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ORIGINAL-ARTICLE

Ranking Countries According to Health, Equity, and Efficiency

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Abstract

This paper modifies and updates previous work on ranking countries according to an objective measure of health, equity, and efficiency, and explores some implications. Country Health (CH) is defined as 105 times the ratio of female life expectancy at birth (LE-F) to the product of female child mortality rate (F-U5MR), adolescent birth rate (ABR), and maternal mortality ratio (MMR): CH = (10^5) (F-LE)/(MMR) (ABR) (F-U5MR). Health Equity is the ratio of CH to inequality in life expectancy (IneqLE), and health Efficiency the ratio of CH to per capita health expenditure (Health$/c). Data is the most recent available from reputable sources. Of the 39 countries with Equity > 2900, all have CH > 15,900. Of the 140 countries with Equity < 2500, all have CH < 12,500. Equity is the means to CH and Efficiency, and primary health care the means to Equity.

Key Words: Health, Wealth, Nations, Equity, Efficiency

1 | INTRODUCTION

In a previous article, I described an objective method for ranking countries according to health, equity, and efficiency (1). This paper modifies that method to focus on females and include adolescent birth rate, and updates the results according to most recent data. The impetus for this work derives in part from lack of consensus on the definition of health (2). What, precisely, do we mean by country health? The United Nations Development Program offers a holistic answer, i.e., human development, a synthesis of health, education, and wealth (3). But, overall countries, the Human Development Index ranges only from 0.39 for South Sudan and Chad to 0.96 for Switzerland, Norway, and Iceland suggesting that country health in the sickest countries is 40% as good as in the healthiest, and that's not realistic. The World Health Organization offers a "healthy life expectancy" that combines morbidity and mortality, but, again, over all countries, this HALE varies only from 46 in Central African Republic to 74 in Japan, suggesting that health in the sickest country is 62% as good as in the healthiest (4). With such gross underestimates of health disparity, it's not surprising that healthy countries let sick countries fester. Other indices that include subjective criteria disagree in the ranking of counties. USA, for instance, ranks 35th by The Bloomberg Global Health Index, and first by the Global Health Index (5), (6). Without consensus on definition, consensus on goal is impossible.

I offer a simple, objective, and relevant definition: Country Health, CH, is 10^5 times the ratio of female life-expectancy at birth (F-LE) to the product of female child mortality rate (F-U5MR), maternal mortality ratio (MMR), and adolescent birth rate (ABR):

CH = (10^5) (F-LE)/ (F-U5MR) (MMR) (ABR). The 10^5 is for convenience. I call the ratio of CH to inequality of life expectancy (IneqLE), "Equity,"

and the ratio of CH to per capita health expenditure (Health $/c), "Efficiency." I ignore all units, rank the countries according to these parameters, and explore the implications.

I suggest that the health of a country's females is the best measure of the health of that country because men, typically, apportion care, and apportioning less than adequate care for females is a measure of less healthy men.

I suggest that healthy countries become healthier for the world by curtailing inefficient domestic spending in order to fund extremely efficient spending in sick countries. Such international triage is the means, and perhaps the only means, to health for all.

2 | BODY TEXT

Data was obtained principally from UNICEF as follows:

F-LE for 2020 was obtained from Table 1, "Demographics," F-U5MR for 2019 from Table 2, "Child Mortality," MMR for 2017 from Table 3, "Maternal and Newborn Health," ABR for 2015-2019, from Table 5, "Adolescent Health," and GINI for 2010-2019 from Table 13, "Social Protection and Equity" (7). Inequality in life expectancy (IneqLE) was obtained from Table 3 of the "Human Development Report 2020" [3]. Health expenditure per capita (current US$) for 2019 was obtained from the World Bank (8) as was the GDP/c (current US$) (9).

3 | RESULTS AND DISCUSSION

Table 1 lists all countries (n = 179) that reported data permitting calculation of CH, Equity, and Efficiency (Tanzania did not report Health $/c).

Supplementary information: *The online version of this article (https://doi.org/10.52845/ (rrarjmcs/ 2023/9-4-5) Contains supplementary material, which is available to authorized users.*

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Table 1: *Countries Ranked According to CH, with Equity, Efficiency and Abnormality Listed.*

