

# Measuring Distribution and Density

Farizal Rizky Muharram, Lintang Sagoro

## Executive Summary

Debating whether health workers were scarce or distribution was unequal was unnecessary, as both could occur simultaneously. <sup>1-3</sup>. Our research finds that the **Density does not correlate with Distribution**. A province can have an adequate density of healthcare workers but concentrate them in only a few districts (see case study). In the assessment, planning, and policy intervention process, measuring both dimensions were necessary<sup>4,5</sup>. Our study finds that Indonesia's health workforce has suffered in quantity and distribution. However, the Ministry of Health has established a target only for density, implying a focus solely on quantity<sup>6</sup>. Yet, we still do not have a proper measure for distribution, such as the Gini Index, through which a certain level of distribution inequality is compromised. This report provides the technical methods for simultaneously assessing the health workforce's quantity and distribution.

## Methods

We propose two-dimensional analyses to measure health worker distribution and density simultaneously. Density is measured using the **number of health workers per 1000 people** (higher result is better). Distribution is measured using the **Gini Index** (lower result is better)<sup>7,8</sup>. The Gini ratio is commonly used in wealth distribution analysis. We use the same approach by making districts the units of wealth owners; in this context, wealth is translated to health workforce ownership. Two-dimensional analysis produces a quadrant between quantity and distribution, as shown in **Figure 1**.

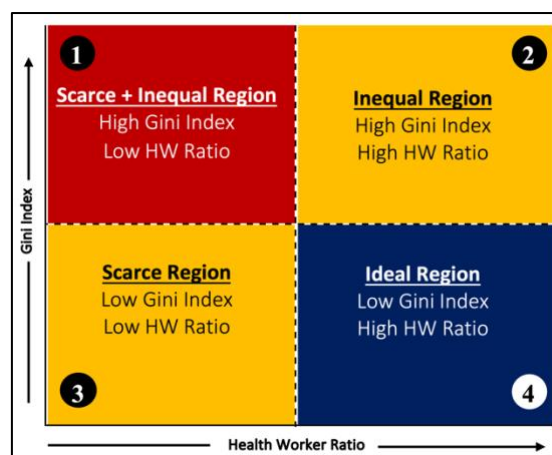
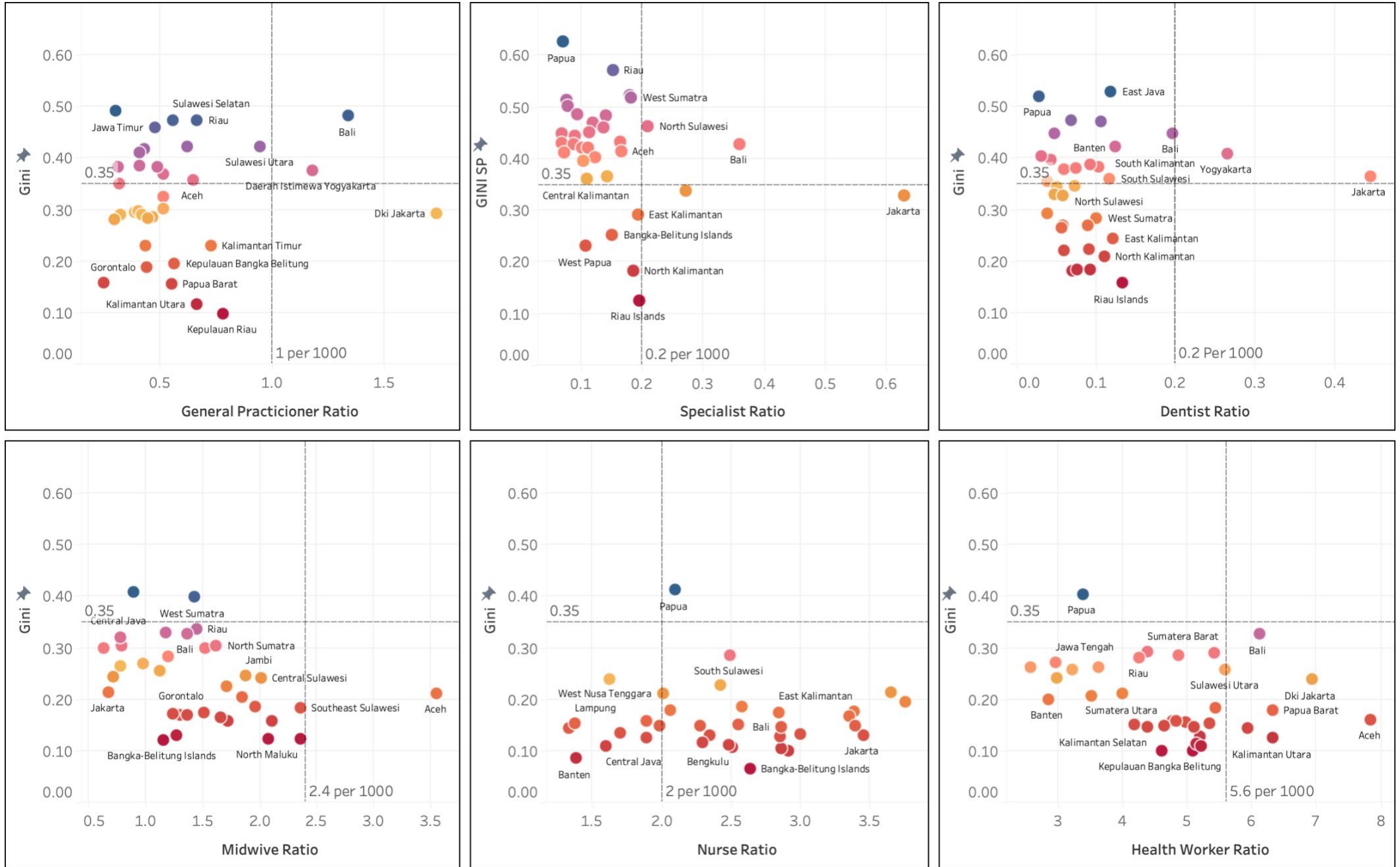


