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ORIGINAL ARTICLE

# Corruption and Health expenditure: A Cross-National Analysis on Infant and Child Mortality

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## Abstract
How does corruption impact a nation's capacity for well-being? Expanding government services and funding for health may not be effective at increasing well-being if corruption is rampant in government authorities. Therefore, both petty and grand corruption in different government bodies have the potential to greatly decrease the effectiveness of health expenditure at improving infant and child health, yet this relationship is understudied in the cross-national literature. Using two-way fixed effects models for a sample of 90 low- and middle-income nations from 1996 to 2012, I examine how the interaction between corruption in the executive and public sector and health expenditure impact infant and child mortality. The findings reveal the importance of controlling for corruption in improving the development effectiveness of health expenditure. In short, while states must have the fiscal capacity to generate enough funds for health expenditure, they must also reduce grand and petty corruption in the executive and public sectors to reduce infant and child mortality.

**Keywords** Corruption · Health expenditure · Child and infant health · Cross-national

## Résumé
Quel est l'impact de la corruption sur la capacité d'une nation à se sentir bien? L'expansion des services publics et du financement de la santé peut ne pas être efficace pour l'amélioration du bien-être si la corruption est généralisée au sein des autorités publiques. Par conséquent, petite et grande corruption au sein de différents organes gouvernementaux peuvent toutes deux réduire considérablement l'efficacité des dépenses de santé sur l'amélioration de la santé des nourrissons et des enfants. Pourtant, cette relation est sous-estimée dans la littérature transnationale. À l'aide de modèles bidirectionnels à effets fixes sur un échantillon de 90 pays à revenu faible et intermédiaire de 1996 à 2012, j'étudie comment l'interaction entre la corruption au sein de la classe dirigeante et du secteur public, et les dépenses de santé, a un impact sur la mortalité infantile et juvénile. Les résultats révèlent qu'il est important de lutter

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contre la corruption pour améliorer le potentiel de développement des dépenses de santé. En bref, si les États doivent avoir la capacité fiscale de générer suffisamment de fonds pour les dépenses de santé, ils doivent également réduire la grande et la petite corruption au sein de la classe dirigeante et dans le secteur public afin de réduire la mortalité infantile et juvénile.

## Introduction

Corruption is present in virtually every government worldwide (Transparency International 2016; Rose-Ackerman and Palifka 2016). These activities impact small-scale processes from the daily life of citizens to global interactions (Li et al. 2018; Achim and Borlea 2018; Transparency International 2016). Corruption is widespread in part due to the difficultly of tracing and prosecuting illegal actors, especially in low- and middle-income nations (Callister 1999; Kaufmann and Kraay 2015). Therefore, corruption impacts everything from education (Heyneman 2007) and housing systems (Wang and Murie 2000) to economic growth (Mo 2001), sustainable development (Cole 2007; Morse 2006), and human rights (Kumar 2003). One of the most studied areas in which corruption is manifested is the health sector (Vian 2008; Gupta et al. 2002; Lewis 2006; Savedoff 2007; Holmberg and Rothstein 2011; Jain 2001; Spector 2005). Academics and practitioners alike share a perennial preoccupation with identifying how corruption impacts health outcomes at local and global levels (Kaufmann et al. 2010; Treisman 2007; Gupta et al. 2000; McGuire 2006; Xin and Rudel 2004; Li et al. 2018; Achim and Borlea 2018).

Recently, research has focused on how corruption impacts the composition of government spending (Rajkumar and Swaroop 2008; Mauro 1998). For example, a Global Corruption Report (2006) finds that between 5 and 10% of Cambodia's health budget disappeared before even reaching the Ministry of Health (Global Corruption Report 2006; Dryer 2006). In other nations, such as Ghana, Peru, Tanzania, and Uganda, the leakage of health funds is around 70% or higher, leaving less money available to buy essential medicines, pay health workers, or update hospital facilities (Engberg-Pedersen et al. 2005; Lewis 2006). Taken together, it has been reported that billions of dollars of health expenditure are taken by government workers, public officials, and health sector employees (Global Corruption Report 2006; Dryer 2006). This not only leaves fewer funds available for health but also makes it more difficult for citizens to pay for health services due to inflated costs and user fees (Lewis 2006; Holmberg and Rothstein 2011). Due to the leakage of government health funds, doctors and nurses often demand unofficial bribes and payments from patients to supplement their meager wages (Lewis 2006; Holmberg and Rothstein 2011). This not only jeopardizes the quality of health services but also the ability of patients to afford and receive basic medical care in times of need, especially during and after childbirth (Lewis 2006; Holmberg and Rothstein 2011; Pandolfelli and Shandra 2013).

It is therefore no surprise that several cross-national studies find evidence that aggregate measures of corruption negatively impact health outcomes, such as child and infant mortality (Kaufmann et al. 2010), immunization rates, low birth weight,

and the presence of birth attendants (Gupta et al. 2000), as well as reducing the effectiveness of health spending (Rajkumar and Swaroop 2008; Filmer and Pritchett 1999). Similarly, previous case study research highlights the importance of unveiling petty corruption in the public sector (see Kaufman et al. 1998; Azfar et al. 2001; Lewis et al. 1992; Lindelow et al. 2003; Savedoff 2007; Akcay 2006; Ensor and Duran-Moreno 2002; Vian 2008).

However, there is a general interest and need for cross-national scholars to move beyond aggregate measures of corruption and focus on how different types of corruption impact the effectiveness of health spending across nations over time (Lewis 2006; Holmberg and Rothstein 2011; Rajkumar and Swaroop 2008), not only due to the leakage of health expenditure and its impact on the trust of state institutions (Savedoff 2007) but also because disaggregation may reveal new information about corruption un-captured by previous cross-national studies that use aggregate measures (Sommer 2017). Therefore, I move beyond previous studies by considering how both executive and public sector corruption impacts infant and child mortality. I seek to address this lacuna by using newly available data from the Varieties of Democracy (2016), which provides indices that represent both grand corruption in the executive sector and petty corruption in the public sector. These disaggregated measures will allow researchers to understand how different types of corruption impact the effectiveness of health expenditure at reducing infant and child mortality cross-nationally.

The specific contribution of this paper is to develop a framework of understanding how corruption manifests in the executive and public sectors, and to integrate a nuanced analysis that empirically tests their impacts on the effectiveness of health spending at reducing infant and child mortality. Using two-way fixed effects regression models for a sample of 90 low- and middle-income nations from 1996 to 2012, I examine if health expenditure is more effective at reducing infant and child mortality in nations with lower levels of corruption in the executive and public sectors.

This is the first cross-national study to disaggregate corruption into executive and public sector corruption to see how it impacts infant and child mortality. This analysis is essential as each type of corruption may have differential impacts on health. On the one hand, previous research suggests that executive-level corruption involves large-scale illegal financial transactions, which may result in large distortions in expenditure (Ensor and Duran-Moreno 2002; Fazekas et al. 2013). On the other hand, public sector corruption concerns smaller infractions that individually may not lead to large distortions in health spending (Ensor and Duran-Moreno 2002). Due to the theoretically proposed different impacts of executive and public sector corruption, it is important to test these hypotheses cross-nationally. I do so by interacting health expenditure with executive sector corruption and public sector corruption, respectively. Figure 1 represents these hypotheses.

