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Corruption and averting AIDS deaths

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ABSTRACT

This paper looks at the impact of corruption on the effectiveness of antiretroviral drugs in preventing AIDS deaths and the potential channels that generate this relationship. This is based on a unique panel dataset of countries in sub-Saharan Africa, which combines information on all imported antiretroviral drugs (ARVs) from the World Health Organization's Global Price Reporting Mechanism, with measures of corruption, estimates of the HIV prevalence, and the number of AIDS deaths in each year and in each country. Countries with higher levels of corruption experience a significantly smaller drop in AIDS deaths as a result of the same quantity of ARVs imported. This is robust to different measures of corruption and to a measure of overall death rates as well as HIV-specific death rates as the outcome. A case-study analysis of the Kenyan experience illustrates one potential mechanism for the observed effect, demonstrating that disproportionately more clinics begin distributing ARVs in areas that are predominantly represented by the new leader's ethnic group.

1. Introduction

Today antiretroviral drugs are widely available in sub-Saharan Africa, with more than 12 million people receiving treatment in 2015 according to the World Health Organization. Until the last decade, this level of provision was considered inconceivable as the drugs were prohibitively expensive, and this enormous expansion in access has been credited with extending the lives of millions of people across the continent. At the same time, corruption in governments is associated with inefficient distribution of public goods, and this could limit the effectiveness of imported drugs in saving lives if the drugs do not reach the intended clinics or individual recipients, or if they are distributed with insufficient guidance.

This paper addresses the role of corruption in changing the effectiveness of antiretroviral drugs in reducing HIV mortality in sub-Saharan Africa. This is first done using a cross-country analysis comparing the impact of imported drugs on HIV deaths across countries with different levels of corruption. This is done using an original panel dataset of countries in sub-Saharan Africa from 2000–2007. This dataset combines standard measures of corruption used in economics and political science, information about HIV prevalence and deaths, and records of the quantities of antiretroviral drugs imported into each country. Using year and country fixed effects, this data provides evidence that HIV deaths are reduced less in corrupt countries given the same quantity of medicine, and the effect is even larger if the relevant quantity of drugs is measured in dollars spent.

There are many channels through which corruption – broadly defined – could influence the effectiveness of health investments. For example, drugs can be purchased and then diverted either outside the country or within the country. The supply chain can fail if governments with higher levels of corruption are generally less capable of delivering public goods. Additionally, corruption within a government can facilitate targeting of public goods based on political or other motivations, rather than need.

Scholars have used many different definitions of corruption, usually following the general idea of "the abuse of public office for private gain" (Bussel, 2015), but varying widely in what qualifies under this umbrella. This paper will use a broad definition, encompassing a wide range of interpretations of what is met by "private gain." Cross-country measure of corruption rely on perceptions of corruption, which are likely to be consistent with a broad definition. In addition, many studies on corruption in the health sector, use a similarly broad definition, specifically including behaviors such as absenteeism, diversion of supplies, shirking, and even not choosing the most cost-effective methods as forms of corruption (See for example: Azfar & Gurgur, 2008; Mackey & Liang, 2012; Vian, 2008). Definitions of corruption and the connection between cross-country measures of perceived corruption and ethnic targeting of goods is discussed in more detail in Section 2.

Diversion of drugs could happen if drugs purchased by governments are resold. Although studies of ARV diversion to illicit markets in developing countries are limited, researchers have

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documented its existence in the US (Tsuyuki, Surratt, Levi-Minzi, O'Grady, & Kurtz, 2015). Even in a context with a less uncertain supply, a back-up stock of ARVs is reported as a key motivation for purchasing ARVs in an informal market. This resale could be particularly lucrative in sub-Saharan Africa for at least two reasons. First, in nearly all countries of sub-Saharan Africa, supply is not nearly sufficient to meet demand and so treatment is rationed. For instance, in Kenya, the National AIDS Control Council estimated 367,985 adults needed ART while only 168,234 received it (NASCOP, NACC, 2007).[1] For the same year, UNAIDS estimated that 31% of those needing antiretrivoral drugs in low- and middle-income countries received them (HIV/AIDS, 2008). This makes resale valuable because some of those excluded are likely to be willing to pay for the treatment. Second, because of international agreements with pharmaceutical companies, ARVs are sold at an enormous discount to governments and NGOs working in many countries in sub-Saharan Africa. This variation in price between different countries creates a substantial opportunity for arbitrage. Vian (2008) discusses the substantial threat of supply chain leakages distributing valuable antiretroviral drugs in sub-Saharan Africa. Further, there is evidence in South Africa of ARVs being used recreationally (Grelotti et al., 2014), another way for the drugs to miss their intended targets.

Such supply chain leakages divert drugs from reaching those who need them most, and they may leave the country entirely. It should be noted that if these drugs are sold to others within the same country, then a change in allocation may not prevent them from reaching someone who needs them. However, if they are diverted to those who need them less – perhaps to those for whom the disease has not progressed as far and their risk of opportunistic infection is reduced or to those who have another source and want the security of accumulating a buffer stock – then this will prevent the drugs from having the same national impact on HIV-related mortality. Taking evidence from the education sector, Reinikka and Svensson (2004) measured how much of an education grant that was supposed to go to schools arrived at the intended beneficiaries, and found that, on average, 13% of the funds arrived successfully. In a study that similarly followed the money, Gauthier and Wane (2008) found only 18% of non-wage health expenditures made it to health facilities in Chad. While it can be difficult to directly measure some of the channels through which supplies are lost or not making it to the targeted beneficiaries, many of them – including shirking, illicit payments, and pilfering drugs – are still readily reported to researchers in qualitative studies (Ferrinho et al., 2004; Lindelow & Serneels, 2006).

Identifying the ideal beneficiaries is open to debate, but not targeting the sickest could dramatically change the immediate impact on mortality. Many researchers have argued that providing ARVs – particularly during drug trials – to those with the most advanced HIV infections "maximizes the number of deaths averted" (McGough, Reynolds, Quinn, & Zenilman, 2005). Recent debates challenge this claim as the likelihood of treatment success may be higher for those with earlier-stage infections, and providing treatment to those in or potentially in sero-discordant couples may additionally prevent future infections. While both of these factors may be important in the ethical consideration of who should receive a limited supply of a treatment, these arguments rely on averting deaths *in the future* rather than immediately. Thus targeting anyone other than the sickest patients would reduce immediate impacts of ARVs on mortality, although this may not be a persistent effect.

Using ethnicity as a factor in determining allocation undermines any other rules designed to reach the most in need. Variation in responses to drugs due to the pre-treatment health of the recipient demonstrates that the benefits will not be realized equally by any person with HIV. Thus a re-allocation to a different person does not only change whose death is averted but whether a death is averted. The link between ethnic targeting and corruption and whether such favoritism should be considered a form of corruption is discussed in detail in Section 2.

Besides the potential prevention of immediate deaths averted, allocating treatment based on ethnicity would strike many as unfair. McGough et al. (2005) write about ARV allocation: "It is also important to operate within a human rights framework to prevent the systematic discrimination in access to treatment according to such factors as sex, ethnicity, and sexual orientation."

Studying the impacts of corruption in the context of ARV provision is particularly appropriate for a few different reasons. First, many important outcomes may be only indirectly linked to welfare, whereas the relevant outcome in this study of deaths averted is clearly of direct importance. Second, during this time period there was virtually no domestic production of Antiretroviral Drugs and there is no substitute for these treatments. The next best alternative (good nutrition and treatment and prevention of opportunistic infections through antibiotics) does not have nearly the impact on morbidity and mortality that these drugs do. Therefore, while other studies that look at corruption and public goods provision will be unable to measure the entire supply of those goods, this is possible in this case.