Country	CH	Equity	Efficiency	Abnormal
Norway	708333	236111	88	none
Italy	358333	115911	120	none
Finland	354166	118055	79	none
Denmark	345833	96064	57	none
Japan	293333	101149	67	none
Singapore	268750	107500	102	none
Rep Korea	260606	86868	99	none
Switzerland	215000	61428	22	none
Iceland	212500	88541	33	none
Luxembour	170000	50000	27	none
Slovenia	150000	51724	67	none
Netherland	140000	45161	26	none
Sweden	132812	45797	23	none
Spain	119444	39814	44	none
Israel	118055	35774	34	none
Belarus	111111	25252	278	none
Greece	104938	29982	69	none
Poland	103751	24128	102	none
United Arab	95238	18315	51	none
Austria	93333	25225	17	none
Ireland	93333	27450	17	none
Belgium	93333	25925	18	none
Cyprus	86458	24016	43	none
Czechia	83838	27946	45	none
Montenegr	65833	18286	89	none
Germany	57142	15037	10	none
Australia	53086	14347	9	none
Portugal	50595	14455	22	none
Estonia	46111	12808	28	none
Lithuania	31060	5647	22	none
Canada	30357	6599	6	none
France	29861	7858	6	none
Croatia	28472	6621	27	none
UK	24702	6024	5	none
Qatar	21693	3805	12	none
Malta	19444	4226	7	none
Kuwait	18333	3107	10	none
New Zeal	17948	4173	4	
Bos & Hers	16000	2962	28	none
Slovakia	12461	2492	9	b
Latvia	11695	2165	10	a
Serbia	10972	2239	17	none
Hungary	10101	2405	9	b
Saudi Arab	8387	1310	6	a
Bahrain	6200	1127	6	a
Oman	5328	795	8	a
Chile	4626	734	3	a,b
China	4269	540	7	a
Albania	4232	587	15	a,b,c
USA	4231	671	0.3	a,b
Russia	4224	594	6	a,b
Malaysia	3783	620	8	a,c
Kazakhstan	3768	489	13	b,c
Bulgaria	3376	553	4	b

Lebanon	3325	449	5	a
Ukraine	2814	380	11	a,b,c
Turkey	2786	309	7	a,b,c
Brunei Dar	2483	326	3	a,c
Maldives	2426	404	2	a
Uruguay	2233	282	1	a,b
Romania	1949	309	2	a,b
Sri Lanka	1763	251	10	a,b
Tunisia	1749	194	7	a
Armenia	1453	167	2	a,b
Georgia	1344	170	4	a,b,c
Turkmenist	1298	54	2	b,c,d
Iran	1209	131	2	a,b,c
Thailand	1189	150	4	a,b,c
Antiq & Bar	1105	190	1	a,b
Libya	959	105	3	a,c,d
Costa Rica	937	131	1	a,b,c
Uzbekistabn	895	64	9	a,b,c,d
Cuba	849	166	0.8	a,b
Cabo Verde	839	68	4	a,c,d
Syria	601	46	8	a,b,c
Grenada	555	49	1	a,b,c,d
Barbados	545	62	0.4	a,b,c
Argentina	512	59	0.5	a,b,c
Jordan	437	41	1	a,b,c,d
Fiji	389	26	1	a,b,c,d
Mongolia	378	28	2	a,b,c,d
Mauritius	341	36	0.4	a,b,c,d
Belize	339	30	1	a,b,c
Azerbaijan	338	24	1	a,b,c,d
Samoa	323	32	1	a,b,c,d
Viet Nam	312	24	1	a,b,c
Bahamas	311	45	0.1	a,b,c,d
Morocco	308	23	1	a,b.c
Mexico	293	27	0.5	a,b,c
Tajikistan	268	16	4	a,b,c,d
Algeria	263	18	1	a,c
Tonga	259	24	1	a,b,c,d
Brazil	226	20	0.2	a,b,c
Trin & Tob	221	14	0.1	a,b,c,d
El Salvador	208	16	0.6	a,b,c
Kyrgyzstan	208	18	3	a,b,c,d
Egypt	201	10	1	a,b,c,d
Ecuador	176	15	0.3	a,b,c
Peru	172	15	0.4	a,b,c
Seychelles	166	17	0.1	a,b,c,d
Panama	163	13	0.1	a,b,c
Jamaica	152	15	0.4	a,b,c,d
Columbia	138	12	0.2	a,b,c
St. Lucia	133	12	0.2	a,b,c,d
St. Vin & Gr	126	11	0.3	a,b,c,d
India	116	5.8	1	a,b,c,d
Honduras	89	6.6	0.4	a,b,c,d
Vanuato	81	5.6	0.7	a,b,c,d
Paraguay	74	5.3	0.1	a,b,c
Suriname	72	5.6	0.1	a,b,c,d
Philippines	72	4.7	0.5	a,b,c,d
Micronesia	69	4.2	0.1	a,b,c,d

