Governance commitment to reduce maternal mortality. A political determinant beyond the wealth of the countries

Abstract

Some countries reached, in 2015, the Millennium Development Goal of reducing maternal mortality to 96 or less maternal deaths per 100,000 live births. Others, however, did not. This paper analyses the strength of the association between maternal mortality and each of the six components of Governance—a political determinant scarcely explored in the literature—in 174 countries. It was found that the greater the governance, the lower maternal mortality, independently of a country's wealth. We used all six indicators of the World Bank´s Worldwide Governance Indicators Project in 2015: government effectiveness, regulatory quality, rule of law, control of corruption, voice and accountability, and political stability and absence of violence. Findings were encouraging as maternal mortality in low-income countries with higher government effectiveness and regulatory quality was similar to that of medium-income countries with lower government effectiveness and regulatory quality. To achieve the post-2015 sustainable development goal on preventable maternal mortality—which persists despite economic development—all governance dimensions are essential and represent interdependent cornerstones.

1. Introduction

Maternal mortality is a deep-seated issue, at the heart of global health and development. Over the last 30 years, the world community has sought to address maternal mortality — its prevalence, causes, and elimination. Most notably, the United Nations Millennium Development Goals (MDG), adopted in 2000, established the target of a 75% reduction in worldwide maternal mortality by the year 2015 (United Nations, 2000). However, the efforts of the world's health community resulted in an average reduction of only 44 % of the maternal mortality ratio (MMR), with a drop from 385 to 216 deaths per 100,000 live births between 1990 and 2015 (Alkema et al., 2016; Cabero-Roura and Rushwan, 2014; United Nations, 2013; World Health Organization, 2015a). This reduction rate equates to a 2.9% drop in annual maternal mortality, and "in the next 15 years, 3.9 million women [will] die from a maternal cause of death" (Alkema et al., 2016, p, 463) —numbers which would fall drastically short of the Sustainable Development Goal (SDG) of 70 or less maternal deaths per 100,000 live births (United Nations 2015).

Successful health interventions carried out between 1990 and 2015 have focused on maternal mortality clinical components and have sought to increase both the number of skilled attendants and access to quality obstetric care (World Health Organization, 2015; Yamin, 2013). However, literature has emerged on the influence that structural determinants such as policies, that systematically put certain groups at a disadvantage, have on MMR. (Ciccone et al., 2014; Sajedinejad et al., 2015).

One of these structural factors is governance. The international community has recently fully recognised accepted and incorporated the effects of governance on health outcomes through the adoption of the 2016 United Nations Sustainable Development Goals. Goal 16 aims to promote "Peace, Justice, and Strong Institutions", specifically

listing the global need to improve rates of public corruption, government accountability and the rule of law.

Over the last decade, some studies have established a direct association between health outcomes (Ciccone et al., 2014; Ruger, 2006)— such as the reduction of mortality rates (Farag et al., 2012)—and specific dimensions of governance—which is understood as the way in which a society organises and manages its affairs collectively. In this sense, level of democracy was observed to be positively related to health (Krueger et al., 2015) and rule of law to child mortality (Lin et al., 2014), maternal mortality (Holmberg and Rothstein, 2011; Pinzon-Rondon et al., 2015; Sajedinejad et al., 2015) and other health issues (Klomp and de Haan, 2008; Lazarova and Mosca, 2008). Maternal mortality has also been found to be associated with the quality of government (Holmberg and Rothstein, 2011). Further investigations have provided evidence that corruption is related to health, child and maternal mortality and HIV prevalence (Factor and Kang, 2015; Holmberg and Rothstein, 2011; Klomp and de Haan, 2008; Lazarova and Mosca, 2008; Lee et al., 2015; Lin et al., 2014; Muldoon et al., 2011; Pinzón-Flórez et al., 2015; Sajedinejad et al., 2015). Low levels of corruption (Muldoon et al., 2011; Pinzón-Flórez et al., 2015), high adherence to rule of law (Pinzon-Rondon et al., 2015) and government effectiveness (Batniji et al., 2014) have been linked to lower maternal mortality, even when adjusting for wealth (Pinzon-Rondon et al., 2015). However, a major limitation of these studies is that they analyse only some governance dimensions. In most cases, they identify the global concept of governance with only one of its dimensions. The Corruptions Perception Index (Transparency International, 2019) was the most widely used in governance and health outcomes literature (Factor and Kang, 2015; Holmberg and Rothstein, 2011; Krueger et al., 2015; Pinzón-Flórez et al., 2015). However, as corruption

is only one aspect of governance, a more expansive analysis of the governance concept and its health effects is required.

Since improving governance is a difficult task, several approaches have been developed. The World Bank defines governance as "the traditions and institutions by which authority in a country is exercised" (Kaufmann et al., 2011, p, 222) and measures it using six indicators related to each governance dimension: government effectiveness, regulatory quality, rule of law, control of corruption, voice and accountability, and political stability and absence of violence. Several papers have elaborated aggregated measures based on some of the World Bank´s dimensions of governance (Batniji et al., 2014; Factor and Kang, 2015; Holmberg and Rothstein, 2011; Lazarova and Mosca, 2008; Sajedinejad et al., 2015). Other studies have opted to use any pre-existing indices to create their own tool (Klomp and de Haan, 2008; Lazarova and Mosca, 2008; Pinzon-Rondon et al., 2015). However, this strategy results in an inability to compare or standardise findings. In this sense, correlating some of the World Bank´s indicators should be considered (Kaufmann et al., 2010).

Despite the decline in MMR between 1990 and 2015, the United Nations MDG on this preventable public health problem has not been reached. Adding the function of advocating healthier societies to health professionals´ other functions can lead to benefits (Frenk et al., 2010), but it requires the provision of detailed information.

Providing meaningful results based on the strength of the association between maternal mortality and each of the components that make up governance—rather than with just one governance component or from scattered data sources—is warranted. This study analyses the strength of the association between maternal mortality and each of the six governance components of the World Bank´s Worldwide Governance Indicators

(WGI) Project (World Bank, 2017) in 174 countries. It identified that the greater the governance, the lower the maternal mortality, independently of national wealth.

2. Data and Methods

2.1 Definition of variables and data sets

A cross-sectional ecological study was conducted using each country as a unit of observation and analysis. The study was based on the most updated and comprehensive publicly available data sets of the study variables from 174 member-countries of the United Nations.

The MMR is understood as the number of registered maternal deaths, divided by the number of live births per 100,000 women over a given period. Statistics on MMR were obtained for each country from the World Health Organization (WHO) (World Health Organization, 2015b).

The six dimensions of governance proposed by the World Bank´s WGI Project enable adopting a comprehensive approach to the concept of governance: government effectiveness, regulatory quality, rule of law, control of corruption, voice and accountability, and political stability and absence of violence.

