A Global Analysis of Infant Mortality

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Abstract:

As the best indicator of a country's level of health, the infant mortality rate can be analyzed to determine how we may improve the state of global health. Using eight independent variables, I conduct an empirical analysis of the 2013 infant mortality rates in 150 countries. I utilize a single multivariate regression with the following independent variables for each country: gross domestic product per capita (using purchasing power parity), the female literacy rate, the percent of the population with access to improved drinking water sources, physician density, percent of households using solid fuels as their primary energy source for cooking and heating, prevalence of HIV/AIDS (ages 15-49), prevalence of malaria, and the democracy index. I performed a one-tailed t-test for every variable. GDP per capita (PPP) and physician density were not significant. The other six variables were significant at the one-percent level. The female literacy rate had the highest impact, which indicates that the female literacy rate has the greatest influence on infant mortality rates of these variables.

I. Introduction:

The infant mortality rate is widely used to assess the health of a country's population. The infant mortality rate (IMR) is defined as the number of infants who die before they are one year old per 1,000 live births within the same year.[1] Since 1990, the global infant mortality rate has dropped from sixty-one to approximately thirty-eight in 2013.[2] Although this rate has been declining, infant mortality is still rampant, particularly in sub-Saharan Africa and South Asia. As of 2013, infant mortality is as high as 119.41 in Afghanistan and 106.49 in Mali. In most highly industrialized countries, the IMR is around two.[1] By understanding which factors significantly affect the IMR, we can implement changes and policies to combat infant mortality and improve health care world-wide.

II. Significant Results from Previous Literature

There have been a multitude of studies performed on infant mortality. For the most part, these studies have focused on a single country or geographic region (e.g. India, sub-Saharan Africa, or Southeast Asia). There have been far fewer global analyses performed. Previous research has shown that economic factors, such as GDP per capita, average income, and income equality, have a significant and negative correlation with infant mortality rates. That is, as income rises, infant mortality rates

[1] *Infant Mortality Rate* (accessed July 6, 2013); available from https://www.cia.gov/library/publications/the-world-factbook/rankorder/2091rank.html

[2] Infant Mortality." WHO. World Health Organization, 2013. Web. 4 Sept. 2013. <http://www.who.int/gho/child_health/mortality/neonatal_infant_text/en/index.html>.

should fall. In a 2005 study, Edward G. Stockwell, Franklin W. Goza, and Jack L. Roach analyzed the relationship between income levels and infant mortality in the state of Ohio. Comparing five economically distinct regions of Ohio, they found that there was a disparity in mortality rates between wealthy and poor families. Higher levels of income corresponded to lower infant mortality rates.[3] Additionally, in 2004, Oystein Kravdal from the University of Oslo published a study about child mortality rates in India. Professor Kravdal's results indicated that education had a significant and negative correlation with child mortality at the one-percent level.[4] Furthermore, Carl Otto Schell, Marie Reilly, Hans Rosling, Stefan Peterson, and Anna Mia Ekstrom did a study of infant mortality in 152 countries using data from 2003. They found that gross national income per capita, young female illiteracy, and income equality were significant and predicted 92% of the variation in national infant mortality rates. They found public health spending and poverty rates to be insignificant.[5] These three studies are among the most highly cited works on infant and child mortality.

I have found minimal representation of non-socioeconomic variables in infant mortality analyses. Therefore, in addition to analyzing GDP per capita and female literacy, I also assess the significance of environmental conditions with two variables: the percent access to improved drinking water sources and household solid fuel use. Additionally, I include the prevalence of both HIV/AIDS and malaria in order to evaluate the effect of disease on mortality. In order to capture the effect of the amount of medical resources on mortality, I also include the physician density, which is the number of physicians per 1000 people. The data used in my regression are also quite recent (most data are from 2010-2013), which should serve to provide a very current analysis of the issue of infant mortality.

III. <u>Sample</u>

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[3] Edward G. Stockwell, Franklin W. Goza and Jack L. Roach, "The Relationship between Socioeconomic Status and Infant Mortality in a Metropolitan Aggregate, 1989-1991" *Sociological Forum,* Vol. 10, No. 2, 1995. Accessed September 4, 2013. Available from Jstor.

[4] Kravdal, Oystein, "Child Mortality in India: The Community-Level Effect of Education" *Population Studies,* Vol. 58, No. 2, 2004. Accessed August 24, 2013. Available from JStor.

