency, indicating that the results of aid projects depend upon the recipient country's level of corruption. If more transparent countries not only receive more health aid but also use that aid more efficiently, there may be a spurious relationship between aid and recipient country health indicators.

Thus, our analysis provides evidence that health aid may improve health under certain conditions, but our results are mixed and at times contradictory. While it appears that health aid is correlated with better health, measuring its effects on short-term changes in health indicators casts doubt on its effectiveness. In models of health change over five-year periods, we found that aid was associated with positive trends in mortality and reductions of life expectancy. We hope to partially attribute this discouraging finding to the mechanics of aid allocation. It is possible

that donors give more health-targeted aid to the poorest countries in which public health is already declining. However, due to health aid's significance in improving health in our first three models, we believe this relationship warrants further study.

We recognize that as ours is among the first attempts to quantitatively study sector-specific foreign aid, there is much need for further research and additional testing. The inconclusive results of our quantitative analysis of health-targeted aid leave the question of its effectiveness largely unanswered. We hope to more fully specify our models in future analysis in order to determine if our findings are robust. As the PLAID dataset continues to expand, we hope to run additional tests which will account for an ever-increasing number of health-targeted aid projects. To omit any bias currently generated by dropping observations without data, we will impute missing data to increase our sample size. We propose to include aid projects in other sectors which may have a health impact such as water and sanitation in our analysis. We also suggest that future studies include regression tests on bilateral and multilateral health aid separately in order to capture any differences that donor preferences may have on project outcomes.

Finally, we also recognize that quantitative research by nature offers only a general, broad picture of the impact of health aid on a global scale. Thus the importance of qualitative research on health-targeted aid will continue to be of paramount importance. Following the lead of Croghan, Beatty, and Ron, we hope that further quantitative tests will be accompanied by empirical evidence from qualitative case studies. Ultimately, the only way to determine what is happening on the ground is to unglue our eyes from the computer screen and actually trace aid from its source to its intended target. Although quantitative research can help us find which pieces fit into the puzzle, qualitative studies will allow us to fit them together.

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Appendix 1. CRS Codes in the Health Sector

CRS Code	Title	Description
12110	Health policy and administrative management	Health sector policy, planning and programmes; aid to health ministries, public health administration; institution capacity building and advice; medical insurance programmes; unspecified health activities.
12181	Medical education/training	Medical education and training for tertiary level services.
12182	Medical research	General medical research (excluding basic health research)
12191	Medical services	Laboratories, specialised clinics and hospitals (including equipment and supplies); ambulances; dental services; mental health care; medical rehabilitation; control of non-infectious diseases; drug and substance abuse control [excluding narcotics traffic control (16063)].
12220	Basic health care	Basic and primary health care programmes; paramedical and nursing care programmes; supply of drugs, medicines and vaccines related to basic health care.
12230	Basic health infrastructure	District-level hospitals, clinics and dispensaries and related medical equipment; excluding specialised hospitals and clinics (12191).
12240	Basic nutrition	Direct feeding programmes (maternal feeding, breastfeeding and weaning foods, child feeding, school feeding); determination of micro-nutrient deficiencies; provision of vitamin A, iodine, iron etc.; monitoring of nutritional status; nutrition and food hygiene education; household food security.
12250	Infectious disease control	Immunisation; prevention and control of malaria, tuberculosis, diarrheal diseases, vector-borne diseases (e.g. river blindness and guinea worm), etc.
12261	Health education	Information, education and training of the population for improving health knowledge and practices; public health and awareness campaigns.
12281	Health personnel development	Training of health staff for basic health care services.

Table 1. Effects of Health-Targeted Aid on Infant Mortality Rate

Variable	Model 1	Model 2	Model 3	Model 4
Ln health aid	-2.30***	-0.74***	-0.79***	
	(0.23)	(0.27)	(0.26)	
Ln GDP	-18.24***	-8.25***	-17.80***	-9.34***
	(1.77)	(2.06)	(1.61)	(2.04)
Sub-Saharan Africa	32.59***	23.59***	40.28***	22.44***
	(5.16)	(5.615)	(6.16)	(6.75)
Democracy	-1.28***	-0.48***		-0.55***
	(0.13)	(0.15)		(0.17)
Sanitation		-0.71***		-0.71***
		(0.08)		(0.09)
Transparency			-1.51**	
			(0.67)	
Aid*Transparency				-0.13*
				(0.08)
Intercept	193.43***	155.11***	179.03***	160.87***
	(13.73)	(13.73)	(13.84)	(14.19)
R^2	0.64	0.73	0.72	0.75
N	599	304	367	240