In accordance with the WGI Project, these six dimensions cover the three areas that make up the notion of governance:

1. The capacity of the government to effectively formulate and implement sound policies measured by the dimensions of government effectiveness and regulatory quality. The government effectiveness dimension describes perceptions of the quality of public services, civil service (and degree of independence from political pressures), quality of

policy formulation and implementation, and the credibility of government's commitment to such policies. The regulatory quality dimension captures perceptions relating to the government's ability to formulate and implement sound policies and regulations that permit and promote private sector development.

2. The respect of citizens and the state for the institutions that govern economic and social interactions among them measured by the dimensions of control of corruption and rule of law. The control of corruption dimension measures 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 rule of law dimension captures perceptions of the extent to which agents have confidence in, and abide by the rules of society, and, particularly, the quality of contract enforcement, property rights, the police, the courts, and likelihood of crime and violence.

3. The process by which governments are selected, monitored and replaced, measured by the dimensions of political stability and absence of violence/terrorism and voice, as well as accountability. The political stability and absence of violence/terrorism dimension summarises the perceptions of the likelihood that the government will be destabilised or overthrown, by unconstitutional or violent means, including politically motivated violence and terrorism. The voice and accountability dimension captures the perceptions of the country's citizens' ability to participate in selecting their government, as well as freedom of expression, freedom of association, and free media.

Since the six WGI related to the six dimensions are based on several governance variables, each country has an estimated value for each indicator. Each one of them is expressed in standard normal units and ranges from -2.5 (lowest governance level) to 2.5 (highest governance level), the global average being equal to 0 for each indicator

(Kaufmann et al., 2011). Information regarding governance was retrieved from the World Bank`s WGI data set for 2015 (World Bank, 2017).

Concerning a nation's wealth, we chose to employ the Gross National Income (GNI) variable as it is an important determinant of health (Lee et al. 2011; Muldoon et al., 2015). This variable was converted to U.S. dollars using the World Bank Atlas Method and divided by the midyear population to obtain the GNI per capita (GNI pc) (Wold Bank, 1989). Information related to GNI pc for each country came from the World Bank database for 2015 (World Bank, 2018a).

We used the World Bank Analytical Classification for 2015 (World Bank, 2018b) to create three groups of countries by income level: "low-income" countries, with a GNI pc of $ 4,035 or less; "middle-income" countries with a GNI pc between $ 4,046 and $ 12,475; and "high-income" countries with a GNI pc of $12,476 or more.

2.2 Statistical analysis

To illustrate bivariate trends, we estimated the Pearson`s correlation coefficient between MMR and each of the six WGI within the corresponding income level. We performed the one-tailed t-test to analyse the significance of the results.

We conducted a simple and multiple logistic regression analysis to estimate the risk of failing to achieve the maternal mortality millennium goal target according to each governance dimension. The logistic regression approach is the natural statistical procedure to analyse the influence of one or more factors on a dependant categorical variable (Janzen and Stern, 1998). According to the United Nations MDG target to reduce the MMR by three-quarters between 1990 and 2015—that is, from 385 to 96 or less maternal deaths for each 100,000 live births—, the countries were classified into two

groups: countries with an MMR value of 96 or less were included in the "MMR-target of the MDG achieved" group, while the others were included in the "MMR-target of the MDG not achieved" group.

Moreover, for each of the six WGI, we considered the countries' classification according to their governance level: below the global average set by the World Bank (Kauffman, 2011) equal to 0 ("lower"); or above ("higher"). Categorising the covariates has the advantage of assuming the linearity between the independent variables and the odds ratio logarithm required by the logistic regression (Stoltzfus, 2011). It also leads to greater efficiency in data summarisations (Baneshi and Talei, 2011). Furthermore, interpreting the impact of a binary independent variable on the dependent variable is easier than interpreting the impact of a 1 unit change in a continuous independent variable (Baneshi and Talei, 2011; Sperandei, 2013). This fact is particularly worthy of note given that governance indicators are dimensionless standardised variables (Kaufmann et al., 2011).

We estimated the odds ratio (OR) (Model 1) and the adjusted OR by income as a potential confounding variable (Model 2) with their respective 95% confidence interval (CI).

To describe the data's main characteristics, we calculated the MMR average and the standard deviation by income and governance levels for each of the six WGI.

Our analysis was conducted using Microsoft Office Excel 2013 and the Statistical Package of the Social Sciences (SPSS) version 15.0.

3. Results

3.1 Maternal mortality ratio trends according to each of the six governance indicators

According to the government's capacity to effectively formulate and implement sound policies, a country's general trend of increased government effectiveness and increased wealth resulted in lower MMR (Figure 1). This trend was particularly visible in low-income countries where the relationship between government effectiveness and MMR was stronger and more significant ($r = -0.567$, $p < 0.001$). Despite this general trend, the MMR average of low-income countries with greater government effectiveness was only slightly higher than the MMR average of the middle-income countries with lower government effectiveness (98.3 vs. 93.7 maternal deaths for each 100,000 live births) (Table 1).
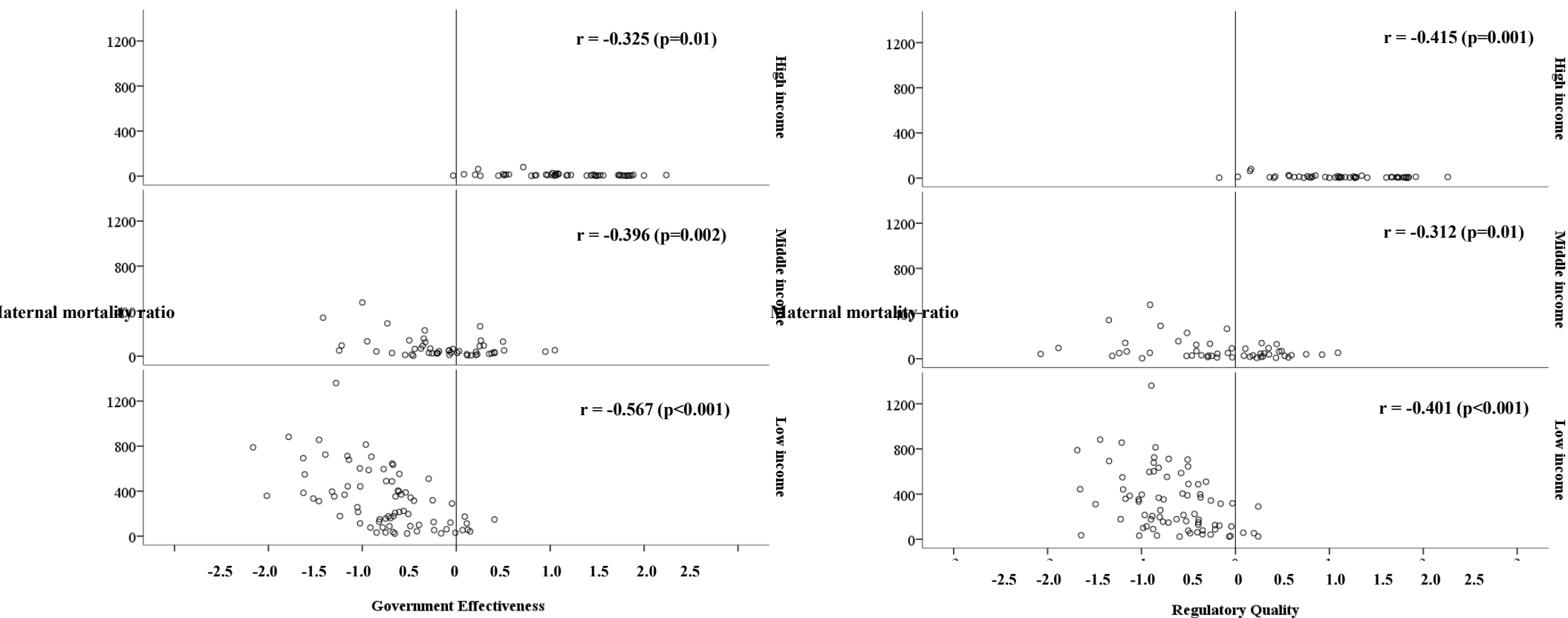
Figure 1. Trends of Maternal Mortality Ratio by Government Effectiveness and by Regulatory Quality. Countries (N = 174) were classified in "Low-income" (GNI pc of $ 4,035 or less), "Middle-income" (GNI pc between $ 4,046 and $ 12,475), and "High-income" (GNI pc of $12,476 or more). Notes: r = Pearson´s correlation coefficient; p = p-value from the one-tailed t-test; p-value < 0.05 indicates statistical significance.