Next, I discuss how corruption is defined and operationalized in previous research to form the theoretical framework for this study. Afterwards, I describe how corruption in the executive and public sectors can decrease the effectiveness of funds for health in low- and middle-income nations. I go on to describe the data, methods, and findings. I conclude by discussing the theoretical and policy implications of the study.


**Fig. 1** Illustration of main hypothesis

## Background

Corruption is a multifaceted process that is difficult to define (Knox 2009). While some definitions of corruption focus on 'behavior which deviates from formal duties' for private gain (Nye 1967, p. 419), including the misuse of public funds, bribery, and nepotism (Knox 2009), others concern the abuse of public office for private or personal gain (Klitgaard et al. 2000; Rose-Ackerman 1999; Knox 2009; Transparency International 2016). Because 'corruption' is a highly value-laden concept, that varies from place to place, it is often difficult for academics and practitioners to agree on a concrete definition (Ivanov 2007; Knox 2009; Savedoff 2007; Lewis 2006).

Still, there is some agreement that studies ought to focus on sector-specific approaches to diagnosing and creating ways to combat corruption (Spector 2005; Knox 2009; Kaufmann 2003; Vian 2005). Health sectors in particular are vulnerable to corruption because of the demand for health care, the variety of health services (from prevention to intervention), and the scope of procurement (from urban to rural areas; Vian 2005; Knox 2009). Still, even if we limit corruption to areas of health, there is still concern of disaggregating corruption in terms of grand and petty (Callister 1999; Sundström 2016; Meehan and Tacconi 2017), collusive and non-collusive (Smith et al. 2012), as well as other forms (Rose-Ackerman 1987; Rose-Ackerman and Palifka 2016).

However, previous measures of corruption, such as Transparency International's Corruption Perception Index, the World Governance Indicators measure of control of corruption, and the Political Risk Services/International Country Risk Guide database (including others) do not disaggregate measures that could be useful in accessing how different types of corruption impact health cross-nationally (Gupta et al. 2000; Kaufman et al. 2010; Rajkumar and Swaroop 2008; Filmer and Pritchett 1999). Newly available data from Varieties of Democracy (2016) begins to address the need for disaggregated corruption measures. These measures focus on levels of corruption in the executive and public sectors, allowing researchers to investigate how grand and petty corruption, respectively, limit the effectiveness of health spending at improving health. Although data do not yet exist to estimate collusive and non-collusive corruption (among other

distinctions) cross-nationally, this study begins to address the distinction between petty and grand corruption cross-nationally.

## Grand and Petty Corruption

Corruption is frequently subdivided into grand and petty (Ensor and Duran-Moreno 2002). Grand corruption is commonly defined in terms of the scale of illegal financial transactions which result in large distortions in expenditure (Ensor and Duran-Moreno 2002; Fazekas et al. 2013). Therefore, because of the large-scale embezzlement and bribes associated with grand corruption, such actions are usually carried out by those within the upper echelons of government, which encompasses those in the executive branch of government (Kenny and Søreide 2008; Gray and Kaufmann 1998; Tanzi and Davoodi 1998; Ensor and Duran-Moreno 2002). According to some researchers, grand corruption reflects corrupt actions by political figures (Tanzi 1998), high-level officials (Callister 1999), or unscrupulous relationships between the private sector and the upper echelons of government (Hellman et al. 2000). For the purposes of this article, grand corruption is understood as occurring in the executive sector, as commonly held definitions reflect this (Transparency International 2016; Kenny and Søreide 2008; Gray and Kaufmann 1998; Tanzi and Davoodi 1998; Ensor and Duran-Moreno 2002; Sommer 2017). Therefore, grand corruption is defined as "the abuse of high-level power that benefits the few at the expense of the many" (Transparency International 2016, p. 1).

In some nations, grand corruption is normalized to the point where even elected or appointed officials and politicians do not have the "entrusted" power of their citizens (Rose-Ackerman and Palifka 2016, p. 16). Governments lacking this legitimacy, such as failed or weak states, are often part of a cycle of corruption, whereby it is regular and commonplace (Rothstein and Teorell 2008). For instance, nations such as Nigeria have suffered under corrupt regimes (i.e., Babangida and the Abacha regimes), reducing the amount of health funds available and diminishing their quality of life (Ogbeidi 2012). Furthermore, in various nations, health funds often just go missing due to corruption. For example, reports have found that about 30 percent of Moscow's health budget has not been accounted for (Ensor and Duran-Moreno 2002).

On the other hand, petty corruption concerns smaller infractions that individually may not lead to large distortions in health spending (Ensor and Duran-Moreno 2002). Petty corruption is manifested in the public sector, encompassing everything from small routine payments to doctors to the theft of supplies from health facilities (Thompson and Witter 2000; Cockcroft et al. 2008; Blundo 2006; Ensor and Duran-Moreno 2002). Using Transparency International's (2016) definition, petty corruption "refers to everyday abuse of entrusted power by low- and mid-level public officials in their interactions with ordinary citizens, who are often trying to access basic goods or services in places like hospitals, schools, police departments and other agencies" (1).

Petty corruption in the form of unofficial payments also often becomes normalized within societies; public employees in the administration and hospitals (such as

doctors and nurses) are "obliged" to use corruption to make a living. For example, Chawla et al. (1998) found that in Poland almost half of the patients surveyed paid for free services. Similarly, a study in Turkmenistan found that patients commonly give non-monetary gifts to practitioners, and that doctors often demand unofficial payment in accordance with the wealth of the patient (Ladbury 1997). According to Thompson and Rittman (1997), specialist hospitals developed a system of bribery in Kazakhstan where payments are demanded between each specialist to receive care. However, it is not just doctors who are involved with petty corruption. A report by the Albanian *Klan* magazine finds that even porters and cleaners receive illegal payments just to do their jobs (Ensor and Duran-Moreno 2002). Studies have found similar stories in India (Sengupta and Nundy 2005) and Vietnam (Vian et al. 2012).

Both grand corruption in the executive branch and petty corruption in the public sector are responsible for the leakage of expenditure for health, which can compromise the well-being of infants and children. Although previous research regularly cites the ineffectiveness of health expenditure stemming from an unbalanced budget, failure to implement and monitor interventions (Gupta et al. 1999), and low amounts of spending (Pandolfelli and Shandra 2013; Pritchett 1996; Filmer and Pritchett 1999), corruption within governments and health sectors may be the underlying issue preventing improved governance for health spending (Rajkumar and Swaroop 2008). In the next section, I review several reasons why petty and grand corruption can limit the effectiveness of health spending at reducing infant and child mortality.

## Health Spending, Corruption, and Infant and Child Mortality

Why may grand and petty corruption leave health expenditure ineffective at improving infant and child health? There is a burgeoning body of work assessing how petty corruption in the public sector and grand corruption in the upper echelons of government impact health, yet research has yet to integrate how different types of corruption distort health spending (Rajkumar and Swaroop 2008). Through integrating previous research, I detail processes through which both grand and petty corruption contribute to distortions in health spending, limiting its effectiveness at reducing infant and child mortality. Table 1 summarizes the relationships between each type of corruption and health spending.