Cambodia	65	3.6	0.5	a,b,c,d
Dom Rep	60	3.5	0.1	a,b,c
Iraq	57	3.5	0.2	a,b,c,d
Indonesia	55	3.9	0.4	a,b,c,d
Nicaragua	51	3.8	0.3	a,b,c
Solomon	51	4.2	0.4	a,b,c,d
Guatemala	47	3.2	0.1	a,b,c
South Afric	44	2.2	0.08	a,b,c,d
Kiribati	33	1.3	0.1	a,b,c,d
Timor-Lest	30	1.3	0.3	a,b,c,d
Bolivia	29	1.2	0.1	a,b,c,d
Venezuela	29	1.6	0.08	a,b,c,d
Bhutan	26	1.5	0.2	a,b,c,d
Botswana	25	1.2	0.05	a,b,c,d
Djibouti	25	1.1	0.4	a,b,c,d
Myanmar	25	1.1	0.4	a,b,c,d
Sao Tome	24	1.4	0.2	a,b,c,d
Guyana	23	1.2	0.07	a,b,c,d
Rwanda	22	1.1	0.4	a,b,c,d
Nepal	22	1.2	0.4	a,b,c,d
Bangladesh	20	1.1	0.4	a,b,c,d
Papua	16	0.6	0.2	a,b,c,d
Pakistan	14	0.4	0.3	a,b,c,d
Namibia	13	0.5	0.03	a,b,c,d
Laos	11	0.4	0.1	a,b,c,d
Yemen	11	0.4	0.1	a,b,c,d
Senegal	7.9	0.3	0.1	a,b,c,d
Gabon	7.9	0.3	0.03	a,b,c,d
Ghana	6.7	0.2	0.08	a,b,c,d
Comoros	5.9	0.2	0.08	a,b,c,d
Kenya	5.3	0.2	0.06	a,b,c,d
Eritrea	5.4	0.2	0.2	a,b,c,d
Sudan	4.9	0.1	0.1	a,b,c,d
Ethiopia	4.7	0.1	0.1	a,b,c,d
Haiti	4.4	0.1	0.07	a,b,c,d
Zambia	4	0.1	0.05	a,b,c,d
Burundi	3.8	0.1	0.1	a,b,c,d
Uganda	3.8	0.1	0.1	a,b,c,d
Malawi	3.8	0.1	0.1	a,b,c,d
Eswatini	3.7	0.1	0.01	a,b,c,d
Congo	3.5	0.1	0.07	a,b,c,d
Gambia	3.3	0.1	0.1	a,b,c,d
Togo	3.2	0.1	0.06	a,b,c,d
Madagascar	2.9	0.1	0.1	a,b,c,d
Afghanista	2.9	0.1	0.04	a,b,c,d
Zimbabwe	2.5	0.1	0.02	a,b,c,d
Angola	2.3	0.07	0.03	a,b,c,d
Tanzania	1.9	0.07		a,b,c,d
Burk Faso	1.7	0.05	0.04	a,b,c,d
Benin	1.7	0.04	0.05	a,b,c,d
Mozambiqu	1.7	0.05	0.04	a,b,c,d
Mauritania	1.5	0.05	0.02	a,b,c,d
Guinea-Bis	1.5	0.04	0.02	a,b,c,d
D. R. Congo	1.5	0.04	0.07	a,b,c,d
Eq Guinea	1.4	0.04	0.005	a,b,c,d
Lesotho	1.4	0.04	0.01	a,b,c,d
Cameroon	1.3	0.03	0.02	a,b,c,d
Cote Ivoire	1.1	0.03	0.01	a,b,c,d

Niger	1	0.03	0.03	a,b,c,d
Liberia	1	0.03	0.01	a,b,c,d
Gunea	0.9	0.02	0.02	a,b,c,d
Mali	0.7	0.01	0.02	a,b,c,d
Nigeria	0.5	0.01	0.006	a,b,c,d
Sierra Leo	0.4	0.01	0.008	a,b,c,d
South Sud	0.3	0.008	0.01	a,b,c,d
Chad	0.2	0.004	0.006	a,b,c,d
Cent Af Rep	0.2	0.004	0.005	a,b,c,d

Abnormality:
a = MMR, >12
b = ABR >13
c = F-U5MR >7
d = F-LE <77

Figure 1 shows the L-shaped relationship between CH and IneqLE. Despite some messiness at the corner, the plot clearly distinguishes two groups of countries, a small group with high CH and low IneqLE, and a large group with low CH and high IneqLE.