Similar to the behaviour of the effectiveness indicator, the regulatory quality indicator had a moderate and significant relationship with MMR in all income groups (r = -0.401, $p < 0.001$; r = -0.312, $p = 0.01$, and r = -0.415, $p = 0.001$, for low, middle and high-income countries, respectively) (Figure 1). However, strikingly, the MMR average of low-income countries with higher regulatory quality was quite similar to the MMR average of middle-income countries with lower regulatory quality (104.1 vs. 106.8 maternal deaths for each 100,000 live births) (Table 1).

Governance indicators that encompass the respect of citizens and the state for the institutions that govern economic and social interactions among them followed a similar trend to that of the latest indicators, with an MMR that decreased as the countries improved their levels of these governance dimensions and wealth (Figure 2). This trend was observed primarily in low-income countries for each indicator—control of corruption and rule of law— (r = -0.403, $p < 0.001$ and r = -0.446, $p < 0.001$, respectively).

Political stability and absence of violence/terrorism and voice and accountability indicators—relating to the process by which governments are selected, monitored and replaced—were significantly related to MMR in the low-income countries group (r = -0.335, $p = 0.002$ and r = -0.272, $p = 0.009$, respectively) (Figure 3).
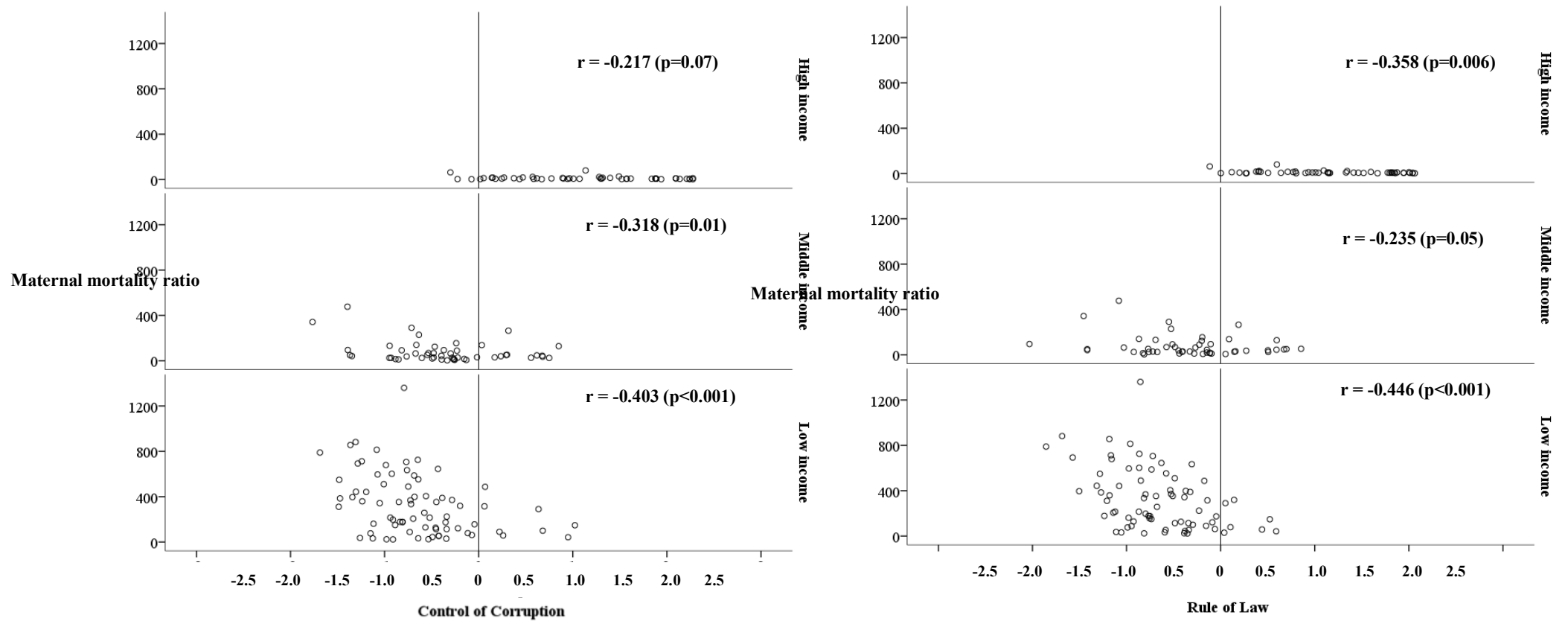
Figure 2. Trends of Maternal Mortality Ratio by Control of Corruption and by Rule of Law. Countries (N = 174) were classified in "Low-income" (GNI pc of $ 4,035 or less), "Middle-income" (GNI pc between $ 4,046 and $ 12,475), and "High-income" (GNI pc of $12,476 or more). Notes: r = Pearson´s correlation coefficient; p = p-value from the one-tailed t-test; p-value < 0.05 indicates statistical significance.

