

An Analysis of Health and Economic Indicators in African Countries where CHIME works

Introduction

In 2012, John Snow, Inc./JSI Research and Training Institute, Inc. (JSI), a public health management and consulting firm, was the 3rd largest recipient of United States Agency for International Development (USAID) funding, behind the World Bank and United Nations World Food Program.¹ JSI continues to be a leader in global health, improving the lives of marginalized populations through a cadre of programs in the United States and over 60 countries.

The Center for Health Information, Monitoring & Evaluation (CHIME) is a group within JSI that strengthens projects by providing them with evaluations and tools which help program managers and their staff produce better outcomes.² Since 2009, CHIME has aided 27 different projects operating in 21 countries. Appendix A demonstrates the breadth of CHIME’s work since 2009. CHIME predominately assists projects working in Africa in the technical areas outlined in Table 1. Table 2 demonstrates the type of services CHIME has provided to those projects. As CHIME nears almost 10 years of existence, they want to know if they are targeting countries with the greatest health needs. They also want to see what countries have potentially untapped resources of external funding where they can target their efforts to procure projects to continue improving health indicators. Since CHIME works with various projects within JSI, identifying countries with the greatest health needs and greatest availability of funds will allow them to focus their resources on those areas most in need.

Table 1: Technical Areas of Projects	% of area
Family Planning & Reproductive Health	2%
Health Information Technology	2%
Health Systems Strengthening	7%
HIV	5%
Human Resources Management	2%
Immunization	2%
Infectious Diseases	2%
Information and Communications Technology	12%
Maternal Health, Newborn and Child Health	5%
Newborn and Child Health	7%
Non-Communicable Diseases	2%
Nutrition	2%
Research, Monitoring, and Evaluation	43%
Social and Behavior Change	2%
Youth & Adolescent Health/OVC	2%

Table 2: Services Performed by CHIME	% of work
Applied Research & Evaluation	2%
Assessment	10%
Capacity Development	10%
Information System Development	14%
Knowledge Management	5%
Monitoring, Evaluation, and Research	39%
Quality Assurance and Improvement	5%
Technical Assistance	15%

¹ "Where Does the Money Go?" Where Does the Money Go? September 27, 2013. Accessed November 12, 2015. <https://www.usaid.gov/results-and-data/budget-spending/where-does-money-go>.

² "Data analytics, evaluation and learning at JSI: One USAID contractor's approach to strengthening the use of evidence in global health." USAID Learning Lab. April 10, 2015. Accessed April 23, 2017. <https://usaidlearninglab.org/lab-notes/data-analytics-evaluation-and-learning-jsi-one-usaid-contractor%E2%80%99s-approach-strengthening>.

This project will focus specifically on the continent of Africa, where the majority of JSI and CHIME's work is completed. Oftentimes, development indicators are presented in long tables comparing multiple countries or many indicators for one specific country, which makes comparisons and information digestion tedious and difficult. Visualizing the data through maps will quickly and effectively compare profiles of African countries. This information will help CHIME determine if it is targeting the most appropriate countries and where it should focus its resources on next.

Data and Mapping

Data Collection

Base Maps

For the basemap of the world I imported "World Countries" from ArcGIS Online, which has relevant country information as of December 2015.

CHIME Project Data

CHIME provided a list of projects with their associated funder, funding amount, technical and service areas as well as the timeframe of the project.

Government Health Expenditures and External Health Resources

The data for the Government Health Expenditures and External Health Resources map comes from World Development Indicators (WDI) found in the data bank on the World Bank website. The World Bank gathers information from reputable and reliable sources and publishes over 1500 indicators for 217 countries. Since Africa is the focus of this project, only data for African countries (except for Comoros, Mauritius and Sao Tome) were collected. This map uses the following three indicators as defined by the World Bank:

- **Health expenditure per capita (current US\$):** Sum of public and private health expenditures (except water and sanitation) as a ratio of total population expressed in US Dollars.³
- **Gross Domestic Product (GDP) per capita (current US\$):** The sum of the goods and services produced by a country in a year, which indicates the economic strength of an economy. The GDP is then divided by total population, which facilitates comparisons between countries and shown in US dollars.⁴
- **External resources for health (% of total expenditure on health):** Funds or services in kind that are provided by entities not part of the country in question. The resources may come from international organizations, other countries through bilateral arrangements, or

³ World Development Indicators | DataBank, accessed April 23, 2017, <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#dbMetadata>.