Grand corruption in the executive sector involves the misallocation of funds for political purposes as well as the embezzlement and theft of expenditure (Ensor and Duran-Moreno 2002; Gray and Kaufmann 1998). Misallocation of health funds for political purposes can divert resources away from health care, leaving less expenditure to be distributed among various hospitals and clinics in a nation (Ensor and Duran-Moreno 2002). In addition, executive officials may directly embezzle or steal funds for their personal use (Ensor and Duran-Moreno 2002). Regardless of whether these actions also involve collusion with private companies, health funds still do not make it to their intended destination (Ensor and Duran-Moreno 2002).

However, though executive corruption should decrease the effectiveness of health spending, it may not have an impact on infant and child mortality if it is irregular or sporadic (Rose-Ackerman 1999). Furthermore, grand corruption

**Table 1** Relationships between health spending and grand and petty corruption

| Type of corruption | Relationship to health spending | References |
|---|---|---|
| Grand: executive sector | Misallocation of money for political purposes<br>Embezzlement and theft of health expenditure | Ensor and Duran-Moreno (2002), Gray and Kaufmann (1998) |
| Petty: public sector | Theft of funds by public officials<br>Stolen supplies, equipment, and medicines generated by health spending<br>Salaries of 'phantom' workers | Cockcroft et al. (2008), Sosa (2000), Goel and Nelson (1998) |

in the executive sector may depend upon the strength of this branch of government, which varies substantially from nation to nation (Rose-Ackerman 1999). For example, grand corruption may not distort health spending cross-nationally if the executive sector is balanced by other areas of government (Ensor and Duran-Moreno 2002; Goel and Rich 1989). Moreover, there may not be economic incentive to partake in grand corruption if monetary benefits outweigh the costs (Sosa 2000; Goel and Nelson 1998), as the risk of getting caught may be greater than the economic gain, deterring executive actors from grand corruption (Treisman 2000; Ensor and Duran-Moreno 2002). Nevertheless, perceived benefits may be stronger than deterrence, leading to more frequent corrupt actions (Gray and Kaufmann 1998).

Executive sector corruption, leading to the leakage of health spending, should impact infant and child mortality in several ways. The most obvious consequence is the reduced amount of funds available for health, which can diminish the effectiveness of patient care, especially for the most vulnerable (Ensor and Duran-Moreno 2002; Gray and Kaufmann 1998). Moreover, corruption at this high level of government can undermine the state's legitimacy and trust in society, leading to political instability (Gray and Kaufmann 1998) resulting in conflict and protest, which tend to have negative implications for civilian health in both the short and long term, and can force allocations for health to be rerouted to other budgets, namely military (Ghobarah et al. 2004).

Petty corruption in the public sector also reduces the amount of health expenditure available (Kar and LeBlanc 2013). Theft of health funds by public officials leaves hospitals and clinics without resources to purchase equipment and to pay hospital and clinic employees (Villegas et al. 1998). Public sector officials also steal materials, supplies, equipment, and medicines, rather than just money itself, and resell them to turn a profit (Cockcroft et al. 2008). Leakage of health funds also occurs in the public sector though the payment of 'phantom workers,' which is where officials include extra workers on the payroll who do not exist and take the salaries that are allotted for them (Cockcroft et al. 2008). Although there is reason to believe that these acts involve minor instances of theft and exchanges, and may be short term, its frequency may decrease the amount of funds available for health (Brack 2003). Following this line of thought, Cockcroft et al. (2008) argue that, "cumulatively, petty corruption can have a massive effect on services delivery" (2).

The siphoning off of health expenditure and the stolen equipment and medicines that were purchased with these funds may impact infant and child health for a number of reasons (Cockcroft et al. 2008). When clinics and hospitals face money shortages, they tend to charge patients to stay in operation (Gupta et al. 2000). This often leaves citizens unable to afford fees for various services, and results in children dying from treatable illnesses (Parsitau 2009; Rothstein and Stolle 2008; Pandolfelli and Shandra 2013). For example, Parsitau (2009) finds that user fees force women to skip doctor and hospital visits or abandon pre-natal and family planning visits altogether in Kenya (Pandolfelli and Shandra 2013). Parsitau (2009) also finds that women at Kenya's Nakuru District Hospital are required to buy materials, such as gloves, syringes, and disinfectants for use during birth, which puts women who cannot afford these items at higher risk for infections and other pregnancy complications (Pandolfelli and Shandra 2013). Even if mothers and their children can afford fees for care, health clinics that do not have adequate funds are often underequipped, understaffed, and inefficient, which can lead to slower service and reductions in the quality of care (Villegas et al. 1998; Falkingham 2004; Szende and Culyer 2006). Moreover, when health spending does not reach its intended destination, health services cannot be improved to current standards, further reducing the quality of care, along with patient satisfaction and trust (Cockcroft et al. 2008).

From the above, it is clear that grand corruption in the executive sector and petty corruption in the public sector can reduce the effectiveness of funds available for health, resulting in poor health outcomes. Together, these processes prevent improvements in the health sector and decrease the ability for health reform in the future (Cockcroft et al. 2008). Corruption should therefore limit the growth of the health sector, making it difficult for low- and middle-income nations to reduce their levels of infant and child mortality. Figure 2 summarizes the outcomes related to the ineffectiveness of health spending from corruption. In sum, I hypothesize that health expenditure is more effective at reducing infant and child mortality in nations with

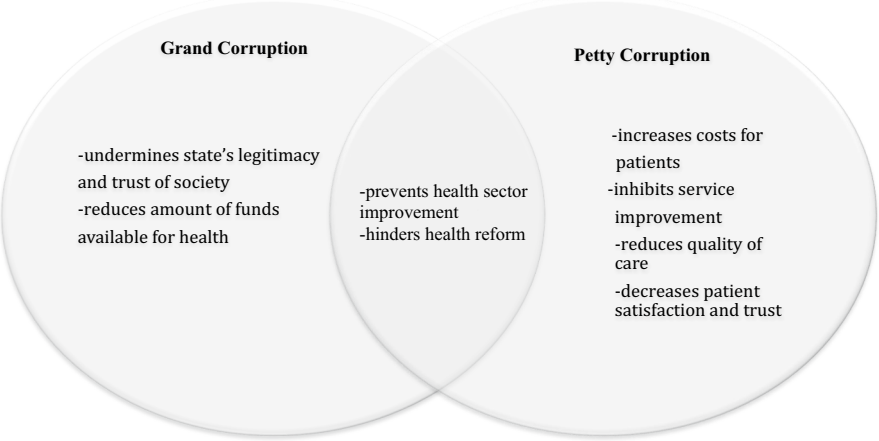


**Fig. 2** Outcomes related to the ineffectiveness of health spending from grand and petty corruption

lower levels of corruption in the executive and public sectors, compared with higher levels.