[5] Schell, et al., "Socioeconomic determinants of infant mortality: a worldwide study of 152 low-, middle-, and high-income countries" *Scandinavian Journal of Public Health,* Vol. 35, Issue 3, May 2007. Accessed September 9, 2013. Available from the National Center for Biotechnology Information, U.S. National Library of Medicine.

The sample for this regression is 150 countries, which includes high, middle, and low-income countries. I included all countries with data available for each variable.

IV. Methodology

I use one multivariate regression to assess the significance and correlation of the independent variables with the IMR. For a variable to be significant in a two-tailed t-test, its t-statistic's absolute value must be at least two for a ninety-five percent confidence level. For a one-tailed test, the absolute value of the t-statistic must be at least 1.67 at the ninety-five percent confidence level. In this regression, I used a one-tailed t-test for each variable because the alternative hypothesis for each variable was in a single direction. I also calculated the impact of each independent variable by multiplying the standard deviation with the coefficient. By looking at the p-values, we can assess at which level each variable is significant. The p-values that were generated by Excel are for a two-tailed test. For a one-tailed test, we divide the Excel p-values by two. For a variable to be significant, the halved p-value must be less than .10 for a 10 percent significance level, less than .05 for a 5 percent level, and less than .01 for a 1 percent level. Attached are the regression results and summary statistics of each variable. As shown in the correlation matrix, none of the values for r (the correlation coefficient) exceed an absolute value of 0.80, which means that multicollinearity should not be a concern.

V. Dependent Variable : Infant Mortality Rate

The data for the current infant mortality rates (as of 2013) were obtained from the Central Intelligence Agency (CIA) World Factbook. The CIA World Factbook defines the

infant mortality rate (IMR) as the number of deaths of infants under the age of one per 1,000 live births in the same year.[6]

VI. Independent Variable #1 : GDP per capita (PPP) in 2012 U.S. $

The first independent variable is the gross domestic product per capita (GDP per capita), which uses a purchasing power parity basis (PPP). By using PPP instead of just GDP per capita, we are able to avoid being misled by fluctuations in exchange rates. Another advantage of using the PPP is each value is calculated by using the same set of prices (in this case, U.S. 2012 prices). This value gives the physical amount of newly produced goods and services per average citizen in a country. The values were given in terms of 2012 United States dollars, were obtained from the CIA World Factbook, and were from the year 2012. A few countries without 2012 data have figures from either 2010 or 2011. The most recent figures were used for each country.

Per capita GDP was used instead of the aggregate GDP because it gives a more accurate picture of the resources of an individual citizen. For example, India's GDP of $ 4,761,000,000,000 is greater than Germany's GDP of $ 3,250,000,000,000.[7] However, from this information, we cannot tell that the average German citizen has a higher standard of living than the average Indian citizen. We know that the average German citizen is economically better off than the average Indian citizen because the GDP per capita of Germany ($39,100) is greater than that of India ($3,900).[8]

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[6] "Infant Mortality Rate." The World Factbook. Central Intelligence Agency, 2013. Web. 6 July 2013. <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2091rank.html>.

[7] *GDP (Purchasing Power Parity)* (accessed July 16, 2013); available from https://www.cia.gov/library/publications/the-world-factbook/rankorder/2001rank.html

[8] *GDP per capita (PPP)* (accessed July 16, 2013); available from https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html

We predict that a country with a higher GDP per capita will have a lower infant mortality rate because wealthier citizens should be better able to afford doctors' visits, medications, clothing, shelter, adequate food, and other resources for their children. Therefore, we would expect a negative coefficient; as GDP per capita rises, the IMR should fall.

In the regression, GDP per capita (PPP) was not significant with a t-statistic of -0.732 and a p-value of 0.233. Surprisingly, this variable did not conform to the results of previous literature. The other studies I reviewed on this topic focused either only on economics variables (inequality, poverty rate, etc.) or only on economic and educational variables. I chose to use GDP per capita because of the lack of recent data on Gini coefficients and poverty rates for all 150 countries in my sample. Perhaps because I included a variety of variables pertaining to disease, democracy, physician density, and environmental issues, the effect of GDP per capita on infant mortality became negligible. This seems plausible because the United States is the world leader in aggregate GDP and has the fifth highest per capita GDP (PPP), yet it only has the thirty-second lowest infant mortality rate. This analysis suggests that GDP per capita does not affect infant mortality rates. However, we simply cannot dismiss the fact that many studies have confirmed the significance of income on the IMR.