Corruption in government could also limit the effectiveness of local supply chains in a number of ways. If promotion within the public sector is not based on performance, there is less incentive for employees to manage transport or work hard at health facilities. Thus the drugs may remain in the country, but sit unused. Callen, Gulzar, Hasanain, and Khan (2016) demonstrate this channel by showing lower effort among health-service providers in Afghanistan when the providers are politically connected, particularly in uncompetitive areas. Similarly, if health facilities are plagued by high absenteeism, drugs may either sit idly or be prescribed with insufficient guidance so that clients are less likely to adhere. Because of its quick rate of mutation, HIV is particularly susceptible to the development of drug resistance resulting from low adherence to the prescribed regimen.[2]

An additional channel through which corruption could influence the impact of imported drugs is through changing allocations within a country. Guaranteeing treatment to those who have low CD4 cell counts and therefore have the most compromised immune system is the most efficient way to immediately avert deaths using ARVs. However, there is also a benefit to an individual of treatment before the CD4 count is extremely low, and the World Health Organization recently increased the recommended CD4 count threshold of eligibility from 200 to 350. With the higher threshold, demand for the drugs increases and without sufficient supply, other systems of allocation besides targeting those with the lowest CD4 count arise. One notable alternative system of allocation of any health expenditure is political favoritism, including, for example, targeting core supporters or co-ethnics.

Using data from Kenya about ARV provision before and after an election, I test for politically motivated targeting of new ARV clinics in one country with a high estimated corruption (186th out of 210 in 2009 according to Kaufmann, Kraay, & Mastruzzi (2011)) and high HIV prevalence. This is done using an original dataset containing all health facilities in Kenya that provide antiretroviral drugs, along with the year in which they began distribution and their GPS locations. This information is linked with ethnicity records

[1] The same report estimated that 1.38 million adults were living with HIV. Only those with low CD4 counts were included in the estimate of need.

[2] It should be noted that adherence to HIV treatment regimens is generally measured to be quite high in developing countries (Mills et al., 2006).

to look for evidence of targeting of the placement of ARV clinics in the home area of a newly elected political leader. I find that the government opened a disproportionate number of clinics in areas of the leader's ethnic group. This suggests one mechanism through which corruption reduces the impact of health inputs. Namely, in a country with high corruption, the assignment of ARV clinics follows a political criterion rather than a public health criterion. Further, this pattern of allocation appears to reflect additional clinics added to areas that were already served rather than expanding access to districts that were underserved previously. This is demonstrated with the inclusion of controls for local and regional HIV prevalence and placebo checks to rule out alternative explanations.

This paper is organized as follows. Section 2 discusses the relevant literature and outlines this paper's contributions. Section 3 describes the data to be used for the main specification and for the analysis of the case study of Kenya. Section 4 presents the empirical strategy and the results of the cross-country analysis and Section 5 discusses the methodology and results of the case study. Section 6 concludes.

2. Literature review

Corruption and patronage have long been noticed as an important barrier to effective government provision of services (see for example Bardhan, 1997, 1995). Specifically focusing on health, this link between corruption and inefficient provision of services has been used to explain weak observed associations between health spending and health outcomes (Filmer, Hammer, & Pritchett, 2000; Gupta et al., 2012; Maureen, 2006; Rajkumar & Swaroop, 2008). One detractor from these findings argues corrupt governments relying on aid flows may have an increased incentive to effectively distribute goods in aid sectors (Dietrich, 2011). The global interest in HIV and the high fraction of funding for ARVs paid by donors suggest that ARVs are clearly in an aid sector. In a cross-country panel, he finds that corruption is associated with an increase the effectiveness of public health aid in improving health outcomes. This divergence of findings demonstrates that it may not be clear whether corruption would increase or decrease the benefits garnered from antiretroviral drug provision.

Cross-country corruption studies typically rely on measures of overall corruption rather than corruption in the health sector specifically. This is in part because measures of overall corruption have a wider coverage, while data on variation in corruption across sectors is only available for selected countries, for example through Public Expenditure Tracking Surveys (PETS) (Reinikka & Svensson, 2006). In the cases where corruption is measured separately in different sectors, we see that they are often highly correlated, suggesting that the overall measures of corruption may reasonably proxy for that in a single sector. One study in the Philippines found high correlations across municipalities in the measures of reported and perceived corruption in different sectors, including health services (Azfar & Gurgur, 2008). Across countries, teacher and health-worker absenteeism (a plausible proxy for broadly defined corruption) is highly correlated (Chaudhury, Hammer, Kremer, Muralidharan, & Rogers, 2006).

Another strand of literature addresses the potential mechanisms that bring about the link between corruption and poor outcomes.

Absenteeism and mismanagement are commonly addressed channels through which government corruption can lead to poor health outcomes (Maureen, 2006; Vian, 2008). In a system in which government employment and promotions depend on political patronage or bribes, both the selection and the incentives of public sector workers are limited. Callen et al. (2016) find evidence that government oversight in competitive constituencies decreases absenteeism rates among health-care providers, but the rates are high among those in uncompetitive areas or with ties to politicians. A large literature discusses the threats to health outcomes from health worker absence including Banerjee and Duflo (2006), Chaudhury et al. (2006), and Banerjee, Duflo, and Glennerster (2008). Specific to antiretroviral drugs, other work has shown the impacts of health-worker absence on long-run impacts of HIV positive individuals, including through transmission from mothers to children and HIV testing (Goldstein, Zivin, Habyarimana, Pop-Eleches, & Thirumurthy, 2013).

Health-worker absence will threaten outcomes if the drugs reach the health facilities where they are to be distributed, but another threat comes from breakdowns in the supply chain. Kangwana et al. (2009) find that malaria medicine is regularly out of stock in health facilities in Kenya because of procurement delays, and Schouten et al. (2011) identify weaknesses in the supply chain of ARVs in Malawi, and Bateman (2013) argues that ARV stockouts in South Africa are due to supply chain leakage. These could reflect breakdowns in the distribution or centrally.

Interruptions of treatment for HIV from stock-outs or health-worker absence can be extremely costly for the individual and the general population because of the high risk of development of drug-resistance. While this is a threat with the treatment of many infections, HIV is particularly susceptible for a few reasons. First, the virus mutates especially quickly and second, the condition is chronic, so people live for a long time with treatment, presenting a long period of time for the virus to develop drug resistance in each individual. As a result, a lack of consistent adherence to ARVs allows the virus within an individual to develop immunity to the drugs. When treatment is restarted, it is likely to be less effective at preventing opportunistic infections and keeping the individual alive. If this individual is sexually active, this resistance can be transmitted to others, yielding negative spillovers. In addition, the development of drug-resistance is particularly devastating for individuals in much of sub-Saharan Africa where a large range of drug cocktails may not be available so the length of time until drug resistance develops often determines the duration of survival.[3] Both factors will reduce the effectiveness of future ARVs, because the lack of consistent supply allows the virus to develop drug resistance.

An additional channel that exaggerates the role of corruption is the discouragement of public expenditures that comes from a higher effective price of reaching beneficiaries. Besides reducing the impact of government programs, corruption may also increase the cost of provision of goods and services and discourage investment in provision or redistribution (Claudio, Frederico, & Moreira, 2012; Gupta, Davoodi, & Tiongson, 2000; Olken & Pande, 2012; Olken, 2006; Lant, 1996). If this is the case, then we would expect that government expenditure decisions would depend on the level of corruption, and indeed Mauro (1998) finds that corrupt politicians induce lower expenditures on education using cross-country variation. On the other hand, there is an alternative strain of literature that argues that corruption may be a more efficient form of taxation that helps an economy overcome initial frictions and grow (see for example Leff, 1964 and Huntington & Fukuyama, 2006).