Figure 1. A Quadrant of Gini Index vs. Health Worker Ratio

The quadrant framework categorizes provinces into four distinct groups based on their position relative to the health worker density and distribution. The resulting quadrants are labeled as follows:

- 1. Scarce and Inequal Region:** High Gini Index and Low HW Ratio indicate a region with a shortage of health workers and a highly uneven distribution.
- 2. Inequal Region:** High Gini Index and High HW Ratio suggest a region with sufficient health workers but an unequal distribution among the population.
- 3. Scarce Region:** Low Gini Index and Low HW Ratio, pointing to a region with an overall scarcity of health workers but a relatively even distribution among the population.
- 4. Ideal Region:** Low Gini Index and High HW Ratio, representing a region with many health workers and an equitable distribution.

**Figure 2. Comparative Analysis Between Each Health Worker Ratio (X-Axis) and Gini Index (Y-axis).**



## Report

Figure 2 offers a visual evaluation of health worker distribution across Indonesian regions, incorporating the Gini Index to assess equity in distribution against health worker ratios for various categories, including general practitioners, specialists, dentists, midwives, and nurses. The health worker scatterplot illustrates a widespread distribution across the provinces, with a noticeable lean towards lower ratios, which suggests a general scarcity of health workers in many areas. North Sumatra, in particular, registers a high Gini Index coupled with a low health-worker ratio, underscoring an urgent need for redistribution and an increase in the health workforce.

The scatterplots for physicians, specialists, and dentists display a similar pattern, with most provinces failing to meet minimum health worker targets. Jakarta, Yogyakarta, and Bali are exceptions, exceeding these targets. With its five districts and a substantial physician population, Jakarta is uniquely situated in the bottom-right quadrant, highlighting an oversupply of physicians compared to other regions clustered to the left. Specialists are predominantly located in the upper-left quadrant, indicating a skewed distribution that favors urban centers or provincial capitals, and suggests a concentration of specialists in fewer, more developed areas. Nurses exhibit the most equitable distribution, with only Papua showing significant disparities. However, the range between the highest and lowest ratios remains considerable, from 1.2 to 3.6 per 1,000. The Midwives ratio plot identifies Aceh as the only province exceeding the equity threshold. Conversely, Jakarta, typically lower-right in other health worker categories, deviates in the case of Midwife, showing a surprisingly low ratio and positioning it towards the left quadrant.