13

Figure 3. Trends of Maternal Mortality Ratio by Political Stability and Absence of Violence/Terrorism, and by Voice and Accountability. Countries (N = 174) were classified in "Low-income" (GNI pc of $ 4,035 or less), "Middle-income" (GNI pc between $ 4,046 and $ 12,475), and "High-income" (GNI pc of $12,476 or more). Notes: r = Pearson´s correlation coefficient; p = p-value from the one-tailed t-test; p-value < 0.05 indicates statistical significance.
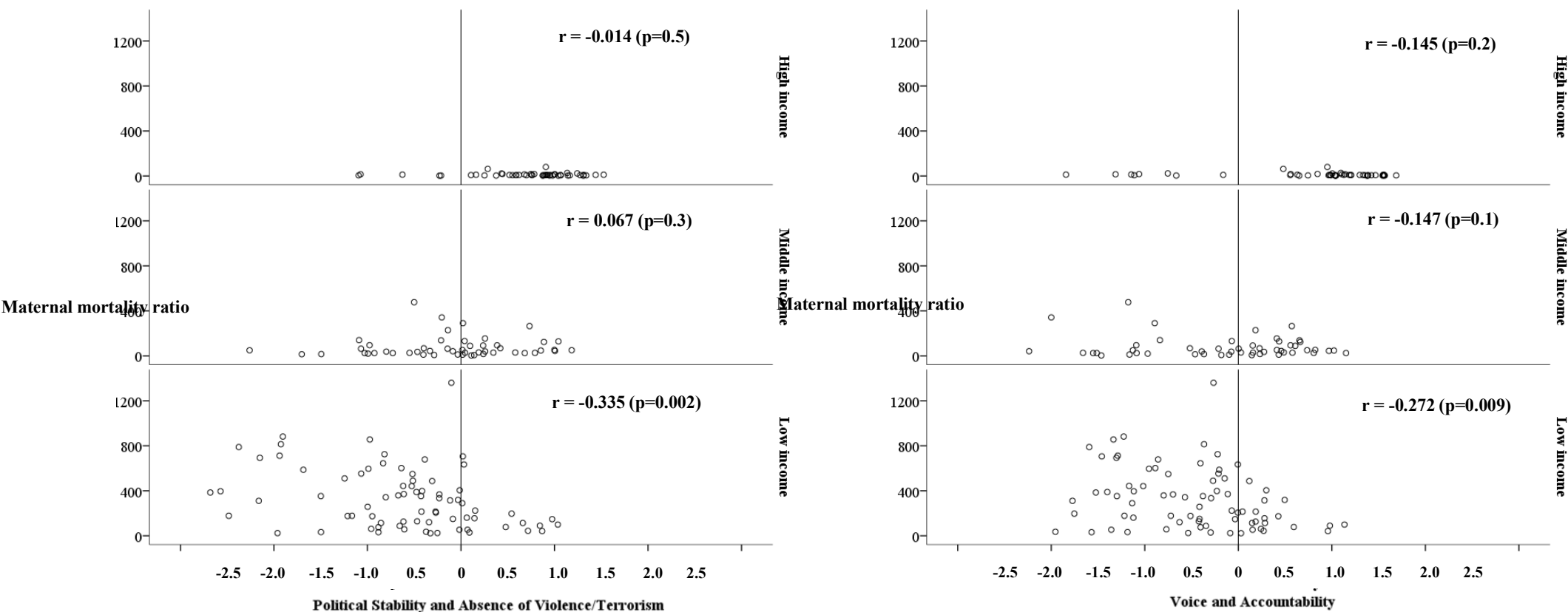
Table 1. Maternal mortality ratio average by income and governance level

		Government Effectiveness				
		Lower			**Higher**	
	N	**Mean**	**(SD)**	**N**	**Mean**	**(SD)**
Low-income	69	348.4	(268.3)	6	98.3	(50.3)
Middle-income	30	93.7	(107.5)	20	56.9	(60.4)
High-income	1	4.0	(0)	48	11.9	(13.7)
		Regulatory Quality				
		Lower			**Higher**	
	N	**Mean**	**(SD)**	**N**	**Mean**	**(SD)**
Low-income	71	340.9	(267.4)	4	106.8	(106.5)
Middle-income	28	104.1	(114.5)	22	47.0	(36.0)
High-income	1	4.0	(0)	48	11.9	(13.7)
		Control of Corruption				
		Lower			**Higher**	
	N	**Mean**	**(SD)**	**N**	**Mean**	**(SD)**
Low- income	67	344.8	(272.8)	8	191.3	(147.0)
Middle-income	38	80.6	(100.1)	12	73.9	(67.9)
High-income	3	23.3	(28.1)	46	10.9	(11.7)
		Rule of Law				
		Lower			**Higher**	
	N	**Mean**	**(SD)**	**N**	**Mean**	**(SD)**
Low-income	68	348.0	(270.1)	7	137.9	(111.4)
Middle-income	37	82.5	(100.7)	13	68.8	(67.5)
High-income	1	63.0	(0)	48	10.6	(11.5)
		Political Stability and Absence of Violence/Terrorism				
		Lower			**Higher**	
	N	**Mean**	**(SD)**	**N**	**Mean**	**(SD)**
Low-income	59	365.5	(271.4)	16	191.8	(193.9)
Middle-income	24	83.8	(112.1)	26	74.5	(71.6)
High-income	5	7.8	(4.8)	44	12.1	(14.1)
		Voice and Accountability				
		Lower			**Higher**	
	N	**Mean**	**(SD)**	**N**	**Mean**	**(SD)**
Low-income	56	383.9	(278.3)	19	164.9	(127.7)
Middle-income	23	85.5	(119.2)	27	73.4	(63.0)
High-income	8	12.5	(5.7)	41	11.5	(14.6)

Notes: N = size of the group of countries by income and governance levels; SD = standard deviation.

[a] For each of the six governance indicators, the countries were classified according to their governance level: below 0 ("lower"), and above 0 ("higher").

[b] "Low-income" (GNI pc of $ 4,035 or less); "Middle-income" (GNI pc between $ 4,046 and $ 12,475), and "High-income" (GNI pc of $12,476 or more).