⁴ Ibid

foreign nongovernmental organizations. These resources are part of total health expenditure.⁵

The data used for the map came from 2014, since only GDP data existed for more recent years. This data will permit for comparisons between countries expenditures on health care. GDP is a measure of a country's economy. Creating a percentage of expenditures on health care per capita from GDP per capita facilitates comparisons between countries as it demonstrates how much of a priority health care is as measured by percent of resources available spent on healthcare. The less resources going into healthcare could indicate a need for greater assistance. Looking at the amount a country spends on its health care will permit CHIME to see if it is working in countries that have higher or lower internal resources for assisting its citizens. It also provides a measurement of general wealth of a country. Overlaying external resources for health will allow CHIME to quickly identify countries where funding could be available to facilitate future work since it shows what percentage of the country's healthcare is paid for by external sources.

Health and Education Indicators

For the Health and Primary Education map, data was extracted from the World Economic Forum; Global Competitiveness Report 2016-2017 using the search engine Knoema. This report aggregates various indicators into one score reflecting 12 different pillars. For the purposes of this project, I used the data from Pillar 4: Health and Education, since it comprises many variables relevant to the Technical areas of the project's CHIME serves. According the World Bank Databank "This indicator is derived from the following indicators: - (a) Business impact of malaria (b) Malaria incidence (c) Business impact of tuberculosis (d) Tuberculosis incidence (e) Business impact of HIV/AIDS (f) HIV prevalence (g) Infant mortality (h) Life expectancy (i) Quality of primary education and (j) Primary education enrollment rate."⁶ The higher the rank, or score, the better the health and primary education attainment the country has. As of 2016, the highest score any country achieved was Finland at 6.9.⁷ Looking at this indicator will demonstrate if CHIME is working in countries with comparatively higher or lower health outcomes.

For consistency, data from 2014 was used for this indicator, although more relevant data exists. For Benin and the Democratic Republic of the Congo, 2014 data was not available, so 2016 data was used instead.

⁵ Ibid

⁶ "The Global Competitiveness Index 2016-2017." Global Competitiveness Index. Accessed April 23, 2017. <http://reports.weforum.org/global-competitiveness-index/>.

⁷ World Development Indicators | DataBank, accessed April 23, 2017, <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#dbMetadata>.

Data Cleaning

The first step in mapping, was creating a usable address locator. To do this, I used the Feature to Point tool on the World basemap layer I downloaded from ArcGIS Online. I needed to create centroids from the polygons because creating an address locator from the polygons generated an error. I was then able to geocode the CHIME-relevant countries. I applied this same address locator to geocode the data imported from the World Bank and the World Economic Forum. For all the data I imported, I had to ensure that the country names were consistent as this was the column the geocoding was based on.

Next, I created a shapefile to change my geocoded centroids back into polygons of countries. The first step to make the shapefile was to clean up the data table associated with the World basemap layer to only include primary land masses and large islands, to be sure that the correct land mass would be selected when I used select by location. This step was necessary because the attribute table for the entire world had three or four entries for one country. For example, the country of Benin had the following three entries in the world basemap attribute table:

NAME	LONG_NAME	LOCLNGNAM	CAPITAL	CONTINENT	LAND_TYPE
Benin	Republic of Benin	Republique du Benin	Porto-Novo	Africa	Small island
Benin	Republic of Benin	Republique du Benin	Porto-Novo	Africa	Primary land
Benin	Republic of Benin	Republique du Benin	Porto-Novo	Africa	Very small island

Therefore, if I did not remove the smaller land masses, when I applied select by location, it would often choose a small island off the coast of a country rather than the main land mass polygon. By removing medium, small, and very small land masses from this attribute table, making shapefiles for each dataset was much quicker and cleaner. The only downside of this is that it excluded some very small island countries from analysis such as Comoros, Mauritius, and Sao Tome.

After creating the shapefiles, I joined it to the table that contained all the relevant indicators for mapping.