[3] ARV treatment becomes ineffective for an individual once the HIV in their system develops resistance to the treatment they are given. Once this happens, a person is given a different treatment, referred to as the second line. In developed countries, this process can repeat many times with those who live with HIV for many years progressing to third, fourth, etc. line treatments. For more information about ARV resistance see Gupta et al. (2012).

2.1. Clientelism and political patronage

This paper links ethnic targeting at the subnational level with national measures of perceived corruption. As there are important differences between the two, this connection merits a more detailed discussion. It is clear that the ideal type version of corruption – in which a political official provides a service in exchange for money – is quite different from ethnic targeting of public goods. Many definitions of corruption focus on the former – sometimes referred to as market corruption – but at least some definitions include both, and other theories suggest an important relationship between the two.

Corruption is frequently defined as "the abuse of public office for private gain" (Bussel, 2015). Private gain can be interpreted to include the political power or social status associated with the ability to personally allocate goods, which would suggest that ethnic favoritism would be included. However, some further refinements of the definition focus on financial or material private gain, thereby excluding ethnic favoritism from the category of corrupt behavior (for example Banerjee, Mullainathan, & Hanna, 2013; Olken & Pande, 2012; Reinikka & Svensson, 2004). Yet broader definitions frequently do include it (for example, Vian (2008)). Even when arguing that clientelism is a type of corruption, some researchers explicitly acknowledge that it does not fall under all definitions. For example, Hodler and Raschky (2014) begin a paper on regional targeting of benefits by political leaders in sub-Saharan Africa with "Some political leaders choose policies that mainly benefit their preferred regions. We call this phenomenon regional favoritism and see it as a form of rent seeking and possibly corruption."

Allowing this broader definition of corruption that can include ethnic favoritism should not be seen as undermining the valuable literature disentangling types of corruption (for example Bussel, 2015). Instead, the connection is made between clientelism and corruption in order to gain some traction in reaching a deeper understanding through subnational analysis of the same product – antiretroviral drugs. Earlier work on corruption sometimes distinguished between market corruption – involving monetary payments – and parochial corruption – in which provider and beneficiary shared some network, for example ethnicity (Scott, 1969). In this typology, the distinction between types is still acknowledged, but both types of provision of public goods not based on need fall under the general definition of corruption.

With relevance for this paper, a broader umbrella definition of corruption may be more likely to be picked up by a measure based on perceptions, as are the most frequently used cross-country measures, including those in this paper. The primary corruption measure in this paper is defined by its authors as "capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests." The measure is based on aggregating reports from 31 sources, including perceptions of corruption from NGOs, households, researchers, and journalists. With this methodology, it seems likely that this measure includes some reports of corruption based on a broad definition including ethnic or other favoritism in public goods provision.

A secondary relationship between corruption and ethnic favoritism suggests that ethnic politics may lead to more corrupt politicians being in power. If voters choose politicians based on ethnicity – and their continued provision of goods to co-ethnics – then politician quality can be reduced (Banerjee & Pande, 2007).

There is growing evidence of political patronage in the form of public goods targeted to co-ethnics of leaders. Some of these studies use data from a large number of countries, including Franck and Rainer (2012) who estimate impacts of co-ethnicity with African leaders on primary-school education and infant mortality, and Hodler and Raschky (2014) using satellite images to measure electrification in countries receiving foreign aid. Many of these studies have focused linking outcomes in Kenya with the ethnicity of presidents and ministers. Burgess, Jedwab, Miguel, Morjaria, and Padró i Miquel (2015) find impacts on infrastructure development, although they find that the introduction of multiparty democracy limited the cross-ethnic differences. Other studies find different impacts on a range of outcomes (Briggs, 2014; Jablonski, 2014; Kramon & Posner, 2013; Kramon & Posner, 2016; Weinreb, 2001). Other studies find such links in different contexts (Besley, Pande, & Rao, 2012; Besley, Pande, Rahman, & Rao, 2004; Bhalotra, Clots-Figueras, Cassan, & Iyer, 2014; Dreher et al., 2016; Dionne & Horowitz, 2016; Do, Nguyen, & Tran, 2017). Using similar methodologies to the previously mentioned studies, Kudamatsu (2009) does not find evidence of co-ethnicity with the leader in Guinea reducing infant mortality and Luca and Rodríguez-Pose (2015) finds no evidence of political targeting of public resources in Turkey.[4] Most of these studies estimate the impacts of co-ethnicities on individual outcomes using large surveys of individuals, although Burgess et al. (2015) measures differences in construction of roads directly. The second empirical analysis in this paper will follow Burgess et al. (2015) and estimate political targeting of health services directly with evidence of placement of new antiretroviral clinics. This type of political targeting could help to explain the link between corruption and inefficient provision of medicine, because targeting based on ethnicity and politics implies not targeting primarily based on need. This will be discussed further below.

One threat to the claim that ethnic-targeting is linked to poor outcomes is the idea that politically motivated allocation of contracts and services may simply shift resources from the small number who got the service-provision contract to the small number who didn't. Yet there is extensive evidence from other contexts that such allocation leads to worse service provision. Lehne, Shapiro, and Eynde (2018) show tangible consequences – lower quality and higher costs – when road contracts are allocated according to political favoritism.

This can happen for a number of reasons. First, those allocated contracts for political reasons may not be as good at providing the service if quality of service is not the criteria for getting the contract. Second, the services can be sent to where there is less need. In the case of ARV-clinic opening, the contract is sent to a location, not just to a provider, and the need may be greater elsewhere. Third, when the quality of service provision is a key criteria for continued allocation of a service contract, the central government can incentivize high quality services by offering continued contracts. When this is not a key criteria, the tools to incentivize better services are limited.

3. Data

3.1. Cross-country impacts of corruption and ARVs

The data in this paper come from many sources. For the first section of the paper, all data are collapsed to a single observation per year in each country in sub-Saharan Africa. The sample is restricted to one region of the world in order to avoid some – but not all – of the standard concerns with cross-country analysis, and to focus on the region that is the hardest hit by the HIV epidemic. The first datasource is used to measure the quantity of drugs entering each country. This information comes from the WHO Global Price Reporting Mechanism (GPRM). This is an online database of all international purchases of drugs associated with HIV/AIDS, malaria, and tuberculosis going into developing and middle income countries. For each purchase, the database reports

[4] A broader summary of this literature on distributive politics is provided in Golden and Min (2013).

the date of purchase, the country and company of manufacture, the country of the purchaser, and the price and quantity of each type of drug. The WHO GPRM contains records for approximately 30,000 purchases of antiretroviral drugs.[5] The records include purchases on the parts of governments, NGOs, and researchers.[6]

The analysis uses two measures of the quantity of drugs entering each country in each year. The first measure uses standard doses to calculate the quantity of drugs in terms of person-years. Because some drugs are used in combination with others, this measure is imperfect and may be higher in countries that use fewer combination pills. The second measure is the quantity of money spent on all imported ARVs. This is simply the sum of the costs of all purchases.

Some researchers have pointed out that one concern with many studies linking health expenditures to outcomes is an insufficient appreciation for displacement of private spending as a result of public investment (Filmer et al., 2000; Mauro, 1995; Lant, 1996). One driver of this issue is that in many cases, researchers have access to information about what is provided through the public sector, but it is difficult to obtain a complete record of private provision of goods. This is a strength of this paper, because the measure of the quantity of antiretroviral drugs comes from information about international imports and should therefore represent the entire flow of antiretroviral drugs into each country to be distributed both through the public and private sectors.

HIV statistics come from the UNAIDS/WHO 2013 Report on the Global AIDS Epidemic, which for each country in each year reports an estimate of the prevalence, the number of people living with HIV, and the number of AIDS deaths. There is no better source of information about HIV prevalence in all countries. Overall death rates come from the World Bank's World Development Indicators database.