VII. Independent Variable #2: Female Literacy Rate (%)

The next independent variable is the female literacy rate. This number is the percentage of women who are literate out of the population of women in a country. Most typically, a person must be able to read and write by the age of fifteen to be

considered "literate."[9] A few countries use age sixteen, age twelve, or age eighteen. Most of the data are from 2012. However, some countries have not updated their numbers for the past several years because they have already reached 99-100 percent literacy. For example, the United States, France, and the United Kingdom had a 99 percent female literacy rate in 2003 and have not updated their rates since then. It is reasonable to assume that literacy rates have not changed for these countries since literacy tends to improve over time, and 99-100 percent is the maximum level of literacy that can be attained. The latest available rate for each country is used in the regression. These data are also from the CIA World Factbook.

Because literate women are more educated, they should have more knowledge about prenatal care, proper nutrition, and health. When women are equipped with this information, infants should be well cared for and face a lower risk of mortality. We predict that an increase in the literacy rate of women will lead to a decrease in the infant mortality rate (negative coefficient).

As predicted, this variable had a negative coefficient (-0.366). This means that as female literacy rises by one percent, infant mortality falls by 0.366 deaths per 1000 live births. It was significant at the one-percent level with a t-statistic of -5.964 and a p-value of 9.417 x 10^-9. Additionally, the impact was -8.377, which was the highest of all the variables. This means that the female literacy rate has the greatest effect on infant mortality of these variables. Based on this result, if a country would like to reduce its infant mortality, then it should try to create more educational opportunities for women.

[9]"Literacy." The World Factbook. Central Intelligence Agency, 2012. Web. 29 July 2013. <https://www.cia.gov/library/publications/the-world-factbook/fields/2103.html>.

VIII. Independent Variable #3: Access to Improved Drinking Water Sources (%)

The next independent variable is access to improved drinking water sources. This value is the percent of individuals within a country who use water from improved drinking water sources. Unicef defines improved drinking water sources as sources whose construction prevents contamination from outside sources, particularly fecal matter.[10] Most of the data points were from 2011. However, in the few countries where there were no data available for 2011, the percentages from 2000 were used. These data were obtained from Unicef's "Progress on Drinking Water and Sanitation: 2013 Update" publication.

We predict that as the percent access to improved drinking water sources increases, the infant mortality rate will fall (negative coefficient). The rationale behind this hypothesis is that water from cleaner sources should contain fewer disease-causing pathogens and fewer toxic chemicals, which should decrease the risk of health problems and infant death.

As hypothesized, this variable had a negative coefficient (-0.322). It was also significant at the one-percent level with a t-statistic of -3.383 and a p-value of 4.635 x 10^-4. Of these variables, this had the third largest impact (-4.971). Therefore, we can say that access to improved drinking water sources does significantly affect infant mortality.

[10]"Progress on Drinking Water and Sanitation (2013 Update)." Unicef. Unicef and World Health Organization, 2013. Web. 15 Oct. 2013. <http://www.unicef.org/wash/files/JMP2013final_en%281%29.pdf>.

IX. Independent Variable #4 : Physician Density (number of physicians per 1000 people)

The next independent variable is the physician density, which is the number of doctors per one thousand people in a country. These figures include both general and specialized physicians. With most figures coming from 2010-2012, these data were taken from the World Bank.

We predict that as the density increases, then infant mortality rate should fall (negative coefficient). The rationale behind this hypothesis is that when more doctors are available, families can more easily make appointments, receive immunizations, and have a doctor deliver their baby. All of these benefits should lead to better infant health.

In the regression, this variable was not significant. This may be because this variable captures neither the availability of other vital medical resources, such as hospitals, immunizations, and medications, nor the prices of medical resources. If a country has a costly healthcare system, the infant mortality rate may be high if poorer families cannot afford medical care, regardless of how high the physician density is. There may also be a disparity between physician density in urban and rural areas. This variable measures average density throughout an entire country, which means that this does not specifically pick up on shortages in rural areas. The rural physician density rates could not be used instead because they were only available for a small number of countries in this sample.