## Methodology

### Sample

Infant and child mortality rates are among the highest in low- and middle-income nations (World Bank 2016). Moreover, low- and middle-income nations often have lower levels of health expenditure and higher levels of corruption (Transparency International 2015). As a result, this study only focuses on these nations. Following previous studies (Shandra et al. 2011), I use list-wise deletion of missing data, which yields a panel of 90 country years (1996–2011) with a minimum of 9, an average of 15, and a maximum of 16. It is common that cross-national longitudinal studies of this kind include this number of country years (90 nations out of a possibility of 140 nations) due to missing data (Shandra et al. 2004, 2005; Coburn et al. 2015; Wang et al. 2014).[1]

### Statistical Models

Following previous studies in this area, this research uses two-way fixed effects models for both time and country, with robust standard errors clustered by country, to examine the effect of health expenditure and different types of corruption on infant and child mortality (Shandra et al. 2004, 2005). This panel technique helps correct for heterogeneity bias (Halaby 2004) and deals with the impact of unmeasured time invariant

[1] Afghanistan (2002–2011); Algeria (1996–2011); Angola (1996–2011); Argentina (1996–2011); Armenia (1996–2011); Azerbaijan (1996–2011); Bangladesh (1996–2011); Belarus (1996–2011); Benin (1996–2011); Bolivia (1996–2011); Botswana (1996–2011); Brazil (1996–2011); Burkina Faso (1996–2011); Burundi (1996–2011); Cabo Verde (1996–2011); Cambodia (1996–2011); Cameroon (1996–2011); Central African Republic (1996–2011); Chad (1996–2011); Colombia (1996–2011); Congo, Dem. Rep. (1996–2011); Costa Rica (1996–2011); Cote d'Ivoire (1996–2011); Cuba (1996–2011); Djibouti (1996–2007); Dominican Republic (1996–2011); Ecuador (1996–2011); Egypt, Arab Rep. (1996–2011); El Salvador (1996–2011); Eritrea (1996–2011); Gabon (1996–2011); The Gambia (1996–2011); Georgia (1996–2011); Ghana (1996–2011); Guatemala (1996–2011); Guinea (1996–2011); Guyana (1996–2011); Haiti (1996–2011); Honduras (1996–2011); Indonesia (1996–2011); Iran (1996–2011); Jamaica (1996–2011); Kazakhstan (1996–2011); Kenya (1996–2011); Kyrgyz Republic (1996–2011); Lebanon (1996–2011); Lesotho (1996–2011); Liberia (1998–2011); Madagascar (1996–2011); Malawi (1996–2011); Malaysia (1996–2011); Mali (1996–2011); Mauritania (1996–2011); Mauritius (1996–2011); Mexico (1996–2011); Moldova (1996–2011); Mongolia (1996–2011); Morocco (1996–2011); Mozambique (1996–2011); Namibia (1996–2011); Nepal (1996–2011); Nicaragua (1996–2011); Niger (1996–2011); Nigeria (1996–2011); Pakistan (1996–2011); Panama (1996–2011); Papua New Guinea (1996–2004); Paraguay (1996–2011); Peru (1996–2011); Philippines (1996–2011); Rwanda (1996–2011); Senegal (1996–2011); Sierra Leone (1996–2011); South Africa (1996–2011); Sri Lanka (1996–2011); Sudan (1996–2011); Suriname (1996–2011); Swaziland (1996–2011); Tajikistan (1996–2011); Tanzania (1996–2011); Thailand (1996–2011); Togo (1996–2011); Tunisia (1996–2011); Uganda (1996–2011); Ukraine (1996–2011); Uzbekistan (1996–2011); Venezuela (1996–2011); Vietnam (1996–2011); Zambia (1996–2010); Zimbabwe (2000–2011).

factors that are omitted from a regression model (Hsiao 2003). Fixed effects models simulate unmeasured time invariant factors as country-specific intercepts (Brady et al. 2007), by estimating unit- and time-specific intercepts for each case. Sargan–Hansen statistics (similar to a Hausman test) show that, in the random effects equations, the country-specific error terms are correlated with the independent variables included in the models, which would make generalized least squares random effects regression inappropriate (Baum 2006; Hsiao 2003). Therefore, only fixed effects estimates are presented. Moreover, the models include time dummy variables for each year (1996–2012), rather than five-year windows or decades, because all data are available for each year. In short, the fixed effects estimator described above, and the use of time dummy variables, lead to a stringent test of the issue under investigation.

### Two-Way Fixed Effects

$$y_{it} = a + B_1 x_{it1} + B_2 x_{it2} + \cdots + B_k x_{itk} + u_I + w_t + e_{it},$$

where $I$ is each country in the analysis, $t$ each time period in the analysis, $y_{it}$ a dependent variable for each country at each time period, $a$ a constant, $B_1$ to $B_k$ the coefficients for each independent variable, $x_{itk}$ independent variables for each country at each time point, $u_I$ country-specific disturbance terms that are constant over time, $w_t$ period-specific disturbance terms that are constant across all countries, and $e_{it}$ disturbance terms specific to each country at each time point.

### Regression Assumptions

First, to determine if multicollinearity is problematic, I calculate a bivariate correlation matrix for all the variables in the analysis (Table 2). There are a few high correlations between the independent variables, including access to water, fertility rate, and gross domestic product (GDP). As a result, I identify the variation inflation factor (VIF) scores for each model by using corresponding pooled OLS regression. Although the models had mean VIFs below 2.5, two variables (water access, fertility rate) exceeded a VIF value of 2.5, which indicates potential problems with multicollinearity (York et al. 2003). To address these high correlations, I ran a series of models with only one of the highly correlated predictors. The results are similar to the findings presented, indicating no potential problems with excessive multicollinearity. Second, to see if there were potential problems with outliers in the data, I calculate standardized residuals. Cuba and Belarus were identified as potential multivariate outliers, but their removal does not bias the results. Therefore, these nations are included in the analysis. I deal with issues of linearity by taking the natural logarithm of variables when appropriate (I note this in Tables 2, 3, 4).

**Table 2** Descriptive statistics and bivariate correlation matrix

| Variable | Mean | SD | Min | Max | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Infant mortality (log) | 3.52024 | 1.07515 | 0.40547 | 5.62366 | 1.000 | | | | | | | | | | | | |
| Child mortality (log) | 3.80386 | 1.18144 | 0.64185 | 6.0947 | .993 | 1.000 | | | | | | | | | | | |
| Health expenditure (% of gdp) | 7.25858 | 2.68008 | 1.36832 | 31.8293 | − .151 | − .148 | 1.000 | | | | | | | | | | |
| Public sector corruption ($X-1$) | − 0.48605 | 0.29362 | − 0.97212 | − 0.005 | − .424 | − .409 | .173 | 1.000 | | | | | | | | | |
| Executive corruption ($X-1$) | − 0.49039 | 0.29661 | − 0.97921 | − 0.01091 | − .295 | − .283 | .207 | .857 | 1.000 | | | | | | | | |
| Fertility rate | 5.07925 | 2.02632 | 1.827 | 9.873 | .833 | .871 | − .116 | − .315 | − .222 | 1.000 | | | | | | | |
| Trade (% of GDP) (log) | 4.1967 | 0.63273 | 0.02078 | 6.27803 | − .198 | − .211 | .072 | − .009 | − .018 | − .251 | 1.000 | | | | | | |
| Debt service (% of GDP) | 4.79631 | 10.5931 | 0 | 156.858 | .001 | − .011 | .009 | .124 | .177 | − .019 | .090 | 1.000 | | | | | |
| GDP (per capita) (log) | 7.52659 | 1.75569 | 0 | 12.1738 | − .749 | − .754 | .097 | .411 | .331 | − .684 | .160 | .017 | 1.000 | | | | |