3.2 Achievement of the Maternal Mortality Ratio Target according to governance indicators

As shown in Table 2, all six World Bank´s Worldwide Governance Indicators were found to have a great and significant effect on MMR target achievement and, after adjusting for GNI pc, the effect was preserved. The government effectiveness and the regulatory quality indicators were those that were the most strongly associated with MMR, with an AOR of 5.48 (95 % CI 1.86-16.16; p = 0.002) and of 12.42 (95 % CI 3.23-47.76; p < 0.001), respectively. Regarding control of corruption, a significant association was found between the governance levels represented by this indicator. The risk of failing to reach the maternal mortality target in a country with low control of corruption was greater than in a country with high control of corruption (AOR 2.90; 95 % CI 1.04-8.12; p = 0.043). The risk of maternal mortality increased in countries with low rule of law (AOR 4.20; 95 % CI 1.4-12.61; p = 0.010). Finally, despite being the variable with the weakest association, political stability and absence of violence/terrorism indicator still showed a significant association with lower MMR (AOR 2.78; 95 % CI 1.16-6.62; p = 0.021). Similarly, the analysis showed that the probability failing to achieve the maternal mortality target was higher in countries with low voice and accountability (AOR 2.96; 95 % CI 1.67-6.93; p = 0.012).

Table 2. Maternal mortality ratio (MMR) according to each Worldwide Governance Indicator. 2015

Governance Indicator [b]	MMR-target of the MDG not achieved (%) [a]	MMR-target of the MDG achieved (%)	Model 1			Model 2 [c]		
			OR	95% CI	p-value [d]	Adjusted OR	95% CI	p-value
Government Effectiveness								
Lower	91.3	35.2						
Higher	8.7	64.8	19.30	(7.63. 48.82)	< 0.001	5.48	(1.86. 16.16)	0.002
Regulatory Quality								
Lower	95.7	32.4						
Higher	4.3	67.6	45.94	(13.47. 156.72)	< 0.001	12.42	(3.23. 47.76)	< 0.001
Control of Corruption								
Lower	88.4	44.8						
Higher	11.6	55.2	9.41	(4.09. 21.61)	< 0.001	2.90	(1.04. 8.12)	0.043
Rule of Law								
Lower	91.3	41.0						
Higher	8.7	59.0	15.14	(6.01. 38.12)	< 0.001	4.20	(1.40. 12.61)	0.010
Political Stability and Absence of Violence/Terrorism								
Lower	76.8	33.3						
Higher	23.2	66.7	6.62	(3.32. 13.22)	< 0.001	2.78	(1.16. 6.62)	0.021
Voice and Accountability								
Lower	73.9	34.3						
Higher	26.1	65.7	5.43	(2.77. 10.63)	< 0.001	2.96	(1.67. 6.93)	0.012

Notes: OR = odds ratio: CI = confidence interval.

[a] The countries with an MMR value of 96 or less were in the group labelled "MMR-target of the MDG achieved" (n = 69) while the others were in the group "MMR-target of the MDG not achieved" (n = 105). Row percentages are shown.

[b] For each of the six governance indicators, the countries were classified according to their governance level: below 0 ("lower"), and above 0 ("higher").

[c] Model 2 was adjusted by GNI (US$ per capita). 2015.

[d] p-value < 0.05 indicates statistical significance.

4. Discussion

4.1 Summary of the main findings

Our findings show that in 2015, all six governance dimensions were associated with the countries' MMR target achievement. Overall, the higher a country scored on any governance indicator, the lower the probability of MMR. This risk remained even after adjusting for country wealth. We found that a government's ability to formulate and implement sound policies effectively, along with compliance with the rules of society, were as important as a country's wealth. In this sense, the maternal mortality risk is 12 times higher in countries with low regulatory quality than in those with high regulatory quality. For government effectiveness and rule of law, the risk is 6 and 4 times higher, respectively. We have thus contributed information on the dimensions of regulatory quality and voice and accountability, whose influence on maternal mortality have been scarcely examined to date.

As demonstrated in a literature review, studies are lacking on the association between maternal mortality and each of the six dimensions of governance (Ciccone et al., 2014 The present analysis is a useful contribution in this sense. Although some authors use factorial analysis, looking for "the unobserved common factor" (Kaufmann et al., 2010, p. 2) of governance— referred to as "good government" (Knack and Langbein, 2010, p. 356)—to substitute the six WGI by this factor, the existing correlation between the six WGI justifies analysing MMR in relation to each indicator separately: the reason is, if one governance dimension is weakened, the entire structure can be affected.

4.2 Findings from other relevant studies

Maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death (Hill and Yoonjoung, 2004).

Reproductive health and maternal mortality care pathways are determined by individual, family, societal, institutional and policy levels, including lack of care during the pregnancy, natal and postnatal periods. Countries are experiencing their own obstetric transition (Souza et al., 2014), in which the "three delays" model is useful to explain maternal mortality (Barnes-Josiah et al., 1998). Delays in the decision to seek care (first delay) and in reaching health care (second delay) occur in many countries that still have high maternal mortality, mainly due to direct causes as well as underlying cultural and socio-economic conditions of access to health care (Kaur et al., 2018).

Many other countries are experiencing an obstetric transition, consisting in passing from higher prevalence of direct obstetric causes to an increasing amount of indirect causes of maternal mortality. These new scenarios have implications for the strategies aimed at reducing maternal mortality because they are related to non-communicable causes: ageing of the maternal population and moving from the natural history of pregnancy and childbirth towards institutionalisation of maternity care, increasing rates of obstetric intervention and eventual over-medicalization (Millet et al., 2016; Souza et al. 2014).

In this panorama, our findings show that countries with lower income and low governance exhibited higher MMR than those with higher income and higher governance, as expected. However, we observed some noteworthy exceptions: as low-income countries with upper regulatory quality have similar MMR values as middle-income countries, who presented a lower regulatory quality of formulation and implementation of sound private sector development policies. This finding may reveal how regulatory quality influences economic development, capacitation, and women's decision-making independence regarding their own sexual and reproductive health. The same pattern can be found in the relation between MMR and government effectiveness. Specifically, this could mean that if governments have the

political will to increase the quality of public services and prioritise formulating and implementing of sexual and reproductive policies, along with that of gender equity, including public service's independence from political pressures, they would contribute to curbing and reducing maternal deaths.

Evidence about the importance that government effectiveness and regulatory quality have for health suggests that absolute income is the major health determinant in countries below a certain income threshold. However, governance is more important in countries situated above this threshold (Lazarova and Mosca, 2008). This may reflect the situation of wealthier countries who focus more on private health care than on investments in their public health care systems. This finding is in line, on the one hand, with studies that showed that public health spending only leads to improvements when there is good governance (Sajedinejad et al., 2015); on the other hand, the finding is also compatible with the study that found that public spending improved lives more than private health spending (Holmberg and Rothstein, 2011). While the climate for private sector success can hamper not only economic growth but also access to goods and services for the general population, regulatory quality is the other side of the coin (Kaufmann et al., 2011).

A high-income country such as the United States experienced an increase in MMR during the MDG period (Creanga et al., 2014). The country, historically, has relied more heavily on private health care than other high-income—and even some lower-income—countries (Creanga et al., 2014). Many European countries, notably Spain and northern countries such as Norway, Sweden, and Denmark, have funded and established public health systems, and present the lowest MMR values, at 5 maternal deaths or less per 100,000 (World Health Organization, 2015a).