Governance indicators for Control of Corruption, Government Efficacy, and Rule of Law are taken from Kaufmann et al. (2011).[7] In each year, each country is given a score for each of these indexes. In order to not rely on small differences, the analysis uses binary measures of each of these representing an indicator for a score above the median in sub-Saharan Africa.

Table 8 lists which countries are above and below the median level of corruption in sub-Saharan Africa. Table 1 presents summary statistics describing these countries, split by corruption level. As seen in Table 1, more corrupt countries have lower HIV prevalence rates. They also spend more on ARVs, but for a lower quantity. Tables 2 and 3 show the breakdown of types of antiretroviral drugs purchased by more and less corrupt countries. This is measured as the percentage of all drugs purchased in each category these quantities by the specific type of drug.

3.2. Case study

The second section of the analysis uses more detailed data on ARV distribution, combined with population data from MeasureDHS. Information on the timing of initiation of ARV distribution in clinics is from Kenyapharma, a procurement agency, and the National AIDS and STI Control Program of the Ministry of Health. These reports were provided directly to the author in the Fall of 2011. The location of each clinic comes from the Kenya Open Data Initiative.[8] The information about ethnic backgrounds of populations

Table 1
Summary statistics, by corruption level.

Variable	Less corrupt	More corrupt
HIV prevalence	7.36	4.02
	(8.46)	(3.57)
Number of People Living With HIV/AIDS	577290	477380
	(1142260)	(761000)
AIDS Deaths	39770	36180
	(74500)	(56200)
Death Rate(per 1,000)	11.62	14.03
	(3.4)	(2.81)
ARVs (person years)	26090	19910
	(49460)	(55810)
Spending on ARVs (USD1000s)	5980	5280
	(10010)	(12340)
GDP per capita	1720	1660
	(2540)	(3480)

Notes: Countries are assigned to the more and less corrupt categories based on whether the average Kaufmann et al. (2011) corruption score in that country is above or below the median in the sample.

Table 2
Drugs purchased by country, by dose.

Variable	Less corrupt	More corrupt
Abacavir (ABC)	1.66	1.04
Combination	21.41	23.11
Didanosine (ddI)	2.16	1.37
Efavirenz (EFV)	18.95	20.49
Indinavir (IDV)	0.63	0.31
Lamivudine (3TC)	13.78	14.92
Nelfinavir (NFV)	0.32	0.35
Nevirapine (NVP)	22.78	21.29
Ritonavir (RTV)	0.45	0.28
Saquinavir (SQV)	0.08	0.02
Stavudine (d4T)	9.45	13.06
Tenofovir (TDF)	0	0
Zidovudine (ZDV)	8.33	3.77

Notes: Countries are assigned to the more and less corrupt categories based on whether the average Kaufmann et al. (2011) corruption score in that country is above or below the median in the sample. The quantities listed are as a fraction of total doses of ARVs entering countries in each category (more and less corrupt).

Table 3
Drugs purchased by country, by money spent.

Variable	Less corrupt	More corrupt
Abacavir (ABC)	2.69	1.96
Combination	60.7	54.24
Didanosine (ddI)	1.93	1.31
Efavirenz (EFV)	14.91	21.06
Indinavir (IDV)	1.23	.61
Lamivudine (3TC)	3.01	4.17
Nelfinavir (NFV)	1.28	1.64
Nevirapine (NVP)	5.79	8.59
Ritonavir (RTV)	0.16	0.17
Saquinavir (SQV)	0.44	0.11
Stavudine (d4T)	1.39	2.06
Tenofovir (TDF)	2.41	1.48
Zidovudine (ZDV)	4.08	2.59

Notes: Countries are assigned to the more and less corrupt categories based on whether the average Kaufmann et al. (2011) corruption score in that country is above or below the median in the sample. The quantities listed are as a fraction of total spending on ARVs entering countries in each category (more and less corrupt).

[5] Antiretroviral drugs in this database may also be used for Prevention of Mother to Child Transmission, and as HIV positive babies typically are overcome by the disease quickly, this should also show up in preventing future deaths.

[6] Agreements between drug companies and developing countries set maximum prices that are low if drugs are purchased by governments or NGOs, but the prices are higher for the private sector. Partly because of this, the private sector does not import large quantities of ARVs in these countries, but it minimally participates in distribution of drugs once they are in the country.

[7] There are many other options of corruption measures, and this measure was chosen because it is both widely used and covers a large number of African countries, which is not the case of many of the more recent measures of actual (rather than perceived) corruption. Other studies have found that the different measures are quite highly correlated, and that the choice of measures rarely changes the outcomes of a study (Olken, 2009; Svensson, 2005).

[8] (opendata.go.ke).

Table 4
Impact of corruption on effectiveness of ARVs (Continuous corruption and GDP).

Variables	(1) deaths	(2) deaths	(3) deaths	(4) deaths
ARVs (person years)	−0.152**	−0.224**		
	(0.0591)	(0.111)		
ARVs∗Corruption	0.125**	0.182**		
	(0.0548)	(0.0858)		
ARVs∗GDP		3.47e−05		
		(2.77e−05)		
Spending on ARVs (1000s)			−0.827***	−1.141***
			(0.246)	(0.304)
Spending∗Corruption			0.675**	0.902***
			(0.284)	(0.292)
Spending∗GDP				0.000169
				(0.000102)
HIV prevalence (t − 1)	7,727***	8,552***	7,628***	8,406***
	(1267)	(1405)	(1358)	(1747)
PLWH (t − 1)	0.0503***	0.0346**	0.0485***	0.0356***
	(0.0161)	(0.0138)	(0.0120)	(0.0119)
Observations	196	196	196	196
R-squared	0.683	0.703	0.707	0.726
Number of countries	45	45	45	45

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. In all estimates, the dependent variable is the number of AIDS deaths in a given year, as reported by WHO. All estimates include controls for HIV prevalence and the number of people living with HIV in the previous year, as well as country and year fixed effects. Standard errors (reported in parentheses) are clustered at the country level. *Corruption* is the continuous corruption score reported in Kaufmann et al. (2011), averaged over time from 2004 through 2008. GDP per capita is also continuous, averaged over time. Columns 1 and 2 report estimations in which quantity is defined as the number of doses sufficient for one individual for one year. In columns 3 and 4, this is replaced by spending (in USD1000s) on ARVs.

comes from the 2008/2009 Measure DHS data, in which respondents are asked to report their own ethnicity. In order to combine the datasets, the unit of observation in this analysis is the division, a small geographic unit in Kenya.

4. Empirical strategy and results

4.1. Cross-country impacts of corruption and ARVs

This paper will follow previous analysis of cross-country panel-data, including country and year fixed effects and estimating the coefficient on the interaction of corruption and quantities of imported drugs. To investigate the role of corruption in changing this effect, I focus on the interaction between the quantity of ARVs and the level of corruption. To do this, I estimate the following equation:

$$deaths_{jt} = \alpha_t + \gamma_j + \beta_1 * ARVs_{jt} + \beta_2 * corruption_j + \beta_3 * ARVs_{jt} * corruption_j + \Sigma b_i * X_{ij} + e_j$$

where $deaths_{jt}$ is the number of AIDS deaths in year t in country j as reported by the WHO, and $ARVs_{jt}$ is the person-years purchased by country j in year t, according to the WHO GPRM. In the first set of specifications (columns 1 and 2), ARVs are measured in doses (person-years), and in the second set of estimates (columns 3 and 4), ARVs are reported in dollars spent. $Corruption_j$ is the normalized Kaufmann et al. (2011) Control of Corruption Index, averaged over the period from 2004–2008. To ease interpretation, the quantity of ARVs are demeaned so that the mean is zero. This way the coefficients on the un-interacted terms are meaningful and can be interpreted as the impact at the mean. Controls are included for the prevalence of HIV ($prev_{jt}$) and the number of people living with HIV ($PLWH_{jt}$) as well as country and year fixed effects (α_j and γ_t).