**Table 2** (continued)

| Variable | Mean | SD | Min | Max | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Democracy | 16.2199 | 12.0729 | 0 | 46.2 | − .461 | − .477 | .136 | .355 | .307 | − .442 | .121 | − .014 | .401 | 1.000 | | | |
| Access to water | 84.4099 | 18.2019 | 13.2 | 100 | − .753 | − .771 | .118 | .400 | .268 | − .779 | .103 | .023 | .710 | .372 | 1.000 | | |
| Total population | $2.35^{7}$ | $9.90^{7}$ | 4453 | $1.36^{9}$ | − .065 | − .082 | − .249 | − .038 | .001 | − .134 | − .329 | .005 | .104 | .144 | .145 | 1.000 | |
| HIV prevalence (log) | −0.37073 | 1.58128 | − 2.30259 | 3.36038 | .499 | .533 | .070 | .000 | .034 | .514 | .080 | .027 | − .230 | − .212 | − .355 | − .237 | 1.000 |

**Table 3** Two-way fixed effects estimates of health spending, corruption, and infant and child mortality, 1996–2012

| Independent variables | Infant (3.1) | Infant (3.2) | Child (3.3) | Child (3.4) |
|---|---|---|---|---|
| Health expenditure (as a % of GDP) | − .005 | − .005 | − .005 | − .005 |
| | − .013 | − .013 | − .012 | − .011 |
| | (.007) | (.007) | (.007) | (.007) |
| Public sector corruption | − .089 | | − .071 | |
| | − .024 | | − .018 | |
| | (.079) | | (.087) | |
| Executive sector corruption | | − .120* | | − .097 |
| | | − .033 | | − .024 |
| | | (.052) | | (.058) |
| Political factor | | | | |
| Democracy | .001 | .001 | .001 | .001 |
| | .001 | .003 | .001 | .002 |
| | (.001) | (.001) | (.001) | (.001) |
| Economic factors | | | | |
| GDP (per capita) | − .098** | − .100*** | − .091** | − .093** |
| | − .159 | − .163 | − .136 | − .139 |
| | (.034) | (.034) | (.035) | (.035) |
| Trade (as a % of GDP) | − .102** | − .102** | − .113** | − .113** |
| | − .060 | − .060 | − .060 | − .060 |
| | (.038) | (.039) | (.041) | (.042) |
| Debt service (as a % of GDP) | − .001 | − .001 | − .001 | − .001 |
| | − .004 | − .004 | − .003 | − .004 |
| | (.001) | (.001) | (.001) | (.001) |
| Health factors | | | | |
| Access to improved water | − .006* | − .006* | − .009* | − .009* |
| | − .097 | − .098 | − .133 | − .134 |
| | (.003) | (.003) | (.004) | (.004) |
| HIV prevalence | .007 | .006 | .020 | .019 |
| | .010 | .009 | .027 | .026 |
| | (.033) | (.032) | (.034) | (.034) |
| Demographic factors | | | | |
| Total population | .001 | .001 | . 001 | . 001 |
| | .015 | .027 | .009 | .001 |
| | (.001) | (.001) | (.001) | (.001) |
| Fertility rate | − .053 | − .054 | − .049 | − .050 |
| | − .100 | − .102 | − .085 | − .086 |
| | (.042) | (.041) | (.047) | (.046) |
| Constant | 5.712*** | 5.714*** | 6.259*** | 6.259*** |
| | (.446) | (.431) | (.487) | (.469) |
| Within $R^2$ | .831 | .833 | .824 | .824 |
| Number of observations | 1496 | 1496 | 1496 | 1496 |
| Number of countries | 90 | 90 | 90 | 90 |
| Mean Vif | 1.89 | 1.87 | 1.89 | 1.87 |

The first number is the unstandardized coefficient, the second the standardized beta, and the robust standard error is in parentheses

*$p < .05$, **$p < .01$, ***$p < .001$ for a o ne-tailed test

**Table 4** Two-way fixed effects estimates of health spending, corruption, and infant and child mortality, 1996–2012

| Independent variables | Infant (4.1) | Infant (4.2) | Child (4.3) | Child (4.4) |
|---|---|---|---|---|
| Interactions | | | | |
| Public sector corruption × health expenditure | − .046* | | − .053* | |
| | − .034 | | − .035 | |
| | (.026) | | (.029) | |
| Executive corruption × health expenditure | | − .040* | | − .044* |
| | | − .029 | | − .030 |
| | | (.024) | | (.025) |
| Independent variables | | | | |
| Health expenditure (as a % of GDP) | − .035* | − .030* | − .040* | − .033* |
| | − .032 | − .026 | − .032 | − .025 |
| | (.018) | (.015) | (.021) | (.017) |
| Public sector corruption | .254 | | .326 | |
| | − .021 | | − .014 | |
| | (.199) | | (.223) | |
| Executive sector corruption | | .162 | | .213 |
| | | − .036 | | − .027 |
| | | (.178) | | (.189) |
| Political factor | | | | |
| Democracy | .001 | .001 | .001 | .001 |
| | .004 | .001 | .004 | .001 |
| | (.001) | (.001) | (.010) | (.001) |
| Economic factors | | | | |
| GDP (per capita) | − .097** | − .100** | − .091** | − .094** |
| | − .158 | − .164 | − .135 | − .139 |
| | (.034) | (.034) | (.035) | (.035) |
| Trade (as a % of GDP) | − .109** | − .105** | − .120** | − .116** |
| | − .064 | − .062 | − .065 | − .062 |
| | (.039) | (.039) | (.041) | (.042) |
| Debt service (as a % of GDP) | − .001 | − .001 | − .001 | − .001 |
| | − .006 | − .006 | − .006 | − .006 |
| | (.001) | (.001) | (.001) | (.001) |
| Health factors | | | | |
| Access to improved water | − .006* | − .006* | − .009** | − .009* |
| | − .103 | − .097 | − .140 | − .133 |
| | (.003) | (.003) | (.004) | (.004) |
| HIV prevalence | .005 | .006 | .019 | .019 |
| | .008 | .009 | .025 | .026 |
| | (.032) | (.032) | (.034) | (.034) |

**Table 4** (continued)

| Independent variables | Infant (4.1) | Infant (4.2) | Child (4.3) | Child (4.4) |
|---|---|---|---|---|
| Demographic factors | | | | |
| Total population | .001 | . 001 | . 001 | . 001 |
| | .003 | .006 | .021 | .033 |
| | (.001) | (.001) | (.001) | (.001) |
| Fertility rate | − .053 | − .054 | − .049 | − .050 |
| | − .099 | − .102 | − .084 | − .086 |
| | (.042) | (.041) | (.047) | (.046) |
| Constant | 5.990*** | 5.911*** | 6.581*** | 6.476*** |
| | (.454) | (.445) | (.490) | (.480) |
| Within $R^2$ | .834 | .835 | .827 | .827 |
| Number of observations | 1496 | 1496 | 1496 | 1496 |
| Number of countries | 90 | 90 | 90 | 90 |

The first number is the unstandardized coefficient, the second the standardized beta, and the robust standard error is in parentheses

*$p < .05$, **$p < .01$, ***$p < .001$ for a one-tailed test

## Data

### Dependent Variables

#### Child and Infant Mortality

Child mortality measures the probability per 1000 live births that a newborn baby will die before reaching age 5 years (World Bank 2016). The infant mortality rate measures the probability of a child dying between birth and age 1, and is expressed in deaths per 1000 live births (World Bank 2016). Please note that all data are publicly available from the cited reference unless otherwise specified below. It is important to note that there may be issues with underreporting mortality data (Gonzalez and Gilleskie 2017). Therefore, care should be taken when drawing inferences from the included analyses.