## Case Study: Unequal Province

Province Bali, where the ratio of GPs and Specialists has reached the recommended threshold at the provincial level, but the Gini coefficient reaches 0.48, put Bali in **Quadrant 2, Unequal Province**. This happens because the GPs and Specialists in Bali province are severely focused on Denpasar City, with a GP ratio of 4.4 compared to Buleleng District, which has only 0.41, even though the Buleleng population is larger. From the planning perspective, the intervention to make Bali more equal is making policies that could drive new health workers to Buleleng and providing a retention policy that helps health workers stay in Buleleng by providing more incentives (security, welfare, and supporting facilities).

## Implication

This report shows that human resources for health in Indonesia suffer in terms of quantity and distribution. Using only the HW ratio is not enough, as it does not address the distribution dimension and can generate bias towards provinces with a high number of health workforce but suffer from unequal distribution. Even if a province has a high ratio of healthcare workers, the distribution is unequal if they are concentrated in certain areas while others are underserved. The overall healthcare needs of the province may not be adequately met.

Our finding underscores the importance of considering inter-province and inter-district HW distribution disparities to tailor policies to tackle each region's unique problems<sup>9,10</sup>. All levels of government have their responsibilities. District and city governments are responsible for providing a work environment that helps health workers stay longer. The provincial governments help increase referral capacities and oversee the processes in the districts and cities while ensuring no gaps between regions within one province. Further analysis

may be needed at the district level to observe the number and distribution of healthcare workers at the sub-district level.

The health workforce improvement planning must focus on increasing the number of health workers and distributing it equally to everyone. We suggest the role of the Central government in improving health worker production and distribution to areas needed and the Local government's role in healthcare worker retention<sup>1</sup>. Tailor strategies to local contexts, improve working conditions, offer professional development, and create supportive environments.

## Actionable Policies

- 1. Establish and include clear Gini ratio targets:** The Ministry of Health must define specific, measurable, and achievable Gini ratio benchmarks considered acceptable at the national and provincial levels.
- 2. Conduct a comprehensive reassessment of the quadrant analysis:** Reevaluate and redo the quadrant analysis, integrating the agreed-upon Gini ratio formula and HW ratio, employing the latest data, including for the newly established provinces and districts.
- 3. Dissemination to provincial stakeholders for feedback and reporting:** Distribute the findings of the quadrant analysis to provincial stakeholders as a health workforce assessment guide, urging them to report back on challenges identified at the regional level and the contributing factors.
- 4. Establish a mid-term strategic plan with key stakeholders:** Collaborate with (1) the Director of Human Resources for Health at the Ministry of Health, (2) Medical Schools and professional collegiums, (3) Provincial Level Health Officers, and (4) Academic Health System (AHS) Bodies, to produce a mid-term plan that addresses provincial or regional level problems.

## Limitations

This study focuses on assessing the health workforce as part of Health Input. Previous research shows that health input doesn't always directly reflect health performance. Further study must be done to measure how density and distribution affect the quality of the health system.

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**Corresponding:** Farizal R. Muharram, Email: [farizal\\_rizkymuharram@hms.harvard.edu](mailto:farizal_rizkymuharram@hms.harvard.edu)

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Supplementary Table 1. Healthcare Workforce Distribution by Region: Population-to-Health Worker Ratios in Indonesia. The ratios are calculated per 1,000 population.