If corruption does limit the reduction in deaths generated by purchased drugs, then β_3 should be positive (reflecting a dampened reduction in deaths). The estimated parameters from this equation are reported in columns 1 and 3 of Table 4. In this table, the coefficients on quantities of ARVs are large and negative and significant, showing that in less corrupt countries, ARVs reduce more AIDS deaths. The coefficient on the interaction term in column 1 is positive and significant, reflecting a reduced impact of ARVs in corrupt countries. In column 3, using spending as the measure of quantity, the interaction term is positive and significant, and large enough to nearly wipe out the impact of ARVs on deaths averted. This suggests that corruption mitigates the impact of imported ARVs.

This analysis relies on – the most reliable available, but still – imperfect measures of HIV death rates, corruption, and drug quantities. In order to test the robustness of these findings, the following tables incorporate alternative measures of all of these.

Table 5 replaces the Kaufmann et al. (2011) corruption score with the Political Risk Services International Country Risk Group's corruption score.[9] Table 6 repeats the same estimation but with overall death rates (not only due to HIV) as the outcome variable. According to WHO, HIV/AIDS is the primary cause of 11.7% of all deaths in sub-Saharan Africa in 2012. Because HIV makes other diseases more likely and all deaths in this dataset are attributed to a single cause, this number is likely an underestimate of the total number of deaths attributable to HIV. This follows Bendavid, Holmes, Bhattacharya, and Miller (2012), who finds that all-cause mortality declined more in PEPFAR focus countries between 2004 and 2008. Therefore, we would expect the impacts on overall deaths to represent a smaller fraction of the total deaths, but still a substantial number. These estimates are consistent with the earlier findings. This demonstrates that the relationship is not only through estimates from HIV-related organizations.

Table 7 begins to examine whether corruption is simply picking up government efficiency. In three sets of estimates – with and without GDP controls – this presents estimates that additionally include Kaufmann et al. (2011) estimates of government effectiveness in the same ways as corruption. These variables appear to matter in the same way (higher government effectiveness yields higher

[9] Downloaded 2013–12-11 from info.worldbank.org/governance/wgi/pdf/PRS.xlsx?.

Table 5
Impact of corruption on effectiveness of ARVs (PRS – binary measure of corruption).

Variables	(1) deaths	(2) deaths	(3) deaths	(4) deaths
Spending on ARVs (1000s)	−0.482***	−0.562***	−0.412***	−0.423**
	(0.116)	(0.189)	(0.105)	(0.165)
Spending∗Corrupt	0.374*	0.349*		
	(0.206)	(0.176)		
Spending∗Corrupt(PRS)			0.361	0.352*
			(0.220)	(0.186)
Spending∗High GDP		0.130		0.0215
		(0.170)		(0.161)
HIV prevalence (t − 1)	7790***	7732***	10,009***	9980***
	(1381)	(1354)	(1210)	(1209)
PLWH (t − 1)	0.0365***	0.0352**	0.0287**	0.0286**
	(0.0132)	(0.0137)	(0.0133)	(0.0135)
Observations	196	196	136	136
R-squared	0.682	0.687	0.701	0.701
Number of countries	45	45	31	31

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. In all estimates, the dependent variable is the number of AIDS deaths in a given year, as reported by WHO. All estimates include controls for HIV prevalence and the number of people living with HIV in the previous year, as well as country and year fixed effects. Standard errors (reported in parentheses) are clustered at the country level. *Corrupt* is a binary variable equal to one if a country has a PRS control of corruption score below the median within the sub-Saharan African sample. This is fixed over time from 2004 through 2008. *High GDP* is also represented by a binary measure, fixed over time, reflecting a country's position above or below the median in GDP per capita. Columns 1 and 2 report estimations in which quantity is defined as the number of doses sufficient for one individual for one year. In columns 3 and 4, this is replaced by spending (in USD1000s) on ARVs.

Table 6
Impact of corruption on effectiveness of ARVs on overall death rates (PRS – binary measure of corruption).

Variables	(1) deathrate	(2) deathrate	(3) deathrate	(4) deathrate
Spending on ARVs (1000s)	−0.00249***	−0.00289***	−0.00203***	−0.00207***
	(0.000589)	(0.000717)	(0.000596)	(0.000403)
Spending∗Corrupt	0.00153**	0.00140*		
	(0.000644)	(0.000794)		
Spending∗Corrupt(PRS)			0.00127**	0.00123
			(0.000616)	(0.000926)
Spending∗High GDP		0.000650		9.15e−05
		(0.000698)		(0.000857)
HIV prevalence (t − 1)	24.31***	24.02***	30.33***	30.21***
	(7.963)	(7.814)	(8.463)	(8.734)
PLWH (t − 1)	0.000158*	0.000152*	0.000134	0.000133
	(8.45e−05)	(8.47e−05)	(9.02e−05)	(9.02e−05)
Observations	198	198	137	137
R-squared	0.850	0.852	0.890	0.890
Number of countries	45	45	31	31

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. In all estimates, the dependent variable is the crude death rate (per 100,000) due to all causes in a given year, as reported in the World Bank's World Development Indicators database. All estimates include controls for HIV prevalence and the number of people living with HIV in the previous year, as well as country and year fixed effects. Standard errors (reported in parentheses) are clustered at the country level. *Corrupt* is a binary variable equal to one if a country has a PRS control of corruption score below the median within the sub-Saharan African sample. This is fixed over time from 2004 through 2008. *High GDP* is also represented by a binary measure, fixed over time, reflecting a country's position above or below the median in GDP per capita. Columns 1 and 2 report estimations in which quantity is defined as the number of doses sufficient for one individual for one year. In columns 3 and 4, this is replaced by spending (in USD1000s) on ARVs.

impacts of spending on ARVs), but they do not remove – or even substantially reduce – the relationship between the corruption variables and the measured impacts of ARVs on HIV deaths.

5. Case study in Kenya

Examining the mechanisms through which corruption could change effectiveness of imported HIV treatment is a pertinent next step. At the same time, identifying specific mechanisms provides additional support that the relationship is causal.

Because controlling for government efficacy does not eliminate corruption's effect on AIDS deaths, the channel through which corruption has an influence is not in simply making government programs less efficient generally with poor incentives for performance or high absenteeism. Instead, the cross-national analysis suggests other channels through which drugs are diverted or allocated inefficiently.

One channel through which corruption could reduce the impact of imported drugs is by preventing targeting based on need in favor of other motives. Drugs are maximally beneficial when distributed to those in need such that they have sufficient access to begin and successfully adhere to treatment. If corruption allows targeting based on other criteria, the drugs may not reach those most likely to be helped. In this section, I test for co-ethnic targeting in Kenya, a country consistently listed as in the top half of corrupt countries in sub-Saharan Africa.

In particular, I look for evidence of selective placement of ARV clinics in Luo areas after Raila Odinga became Prime Minister in 2008. In 2008, after a fiercely contested election for president, followed by allegations of electoral fraud and eventually by violence, the opposition leader, Raila Odinga, became prime minister.

Table 7
Impact of corruption on effectiveness of ARVs (PRS – binary measure of corruption).

