ESSENCE on Health Research

Analysis of country-level health research capacity for the ESSENCE on Health Research Initiative

APRIL 2022

Janelle Lynn C. Cruz, MPH, PMP
Peter H. Kilmarx, MD

Fogarty International Center
National Institutes of Health
Bethesda, Maryland, USA

Table of Contents

LIST OF TABLES 2
LIST OF FIGURES 3
LIST OF ACRONYMS 4
INTRODUCTION 5
METHODOLOGY 5
RESULTS 6
Basic univariate analyses 6
Map 7
How the ESSENCE indicators relate to each other 8
How certain country indicators relate to the aggregate measure of national health research capacity. 12
DISCUSSION 18
APPENDIX 19
REFERENCES 24

LIST OF TABLES

Table 1. ESSENCE indicators for analysis of national health research capacity 5

Table 2. Summary statistics of ESSENCE indicators, all countries with population < 100,000 (N=180) 6

Table 3. Trend model statistics for Clinical trial capacity vs. Capacity to attract funding for health/clinical research 9

Table 4. Trend model statistics for clinical trial capacity vs. capacity to produce research output in peer-reviewed journals 10

Table 5. Trend model statistics for capacity to attract funding for health/clinical research vs. Capacity to produce research output in peer-reviewed journals 11

Table 6. Trend model statistics for Population vs. Aggregate measure of national health research capacity 13

Table 7. Trend model statistics for GDP overall vs. Aggregate measure of national health research capacity 14

Table 8. Trend model statistics for GDP per capita vs. Aggregate measure of national health research capacity 15

Table 9. Trend model statistics for HDI vs. Aggregate measure of national health research capacity 16

Table 10. Trend model statistics for DALYs per 1M vs. Aggregate measure of national health research capacity 17

LIST OF FIGURES

Figure 1. Map of Aggregate measure of national health research capacity, all countries with population > 100,000 (N=180) 7

Figure 2. Scatter plot for Clinical trial capacity vs. Capacity to attract funding for health/clinical research.. 9

Figure 3. Scatter plot for Clinical trial capacity vs. Capacity to produce research output in peer-reviewed journals 10

Figure 4. Scatter plot for Capacity to attract funding for health/clinical research vs. Capacity to produce research output in peer-reviewed journals 11

Figure 5. Population vs. Aggregate measure of national health research capacity 13

Figure 6. GDP overall vs. Aggregate measure of national health research capacity 14

Figure 7. GDP per capita vs. Aggregate measure of national health research capacity 15

Figure 8. HDI vs. Aggregate measure of national health research capacity..... 16

Figure 9. DALYs per 1M vs. Aggregate measure of national health research capacity 17

LIST OF ACRONYMS

DALY	Disability-Adjusted Life Year
GDP	Gross Domestic Product
HDI	Human Development Index
ICTRP	International Clinical Trials Registry Platform
LMICs	Low- and Middle-Income Countries
R&D	Research & Development
UNDP	United Nations Development Programme
WGRI	Working Group on Developing a Mechanism for Reviewing Investments in Clinical Research Capacity Building
WHO	World Health Organization

INTRODUCTION

In 2008, the ESSENCE on Health Research Initiative was created to promote more effective strategic cooperation within the realm of clinical and health research capacity strengthening. The focus of the initiative is on low- and middle-income countries (LMICs).[1] In 2018, the *Money and Microbes* report from the World Bank recommended that ESSENCE should articulate a mechanism for review of investments in health research capacity strengthening.[2] In 2019, ESSENCE member agencies approved the *Mechanism for review of investments in research capacity strengthening in LMICs*.[3]

A significant part of the Mechanism is mapping research capacity, in which an initial set of basic indicators and metrics were developed to broadly assess the health research capacity at the country level to enable increased effectiveness and equity in capacity strengthening efforts.

METHODOLOGY

The purpose of this analysis is to conduct a deep-dive data analysis of the health research capacity indicators that were developed for the ESSENCE Mechanism and to update the metrics data for 2021.[4] All countries with population greater than 100,000 were included (N=180 countries).

The three indicators that were analyzed are listed in Table 1 below.

Table 1. ESSENCE indicators for analysis of national health research capacity

ESSENCE indicator	Metric
Clinical trial capacity	Number of clinical trials registered in-country from 2018-2020 (annual average) from the WHO International Clinical Trials Registry Platform (ICTRP)[5]
Capacity to attract funding for health/clinical research	Number of health/clinical research activities in-country from 2018-2020 (annual average) from World RePORT[6]
Capacity to produce research output in peer-reviewed journals	Number of scientific publications in Scopus[7] from 2018-2020 (annual average) for which any listed author had an affiliation to the country

Separately, an aggregate measure for each country was calculated, by computing the mean of the country's percentile ranks of all three indicators. The higher the value of the aggregate measure, the higher the research capacity is for the individual country.

For each category, basic univariate analyses and bivariate analyses were conducted. Bivariate correlations were used to 1) examine how each of the three indicators relates to each other, and 2) examine how the aggregate measure relates to certain country indicators.

The Kendall's tau correlation test was performed on each pair of health research capacity indicators, and for the aggregate measure against each country indicator. Kendall's correlation coefficient is denoted by the Greek letter, tau, or τ. Kendall's tau values range from -1 to +1, which are shown in following tables. A higher absolute value of tau means a stronger correlation between the two indicators.

For each pair of indicators, the value of R-squared (R^2) was determined. R-squared is a metric that evaluates the scatter of the data points around a fitted regression line and is equal to the percentage of the variation of the response variable that is explained by a linear model. The value of R-squared is always between 0 and 1.0. In general, the higher the value of R-squared, the better fit the model is for the data. A high R-squared value represents a smaller difference between the observed data and fitted values.

Regions were assigned to each entry based on country, using the groupings from the World Health Organization (WHO).

Entries were grouped by World Bank income classification[8] and assigned to one of the following income groups: High-Income, Upper Middle-Income, Lower Middle-Income, and Low-Income.

Data for select country indicators (i.e., population, GDP, HDI, DALYs) were derived from The World Bank Group[9], Our World in Data[10], and the United Nations Development Programme (UNDP)[11].

RESULTS

Basic univariate analyses

The table below shows summary statistics for countries with population greater than 100,000 (N=180), for each of the three ESSENCE indicators, including mean, minimum, maximum, and median.