A recent study shows that when government spending on health in the European Union decreased, countries experienced an increase in MMR of up to 10 %, even after controlling for confounding variables (Maruthappu et al., 2015). Other studies have shown that public—not private—health spending is associated with better public health (Holmberg and Rothstein, 2011), which could be the effect at play here.

Policies and plans related to the third delay, that address and ensure the sustainability of health care quality, and that improve reference systems between health centres and hospitals to eliminate delays within health systems, are key measures to reduce maternal mortality (Souza et al., 2014).

In addition, there is a persisting need in high income countries to consolidate more efficient policies regarding vulnerable populations: in high income countries, MMR is higher among vulnerable populations and maternal mortality outcomes are sensible indicators of socioeconomic deprivation as shown in a study on immigrants in France (Tessier et al., 2017).

Control of corruption has been studied more in-depth than other governance dimensions. Corruption has the strongest association with health expenditure in terms of GDP per capita percentage (Factor and Kang, 2015). Corruption at upper levels was associated both with lower levels of health expenditure as a percentage of GDP per capita, and with poorer health outcomes (Factor and Kang, 2015; Holmberg and Rothstein, 2011; Pinzón-Flórez et al., 2015). Our analysis observed this to be true, as corruption demonstrated a perfect inverse association with MMR, even after adjusting for GNI pc. The rule of law dimension, together with control of corruption, capture the respect of citizens and state for institutions that govern economic and social interactions among them. Our findings corroborate the fact that a country's overall health status is positively associated with the rule of law (Pinzon-Rondon, et al., 2015); a health status inclusive of MMR. Interestingly, we observed an example of a high-income country

characterised by its poor situation with respect to the rule of law in which MMR was only slightly lower than the MMR of middle-income countries with higher levels of rule of law.

Political stability and absence of violence/terrorism is associated with higher national MMR across income levels. Although political stability is a broad term—covering internal, external and armed conflicts, protests and riots, terrorist acts, civil war and government stability (Kaufmann et al., 2011)—, implications for mortality rates are weak. The literature covering the relationship between MMR and both political stability and the presence of violence and terrorism demonstrates torturous and long-lasting consequences for increased mortality rates, particularly for women and children (Akseer et al., 2016; Firoz et al., 2016; Loyer and Loyer, 2014; Oyerinde et al., 2011; Sen et al., 2012; Southall, 2011; Swatzyna and Pillai, 2013). Our analysis also supported the fact that developing countries are among those most afflicted by political instability, armed, ethnic or religious conflicts and the slowest to recover. Recent studies on Myanmar, Sierra Leone and Mozambique include qualitative components such as resulting post-conflict unemployment, internal displacement of vulnerable populations, breakdown of basic road and health infrastructure as influencers of high MMR. They find that, in some cases, the effects can last up to 20 years after the conflict (Firoz et al., 2016; Loyer and Loyer, 2014; Oyerinde et al., 2011; Swatzyna and Pillai, 2013).

We could learn from Afghanistan and Syria, two notable examples of countries with robust public health systems who have been able to decrease or maintain a low MMR in the midst of conflict. Despite this, as both countries remain in armed conflict, long-term results are yet unknown (Akseer et al., 2016; Sen et al., 2012).

A 2013 study of 128 countries revealed that countries suffering armed conflict were adversely affected, to a higher degree and for a longer period, than countries that suffered natural disasters (Swatzyna and Pillai, 2013). Our results also reveal a similar relationship of

political instability and violence/terrorism with these "man-made disasters". The highest MMR was found in low-income countries with lesser resources and a lesser ability to deal with health care emergencies.

This last indicator, together with the voice and accountability indicator, measure the process by which governments are selected, monitored and replaced. Specifically, the voice and accountability dimension, which indicates the perceptions of country's citizens' ability to participate in selecting their government—as well as freedom of expression, freedom of association and free media—was inversely related to MMR. This dimension is valuable because it is representative of democratic countries —which are more able than autocratic countries to prioritise and make efficient decisions to improve the remaining and more feasible governance dimensions. Our results are consistent with that of studies that have shown a positive association between democracy and health that remains after adjusting for country's wealth. This is the case of recently identified child mortality reduction (Pieters et al., 2016) and—previously, in 2004—maternal and infant mortality (Author et al., 2004). The latter paper shows that in low-income countries, maternal and infant mortality rates were lower in more democratic nations than in dictatorships. Higher life expectancy, between 1960 and 2008, in cumulative democracy—particularly among men—has also been described (Mackenbach et al., 2013). This latter evidence suggests that gender equity may be present despite a society's economic development (Author et al., 2013), and that there are clear possibilities of improving maternal health, by working towards parity within a democracy (Author et al., 2016).

4.3 Limitations

Our findings should be prudently interpreted, within the constraints of an ecological study, and taking into account the limitations proper to the complexity of the governance concept. The study relied on secondary data: information for each country was thus conditioned by statistical

availability. Furthermore, the MMR may be underestimated in some lower socioeconomic status groups in countries presenting high social heterogeneity.

The categorisation of independent variables has several consequences, including diminished statistical power, which is due to information loss (Altman and Royston, 2006; Baneshi and Talei, 2011).

Since one of the groups resulting from the logistic regression analysis included less than 5 countries—the minimum number for this statistical procedure—one of the confidence intervals is greater than would be desirable.

Concerning a nation's wealth, we chose the GNI, a variable that does not reflect in any way a country's income inequality. This limitation could be considered as a starting point for a future analysis in which, the Gini Index for example, could be used as a confounder variable in the regression logistic models.

4.4 Implications

It is important to recognise local health realities. For example, authors from Argentina showed how the use of selected evidence-based maternal practices in its public health hospitals was limited (Karolinski et al. 2009). In this case, it seems that greater government effectiveness is required to ensure higher service quality to manage inadequately trained professionals, together with a choice of politicians aiming at a better redistribution of wealth through the control of corruption. It is worth noting another study that showed differential aetiological patterns for MM that required cause-specific approaches. Abortion complications and septic shock led to a mortality rate that was 8 times higher than that caused by hypertension, and nearly 1 in 5 women with sepsis shock died, mostly those women whose sepsis was due to abortion complications compared to other causes of sepsis. The analysis showed a better quality of care for hypertensive

disorders compared with management of abortion complications. The fact that most complications associated with illegal abortions in Argentina affect poor women lacking access to sexual and reproductive health programmes, points to a problem that requires effective public health policies to be solved (Karolinski et a. 2013).