Variables	(1) deaths	(2) deaths	(3) deaths	(4) deaths	(5) deaths	(6) deaths
Spending on ARVs (1000s)	−0.277*	−0.166	−0.822***	−1.178***	−0.202	0.0353
	(0.155)	(0.204)	(0.248)	(0.316)	(0.176)	(0.186)
Spending∗Corrupt	0.352**	0.373**				
	(0.160)	(0.143)				
Spending∗Corruption			0.275	0.402		
			(0.533)	(0.495)		
Spending∗Corrupt(PRS)					0.315*	0.426***
					(0.175)	(0.120)
Spending∗High Gov Eff	−0.374***	−0.431***			−0.362**	−0.490***
	(0.129)	(0.123)			(0.156)	(0.0949)
Spending∗Gov Eff			−0.474	−0.631		
			(0.487)	(0.507)		
Spending∗High GDP		−0.130				−0.315*
		(0.144)				(0.169)
Spending∗GDP				0.000192**		
				(9.45e−05)		
HIV prevalence (t − 1)	8228***	8353***	7725***	8643***	10,502***	11,104***
	(1688)	(1736)	(1290)	(1691)	(1002)	(1104)
PLWH (t − 1)	0.0340***	0.0349***	0.0520***	0.0386***	0.0257***	0.0273***
	(0.00919)	(0.00853)	(0.0125)	(0.0114)	(0.00838)	(0.00671)
Observations	196	196	196	196	136	136
R-squared	0.741	0.745	0.714	0.737	0.757	0.775
Number of countries	45	45	45	45	31	31

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. In all estimates, the dependent variable is the number of AIDS deaths in a given year, as reported by WHO. All estimates include controls for HIV prevalence and the number of people living with HIV in the previous year, as well as country and year fixed effects. Standard errors (reported in parentheses) are clustered at the country level. *Corrupt* is a binary variable equal to one if a country has a PRS control of corruption score below the median within the sub-Saharan African sample. *Corruption* is a continuous variable equal to the normalized Kaufmann et al. (2011) control of corruption score within the sub-Saharan African sample. *Corruption (PRS)* is a continuous variable equal to the normalized PRS control of corruption score within the sub-Saharan African sample. *High GDP* is also represented by a binary measure, fixed over time, reflecting a country's position above or below the median in GDP per capita. These are all fixed over time from 2004 through 2008.

Table 8
Countries by corruption status.

	More corrupt	Less Corrupt
High GDP	Angola	Botswana
	Cameroon	Cape Verde
	Comoros	Djibouti
	Congo	Ghana
	Cote d'Ivoire	Lesotho
	Equatorial Guinea	Mauritania
	Kenya	Sao Tome and Principe
	Nigeria	Senegal
	Sudan	Seychelles
		South Africa
		Swaziland
		Zambia
Low GDP	Burundi	Benin
	Central African Republic	Burkina Faso
	Chad	Eritrea
	DRC	Ethiopia
	Guinea	Gambia
	Guinea-Bissau	Madagascar
	Liberia	Malawi
	Niger	Mali
	Sierra Leone	Mozambique
	Togo	Rwanda
	Uganda	Tanzania
	Zimbabwe	

Notes: Countries are assigned to categories (high and low GDP per capita and more and less corrupt) based on whether the average GDP per capita and average corruption score in that country is above or below the median in the sample.

Table 9
Targeting of introduction of ARVs in health facilities in Kenya.

Variables	(1) Num. ARV clinics	(2) Num. ARV clinics	(3) Any ARV clinics	(4) Any ARV clinics
Post∗PercLuo	2.079***	1.753**	0.0442	−0.0681
	(0.528)	(0.874)	(0.0760)	(0.161)
Post∗HIVdivision		1.553		−0.132
		(2.565)		(0.306)
Post∗HIVdistrict		0.727		0.774
		(4.841)		(0.685)
Observations	1,568	1,260	1,568	1,260
R-squared	0.721	0.724	0.747	0.748
Clusters	224	180	224	180

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. The unit of observation in each linear regression is a division∗year. The dependent variable in columns 1 and 2 is the number of ARV clinics opened in a division in a given year. In columns 3 and 4, the dependent variable is a binary indicator for whether there is or is not an ARV clinic in that division. In all estimates the independent variable of interest is the interaction between *Post*, an indicator for being observed after the election (2008 or later), and the fraction of the population in that division that is Luo. All estimates include division and year fixed effects, and standard errors are clustered at the level of the division. Columns 3 and 4 also include controls for the HIV prevalence as measured in the DHS survey in the division and district, interacted with *Post*. The sample used in these estimates includes observations from 2004–2007.

Jablonski (2014) looks at government spending in areas populated by Odinga's core supporters after the same election and finds a disproportionate increase in expenditures. This paper uses a similar method, focusing exclusively on ARV clinics.

If there is targeting based on shared ethnicity, then we would expect to see a relative increase in ARV clinics in Luo areas after the election. To test this, I construct a dataset in which each observation represents one division in one year.[10] For each year between 2004 and 2010 and each of the 225 divisions covered in the 2003 or 2008/2009 DHS survey, this dataset contains the number of clinics which disburse antiretroviral drugs and an estimate of the proportion of the population that self-defines as Luo.

[10] Kenya has provinces subdivided into districts, further subdivided into divisions.

These data are used to look for evidence that Luo areas disproportionately introduced ARVs into clinics after the election, by regressing the number of clinics on the proportion of the population that is Luo, an indicator variable for whether the observation is after the election, and the interaction of the two. I also include controls for the local HIV prevalence at both the district and division levels and year and division fixed effects, which begins to address the confounding issue of relatively high HIV prevalence in western Kenya. The coefficient of interest is the coefficient on the interaction term. Formally, the equation to estimate is:

$$NumClinics_{jdt} = \alpha_t + \gamma_{jd} + \beta_1 * PercentLuo_{jd} + \beta_2 * PercentLuo_{jd} * Post_t + \beta_3 Post_t * HIVrate_{jd} + \beta_4 Post_t * HIVrate_d + \epsilon_{jdt}$$

where $NumClinics_{jdt}$ is the number of health facilities distributing ARVs in division j of district d in year t. $Post_t$ is a binary variable that is 1 if the observation is from 2008 or later and 0 if it is earlier. If there exists ethnically-based targeting, one would expect that β_2 would be positive and significant.

Columns 1 and 2 of Table 9 show the estimates of the parameters from the equation above. The coefficient of interest is the coefficient on the interaction between being a year after the election and the percent of the population that is Luo. These are reported in the first row. The first column includes the basic specification without any controls. The second column also includes HIV rates interacted with $Post_t$, the indicator for 2008 and later. In each specification, the coefficient on the interaction term is large, positive and significant. This provides evidence that Luo areas saw a disproportionate increase in the number of HIV clinics after the 2007 election (Figs. 1–3).

Table 10 repeats the analysis above, replacing the percentage of the division that is Luo with a binary indicator for whether or not the division is majority Luo. This guarantees that the identification does not come from minor variation in the measurement of the size of the Luo population. As reference, Fig. 4 shows the distribution of measurements of the fraction Luo in each division. It is clearly bimodal, with very few divisions containing between 10 and 90% Luo-identifying residents.