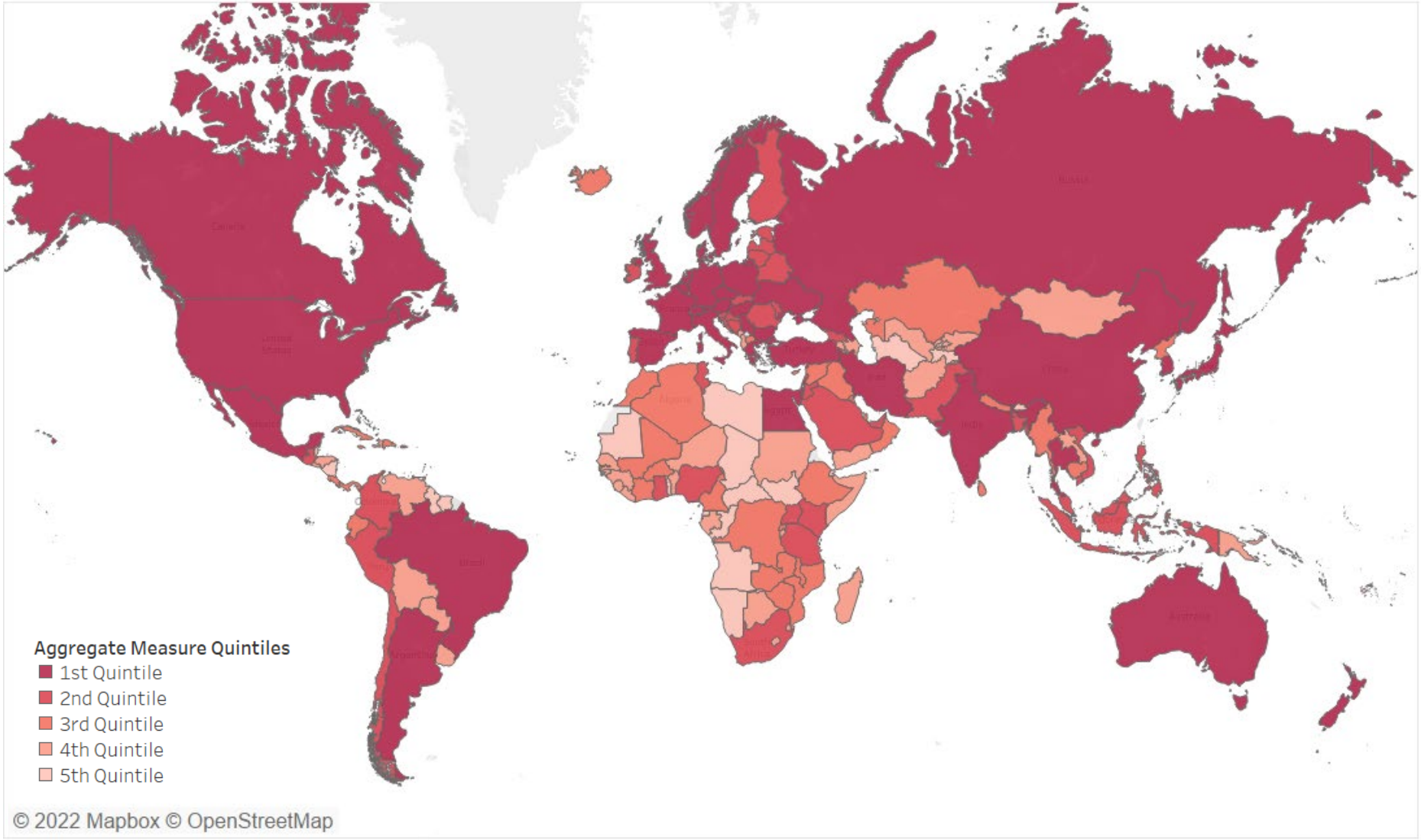
Table 2. Summary statistics of ESSENCE indicators, all countries with population < 100,000 (N=180)

ESSENCE indicator	Summary statistic				
	N countries	Mean	Minimum	Maximum	Median
Clinical trial capacity	180	471	2	10392	22
Capacity to attract funding for health/clinical research	180	572	0	59194	18
Capacity to produce research output in peer-reviewed journals	180	9375	0	345579	465

Map

A map of the aggregate measure values was created using quintiles. Countries in the first quintile have the highest health research capacity. A darker color hue corresponds to a higher health research capacity. Color hue indicates the order of quintiles, e.g., 1st Quintile = darkest color hue; 5th Quintile = lightest color hue.

Figure 1. Map of Aggregate measure of national health research capacity, all countries with population > 100,000 (N=180)



How the ESSENCE indicators relate to each other

Bivariate analyses were conducted for each of the following pairs of ESSENCE indicators:

- Clinical trial capacity vs. Capacity to attract funding for health/clinical research
- Clinical trial capacity vs. Capacity to produce research output in peer-reviewed journals
- Capacity to attract funding for health/clinical research vs. Capacity to produce research output in peer-reviewed journals

For the purposes of this analysis, the values for the x-axis and y-axis for the analyses were plotted on a logarithmic scale.

In most cases, R-squared is less than 0.5. The following figures show the scatter plots for the pairs of ESSENCE indicators. While these measures appear to be correlated, in most cases, one measure accounts for less than half of the variance in the other variable.

While the R-squared value can provide some useful insights regarding the model, the figures below do not disclose information about any causation amongst the indicators.

Amongst the three indicators, there is a relatively strong correlation, indicated by the statistically significant values of tau. The range of Kendall's tau absolute values for the pairs of ESSENCE indicators is between 0.60 and 0.78. The lowest absolute value of Kendall's tau is for Clinical trial capacity vs. Capacity to attract funding for health/clinical research (0.60). The highest absolute value of Kendall's tau is for Clinical trial capacity vs. Capacity to produce research output in peer-reviewed journals (0.78).

Figure 2. Scatter plot for Clinical trial capacity vs. Capacity to attract funding for health/clinical research

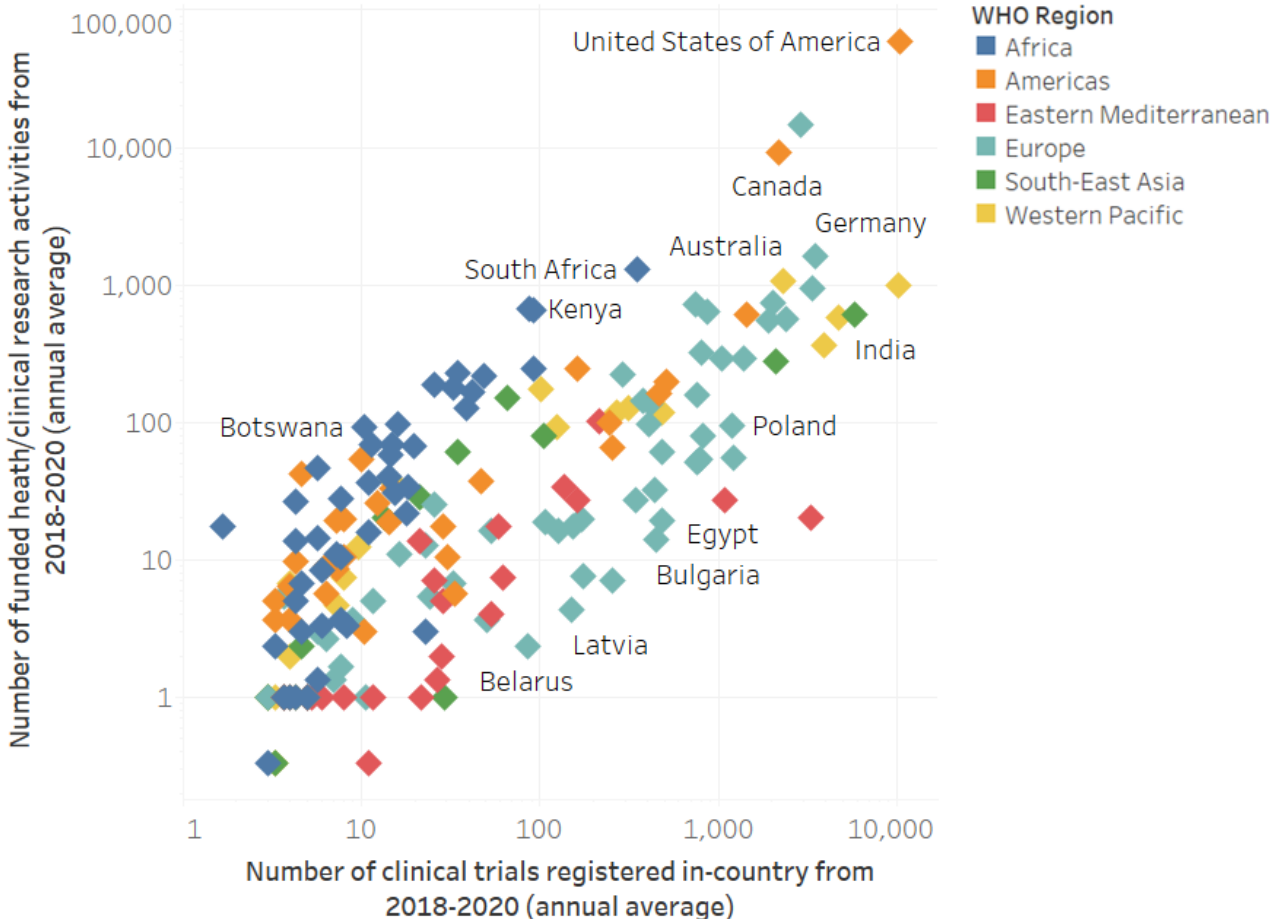


Table 3. Trend model statistics for Clinical trial capacity vs. Capacity to attract funding for health/clinical research