X. Independent Variable #5: Household Solid Fuel Use (%)

Our next variable is the percent of households that use solid fuels as their primary energy source for cooking and heating purposes. These data are in percentage form, are from 2010, and come from the United Nations' Database. Solid fuels include "biomass fuels, such as wood, charcoal, crops or other agricultural waste, dung, shrubs and straw, and coal."[11] According to the World Health Organization, indoor solid-fuel use can lead to acute lower respiratory infections (ALRI), chronic obstructive pulmonary disease (COPD), and lung cancer because they produce a large amount of carbon monoxide, carbon dioxide, and smoke.[12] Unfortunately, since solid fuels are cheap and readily available, rural or impoverished families may not be able to afford or access safer fuels.

Because of these health risks, we predict that as the use of solid fuels increases, the infant mortality rate will increase too (positive coefficient).

As predicted, this variable had a positive coefficient (0.180). Additionally, it was also significant at the one-percent level. The t-statistic was 3.663, and the p-value was 1.758 x 10^-4. The impact was 6.293, which was the second highest. Clearly, household solid fuel use exacerbates the infant mortality problem. Therefore, substituting away from solid fuels and towards safer fuels, such as natural gas, may help reduce infant mortality rates.

XI. Independent Variable #6: Prevalence of HIV/AIDS (%)

[11] "Population Using Solid Fuels, Percentage." *UN Stats*. United Nations, 11 July 2012. Web. 9 Oct. 2013. <http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=712>.
[12] "Indoor Air Pollution." *WHO Household Energy Database*. World Health Organization, 2010. Web. 12 Oct. 2013. <http://www.who.int/indoorair/health_impacts/he_database/en/>.

The sixth independent variable is the adult prevalence of the human immunodeficiency virus and acquired immunodeficiency syndrome, otherwise known as HIV and AIDS. Obtained from the United Nations' AIDS Report, these data are from 2011. The adult prevalence of HIV/AIDS is the percent of individuals between the ages of fifteen and forty-nine who are living with HIV/AIDS. According to the World Health Organization, around 1.7 million people died from HIV/AIDS in 2011. This is particularly of concern in sub-Saharan African, Southeast Asian, and Caribbean countries. Fortunately, the number of new cases has fallen substantially over the past decade.[13]

HIV/AIDS destroys the immune system, can be passed between parents, can be passed from a mother to her baby, and is often terminal. According to the U.S. Department of Health & Human Services, infants can get HIV during pregnancy, during vaginal childbirth, and through breastfeeding. There is a twenty-five percent chance that an infant will contract HIV during pregnancy, labor, and delivery from an HIV-positive mother.[14]

HIV severely weakens the immune system, which can make individuals more susceptible to infections and other diseases. HIV can also develop into AIDS, which is terminal. With a higher prevalence, there is an increased likelihood of infants contracting and suffering from HIV/AIDS. Therefore, we predict that this variable will have a positive correlation with the IMR.

As hypothesized, the coefficient was positive and had a value of 0.734. It was also significant at the one-percent level with a p-value of 1.363 X 10^-3 and a t-statistic of

[13] "Number of Deaths Due to HIV/AIDS." *WHO*. World Health Organization, 2013. Web. 20 Oct. 2013. <http://www.who.int/gho/hiv/epidemic_status/deaths_text/en/>.
[14] "Pregnancy & Childbirth." *AIDS*. U.S. Department of Health & Human Services, 25 Jan. 2012. Web. 12 Nov. 2013. <http://aids.gov/hiv-aids-basics/prevention/reduce-your-risk/pregnancy-and-childbirth/>.

3.051. The impact was 3.008, which was only the fifth highest of the six significant independent variables. Still, given its significance at the one-percent level, it is evident that the prevalence of HIV/AIDS does affect infant mortality.

XII. Independent Variable #7: Prevalence of Malaria (0-1)

The next independent variable is the prevalence of malaria. This value was calculated by taking a country's number of reported malaria cases in 2011 and dividing by its population. This value (from 0 to 1) represents the proportion of the population that contracted malaria during 2011. This data was obtained from the Kaiser Foundation's website.[15]