In countries with a high MMR (> 300 maternal deaths x 100.000 live births), high fertility and a small proportion of women seeking care at health facilities imply the need for effective governmental policies related to education, sexual and reproductive health, and gender equity, beyond the negative economic impact of maternal mortality In addition, barriers of access to health care centres, related to distance and transport problems, as well as critical care and limited resources, also need to be overcome (Idoko et al. 2017; Vasco et al. 2019). Though all dimensions of governance are related to maternal mortality, these countries would benefit from measures that improved the dimensions of voice and accountability, lack of violence, including, notably, laws against gender violence and on gender equality.

5. Conclusions

To achieve the post-2015 sustainable development goal on preventable maternal mortality—which persists despite economic development—all governance dimensions are were essential and represented interdependent cornerstones. The findings of this study contribute to understanding the determinants of maternal mortality that are related to countries' wealth, wealth distribution, and management, as well as human rights. To improve maternal mortality further, serious consideration should be given to governance and political determinants in each country. Policy-makers seeking to reduce maternal mortality through immediate action should detect shortcomings in each of their governance dimensions as well as identify the feasibility of achieving improvements in their country.

Declarations of interest

None.

References

Akseer, N., Salehi, A.S., Hossain, S.M., Mashal, M.T., Rasooly, M.H., Bhatti, Z, Rizvi, A., Bhutta, Z.A., 2016. Achieving maternal and child health gains in Afghanistan: a Countdown to 2015 country case study. Lancet Glob. Health 4, 395–413.

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A., Gemmill, A., Fat, D.M., Temmerman, M., Mathers, C., Say, L., 2016. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. Lancet 387, 462-474.

Altman D.G., Royston, P., 2006.The cost of dichotomising continuous variables. BMJ 332, 1080.

Author et al. 2004 [details removed for peer review]

Author et al. 2013 [details removed for peer review]

Author et al. 2016 [details removed for peer review]

Baneshi M. R., Talei A.R., 2011. Dichotomisation of Continuous Data: Review of Methods, Advantages, and Disadvantages. Iran. J Cancer Prev. 1, 26-32.

Barnes-Josiah, D., Myntti, C., Augustin, A., 1998. The "three delays" as a framework for examining maternal mortality in Haiti. Soc Sci Med 46, 981-93.

Batniji, R., Khatib, L., Cammett, M., Sweet, J., Basu, S., Jamal, A., Wise, P., Giacaman, R., 2014. Governance and health in the Arab world. Lancet 383, 343-355.

Cabero-Roura, L., Rushwan, H., 2014. An update on maternal mortality in low-resource countries. Int. J. Gynecol. Obstetr. 125, 175-180.

Ciccone, D., Vian, T., Maurer, L., Bradley, E., 2014. Linking governance mechanisms to health outcomes: A review of the literature in low- and middle-income countries. Soc. Sci. Med. 117, 86-95.

Creanga, A., Berg, C., Ko, J., Farr, S., Tong, V., Bruce, F, Callaghan, W., 2014. Maternal Mortality and Morbidity in the United States: Where Are We Now? J. Women's Health 23, 3-9.

Factor, R., Kang, M., 2015. Corruption and population health outcomes: an analysis of data from 133 countries using structural equation modeling. Int. J. Public Health 60, 633-641.

Farag, M., Nandakumar, A., Wallack, S., Hodgkin, D., Gaumer, G., Erbil, C., 2012. Health expenditures, health outcomes and the role of good governance. Int. J. Health Care Finance Econ. 3, 33-52.

Firoz, T., Vidler, M., Makanga, P.T., Boene, H., Chiaú, R., Sevene, E., Magee, L., von Dadelszen, P., Munguambe, K., 2016. Community perspectives on the determinants of

maternal health in rural southern Mozambique: a qualitative study. Reproductive Health 13, 112.

Frenk, J., Chen, L., Bhutta, Z.A, Cohen, J., Crisp, N., Evans, T., Fineberg, H., Garcia, P, Ke, Y., Kelley, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D., Zurayk, H., 2010. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 376, 1923-1958.

Hill, K., and Yoonjoung, C., 2004. Maternal mortality in 2000: estimates developed by WHO, UNICEF and UNFPA. World Health Organization.

Holmberg, S., Rothstein, B., 2011. Dying of corruption. Health Economic Policy Law J. 6, 529-547.

Idoko, P., Anyanwu, M.O., Bass, S., 2017. A retrospective analysis of trends in maternal mortality in a Gambian tertiary health centre. BMC Res Notes 10, 493.

Janzen, F.J., Stern, H.S., 1998. Logistic Regression form Empirical Studies of Multivariate Selection. Evolution 52, 1564-1571.

Karolinski, A., Micone, P., Mercer, R., Gibbons, L., Althabe, F., Belizán, J.M., Messina, A., Lapidus, A., Correa, A., Taddeo, C., Lambruschini, R., Bertin, M., Dibiase, L., Montes Varela, D., Laterra, C., 2009. Evidence-based maternal and perinatal healthcare practices in public hospitals in Argentina. Int J Gynecol Obst 105, 118-122.

Karolinski, A., Mercer, R., Micone, P., Ocampo, C., Mazzoni, A., Fontana, O., Messina, A., Winograd, R., Frers, M.C., Nassif, J.C., Elordi, H.C., Lapidus, A., Taddeo, C., Damiano, M., Lambruschini, R., Muzzio, C., Pecker, B., Natale, S., Nowacki, D., Betular, A., Breccia, G., Di Biase, L., Montes Varela, D., Dunaiewsky, A., Minsk, E., Fernández,

D., Martire, L., Huespe, M., Laterra, C., Spagnuolo, R., Gregoris, C.; AMBA Perinatal Network's Research Team, 2013. The epidemiology of life-threatening complications associated with reproductive process in public hospitals in Argentina. BJOG 120 (13),1685-94.

Kaufmann, D., Kraay, A., Mastruzzi, M., 2010. Response to: The Worldwide Governance Indicators: Six, One, or None. Available from: http://siteresources.worldbank.org/DEC/Resources/ResponseToKnackLangbein.pdf [Accessed February 2018].

Kaufmann, D., Kraay, A., Mastruzzi, M., 2011. The Worldwide Governance Indicators: Methodology and Analytical Issues. Hague J. Rule of Law 3, 220-226.

Kaur, M., Gupta, M., Purayil, V.P., Rana M., Chakrapani, V., 2018. Contribution of social factors to maternal deaths in urban India: Use of care pathway and delay models. PLoS ONE 13(10): e0203209.

Klomp, J., de Haan, J., 2008. Effects of governance on health: A Cross‑National analysis of 101 countries. KYKLOS 61, 599-614.

Knack, S., Langbein, L., 2010. The Worldwide Governance Indicators: Six, One, or None? J. Development Studies 46, 350-370.