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard	p-value	R-Squared (R^2)	Kendall's tau (τ)
Clinical trial capacity vs. Capacity to attract funding for health/clinical research	180	12	168	2.29e+08	1.36e+06	1167.86	< 0.0001	0.94	0.60

Figure 3. Scatter plot for Clinical trial capacity vs. Capacity to produce research output in peer-reviewed journals

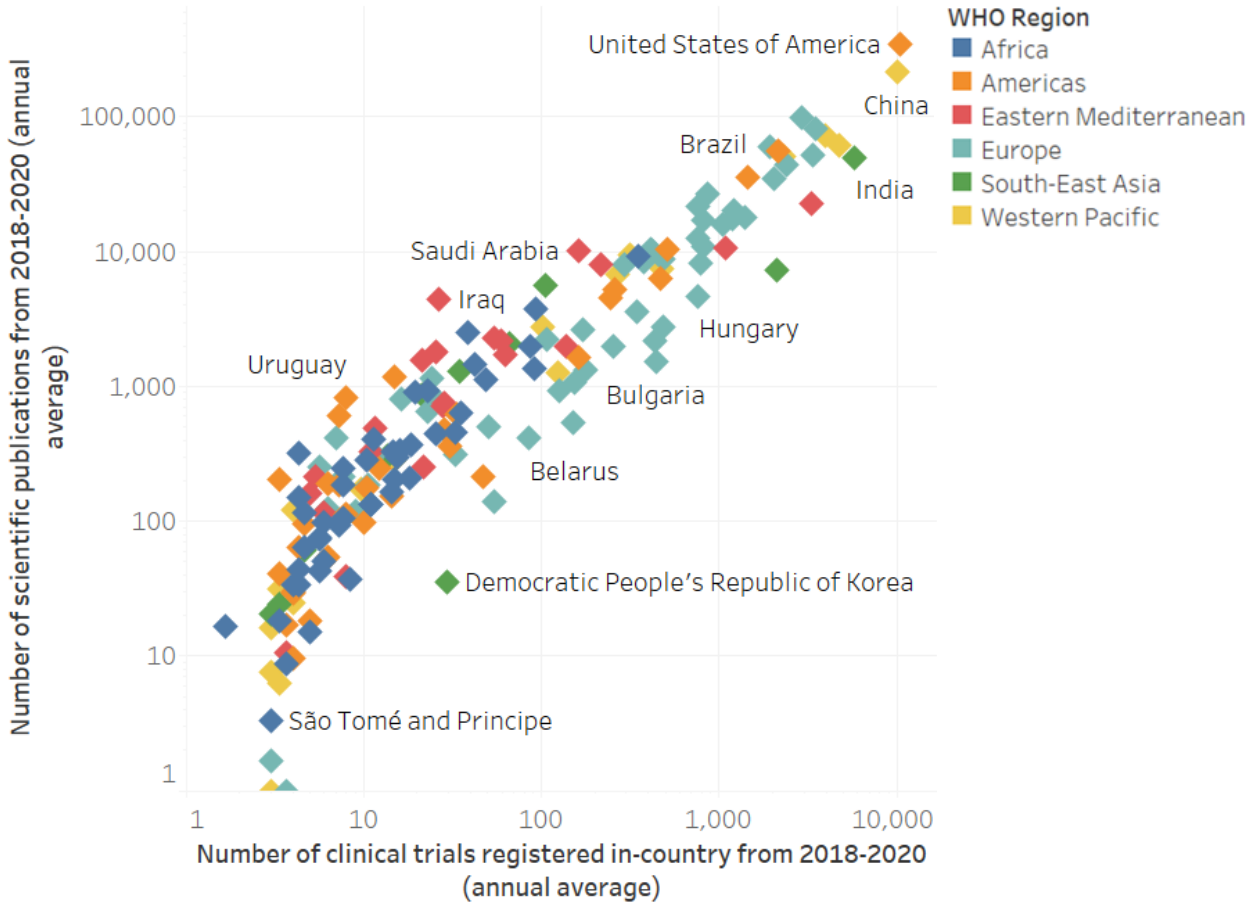


Table 4. Trend model statistics for Clinical trial capacity vs. Capacity to produce research output in peer-reviewed journals

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
Clinical trial capacity vs. Capacity to produce research output in peer-reviewed journals	180	12	168	5.05e+09	3.00e+07	5481.28	< 0.0001	0.97	0.78

Figure 4. Scatter plot for Capacity to attract funding for health/clinical research vs. Capacity to produce research output in peer-reviewed journals