Map Building

World Map

For this basic map, I summarized the country count and applied a graduated color ramp based on this count to show where CHIME has completed the majority of its work.

Government Health Expenditures and External Health Resources Map

This map uses graduated scales to show the ratio of internal health expenditures per capita to GDP per capita and overlays graduated symbols of external resources received for health care. CHIME projects are outlined in blue.

Health and Education Ranking Map

This map reflects a color ramp based on 2014 4th Pillar Rankings. As with the expenditure map, CHIME projects were outlined in blue.

Limitations

Development indicators have a plethora of limitations including the accuracy and availability of data. Even though this data comes from the best possible sources, it is possible that there are inconsistencies in the actual reporting from countries. In the case of the Education and Health Rankings, some countries are not even measured, which makes analysis impossible. Furthermore, there is a limitation inherent in looking at this data at the country level, as opposed to at the department, region or village level. In Benin, for example, resources, access to and quality of healthcare and perceptions about health care utility vary greatly by region. Therefore, assessing average indicators across the country limit the ability of these GIS tools to target specific regions most in need of resources. There is also an assumption made herein about the relationship between the amount of money a country spends on healthcare and the effectiveness of the programs funded with that money. However, using the 4th Pillar data I attempted to control for this by relating funds spent on healthcare to objective health outcome measures (e.g. prevalence and incidence of diseases).

Analysis and Conclusion

The 2014 Government Health Expenditures per Capita compared to External Investments per Capita map in Appendix B, demonstrates that countries that spend more of their own money per capita on health tend to receive less external resources. Some countries which do not follow this observation have extenuating circumstances such as Liberia who's internal and external health expenditure greatly increased with the onset of Ebola in 2014.

CHIME predominately works in countries that spend 6% or less of their GDP per capita on health care for their citizens, which is in the lower tier of health expenditures. Since CHIME aims to improve health outcomes by strengthening projects, it should focus on countries that do not have a lot of resources directed at health, as they most likely need more assistance. So far it is succeeding in this goal since Sierra Leon and Liberia are the only locations where it works that have comparatively high levels of internal health expenditures.

The map also shows that CHIME works in countries that receive the highest levels of external resources for healthcare as a percent of total health expenditures, which makes sense since the funding for CHIME comes from external resources such as USAID and the Bill and Melinda Gates Foundation. Nevertheless, there remains other countries who have high levels of external resources where CHIME does not work, but should target. South Sudan, The Democratic Republic of the

Congo, the Central African Republic, Niger, Burkina Faso, and Mali all receive large amounts of external funding and have low spending of their own. CHIME should identify projects within JSI that work in these countries or respond to RFPs to provide technical assistance to other projects working in these areas.

According to the 2014 Health and Education Ranking Map in Appendix C, CHIME works mostly in countries with comparatively higher education and health rankings. The majority of the countries it works in score between a 4.29 and 5.17, although it does work in several countries that have the lowest ranking such as Cote D'Ivoire, and Guinea. It is possible that a country needs to have a certain level of education and health attainment before CHIME starts working in those places. This could be an interesting point to explore in future research.