Krueger, P., Dovel, K., Denney, J., 2015. Democracy and self-rated health across 67 countries: A multilevel analysis. Soc. Sci. Med. 143, 137-144.

Lazarova, E., Mosca, I., 2008. Does governance matter for aggregate health capital? Applied Economics Letters 15, 199-202.

Lee, H.Y., Yang, B.M., Kang, M., 2015. Factor Configurations with Governance as Conditions for Low HIV/AIDS Prevalence in HIV/AIDS Recipient Countries: Fuzzy-set Analysis. J. Korean Med. Sci. 30, 167-177.

Lin, R-T., Chien, L-C., Chen, Y-M., Chan, C-C., 2014. Governance matters: an ecological association between governance and child mortality. Int. Health 6, 249-257.

Loyer, A.B., Ali, M., Loyer, D., 2014. New Politics, an Opportunity for Maternal Health Advancement in Eastern Myanmar: An Integrative Review. J. Health Popul. Nutr. 32, 471-485.

Mackenbach, J.P., Hu, Y., Looman, C.W., 2013. Democratization and life expectancy in Europe, 1960–2008. Soc. Sci. Med. 93, 166-175.

Maruthappu, M., Ng, K., Williams, C., Atun, R., Agrawal, P., Zeltner, T., 2015. The association between government health care spending and maternal mortality in the European Union, 1981 to 2010. BJOG 122, 1216-1224.

Miller, S., Abalos, E., Chamillard, M,, Ciapponi, A., Colaci, D., Comandé, D., Diaz, V., Geller, S., Hanson, C., Langer, A., Manuelli, V., Millar, K., Morhason-Bello, I., Pileggi Castro, C., Nogueira Pileggi, V., Robinson, N., Skaer, M., Souza, J.P., Vogel, J.P., Althabe, F., 2016. Beyond too little, too late and too much, too soon: a pathway towards evidence-based, respectful maternity care worldwide. Lancet 388(10056), 2176-2192.

Muldoon, K., Galway, L., Nakajima, M., Kanters, S., Hogg, R., Bendavid, E., Mills, E., 2011. Health system determinants of infant, child and maternal mortality: A cross-sectional study of UN member countries. Glob. Health 7, 42.

Oyerinde, K., Harding, Y., Amara, P., Kanu, R., Shoo, R., Daoh, K., 2011. The status of maternal and newborn care services in Sierra Leone 8 years after ceasefire. Int. J. Gynecol. Obstetr. 114, 168-173.

Pieters, H., Curzi, D., Olper, A., Swinnen, J., 2016. Effect of democratic reforms on child mortality: a synthetic control analysis. Lancet Glob. Health 4, 627–632.

Pinzón-Flórez, C., Fernández-Niño, J., Ruiz-Rodríguez, M., Idrovo, Á., Arredondo-López, A., 2015. Determinants of Performance of Health Systems Concerning Maternal and Child Health: A Global Approach. PLoS One 10. https://doi.org/10.1371/journal.pone.0120747

Pinzon-Rondon, A., Attaran, A., Botero, J., Ruiz-Sternberg, A., 2015. Association of rule of law and health outcomes: an ecological study. BMJ Open 5. http://dx.doi.org/10.1136/bmjopen-2014-007004

Ruger, J., 2006. Ethics and governance of global health inequalities. J. Epidemiol. Community Health 60, 998-1002.

Sajedinejad, S., Majdzadeh, R., Vedadhir, A., Tabatabaei, M., Mohammad, K., 2015. Maternal mortality: a cross-sectional study in global health. Glob. Health 11, 4.

Sen, K., Al-Faisal, W., Alsaleh, Y., 2012. Syria: effects of conflict and sanctions on public health. J. Public Health 35, 195-199.

Southall, D., 2011. Armed conflict women and girls who are pregnant, infants and children; a neglected public health challenge. What can health professionals do? Early Human Development 87, 735-742.

Souza, J.P., Tunc O., Vogel, J.P., Bohren, M., Widmer, M., Oladapo, O.T., Say, L., Gülmezoglu, A.M., Temmerman, M., 2014. Obstetric transition: the pathway towards ending preventable maternal deaths. BJOG 121 (Suppl. 1), 1–4.

Sperandei, S., 2013. Understanding logistic regression analysis. Biochemia Medica, 24,12–8.

Stoltzfus, J. C., 2011. Logistic Regression: A Brief Primer. Academic Emergency Medicine 18,1099–1104.

Swatzyna, R.J., Pillai, V.K., 2013. The Effects of Disaster on Women's Reproductive Health in Developing Countries. Glob. J. Health Science 5, 106-113.

Tessier, V., Leroux, S., Guseva-Canu, I., 2017. Mortalité maternelle chez les femmes en situation de precarité. Résultats de l'ENCMM, France 2010-2012. Gynécolie Obstetrique Fertilité and Sênologie 45S, 584-588.

Transparency International, 2019. Available from: https://www.transparency.org [Accessed 1 February 2019].

United Nations, 2000. United Nations Millennium Declaration. Available from: http://www.un.org/millennium/declaration/ ares552e.pdf [Accessed February 2018].

United Nations, 2013. Millennium Development Goals and Beyond 2015. http://www.un.org/millenniumgoals/maternal.shtml [Accessed February 2018].

United Nations, 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Resolution adopted by the General Assembly on 25 September 2015. Available from: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E [Accessed February 2018].

Vasco, M., Pandya, S., Van Dyk, D., Bishop, D.G., Wise, R., Dyer, R.A., 2019. Maternal critical care in resource-limited settings. Narrative review. Int J Obstetric Anesthesia 37, 86-95.

World Bank, 1989. The World Bank atlas 1989. http://documents.worldbank.org/curated/en/323881468764734171/The-World-Bank-atlas-1989 [Accessed February 2018].

World Bank, 2017. The Worldwide Governance Indicators, 2017 Update. Available from http://info.worldbank.org/governance/wgi/index.aspx#home [Accessed 8 May 2018].

World Bank, 2018a. World Development Indicators. Available from https://data.worldbank.org/products/wdi [Accessed 8 May 2018].

World Bank, 2018b. World Bank GNI per capita Operational Guidelines & Analytical Classifications. Available from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519 [Accessed 8 May 2018]

World Health Organization, 2015a. Trends in maternal mortality: 1990 to 2015. Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Populations Division. Geneva, The WHO Document Production Services. http://www.un.org/en/development/desa/population/publications/mortality/maternal-mortality-report-2015.shtml [Accessed February 2018]

World Health Organization, 2015b. Global Health Observatory data repository. Available from http://apps.who.int/gho/data/view.main.1390?lang=en [Accessed 8 May 2018].

Yamin, A., 2013. From Ideals to Tools: Applying Human Rights to Maternal Health. PLoS Med 10. https://doi.org/10.1371/journal.pmed.1001546