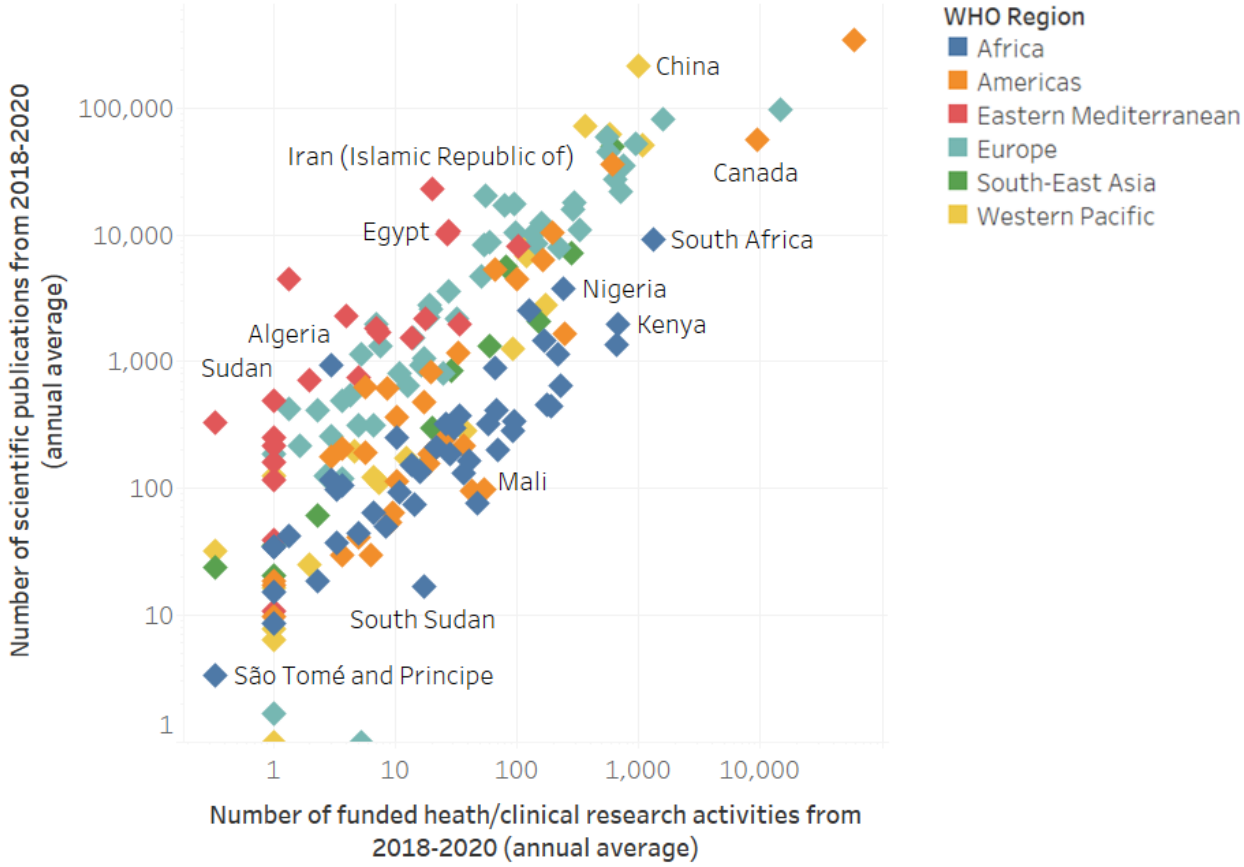


Table 5. Trend model statistics for Capacity to attract funding for health/clinical research vs. Capacity to produce research output in peer-reviewed journals

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
Capacity to attract funding for health/clinical research vs. Capacity to produce research output in peer-reviewed journals	180	12	168	3.01e+10	1.79e+08	13390.4	< 0.0001	0.85	0.62

How certain country indicators relate to the aggregate measure of national health research capacity

Bivariate correlations were conducted to examine the aggregate measure of national health research capacity against country indicators, such as population, GDP, etc.

The following pairs of indicators were analyzed:

- Population, total vs. Aggregate measure of national health research capacity
- Gross Domestic Product (GDP) overall vs. Aggregate measure national health research capacity
- Gross Domestic Product (GDP) per capita vs. Aggregate measure of national health research capacity
- Human Development Index (HDI) vs. Aggregate measure of national health research capacity
- Disability-Adjusted Life Years (DALYs), per 1M population vs. Aggregate measure of national health research capacity

In most cases, R-squared is less than 0.5. The following figures show the scatter plots for the aggregate measures versus various country indicators. While some of these measures appear to be correlated, in most cases, one measure accounts for less than half of the variance in the other variable.

While the R-squared value can provide some useful insights regarding the model, the figures below do not disclose information about the causation between the country indicators and the aggregate measure.

For the purposes of this analysis, the values for the x-axis for some of the analyses were plotted on a logarithmic scale.

The range of Kendall's tau absolute values for the country indicators vs. the aggregate measure is between 0.25 and 0.78. The lowest absolute value of Kendall's tau is for GDP per capita vs. the aggregate measure (0.25). The highest absolute value of Kendall's tau is for GDP overall vs. the aggregate measure (0.78).

Figure 5. Scatter plot for Population vs. Aggregate measure of national health research capacity

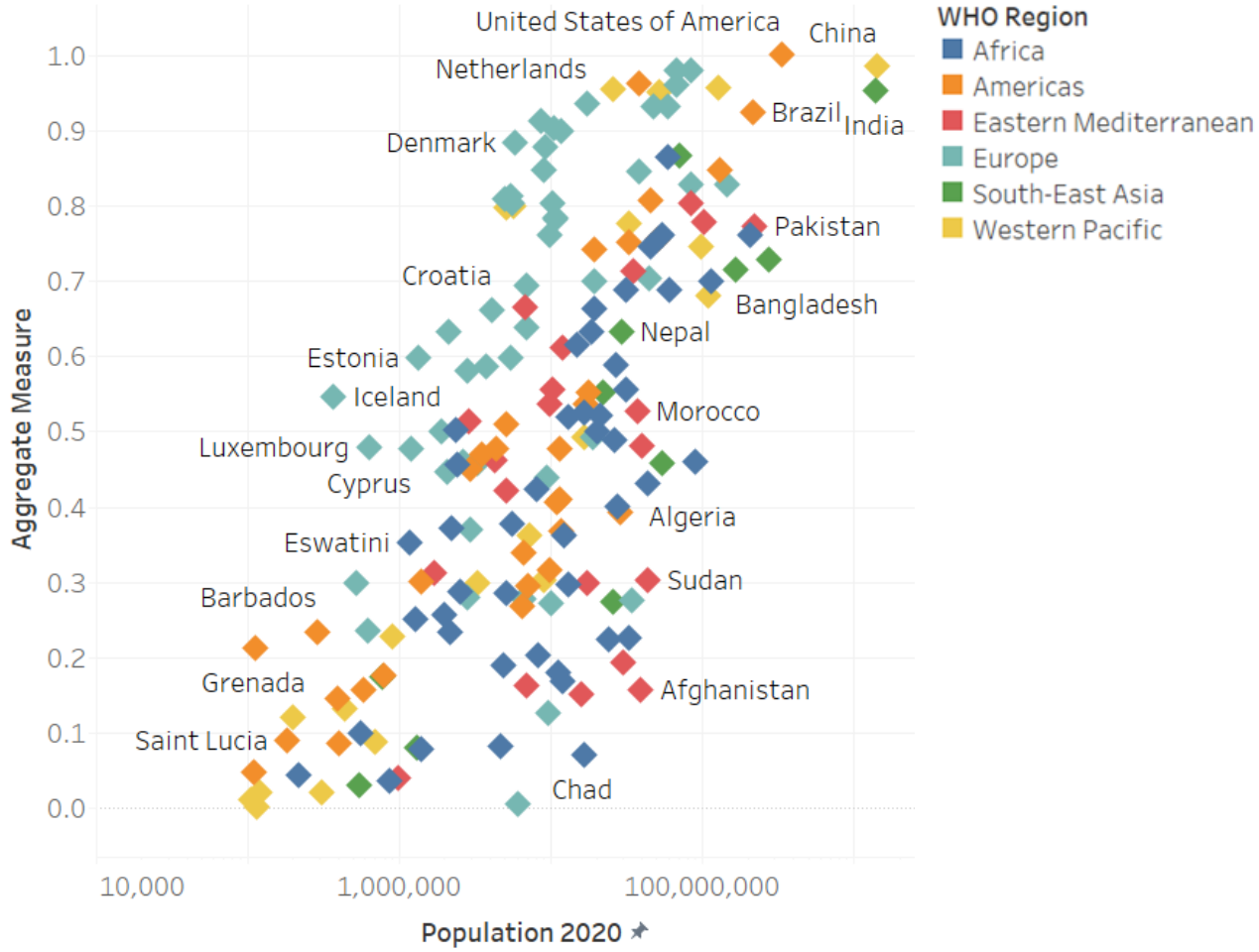


Table 6. Trend model statistics for Population vs. Aggregate measure of national health research capacity

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
Population vs. Aggregate measure	180	12	168	8.98	0.05	0.23	< 0.0001	0.35	0.56

Figure 6. Scatter plot for GDP overall vs. Aggregate measure of national health research capacity