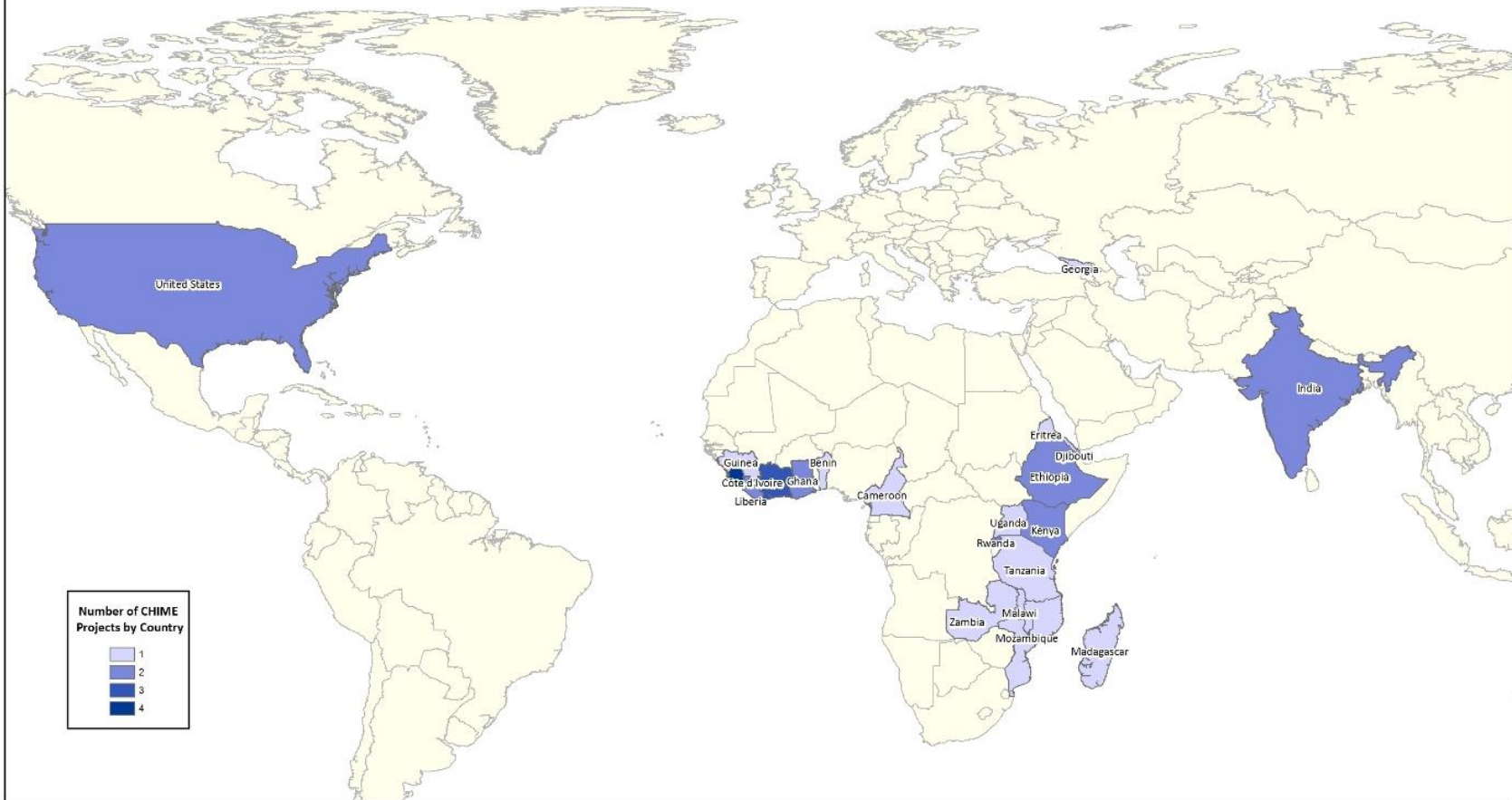
There are many countries who have low health rankings and who also receive large amounts of external resources, which CHIME could target for future work. Burkina Faso and Mali both do not spend a lot on their own healthcare per capita, have a large inflow of external resources and some of the lowest health and education rankings. These two countries also are located near countries where CHIME has experience, which will facilitate networking for projects, and navigating the cultural and health practices in those countries.

If unlimited data and time were available, it would be interesting to break the external resources received by specific technical area, such as HIV/AIDs or Maternal and Child health. This would allow CHIME to further analyze where it is missing out on funding opportunities in technical areas it specializes in. Nevertheless, even if CHIME wished to expand into these countries it is still limited by its ability to secure funding from projects working in those areas, which means donors must be aware of the need and allocate the appropriate funding. It may be beneficial for CHIME members to generate maps similar to the one suggested here to use to encourage funding sources to support projects in underserved regions. Additionally, CHIME could request monitoring and evaluation data from the projects it supports. CHIME could analyze and map the data comparing results from before and after providing technical support to the project to see if certain indicators improved. While drawing a direct causation would be difficult, a correlation would be possible. This would help justify and promote CHIME's work worldwide.

While CHIME is currently working in countries with limited resources and a greater health need, there is still room to expand their services to target more projects and populations throughout Africa.