REGIONAL GROUP	Total Population	GP		Specialist		Dentist		Nurse		Midwife		Total Health worker	
		n	Ratio	n	Ratio	n	Ratio	n	Ratio	n	Ratio	n	Ratio
<b>NATIONAL</b>	<b>272,235,314</b>	<b>145602</b>	<b>0.53</b>	<b>41891</b>	<b>0.15</b>	<b>27177</b>	<b>0.10</b>	<b>531214</b>	<b>1.95</b>	<b>300756</b>	<b>1.10</b>	<b>1046640</b>	<b>3.84</b>
<b>BALI NUSA</b>	<b>15,028,974</b>	<b>9139</b>	<b>0.61</b>	<b>2326</b>	<b>0.15</b>	<b>1259</b>	<b>0.08</b>	<b>36937</b>	<b>2.46</b>	<b>22769</b>	<b>1.52</b>	<b>72430</b>	<b>4.82</b>
Bali	4,287,193	5754	1.34	1541	0.36	839	0.20	12261	2.86	5835	1.36	26230	6.12
West Nusa Tenggara	5,359,579	1657	0.31	413	0.08	212	0.04	10779	2.01	6393	1.19	19454	3.63
East Nusa Tenggara	5,382,202	1728	0.32	372	0.07	208	0.04	13897	2.58	10541	1.96	26746	4.97
<b>JAVA</b>	<b>153,344,799</b>	<b>84221</b>	<b>0.55</b>	<b>25848</b>	<b>0.17</b>	<b>17476</b>	<b>0.11</b>	<b>259769</b>	<b>1.69</b>	<b>110580</b>	<b>0.72</b>	<b>497894</b>	<b>3.25</b>
Banten	12,142,696	6220	0.51	1745	0.14	1136	0.09	16764	1.38	8719	0.72	34584	2.85
D.I. Yogyakarta	3,677,522	4343	1.18	997	0.27	975	0.27	10715	2.91	2890	0.79	19920	5.42
D.K.I. Jakarta	11,249,585	19493	1.73	7071	0.63	5002	0.44	38819	3.45	7582	0.67	77967	6.93
West Java	48,623,371	19863	0.41	5803	0.12	3357	0.07	65009	1.34	30922	0.64	124954	2.57
Central Java	37,323,519	15156	0.41	4528	0.12	2224	0.06	59749	1.60	28892	0.77	110549	2.96
East Java	40,328,106	19146	0.47	5704	0.14	4782	0.12	68713	1.70	31575	0.78	129920	3.22
<b>KALIMANTAN</b>	<b>16,779,243</b>	<b>8089</b>	<b>0.48</b>	<b>2240</b>	<b>0.13</b>	<b>1442</b>	<b>0.09</b>	<b>41324</b>	<b>2.46</b>	<b>21984</b>	<b>1.31</b>	<b>75079</b>	<b>4.47</b>
West Kalimantan	5,482,046	1632	0.30	404	0.07	236	0.04	10876	1.98	6160	1.12	19308	3.52
South Kalimantan	4,069,123	2087	0.51	668	0.16	504	0.12	9283	2.28	5292	1.30	17834	4.38
Central Kalimantan	2,672,790	1112	0.42	294	0.11	156	0.06	7637	2.86	4435	1.66	13634	5.10
East Kalimantan	3,847,792	2790	0.73	743	0.19	468	0.12	10943	2.84	4882	1.27	19826	5.15
North Kalimantan	707,492	468	0.66	131	0.19	78	0.11	2585	3.65	1215	1.72	4477	6.33
<b>MALUKU &amp; PAPUA</b>	<b>8,634,347</b>	<b>3412</b>	<b>0.40</b>	<b>717</b>	<b>0.08</b>	<b>341</b>	<b>0.04</b>	<b>23000</b>	<b>2.66</b>	<b>11254</b>	<b>1.30</b>	<b>38724</b>	<b>4.48</b>
Maluku	1,886,735	920	0.49	171	0.09	90	0.05	6330	3.36	2575	1.36	10086	5.35
North Maluku	1,317,333	571	0.43	117	0.09	63	0.05	3365	2.55	2740	2.08	6856	5.20
Papua	4,272,108	1282	0.30	303	0.07	120	0.03	8961	2.10	3798	0.89	14464	3.39
West Papua	1,158,171	639	0.55	126	0.11	68	0.06	4344	3.75	2141	1.85	7318	6.32
<b>SULAWESI</b>	<b>19,989,579</b>	<b>10662</b>	<b>0.53</b>	<b>2981</b>	<b>0.15</b>	<b>1833</b>	<b>0.09</b>	<b>54455</b>	<b>2.72</b>	<b>33924</b>	<b>1.70</b>	<b>103855</b>	<b>5.20</b>
Gorontalo	1,203,921	531	0.44	148	0.12	72	0.06	3017	2.51	1815	1.51	5583	4.64
West Sulawesi	1,441,712	360	0.25	100	0.07	102	0.07	3382	2.35	3401	2.36	7345	5.09
South Sulawesi	8,980,741	4994	0.56	1611	0.18	1051	0.12	22365	2.49	13716	1.53	43737	4.87
Central Sulawesi	3,074,958	1239	0.40	315	0.10	174	0.06	8789	2.86	6195	2.01	16712	5.43
South-East Sulawesi	2,625,494	1017	0.39	250	0.10	238	0.09	7876	3.00	6195	2.36	15576	5.93
North Sulawesi	2,662,753	2521	0.95	557	0.21	196	0.07	9026	3.39	2602	0.98	14902	5.60
<b>SUMATERA</b>	<b>58,458,372</b>	<b>30079</b>	<b>0.51</b>	<b>7779</b>	<b>0.13</b>	<b>4826</b>	<b>0.08</b>	<b>115729</b>	<b>1.98</b>	<b>100245</b>	<b>1.71</b>	<b>258658</b>	<b>4.42</b>
Aceh	5,356,965	3469	0.65	889	0.17	489	0.09	18178	3.39	19017	3.55	42042	7.85
Bengkulu	2,041,265	903	0.44	211	0.10	154	0.08	5077	2.49	4294	2.10	10639	5.21
Jambi	3,600,625	1684	0.47	405	0.11	276	0.08	8252	2.29	6763	1.88	17380	4.83
Bangka Belitung Isl.	1,464,663	826	0.56	221	0.15	135	0.09	3860	2.64	1696	1.16	6738	4.60
Riau Island	2,072,922	1623	0.78	405	0.20	277	0.13	5019	2.42	2567	1.24	9891	4.77
Lampung	8,866,673	2803	0.32	693	0.08	282	0.03	12216	1.38	10458	1.18	26452	2.98
Riau	6,032,801	4015	0.67	917	0.15	626	0.10	11405	1.89	8736	1.45	25699	4.26
West Sumatera	5,481,484	3398	0.62	999	0.18	552	0.10	11291	2.06	7800	1.42	24040	4.39
South Sumatera	8,489,000	3625	0.43	967	0.11	431	0.05	16032	1.89	14512	1.71	35567	4.19
North Sumatera	15,051,94	7733	0.51	2072	0.14	1604	0.11	24399	1.62	24402	1.62	60210	4.00