The dependent variables of child and infant mortality have been chosen over other health-related variables because infants and children are some of the most vulnerable people in society. Due to disparities in infant and child health cross-nationally, it is important to know how health spending and corruption specifically impacts these populations. Additionally, infant and child mortality is cited as a very good proxy for a nation's ability to provide for the rest of its population, which may tell us something about cross-national development in general (Lena and London 1993; Shen and Williamson 1999; Reidpath and Allotey 2003; Pozzi and Ramiro-Fariñas 2015; Shandra et al. 2010). While other dependent variables, such as immunizations, are important, my

study focuses on infant and child mortality. Further analyses should research additional health-related dependent variables, but this is currently beyond the scope of this analysis.

## Main Independent Variables

### Health expenditure

I include health expenditure as a percentage of GDP in the models. This measure includes all current expenditure by all levels of government for the provision of medical services including private expenditure (World Bank 2016).

### Corruption

The main independent variables measure executive and public sector corruption. These data are from research by Professor Bo Rothstein and Professor Soren Holmberg at an independent research institute (The Quality of Government Institute; Teorell et al. 2017), the Varieties of Democracy data collaboration group within the Department of Political Science at the University of Gothenburg, and the Kellogg Institute at the University of Notre Dame. Their datasets include over 530 indicators that measure democracy and government quality. The measures of interest are interval-ratio indices based on official documents (such as constitutions and government records), and expert assessments on topics like political practices and compliance with rules (Dahlberg et al. 2016; Varieties of Democracy 2016; Teorell et al. 2017). These researchers use measurement models to minimize coder error, and address issues of comparability across countries and time (Varieties of Democracy 2016). The variable descriptions of each corruption indicator are given below. Each variable is multiplied by − 1 so that high levels represent low levels of corruption. This is for ease of interpretation of the interaction terms later in this study. Please note that each measure of corruption can therefore be interpreted as 'controlling' for corruption.

### Measurement and Limitations of Corruption Data

The executive corruption data are an index of executive bribery and corrupt exchanges and executive embezzlement and theft, while the public sector corruption data are an index of public sector corrupt exchanges and public sector theft. Each index is created from an ordinal level variable and converted into intervals by a measurement model. The coding scheme for executive bribery and corrupt exchanges answers the question "How routinely do members of the executive (the head of state, the head of government, and cabinet ministers), or their agents, grant favors in exchange for bribes, kickbacks, or other material inducements?" (Coppedge et al. 2018, p. 119). They are coded using the following scale: "(0) It is routine and expected. (1) It happens more often than not in dealings with the executive. (2) It happens but is unpredictable: those dealing with the executive find it hard to predict when an inducement will be necessary. (3) It happens occasionally but is not expected. (4) It never, or hardly ever, happens" (Coppedge et al. 2018, p. 119).

The coding scheme for executive embezzlement and theft answers the question "How often do members of the executive (the head of state, the head of government, and cabinet ministers), or their agents, steal, embezzle, or misappropriate public funds or other state resources for personal or family use?" (Coppedge et al. 2018, p. 120). This variable is coded using the following scale: "(0) Constantly. Members of the executive act as though all public resources were their personal or family property. (1) Often. Members of the executive are responsible stewards of selected public resources but treat the rest like personal property. (2) About half the time. Members of the executive are about as likely to be responsible stewards of selected public resources as they are to treat them like personal property. (3) Occasionally. Members of the executive are responsible stewards of most public resources but treat selected others like personal property. (4) Never, or hardly ever. Members of the executive are almost always responsible stewards of public resources and keep them separate from personal or family property" (Coppedge et al. 2018, p. 120).

For public sector corrupt exchanges, the question is "How routinely do public sector employees grant favors in exchange for bribes, kickbacks, or other material inducements?", and the coding scheme is "(0) Extremely common. Most public sector employees are systematically involved in petty but corrupt exchanges almost all the time. (1) Common. Such petty but corrupt exchanges occur regularly involving a majority of public employees. (2) Sometimes. About half or less than half of public sector employees engage in such exchanges for petty gains at times. (3) Scattered. A small minority of public sector employees engage in petty corruption from time to time. (4) No. Never, or hardly ever" (Coppedge et al. 2018, p. 120).

Public sector theft is coded with the following question "How often do public sector employees steal, embezzle, or misappropriate public funds or other state resources for personal or family use?", and the coding scheme is "(0) Constantly. Public sector employees act as though all public resources were their personal or family property. (1) Often. Public sector employees are responsible stewards of selected public resources but treat the rest like personal property. (2) About half the time. Public sector employees are about as likely to be responsible stewards of selected public resources as they are to treat them like personal property. (3) Occasionally. Public sector employees are responsible stewards of most public resources but treat selected others like personal property. (4) Never, or hardly ever. Public sector employees are almost always responsible stewards of public resources and keep them separate from personal or family property" (Coppedge et al. 2018, pp. 120–121).

The V-Dem data are generated by surveying country experts. They use a minimum of five country experts for every country variable. According to Teorell et al. (2019), "V-Dem uses a specifically designed measurement model to provide country-year point estimates, aggregated from multiple codings submitted by country experts by taking disagreement and measurement error into account. In this version of the variable, used in the QoG dataset, V-Dem has linearly translated the measurement model point estimates back to the original ordinal scale of each variable as an interval measure (644)." The data can be directly downloaded from https://www.v-dem.net. The data used can be found in the "Country-Date: V-Dem" section, where

it can be freely downloaded in many different formats (i.e., STATA, Excel, etc.), after providing your personal and institutional information. Currently, the data are available from 1789 to 2017, but the data are updated every year. The variable name, V-Dem, gives the data in the present analysis WHICH are v2x_execorr (Executive Corruption Index) and v2xpubcorr (Public Sector Corruption Index).

The data, therefore, more precisely measure the opinions of country experts on corruption. According to the V-Dem website: https://www.v-dem.net/en/news/call-country-experts-v-dem/ "Country Experts (are) individuals with deep knowledge of a specific thematic area for a particular country, or set of countries. Most Country Experts work on one country, observed over the past several decades, and on one or two clusters of questions, e.g., (1) elections and political parties, (2) the executive, the legislature and deliberation, (3) judiciary, civil liberty and sovereignty, and (4) civil society, media freedom and political equality. The coding procedure is entirely web-based. The default language for the online surveys is English but the survey also available in French, Spanish, Portuguese, Arabic and Russian." They compensate 25 USD for each completed survey (a few hours). Country experts generally have a PhD degree, specialized knowledge on the subject they are asked to evaluate and are a resident of the country. These experts are rigorously vetted and go through a full application process, which can be found here: https://sv.surveymonkey.com/r/7BPSZTQ.

These data are limited in that they are not based on source materials, but instead on the opinion of experts in the field. Therefore, the data may be skewed due to the perceptions of the expert, as well as the expert selection and the availability of experts in a given country. Therefore, some data may be more accurate than others, leading to potential bias. However, the database creators aim to minimize bias and data issues through vetting and employing advanced statistical techniques. Despite these potential limitations, these are the only available data that aim to capture both executive and public sector corruption for nations over time.