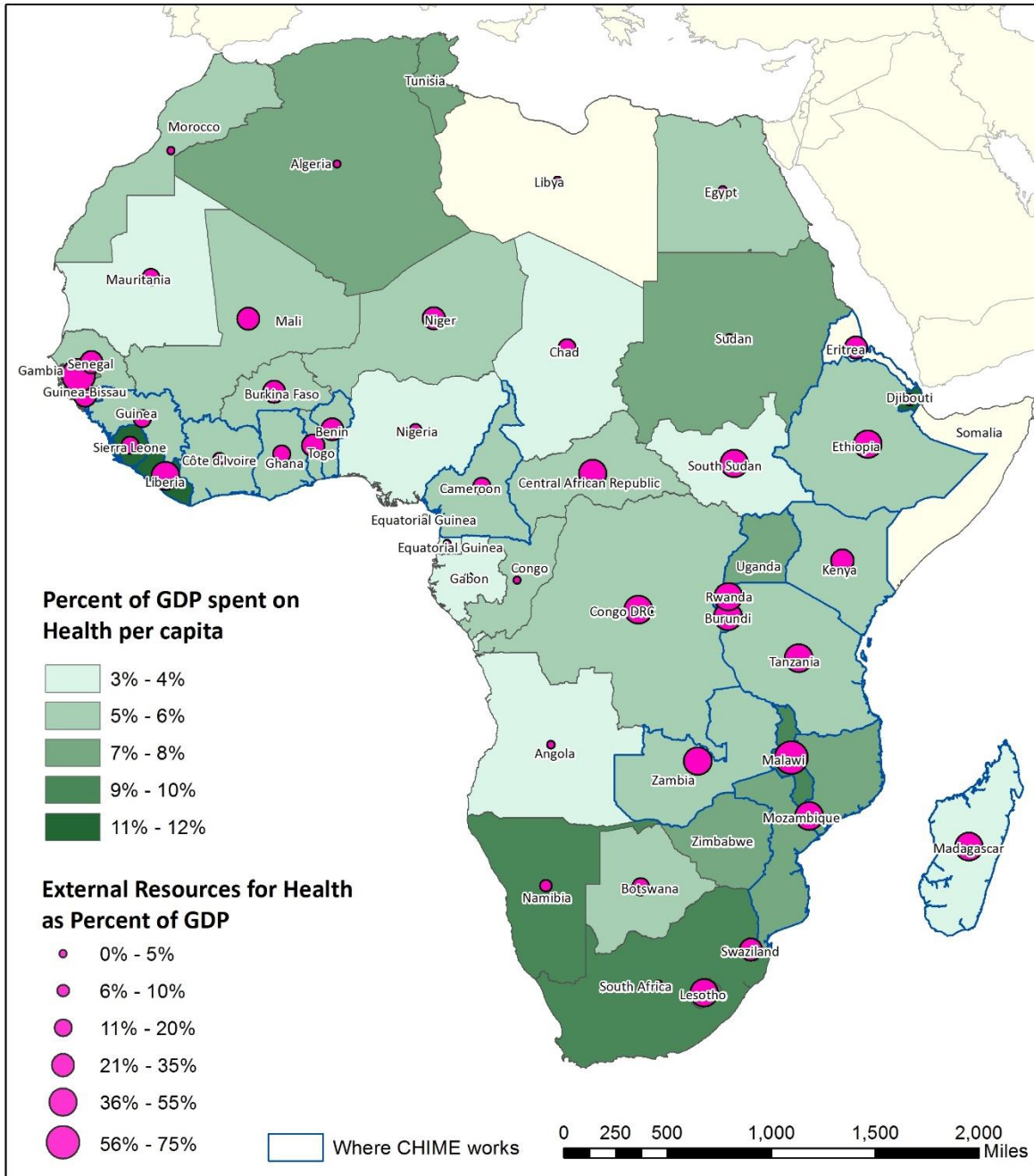
Appendix A:

CHIME Projects Worldwide from 2009 to 2016



Appendix B:

2014 Government Health Expenditures per Capita Compared to External Investments in Health



Appendix C:

2014 Health and Primary Education Rankings