Many countries have a high risk of malaria because of the high taxes on insecticides and mosquito nets. Unfortunately, 660,000 people, who are mostly children under the age of 5, die each year of malaria.[16] For the most part, these deaths occur in sub-Saharan African countries. According to the World Health Organization, malaria can be cured if an antimalarial medication is given twenty-four hours prior to the onset of a fever. However, not all citizens have knowledge of or access to this medication, and it can be difficult to diagnose malaria early on. Malaria is caused by the *Plasmodium* parasite which is spread by mosquito bites. Symptoms (vomiting, fever, headaches) occur typically from ten to fifteen days after exposure and easily spread to other people. Left untreated, it can become fatal very quickly.[17] From the perspective of a highly developed country, the six dollar cost for antimalarial treatment appears to

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[15] "Fact Sheet: Malaria, A Global Crisis." *UNICEF*. Unicef, 27 Aug. 2004. Web. 21 Oct. 2013. <http://www.unicef.org/media/media_20475.html>.
[16] "10 Facts on Malaria." *WHO*. World Health Organization, Mar. 2013. Web. 20 Oct. 2013. <http://www.who.int/features/factfiles/malaria/en/>.
[17] "Malaria." *WHO*. World Health Organization, 2013. Web. 12 Oct. 2013. <http://www.who.int/topics/malaria/en/>.

be quite affordable. However, many families in less developed countries live on less than two dollars per day (the international poverty line), which makes receiving treatment impossible for them.[18]

It is possible that not all cases are reported, especially in less developed countries. For financial reasons, families may not be able to get medical help, which means that cases may go unreported. However, the other measure of malaria prevalence, the number of malaria-caused deaths, has a smaller margin of error but could not be used because it includes malaria-related infant deaths, which are counted in the dependent variable. Although this may not be a perfect measure, the number of reported cases is the best measure of malaria prevalence that we can use.

According to Unicef, women who contract malaria during pregnancy have a greater risk of having a baby with a low birth weight, which can increase the risk of infant illness and mortality. Malaria is also very contagious and can become lethal very quickly if symptoms go undiagnosed or untreated. Therefore, we predict that a higher prevalence of malaria will lead to a higher IMR (positive coefficient).

As hypothesized, this variable had a positive coefficient (37.072). Additionally, it was significant at the 0.01 percent level. The t-statistic was 2.500, and the p-value was 6.784 X 10^-3. With a value of 2.706, the impact for this variable was the lowest of all of the significant variables. By comparing the values for impact, we know that the prevalence of malaria has the smallest effect on the IMR out of all of these

[18] Cohen, Jessica. "Prices, Diagnostic Tests and the Demand for Malaria Treatment: Evidence from a Randomized Trial." *CGDEV*. Center for Global Development, 29 July 2010. Web. 20 Oct. 2013. <http://www.cgdev.org/event/prices-diagnostic-tests-and-demand-malaria-treatment-evidence-randomized-trial>.

independent variables. However, given its significance, it is clear that in order for infant mortality rates to fall, malaria must be combated too.

XIII. Democracy Index (0-100)

The final variable of this regression is the democracy index of a country. These values were computed by The Economist Intelligence Unit for the year 2012. This index is measured on a scale of zero to ten, where ten represents a perfect democracy, and zero represents an authoritarian regime. This index includes information about a country's electoral process, functioning of government, political participation, political culture, and civil liberties. Countries receive points for meeting certain criteria in each of these categories. For example, one component is voter participation. A country receives 1 point for consistently having over 70% participation, 0.5 points for 50-70% participation, or a 0 for less than 50% participation. The total points are then converted into a democracy index for each country.[19] Because personal freedom (which includes freedom for both men and women) is a component of this index, a high value indicates that women participate in political and social activities and can push for access to healthcare, schools, and other resources.

With a democracy, people should be able to demand a sufficient healthcare system and adequate medical facilities, and the government is held accountable for the health and happiness of its citizens. Therefore, we predict that a country with a higher democracy index will have a lower infant mortality rate (negative coefficient).

[19] "Democracy Index 2012: Democracy Is at a Standstill." *EIA*. The Economist Intelligence Unit Limited, 2013. Web. 10 Oct. 2013. <http://www.eiu.com/public/thankyou_download.aspx?activity=download&campaignid=DemocracyIndex12>.

As predicted, the coefficient for this variable was negative (-1.945). Additionally, it was also significant at the one-percent level. The p-value was 1.315 x 10^-4, and the t-statistic was -3.744. The impact was -4.330, which was the fourth highest of the six independent variables. Therefore, we can say that the level of democracy of a country does have a significant effect on the IMR.