### Other Independent Variables and Controls

The following variables are included in the analysis with great care relating to previous research. Model specifications are therefore based on classic and current cross-national sociological studies of infant and child mortality, drawing on political, economic, health, and demographic factors (see Moon and Dixon 1985; Shen and Williamson 2001; Shandra et al. 2005, 2011 for the basis of the model specifications). All the following variables have been identified in previous studies as necessary controls or important factors of infant and child mortality. Multiple model specifications were considered before reaching the variables in the present analysis. Various other factors (including total expenditure, International Monetary Fund, World Bank, and other lenders, urban population, rural population, domestic investment, exports, imports, access to sanitation, child HIV rates, adolescent HIV rates, and anemic pregnancy rates, among others) were considered in this

analysis, but later dropped due to parsimony and theoretical relevance. Other factors such as female secondary school enrollment, contraceptive prevalence, number of birth attendants, and economic inequality were also considered in this analysis, but later dropped because they caused reductions in the sample size and time period of the analysis. In sum, the above variables were excluded from the final models to not over-specify the models, as there was not strong enough theoretical support to include them, and additionally they did not add much to model fit or change the overall results.

The variables in this study include political measures of democracy (Vanhanen 2014; Franco et al. 2004; Lake and Baum 2001; Navia and Zweifel 2003; Shandra et al. 2004), economic variables of GDP per capita (London and Ross 1995; Shen and Williamson 1997), trade (as a percentage of GDP) (Shen and Williamson 2001), and debt service. Health variables include access to improved water sources (Rice 2008), HIV prevalence (Foster and Williamson 2000; Scanlan 2010) and, lastly, the demographic controls include total population (Schultz 1994) and the fertility rate (Shandra et al. 2011; Foster and Williamson 2000). The analysis cannot be extended past 2012 due to the democracy data not being available.

## Findings

Table 3 examines the linear effects of health expenditure and each measure of corruption on infant and child mortality. Table 4 tests the interactive effects of health expenditure and each measure of corruption. Each equation contains one of the two measures of corruption because the measures of corruption are highly correlated with each other (London and Ross 1995).

Table 3 shows that the coefficients that represent health expenditure and public sector corruption fail to reach levels of statistical significance. The coefficients that represent executive corruption only reach levels of statistical significance in model 2. There are a number of other factors that are related to infant and child mortality. First, a number of economic variables are associated with lower infant and child mortality. The coefficients that represent GDP and trade are negative and significant in every equation. This is most likely the case because higher levels of wealth can bring higher standards of living and advanced medical technology (Shen and Williamson 1997). Moreover, higher levels of trade yield a larger availability of imported materials such as medical supplies for infants and children (Shen and Williamson 2001). Second, the coefficients that represent access to water are negative and significant in every equation. This suggests that higher levels of access to water correspond with lower levels of infant and child mortality. According to previous research, this is because a lack of basic access to water corresponds with diarrheal diseases, water-borne illnesses (such as malarial diseases), and parasites, which are some of the leading causes of infant and child mortality (Rice 2008).

There are also some non-significant findings. Economic factors such as debt service, the political factor of democracy, and population, as well as demographic and health factors (fertility rate, HIV prevalence) are not associated with infant and child mortality. These coefficients fail to reach levels of significance in every equation.

The non-significant coefficients for health expenditure and corruption are somewhat surprising; however, so far, I have only considered the *additive* effects of corruption on infant and child mortality. I note in the preceding discussion that there are theoretical reasons for an *interactive* relationship between petty and grand corruption and health expenditure. I construct the interaction terms by multiplying the moderator variable by the focal variable (i.e., health expenditure) (Jaccard 2001). Please note that the corruption variables are multiplied by − 1 for ease of interpretation. In Table 4, the coefficients that represent each interaction term are negative and significant in every equation. The sign and significance of the coefficients that represent the interactions between grand corruption in the executive branch and petty corruption in the public sector and health expenditure suggest that health expenditure decrease infant and child mortality more at lower levels rather than at higher levels of corruption.

The predicted effects of these relationships (see Figs. 3, 4, 5, 6) illustrate that health expenditure has different effects on infant and child mortality at different levels of each type of corruption. In these figures, I use the coefficients from Table 4 to graph the predicted change in health expenditure as corruption in the executive and public sectors simultaneously increases, holding all continuous covariates at their