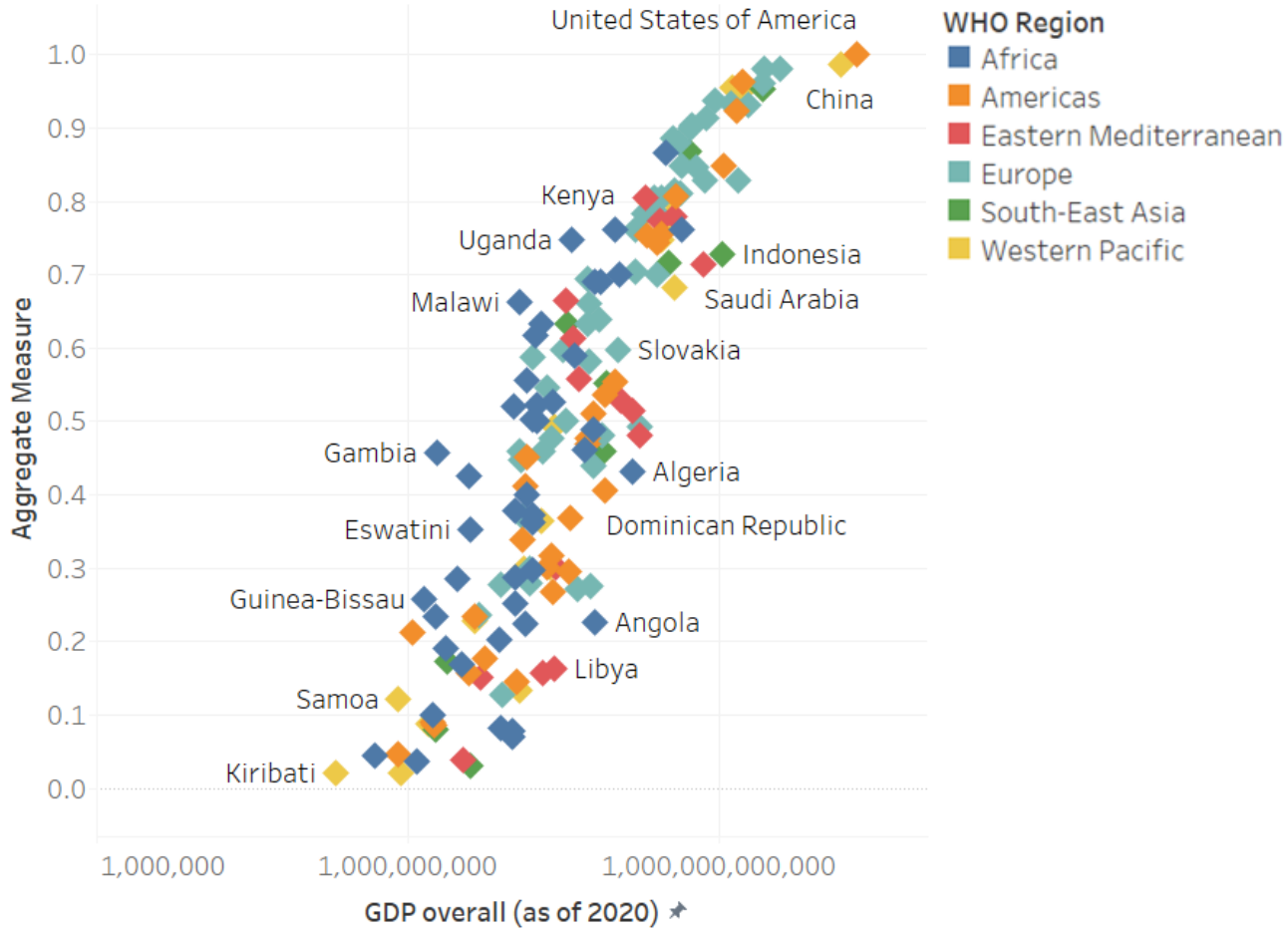


Table 7. Trend model statistics for GDP overall vs. Aggregate measure of national health research capacity

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
GDP overall vs. Aggregate measure	180	12	154	7.80	0.05	0.23	< 0.0001	0.38	0.78

Figure 7. Scatter plot for GDP per capita vs. Aggregate measure of national health research capacity

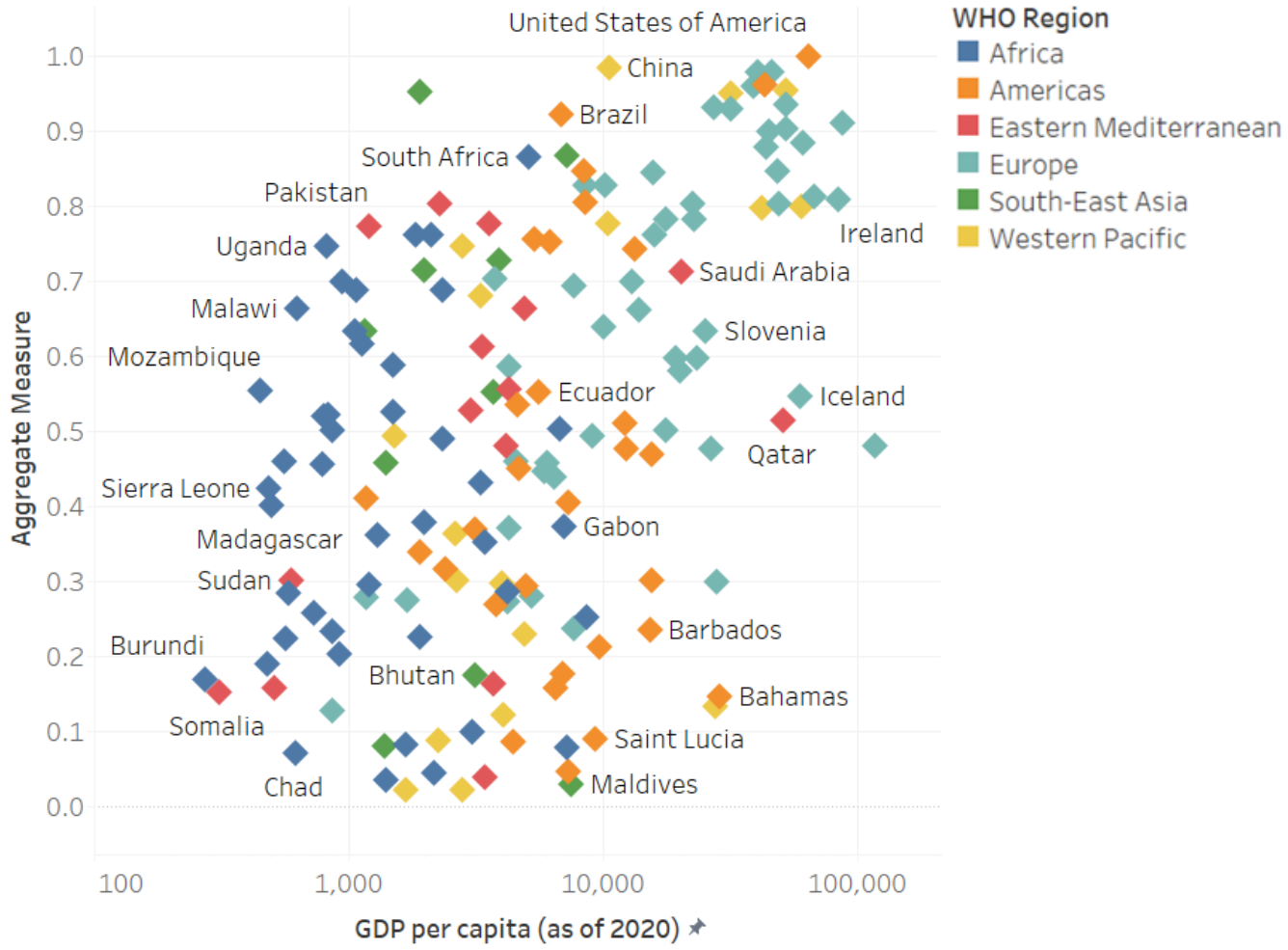


Table 8. Trend model statistics for GDP per capita vs. Aggregate measure of national health research capacity