To better understand the relationship, I replace the outcome with a binary indicator for whether the division has any ARV clinics, estimating the following equation:

$$I\_Clinic_{jdt} = \alpha_t + \gamma_{jd} + \beta_1 * PercentLuo_{jd} + \beta_2 * PercentLuo_{jd} * Post_t + \beta_3 * HIVrate_{jd} + \beta_4 * HIVrate_d + \epsilon_{jdt}$$

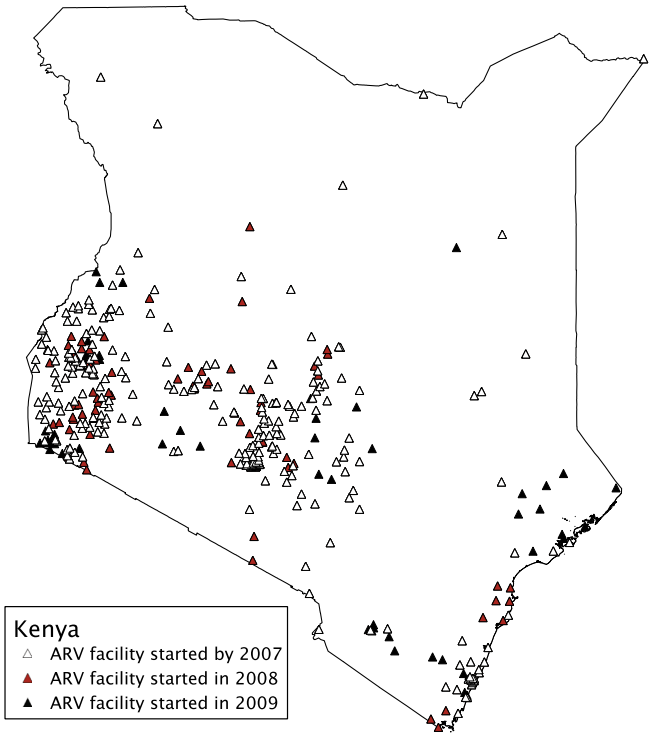

Fig. 1. ARV clinics in Kenya

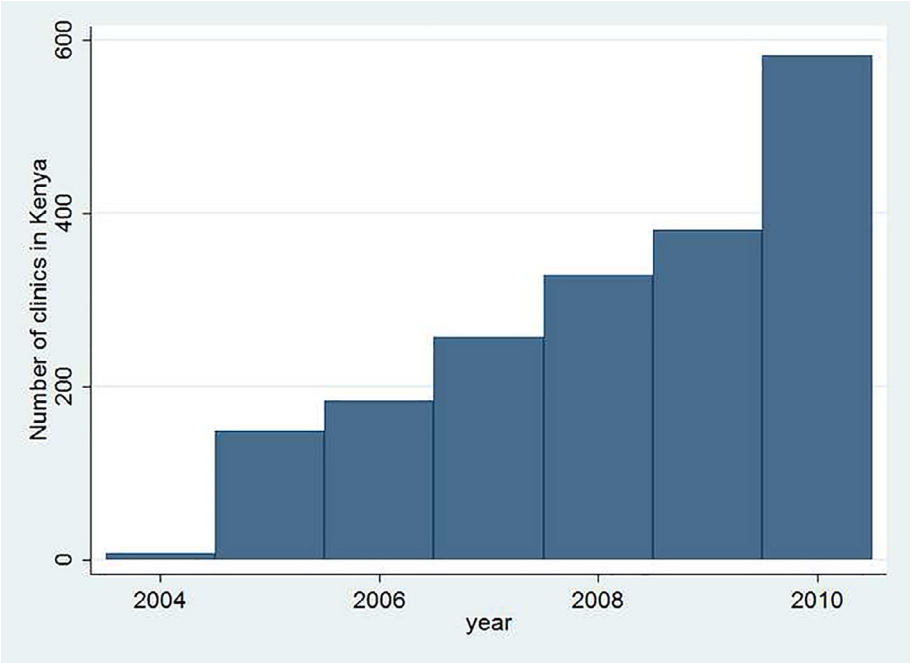

Fig. 2. Total number of clinics in Kenya in each year.

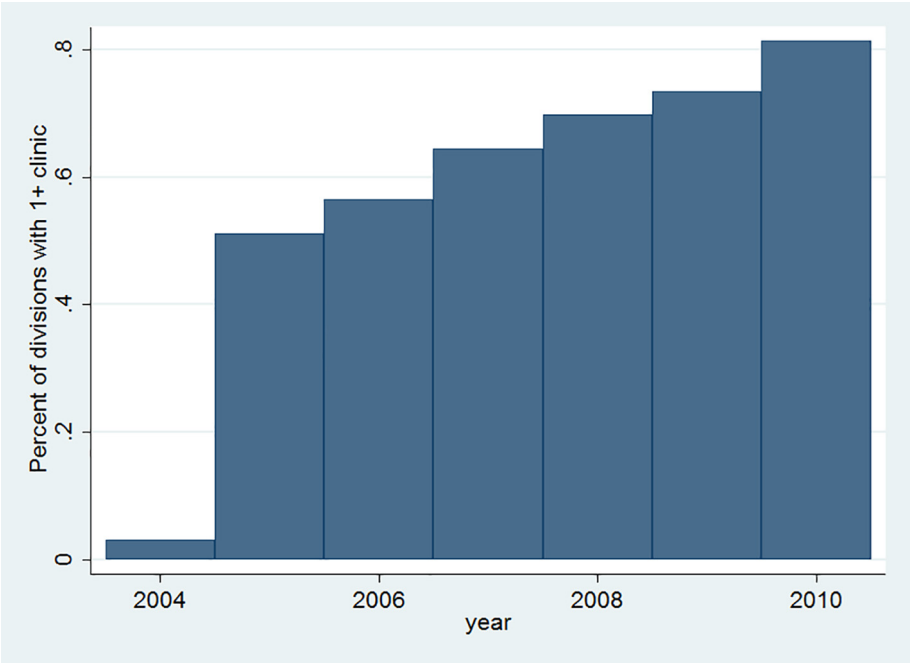

Fig. 3. Percent of divisions (covered by DHS) with clinics in each year.

Table 10
Targeting of introduction of ARVs in health facilities in Kenya.

Variables	(1) Num. ARV clinics	(2) Num. ARV clinics	(3) Any ARV clinics	(4) Any ARV clinics
Post∗LuoMajority	1.906***	1.631**	0.0540	−0.0388
	(0.463)	(0.714)	(0.0705)	(0.131)
Post∗HIVdivision		1.635		−0.144
		(2.588)		(0.296)
Post∗HIVdistrict		0.792		0.684
		(4.496)		(0.638)
Observations	1568	1260	1568	1260
R-squared	0.721	0.725	0.747	0.748
Clusters	224	180	224	180

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. The unit of observation in each linear regression is a division∗year. The dependent variable in columns 1 and 2 is the number of ARV clinics opened in a division in a given year. In columns 3 and 4, the dependent variable is a binary indicator for whether there is or is not an ARV clinic in that division. In all estimates the independent variable of interest is the interaction between *Post*, an indicator for being observed after the election (2008 or later), and an indicator for the population of the division being majority Luo. All estimates include division and year fixed effects, and standard errors are clustered at the level of the division. Columns 3 and 4 also include controls for the HIV prevalence as measured in the DHS survey in the division and district, interacted with *Post*. The sample used in these estimates includes observations from 2004–2007.

where I_Clinic_{jdt} is an binary variable which takes on a value of 1 in divisions with an ARV-distributing facility in a given year and 0 otherwise.

Columns 3 and 4 of Table 9 shows the estimates from this equation. Unlike in the previous table, the coefficients on these interaction terms are consistently insignificant. The estimates are imprecise enough that it is not possible to conclusively rule out some impact on this margin, but the difference between the two tables is suggestive of an increase in intensity rather than an expansion to new areas.

The lack of impact on the extensive margin demonstrated in the last columns of 9 is suggestive of a reduction in welfare as a result of this misallocation. Arbitrary distribution of scarce resources may not reduce welfare, but this suggests an increase in distribution without a corresponding increase in access. The degree to which this is true depends on the degree to which the previously existing ARV-distributing facilities were able to meet the local demand.

The response of targeting to the ethnic composition is not likely to be linear as specified above. The analysis from Table 9 is repeated, replacing the dependent variable *percent_luo* with an indicator for whether the majority of the population is Luo.[11] The results, reported in Table 10, are qualitatively unchanged.

One explanation for the estimated result is that before the election, Luo areas may have been disproportionately underserved and the increase was bringing them to where they would have been otherwise. Limiting the analysis to the years before the election (2004–2007), Table 12 does not provide evidence that Luo areas were previously underserved.