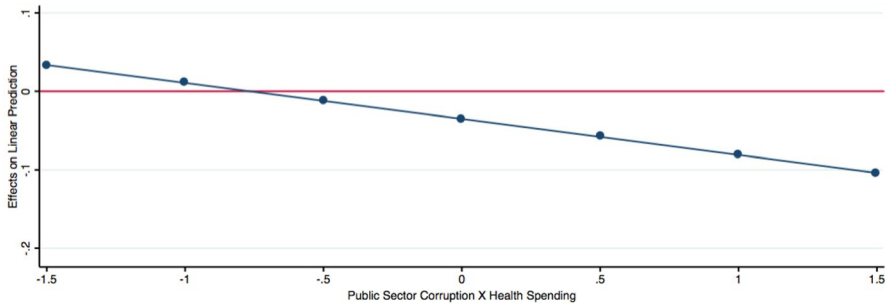


**Fig. 3** Predicted effects on infant mortality

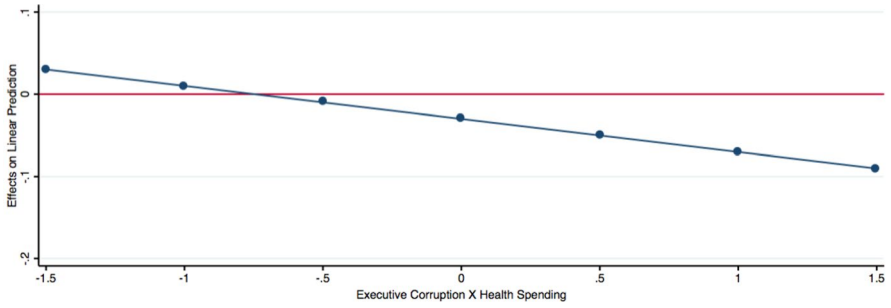


**Fig. 4** Predicted effects on infant mortality

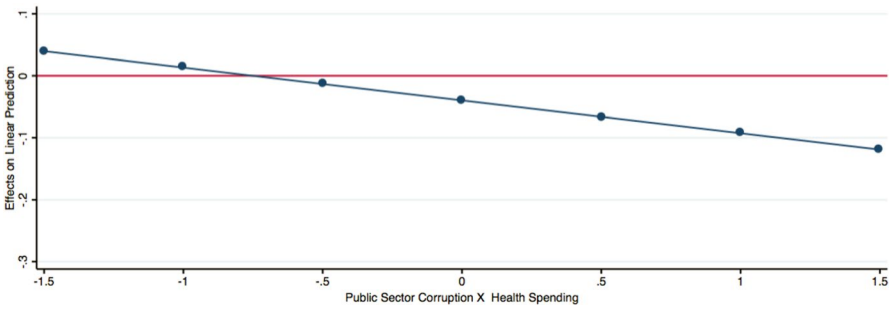


**Fig. 5** Predicted effects on child mortality

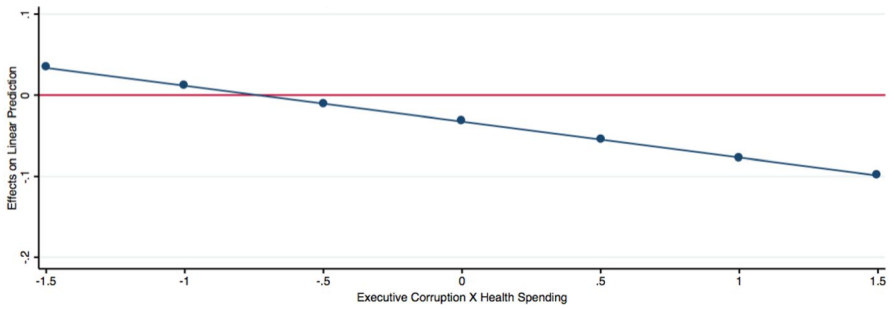


**Fig. 6** Predicted effects on child mortality

mean and categorical covariates (time dummy variables) at the reference category of zero. I find that the effect of health expenditure on infant and child mortality is relatively low when corruption is high. This indicates that, when health expenditure is low and corruption in the executive and public sector is high, there are higher levels of infant and child mortality. Initial decreases in corruption result in an increase in health expenditure, supporting the hypotheses of this study. In particular, as health expenditure increases and corruption decreases, infant and child mortality steadily declines (as indicated by the downward sloping line). The other findings remain stable and consistent across the new model specifications.

## Discussion and Conclusion

Despite previous research and case study evidence suggesting that executive and public sector corruption may have differential impacts on infant and child health, there has been no cross-national analysis to test these assumptions, even though data now exist to evaluate these hypotheses. Therefore, the present study fills this lacuna by disaggregating corruption into executive and public sector corruption in order to see how each impacts infant and child mortality. On the one hand, previous research argues that executive corruption should lead to large distortions in health spending

due to large-scale financial transactions; however, such cases may be infrequent, having less of an impact on health overall (Ensor and Duran-Moreno 2002; Fazekas et al. 2013). On the other hand, research also suggests that public sector corruption may not have a large impact on health funds and outcomes due to the small size of these exchanges, even if they are frequent (Ensor and Duran-Moreno 2002).

These potentially differential impacts are the starting point for this study. I test these hypotheses by interacting health expenditure with executive corruption and public sector corruption, respectively. Notwithstanding previous research, the findings reveal that an increase in spending on health is unlikely to lead to lower infant and child mortality if the country has both high levels of grand corruption in the executive branch and petty corruption in the public sector (Rajkumar and Swaroop 2008, 2004). These findings substantially contribute to previous research in this area, as they suggest that health expenditure decreases infant and child mortality more at lower levels of both executive *and* public sector corruption rather than at higher levels of each type of corruption. As a whole, the findings suggest that both types of corruption, regardless of the perceived amount or frequency, distort health spending and impact infant and child mortality.

At the very least, health spending can be greatly improved when corruption is minimized (Rajkumar and Swaroop 2008). In line with some previous studies, health expenditure may be ineffective at reducing infant and child mortality when there are high levels of corruption due to embezzlement and theft of funds, supplies, and equipment, which can reduce the amount of funds for health, the quality of care, service improvement, and patient trust, and increase patient cost (Filmer and Pritchett 1999; Cockcroft et al. 2008; Ensor and Duran-Moreno 2002).

In the world of practitioners, increased attention should focus on designing and implementing corruption interventions in the health sector. This can involve centralizing health expenditure for essential medicines, equipment, and supplies, which may help provide extra checks on where funds go and what they are used for (Vian 2008). There may also be benefits from employing auditing systems, which can track health funds and identify where leakages are occurring (Kohler 2011). It may also serve nations to increase the wages of public sector workers so there is less incentive for corruption (Callister 1999; Cockcroft et al. 2008). Protecting those who report illegal activities and punishing those who commit them may also help reduce grand corruption in the upper echelons of government (Callister 1999; Ensor and Duran-Moreno 2002).

However, under the institutional and budgetary constraints these nations are facing, such policy measures may not be very helpful. Nations under such constraints may not have the funds to set up such auditing systems, increase wages of workers, or incentivize reporting corrupt behaviors. In these cases, non-governmental organizations (NGOs) are central to combating corruption. Such organizations focus on influencing and developing domestic policies against corruption, researching and monitoring activities on the ground to report corruption and play a large part in anti-corruption advocacy. For instance, Transparência Brasil broadcasts anti-corruption messages in Sao Paulo to disseminate information and awareness on corruption (Carr and Outhwaite 2011).

Similarly, NGOs have helped constrained governments improve their corruption-reporting procedures, spread the word on how to report, and assist with addressing the reports. For instance, an NGO in Ecuador, Corporación Latinoamericana para el Desarrollo, provides information on how to avoid corruption in public procurement by explaining these processes (Carr and Outhwaite 2011). Other organizations, such as the World Bank, United Nations, African Union, and Organisation for Economic Co-operation and Development (OECD), have also tried to combat corruption by requiring borrowing or donor nations to adopt anti-corruption laws or to sign international treaties such as the UN Convention Against Corruption or the OECD Convention on Combating Bribery and Foreign Public Officials in International Business Transactions (Carr and Outhwaite 2011). These treaties also provide bilateral lenders with tools to help reduce corruption in receiving nations. For example, Denmark reportedly reduced its aid to Tanzania by over 3 million USD in an effort to incentivize the government to speed up its proposed anti-corruption legislation (Carr and Outhwaite 2011). Put differently, NGOs, other organizations, and other nations have several tactics to reduce corruption in nations by providing incentives, assistance, or awareness, which can be extremely useful in nations that do not have the capacity or budgetary allowances to reduce corruption.

Due to data availability and potential underreporting of mortality data (Gonzalez and Gilleskie 2017), care should be taken when making generalizations and recommendations beyond this sample and period of time (i.e., 1996–2012). Future research can improve on this study by using more time points when the data become available. Additionally, it is important to know whether the findings are robust against health spending with different goals (e.g., pro the poor versus spending for elite hospitals. Unfortunately, the health expenditure data are not disaggregated at the country level to measure this important phenomenon. To add to the important literature that shows health spending tends to favor richer areas rather than poorer areas, future research may aim to access detailed health spending reports for a few nations in order to compare them.

Moreover, although this study uses new data on types of corruption in the executive and public sector, better measurement of corruption is necessary for researchers to obtain a more precise understanding of how these acts interact with health spending to impact development outcomes. Researchers may want to further investigate the relationship between democracy and corruption in future research, as previous research suggests that accountability and responsiveness can limit corruption (Lee 2005; Brady and Bostic 2015).

One irrefutable conclusion surpasses the fallbacks of this study: the cross-national relationships between different types of corruption on health spending deserve more attention from social scientists in general, both analytically and empirically. Deciphering the relationship between grand and petty corruption and health spending should be a perennial preoccupation of theorists and practitioners alike, in order to figure out ways to reduce infant and child mortality. Moreover, this study suggests the value of moving beyond characterizing corruption in cross-national research as a one-sided concept, and to move towards theorizing it within a larger framework of types, government bodies, and service delivery.

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## Compliance with Ethical Standards

**Conflict of interest** The author has no known conflicts of interests to report.

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