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
GDP per capita vs. Aggregate measure	180	12	154	9.33	0.06	0.25	< 0.0001	0.25	0.25

Figure 8. Scatter plot for HDI vs. Aggregate measure of national health research capacity

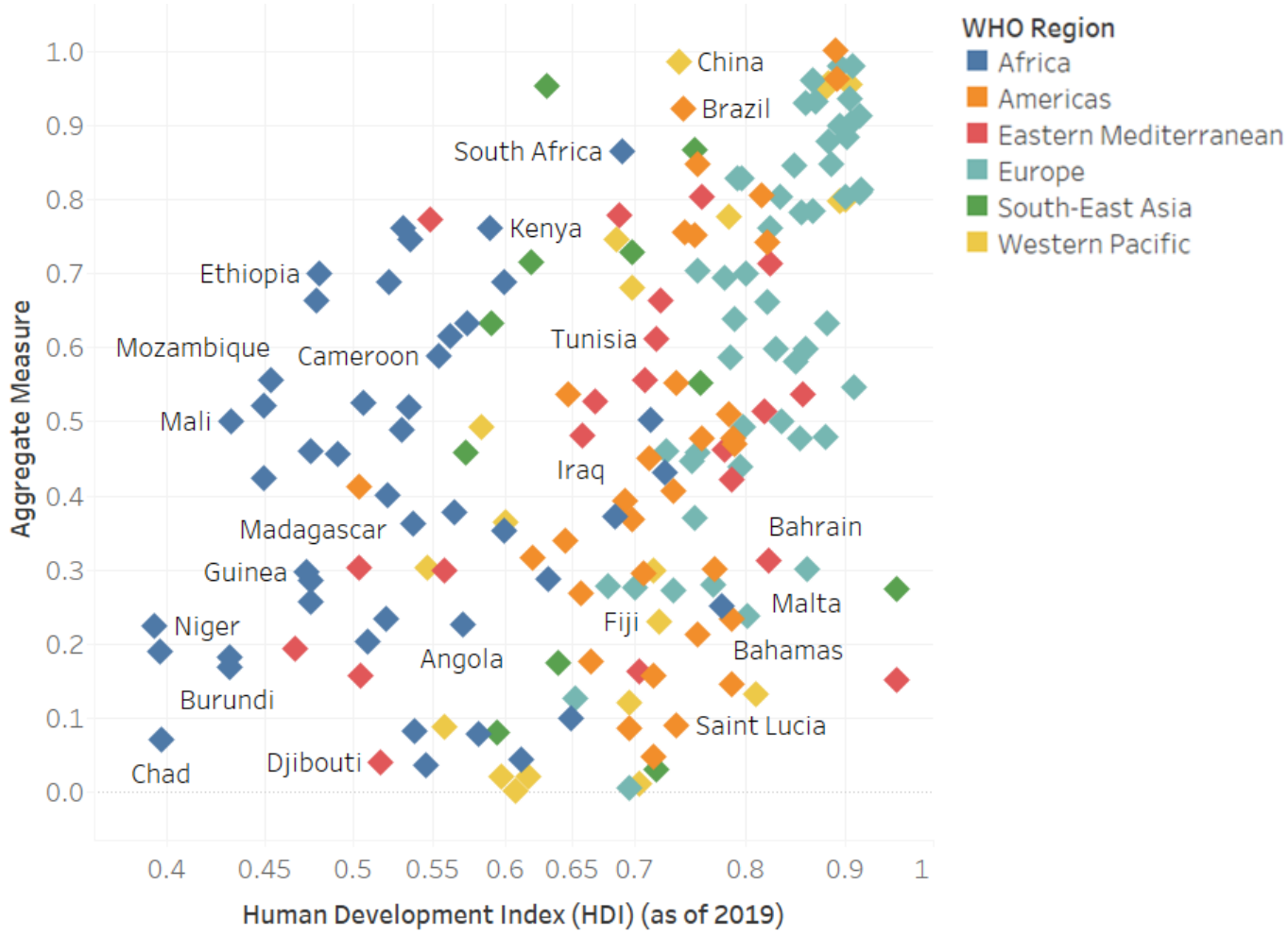


Table 9. Trend model statistics for HDI vs. Aggregate measure of national health research capacity

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
HDI vs. Aggregate measure	180	12	166	8.38	0.05	0.22	< 0.0001	0.39	0.31

Figure 9. Scatter plot for DALYs per 1M vs. Aggregate measure of national health research capacity