Another potential explanation is that Kikuyu areas (matching the ethnicity of the president both before and after the election) were particularly targeted before the election, but the power-sharing agreement limited the government's ability to target Kikuyu areas when Odinga came to power. Table 11 repeats the earlier analysis but with Kikuyu replacing the Luo variable. The

[11] The divisions with Luo majorities are in Homa Bay (Kendul Bay, Lake Victoria, Mbita, Ndhiwa, Oyugis, and Rangwe), Kisumu (Lower Nyakach, Muhoroni, Nyando, Upper Nyakach, and Winam), Migori (Migori and Nyatike), and Siaya(Bondo, Boro, Rarieda, Ugunja, Ukwala, and Yala).

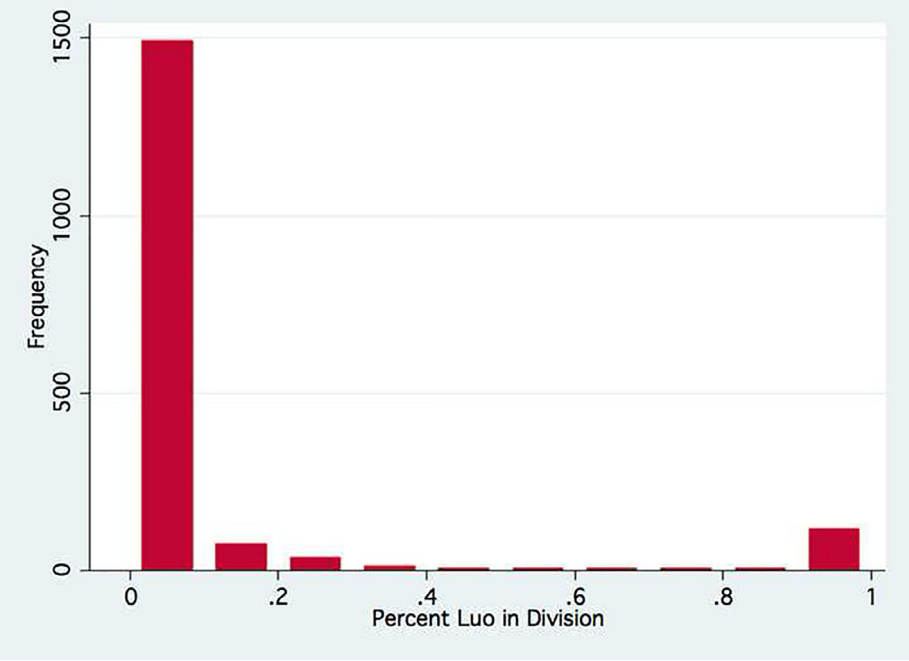

Fig. 4. Fraction Luo by Division.

Table 11
Targeting of introduction of ARVs (Kikuyu?).

Variables	(1) Num. ARV clinics	(2) Num. ARV clinics	(3) Any ARV clinics	(4) Any ARV clinics
Post∗PercKikuyu	0.214	0.274	0.0544	0.0606
	(0.252)	(0.274)	(0.0541)	(0.0592)
Post∗HIVdivision		2.266		−0.152
		(3.163)		(0.269)
Post∗HIVdistrict		6.693*		0.577
		(3.542)		(0.518)
Observations	1568	1260	1568	1260
R-squared	0.696	0.720	0.748	0.748
Clusters	224	180	224	180

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. The unit of observation in each linear regression is a division∗year. The dependent variable in columns 1 and 2 is the number of ARV clinics opened in a division in a given year. In columns 3 and 4, the dependent variable is a binary indicator for whether there is or is not an ARV clinic in that division. In all estimates the independent variable of interest is the interaction between *Post*, an indicator for being observed after the election (2008 or later), and the fraction of the population in that division that is Kikuyu. All estimates include division and year fixed effects, and standard errors are clustered at the level of the division. Columns 3 and 4 also include controls for the HIV prevalence as measured in the DHS survey in the division and district, interacted with *Post*. The sample used in these estimates includes observations from 2004–2007.

Table 12
Previously underserved?.

Variables	(1) Num. ARV Clinics	(2) Any ARV clinics	(3) Num. ARV clinics	(4) Any ARV clinics
LuoMajority	0.237	−0.0392		
	(0.380)	(0.163)		
HIVdivision	0.130	−0.0992	0.0423	−0.125
	(0.858)	(0.383)	(0.829)	(0.374)
HIVdistrict	2.501	1.148	1.847	0.914
	(1.630)	(0.849)	(1.617)	(0.896)
PercLuo			0.448	0.0288
			(0.404)	(0.193)
Observations	720	720	720	720
R-squared	0.212	0.266	0.215	0.266

Notes: Significant at 90% (*), 95% (**), 99% (***) confidence. The unit of observation in each linear regression is a division∗year. The dependent variable in columns 1 and 3 is the number of ARV clinics opened in a division in a given year. In columns 2 and 4, the dependent variable is a binary indicator for whether there is or is not an ARV clinic in that division. The variable, *LuoMajority*, is a binary indicator of being a majority Luo division. The variable, *PercLuo*, is the fraction of the population in the division that is Luo, as measured in the DHS survey. All estimates include controls for the HIV prevalence as measured in the DHS survey in the division and district. All estimates are clustered at the division level. The sample used in these estimates includes observations from 2004–2007.

estimated relationship is small and insignificantly different from zero. This is evidence against this explanation. Given that the incumbent president remained in power after the 2007 election, this may not be surprising.

6. Conclusion

This paper identifies two interesting patterns. First, using a cross-country panel from sub-Saharan Africa, it shows that corruption is associated with a reduction in efficiency of imported antiretroviral drugs. The lack of reduction in mortality from the same expenditure on treatment in relatively more corrupt countries points to a very dangerous consequence of corruption. This contributes to a literature on the national impacts of corruption on various outcomes and adds a new outcome with important consequences. Second, using data from within Kenya, I find evidence of political targeting of HIV treatment, again suggestive of a reduction in efficiency of important health expenditures. This speaks to a separate literature on political favoritism and targeting of public goods.

This raises the question of how corruption is maintained. Why are corrupt politicians not voted out of office? Chong, De La O, Karlan, and Wantchekon (2014) and Banerjee, Green, McManus, and Pande (2014) both find strong evidence that voters punish corrupt politicians, even those of the same ethnicity. Still, targeting resources to constituents may not fit under a legal definition of corruption and thus it could be an effective strategy to increase electoral support. In addition, while corruption may be punished, Ferraz and Finan (2008) find that non-zero levels of corruption may be tolerated. There are other studies that find evidence of various factors that reduce the level of or the impacts of corruption. For example Reinikka and Svensson (2005) find evidence that an increase in public awareness of leakage of public funds in Uganda reduced capture and improved outcomes, demonstrating that these issues may not be intractable. Similarly Burgess et al. (2015) find that multiparty democracy reduced the degree of ethnic targeting of public expenditures in Kenya. Although the findings of this paper suggest that some ethnic targeting continued after the move to multiparty democracy in Kenya. Deeply entrenched corruption may be difficult to truly address. Banerjee et al. (2008) reports the results of a large-scale government monitoring and incentives program aimed at improving health worker attendance. While the initial results showed improvements, the long-term gains were lost as health facilities learned ways around the rules, and Fisman and Miguel (2007) find that corruption norms follow diplomats, predicting their behavior even outside their home countries.

This paper presents evidence of large costs of corruption in reducing the efficiency of health services that are able to save lives. This is combined with suggestive evidence of one mechanism which may contribute to this relationship. Future work is needed to expand the analysis of mechanisms through which corruption limits the effectiveness of health spending in producing outcomes, and to identify more ways in which these barriers to efficiency can be mitigated to save lives.

Conflict of interest

The author declares that no conflict of interest.

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