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 2. Effects of Health-Targeted Aid on Under-Five Mortality

Variable	Model 1	Model 2	Model 3	Model 4
Ln health aid	-4.00***	-1.24***	-1.22***	
	(0.42)	(0.38)	(0.44)	
Ln GDP	-29.07***	-26.96***	-15.44***	-15.80***
	(3.03)	(2.82)	(3.50)	(3.47)
Sub-Saharan	68.22***	75.39***	53.91***	53.21***
Africa	(8.97)	(10.54)	(11.39)	(11.20)
Democracy	-1.95***	-1.41***	-0.92***	-0.96***
	(0.22)	(0.22)	(0.29)	(0.30)
Sanitation			-1.06***	-1.04***
			(0.15)	(0.15)
Transparency		-2.19**	-1.01	
		(1.12)	(1.31)	
Aid*Transparency				-0.26**
				(0.13)
Intercept	298.51***	268.04***	252.12***	247.32***
	(23.66)	(23.14)	(23.98)	(23.27)
R^2	0.66	0.74	0.77	0.77
N	595	341	238	238

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 3. Effects of Health-Targeted Aid on Life Expectancy

Variable	Model 1	Model 2	Model 3	Model 4
Ln health aid	0.25***	0.14**	0.14*	
	(0.08)	(0.07)	(0.09)	
Ln GDP	4.00***	2.29***	2.32***	2.43***
	(0.43)	(0.57)	(0.69)	(0.69)
Sub-Saharan Africa	-11.74***	-10.91***	-11.66***	-11.53***
	(1.31)	(1.54)	(1.75)	(1.75)
Democracy	0.13***			
	(0.03)			
Sanitation		0.12***	0.10***	0.11***
		(0.02)	(0.03)	(0.03)
Transparency			0.85***	
			(0.27)	
Aid*Transparency				0.10***
				(0.03)
Intercept	35.86***	41.68***	40.11***	40.45***
	(3.38)	(3.59)	(4.28)	(4.25)
R^2	0.75	0.79	0.82	0.82
N	519	344	247	247

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 4. Effects of Health-Targeted Aid on Changes in Infant Mortality

Variable	Model 1	Model 2	Model 3
Ln health aid	0.43***	0.25*	0.15*
	(0.10)	(0.15)	(0.08)
Ln GDP	1.52***	0.91	-1.69***
	(0.42)	(0.58)	(0.47)
Sub-Saharan Africa	3.68***	7.11***	7.51***
	(1.20)	(1.61)	(1.20)
Democracy	0.14***		-0.09**
	(0.05)		(0.04)
Sanitation		0.08***	
		(0.03)	
War	0.51**		
	(0.24)		
Lagged IMR			-0.15***
			(0.01)
Intercept	-22.03***	-20.65***	11.98***
	(3.28)	(4.15)	(3.99)
R^2	0.08	0.15	0.32
N	569	333	568

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 5. Effects of Health-Targeted Aid on Changes in Child Mortality

Variable	Model 1	Model 2	Model 3	Model 4
Ln health aid	0.79***	0.08***	0.01	0.24*
	(0.17)	(0.17)	(0.26)	(0.14)
Ln GDP	2.77***	2.95***	2.11**	-2.60***
	(0.70)	(0.70)	(1.06)	(0.77)
Sub-Saharan Africa	5.32***	5.39***	10.02***	14.64***
	(2.02)	(2.03)	(2.46)	(2.14)
Democracy	0.24***	0.24***	-0.21*	-0.14**
	(0.09)	(0.09)	(0.12)	(0.07)
War		0.88**		
		(0.39)		
Sanitation			0.11**	
			(0.05)	
Lagged under-five mortality				-0.16***
				(0.01)
Intercept	-37.68***	-39.50***	-32.24***	17.55***
	(5.41)	(5.44)	(6.66)	(6.46)
R^2	0.08	0.09	0.15	0.33
N	563	563	289	562

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level