XIV. Concluding Remarks

With the exception of GDP per capita (PPP) and physician density, all of the independent variables were significant at the one-percent level. Additionally, all of the significant variables had the predicted signs. The r-squared was 0.842, which means that 84.2% of the variation in infant mortality rates can be explained by these variables. Because it has the highest impact, the female literacy rate has the greatest influence on the infant mortality rate of these variables. Therefore, if a country wishes to reduce its mortality rate, then it should focus on increasing the educational attainment and opportunity for women. Based on the results of this empirical analysis, building safer drinking water systems, switching away from solid fuels, dispersing both HIV/AIDS and malaria education and medication, and adopting democratic policies are all ways through which a country may lower its infant mortality rate. With the results of this paper, I hope that we may understand the means through which we may create a healthier and happier world for all.

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XV. Data

Table 1: Empirical Analysis Results

	Coefficients	*Standard Error*	*t Stat (Excel Generated)*	*P-value*	*Standard Deviation*	*Impact (Coefficient X Std. Dev.)*	*Expected Sign*	*Actual Sign*
GDP per capita (PPP)	-5.254E-05	7.178E-05	-0.732	0.233	16914.478	N/A	Negative	N/A
Female Literacy (%)	-0.366	0.061	-5.964***	9.417E-09	22.883	-8.377	Negative	Negative
Improved Water Access (%)	-0.322	0.095	-3.383***	4.635E-04	15.437	-4.971	Negative	Negative
Physician Density (per 1000)	-1.195	0.939	-1.272	0.103	1.502	N/A	Negative	N/A
Household Solid Fuel Use (%)	0.180	0.049	3.663***	1.758E-04	34.939	6.293	Positive	Positive
Prevalence of HIV/AIDS (%)	0.734	0.241	3.051***	1.363E-03	4.099	3.008	Positive	Positive
Malaria Prevalence (0-1)	37.072	14.829	2.500***	6.784E-03	0.073	2.706	Positive	Positive
Democracy Index (0-10)	-1.945	0.520	-3.744***	1.315E-04	2.226	-4.330	Negative	Negative

***Significant at 0.01 Level, **Significant at 0.05 Level, *Significant at 0.10 Level

Table 2: Summary Statistics

	GDP per capita (PPP)	*Female Literacy*	*Improved Water Access*	*Physician Density*	*Household Solid Fuel Use*	*Prevalence of HIV/AIDS*	*Prevalence of Malaria*	*Democracy Index*	*Infant Mortality Rate*
Mean	15230	80.129	86.787	1.623	35.347	1.656	2.626E-02	5.561	29.736
Standard Deviation	16914.478	22.883	15.437	1.502	34.939	4.099	0.073	2.226	26.640
Minimum	600	12.600	47	0.014	5	0.010	0	0.600	2.170
Maximum	103900	100	100	6.723	95	26	0.520	9.930	119.410

Table 3: Correlation Matrix

	GDP per capita (PPP)	*Female Literacy*	*Improved Water Access*	*Physician Density*	*Household Solid Fuel Use*	*Prevalence of HIV/AIDS*	*Prevalence of Malaria*	*Democracy Index*
GDP per capita (PPP)	1							
Female Literacy	0.492	1						
Improved Water Access	0.543	0.660	1					
Physician Density	0.581	0.642	0.619	1				
Household Solid Fuel Use	-0.606	-0.706	-0.734	-0.706	1			
Prevalence of HIV/AIDS	-0.180	-0.077	-0.226	-0.314	0.264	1		
Prevalence of Malaria	-0.285	-0.415	-0.382	-0.374	0.543	0.213	1	
Democracy Index	0.511	0.459	0.569	0.464	-0.487	-0.033	-0.191	1

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Edward G. Stockwell, Franklin W. Goza and Jack L. Roach, "The Relationship between Socioeconomic Status and Infant Mortality in a Metropolitan Aggregate, 1989-1991" *Sociological Forum,* Vol. 10, No. 2, 1995. Accessed September 4, 2013. Available from Jstor.

"Fact Sheet: Malaria, A Global Crisis." *UNICEF*. Unicef, 27 Aug. 2004. Web. 21 Oct. 2013. <http://www.unicef.org/media/media_20475.html>.

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"Population Using Solid Fuels, Percentage." *UN Stats*. United Nations, 11 July 2012. Web. 9 Oct. 2013. <http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=712>.

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