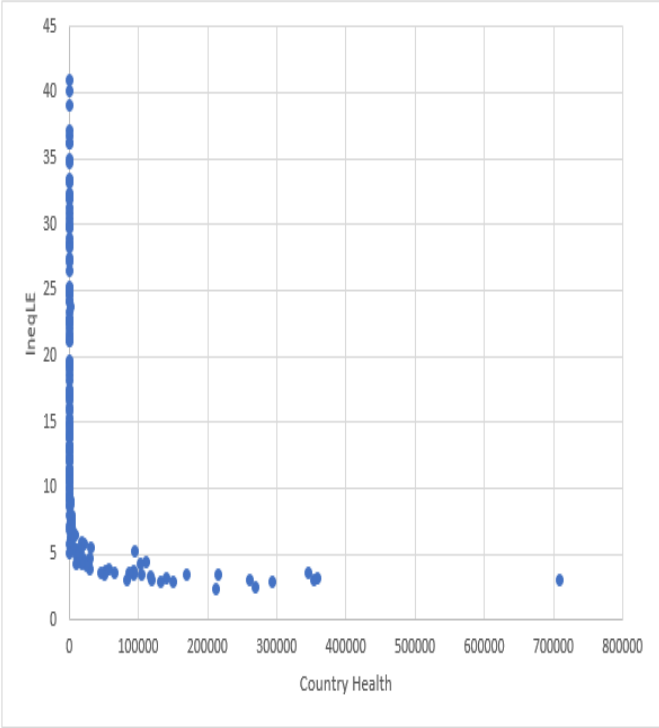

Figure 1: Inequality in Life Expectancy vs Country Health

The plot of CH vs Equity is linear with a positive slope. Over all countries, the correlation coefficient, r, between CH and Equity is 0.984. Between CH and Efficiency the r = 643.

Notice in Table 1 the clean break in Equity between the 39 countries with CH > $16,000, and the 140 with CH < 12,500. I call the former "healthy" and the latter "sick." Notice that USA, with CH = 4231, is firmly in the sick group. The clean break confers upon Equity 100% sensitivity and specificity as a diagnostic test for CH. Unless a country achieves Equity greater than 2500, it is sick (CH < 12,500).

For all other parameters studied, MMR, ABR, F-U5MR, F-LE, IneqLE, Health $/c, GDP/c, ratio of Health $/c to GDP/c, and GINI, the ranges for the healthy and sick countries overlap. I call MMR, ABR, F-U5MR, and F-LE, a country's vital signs, and I define the total range of each of these signs among the healthy countries to be the "normal range:" MMR < 13, ABR < 14, F-U5MR < 8, and F-LE > 76. Except for Serbia, all sick countries have at least one vital sign outside the normal range (Table 1). As CH declines, more vital signs fall outside the normal range. Among the 58 countries with CH < 47, all vital signs are abnormal. MMR is the most sensitive vital sign, i.e., the most frequently abnormal, followed by ABR, F-U5MR, and F-LE. Of the 39 healthy countries, i.e., those with CH > 16,000, all have Efficiency > 3.9, and all but two, have Efficiency > 5. Of the 44 countries with CH < 15, all have Efficiency < 0.31. USA has an Efficiency of 0.30. Of the 39 healthy countries, only 4.7% have GINI > 35.5. Of the 140 sick countries, 72% have GINI > 35.5. USA has a GINI of 41.5. Only three countries, Afghanistan, Lebanon, and USA have a ratio of Health $/c/GDP/c > 0.16, and all three are sick.

Over all countries, CH varies from 0.2 in Central African Republic and Chad to 708,333 in Norway, a 3.5 million-fold difference. It is big, but is it big enough to jog healthy countries from their complacency and complicity?

December 10, 2023, will mark the semi sesquicentennial of the unanimous approval of the Universal Declaration of Human Rights. This milestone proclaimed everyone's right to a standard of living adequate for health (Article 25), and spotlighted mothers and children as warranting special attention. But even a quick look at maternal and child mortality rates and adolescent birth rates shows the abysmal failure of rich countries to respect this right. USA leads the world in Health $/c, but lags all healthy countries in Equity. It rivals the poorest nations in Efficiency. It ignores the basic and inexpensive needs of sick countries in

order to fuel profit-generating technology for the elite (10). CH removes the camouflage.

All results point to Equity as the key to CH, and primary care leading to reductions in country MMH, ABR, F-U5MR, and F-LE as the means to Equity (11). Achieving these reductions need not be expensive as demonstrated by the high Efficiency of Belarus, Poland, Greece, and the countries of the former Yugoslavia (Table 1), but, to be effective, interventions must manifest in lowering Inequality as demonstrated by Figure 1. All countries with large health disparity, as measured by Equity < 2500 are sick, as are most countries with large economic disparity, as measured by GINI > 35.5.

4 | CONCLUSION

Despite the World Health Assembly's 1977 resolution to make "Health for all by the Year 2000," and the unanimous promise of rich countries to achieve Millennium Development Goals by 2015, the world remains partly healthy and mostly sick. Gross underestimates of global health disparity have, no doubt, contributed to this complacency. But the fundamental problem is profit. Companies make more money delivering high-tech innovations in healthy countries than primary health care in poor countries. The solution is a world tax on inefficient spending, perhaps as an inverse percentage of Efficiency for countries that already spend enough to be healthy.

World health implies two goals: 1) Increasing median CH, and 2) decreasing variation about that median. The country that does most to achieve these goals is the healthiest for the world. An appropriate world tax would ignite competition among rich countries to earn this title (12).

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