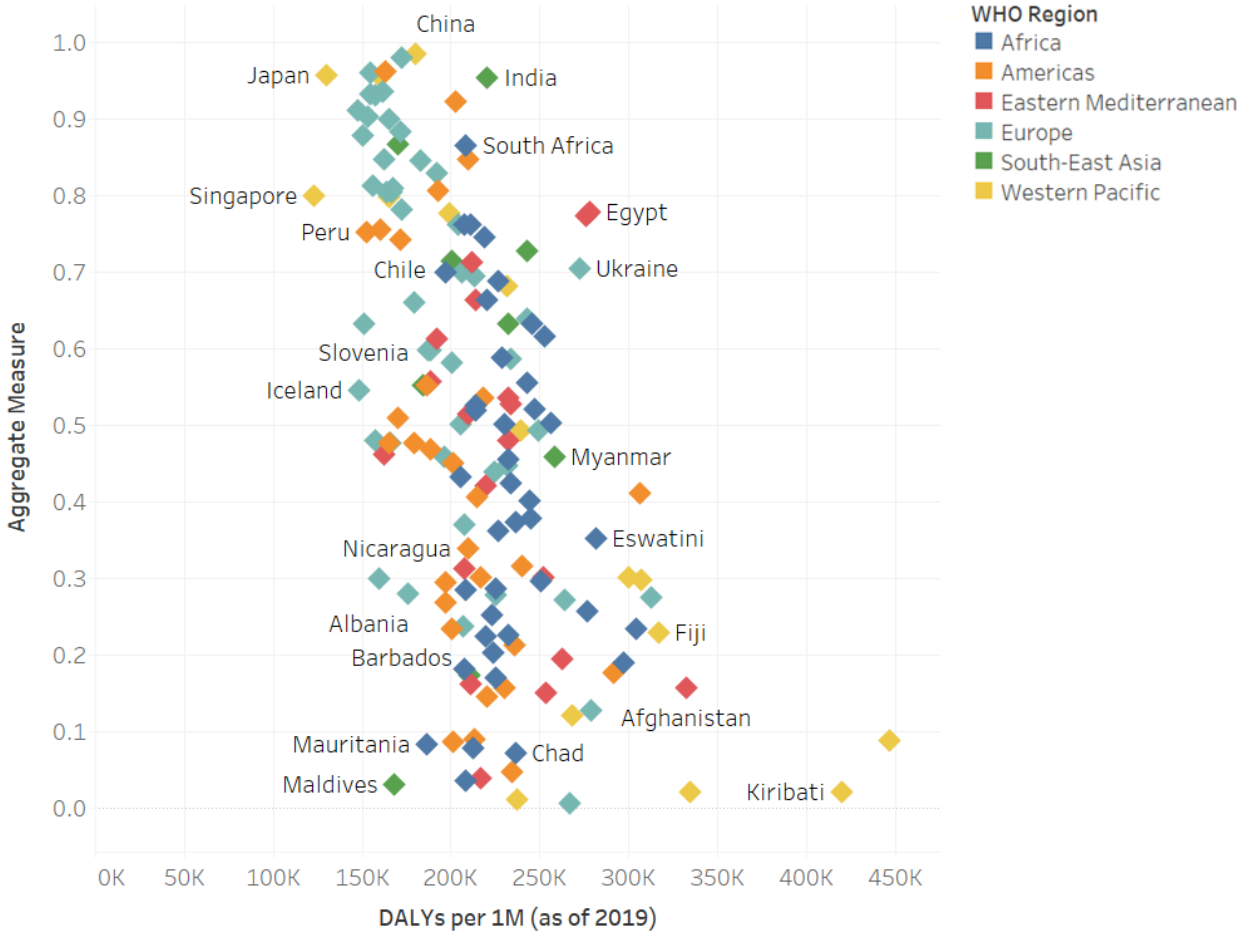


Table 10. Trend model statistics for DALYs per 1M vs. Aggregate measure of national health research capacity

Model	*N* countries	Model degrees of freedom	Residual degrees of freedom (DF)	Sum squared error (SSE)	Mean squared error (MSE)	Standard error	p-value	R-Squared (R^2)	Kendall's tau (τ)
DALYs per 1M vs. Aggregate measure	180	12	147	7.2	0.05	0.22	< 0.0001	0.39	– 0.34

DISCUSSION

From this deep-dive data analysis of the health research capacity indicators that were developed for the ESSENCE Mechanism, we have shown that it is feasible to create basic metrics for country-level health research capacity using publicly available data. The relatively high correlations among the indicators indicate internal consistency and potential good reliability of the metric. These metrics may be helpful to funders, national health authorities, researchers, and other stakeholders to design effective and equitable initiatives to strengthen health research capacity and to focus some resources to the areas of greatest need.

In addition, we found that larger, higher-income countries tended to have greater research capacity; however, these results also confirm that many smaller, lower-income, less-developed countries also have good research capacity. There may be opportunities to apply lessons learned from these outliers for other countries to follow.

To fully characterize research capacity, national health research priorities, and specific facilitators and barriers, more focused work is needed at the country level with relevant national stakeholders. We need to use data and metrics to plan and evaluate capacity-building efforts and make them more effective and equitable. Once good metrics are established for assessing research capacity at the country level, additional resources can be directed to countries with lower capacity, as appropriate. In conclusion, effective use of data and metrics is essential for strengthening research capacity and achieving global health goals.

APPENDIX

List of all countries, in descending order by aggregate measure of national health research capacity

**The data table is also available on the ESSENCE website as a downloadable Microsoft Excel file.*

World Bank Income Group

- High-Income
- Upper Middle-Income
- Lower Middle-Income
- Low-Income

Country	World Bank income classification	Clinical trial capacity	Capacity to attract funding for health/clinical research	Capacity to produce research output in peer reviewed journals	Aggregate measure of national health research capacity
United States of America	High income	10,392	59,194	345,579	1.00
China	Upper middle income	10,138	988	216,876	0.98
United Kingdom of Great Britain and Northern Ireland	High income	2,908	14,558	98,331	0.98
Germany	High income	3,461	1,603	81,802	0.98
Japan	High income	4,750	580	62,154	0.96
Canada	High income	2,169	9,279	55,632	0.96
France	High income	3,361	943	52,014	0.96
Australia	High income	2,320	1,065	50,398	0.96
Republic of Korea	High income	3,933	360	72,283	0.95
India	Lower middle income	5,791	611	50,212	0.95
Netherlands	High income	2,032	739	34,836	0.94
Italy	High income	1,928	553	59,361	0.93
Spain	High income	2,405	569	44,494	0.93
Brazil	Upper middle income	1,441	604	35,575	0.92
Switzerland	High income	866	639	27,056	0.91
Sweden	High income	753	719	21,771	0.90
Belgium	High income	1,398	293	17,895	0.90
Denmark	High income	1,040	292	16,052	0.88
Israel	High income	810	324	10,976	0.88
South Africa	Upper middle income	349	1,308	9,282	0.87
Thailand	Upper middle income	2,119	277	7,216	0.87
Poland	High income	1,192	95	17,669	0.85

Austria	High income	759	158	12,481	0.85
Mexico	Upper middle income	516	197	10,310	0.85
Turkey	Upper middle income	1,213	56	20,269	0.83
Russian Federation	Upper middle income	813	80	17,280	0.83
Norway	High income	420	136	10,129	0.81
Ireland	High income	292	222	7,951	0.81
Argentina	Upper middle income	469	161	6,326	0.81
Iran (Islamic Republic of)	Upper middle income	3,314	20	22,895	0.80
Portugal	High income	411	98	10,501	0.80
Singapore	High income	316	128	9,473	0.80
Finland	High income	380	143	8,449	0.80
New Zealand	High income	480	117	7,484	0.80
Egypt	Lower middle income	1,082	27	10,619	0.78
Greece	High income	482	60	8,735	0.78
Czech Republic	High income	784	54	8,221	0.78
Malaysia	Upper middle income	269	119	6,783	0.78
Pakistan	Lower middle income	215	102	8,073	0.77
Hungary	High income	764	51	4,678	0.76
Colombia	Upper middle income	244	100	4,496	0.76
Nigeria	Lower middle income	92	243	3,717	0.76
Kenya	Lower middle income	87	676	1,982	0.76
Viet Nam	Lower middle income	102	173	2,795	0.75
Uganda	Low income	92	650	1,345	0.75
Peru	Upper middle income	163	247	1,644	0.75
Chile	High income	258	66	5,293	0.74
Indonesia	Upper middle income	105	81	5,576	0.73
Saudi Arabia	High income	161	27	10,134	0.71
Bangladesh	Lower middle income	66	150	2,055	0.71
Romania	High income	342	27	3,606	0.70
Ethiopia	Low income	39	126	2,522	0.70
Ukraine	Lower middle income	437	32	2,169	0.70
Serbia	Upper middle income	487	19	2,777	0.69
Ghana	Lower middle income	42	167	1,454	0.69
United Republic of Tanzania	Lower middle income	48	215	1,129	0.69
Philippines	Lower middle income	125	92	1,261	0.68
Croatia	High income	172	20	2,609	0.66
Lebanon	Upper middle income	138	34	1,967	0.66
Malawi	Low income	35	228	638	0.66
Bulgaria	Upper middle income	445	14	1,533	0.64
Slovenia	High income	107	19	2,245	0.63
Nepal	Lower middle income	35	60	1,309	0.63

Zambia	Lower middle income	33	178	457	0.63
Zimbabwe	Lower middle income	26	189	443	0.62
Tunisia	Lower middle income	59	18	2,176	0.61
Slovakia	High income	256	7	1,993	0.60
Estonia	High income	154	17	1,071	0.60
Georgia	Upper middle income	127	16	935	0.59
Cameroon	Lower middle income	20	67	899	0.59
Lithuania	High income	177	8	1,319	0.58
Jordan	Upper middle income	62	7	1,706	0.56
Ecuador	Upper middle income	15	33	1,173	0.55
Sri Lanka	Lower middle income	21	29	856	0.55
Iceland	High income	26	25	805	0.55
Mozambique	Low income	16	96	339	0.55
United Arab Emirates	High income	54	4	2,303	0.54
Guatemala	Upper middle income	47	37	214	0.54
Morocco	Lower middle income	21	14	1,553	0.53
Senegal	Lower middle income	11	68	409	0.52
Burkina Faso	Low income	18	34	369	0.52
Rwanda	Low income	15	59	325	0.52
Qatar	High income	26	7	1,812	0.51
Costa Rica	Upper middle income	29	17	473	0.51
Latvia	High income	151	4	536	0.50
Botswana	Upper middle income	10	92	283	0.50
Mali	Low income	15	69	202	0.50
Kazakhstan	Upper middle income	23	13	650	0.49
Côte d'Ivoire	Lower middle income	15	31	298	0.49
Cambodia	Lower middle income	15	38	283	0.49
Iraq	Upper middle income	27	1	4,420	0.48
Cyprus	High income	24	5	1,145	0.48
Luxembourg	High income	16	11	797	0.48
Cuba	Upper middle income	33	6	628	0.48
Panama	High income	30	10	361	0.48
Uruguay	High income	8	20	834	0.47
Kuwait	High income	29	5	745	0.46
Bosnia and Herzegovina	Upper middle income	51	4	496	0.46
Myanmar	Lower middle income	14	20	302	0.46
Democratic Republic of the Congo	Low income	18	22	210	0.46
Gambia	Low income	14	40	166	0.46
Republic of Moldova	Lower middle income	54	16	140	0.46
North Macedonia	Upper middle income	33	7	313	0.45
Jamaica	Upper middle income	12	26	245	0.45

Belarus	Upper middle income	86	2	411	0.44
Algeria	Lower middle income	23	3	928	0.43
Oman	High income	28	2	710	0.42
Sierra Leone	Low income	11	37	132	0.42
Dominican Republic	Upper middle income	14	19	155	0.41
Haiti	Low income	10	53	98	0.41
Madagascar	Low income	8	28	184	0.40
Venezuela (Bolivarian Republic of)	Unclassified	7	9	608	0.39
Congo	Lower middle income	4	26	319	0.38
Armenia	Upper middle income	12	5	311	0.37
Bolivia (Plurinational State of)	Lower middle income	7	19	184	0.37
Gabon	Upper middle income	11	16	135	0.37
Benin	Lower middle income	8	10	248	0.36
Lao People's Democratic Republic	Lower middle income	10	12	172	0.36
Eswatini	Lower middle income	6	47	76	0.35
Nicaragua	Lower middle income	5	43	95	0.34
Honduras	Lower middle income	8	10	114	0.32
Bahrain	High income	11	0	329	0.31
Sudan	Low income	12	0	491	0.30
Malta	High income	7	1	417	0.30
Syrian Arab Republic	Low income	22	0	253	0.30
Mongolia	Lower middle income	7	5	196	0.30
Trinidad and Tobago	High income	6	6	189	0.30
Papua New Guinea	Lower middle income	8	7	111	0.30
Guinea	Low income	7	11	94	0.30
Paraguay	Upper middle income	10	3	177	0.29
Namibia	Upper middle income	4	14	151	0.29
Uzbekistan	Lower middle income	8	2	214	0.28
Albania	Upper middle income	11	1	186	0.28
Kyrgyzstan	Lower middle income	9	4	120	0.28
Liberia	Low income	6	14	74	0.28
Azerbaijan	Upper middle income	6	3	255	0.27
El Salvador	Lower middle income	6	9	54	0.27
Democratic People's Republic of Korea	Low income	29	1	36	0.27
Guinea-Bissau	Low income	6	8	50	0.26
Mauritius	High income	8	4	104	0.25
Montenegro	Upper middle income	6	3	125	0.24
Fiji	Upper middle income	4	7	121	0.23
Barbados	High income	4	10	64	0.23
Angola	Lower middle income	5	7	64	0.23

Lesotho	Lower middle income	8	3	37	0.23
Niger	Low income	6	3	97	0.22
Grenada	Upper middle income	3	4	203	0.21
Togo	Low income	5	3	116	0.20
Yemen	Low income	5	0	214	0.19
Central African Republic	Low income	4	5	44	0.19
Guyana	Upper middle income	4	6	30	0.18
South Sudan	Low income	2	17	17	0.18
Bhutan	Lower middle income	5	2	61	0.17
Burundi	Low income	6	1	42	0.17
Libya	Upper middle income	5	0	162	0.16
Afghanistan	Low income	6	0	116	0.16
Suriname	Upper middle income	3	5	41	0.16
Somalia	Low income	8	0	39	0.15
Bahamas	High income	4	4	29	0.14
Brunei Darussalam	High income	4	0	126	0.13
Tajikistan	Low income	4	5	0	0.13
Samoa	Upper middle income	4	2	25	0.12
Cabo Verde	Lower middle income	3	2	18	0.10
Solomon Islands	Lower middle income	3	0	32	0.09
Belize	Upper middle income	5	0	18	0.09
Saint Lucia	Upper middle income	4	1	10	0.09
Mauritania	Lower middle income	4	0	34	0.08
Timor-Leste	Lower middle income	3	0	24	0.08
Equatorial Guinea	Upper middle income	5	0	15	0.08
Chad	Low income	4	0	34	0.07
Saint Vincent and the Grenadines	Upper middle income	4	0	17	0.05
Djibouti	Lower middle income	4	0	11	0.04
Comoros	Lower middle income	4	0	9	0.04
São Tomé and Principe	Lower middle income	3	0	3	0.04
Maldives	Upper middle income	3	0	20	0.03
Vanuatu	Lower middle income	3	0	16	0.02
Kiribati	Lower middle income	3	0	6	0.02
Tonga	Upper middle income	3	0	8	0.01
Turkmenistan	Upper middle income	3	0	2	0.01
Micronesia (Federated States of)	Lower middle income	3	0	0	0.00

REFERENCES

[1] ESSENCE on Health Research Initiative. Available from: https://tdr.who.int/groups/essence-on-health-research

[2] International Vaccines Task Force. Money & Microbes – Strengthening Clinical Research Capacity to Prevent Epidemics Washington, DC: World Bank; 2018. Available from: http://documents.worldbank.org/curated/en/120551526675250202/pdf/126338-REVISED-27231-IVTF-Report-reduced.pdf

[3] Mechanism for review of investments in research capacity strengthening in low- and middle-income countries. Available from: https://tdr.who.int/docs/librariesprovider10/essence/mechanism-talking-points.pdf?sfvrsn=fd63ca20_5&ua=1

[4] Eigbike M. Health research capacity strengthening in low and middle-income countries: current situation and opportunities to leverage data for better coordination and greater impact. Available from: https://tdr.who.int/docs/librariesprovider10/essence/essence-mechanism-consultant-report-2020.pdf?sfvrsn=21f38c1a_5

[5] International Clinical Trials Registry Platform (ICTRP): World Health Organization. Available from: https://www.who.int/clinical-trials-registry-platform

[6] World RePORT: an interactive mapping database of global biomedical research [Internet]. National Institutes of Health. Available from: https://worldreport.nih.gov/

[7] Welcome to Scopus Preview: Scopus. 2021. Available from: https://www.scopus.com/home.uri

[8] World Bank Country and Lending Groups: The World Bank Group. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

[9] Indicators: The World Bank Group. Available from: https://data.worldbank.org/indicator

[10] Roser M. and Ritchie H. (2016). Burden of Disease. Available from: https://ourworldindata.org/burden-of-disease

[11] United Nations Development Programme. Available from: https://www.undp.org/