Supplementary Table 2. Within Province Gini Index Per Province, 2022

Province	GINI GP	GINI SP	GINI DRG	GINI NRS	GINI MW	GINI HW Index
Aceh	0.358	0.415	0.222	0.211	0.147	0.160
Bali	0.481	0.428	0.447	0.327	0.146	0.327
Banten	0.302	0.365	0.388	0.243	0.086	0.200
Bengkulu	0.282	0.395	0.381	0.158	0.111	0.108
DI Yogyakarta	0.376	0.336	0.409	0.304	0.100	0.291
DKI Jakarta	0.293	0.329	0.364	0.214	0.130	0.238
Gorontalo	0.188	0.403	0.220	0.174	0.107	0.148
Jambi	0.284	0.420	0.183	0.245	0.116	0.158
Jawa Barat	0.385	0.469	0.474	0.298	0.143	0.263
Jawa Tengah	0.410	0.469	0.378	0.320	0.110	0.271
Jawa Timur	0.458	0.484	0.528	0.265	0.134	0.258
Kalimantan Barat	0.281	0.412	0.396	0.256	0.148	0.207
Kalimantan Selatan	0.325	0.432	0.421	0.170	0.147	0.146
Kalimantan Tengah	0.291	0.361	0.327	0.165	0.128	0.147
Kalimantan Timur	0.230	0.290	0.244	0.129	0.174	0.113
Kalimantan Utara	0.116	0.182	0.209	0.157	0.212	0.124
Kep. Bangka Belitung	0.195	0.253	0.184	0.121	0.064	0.100
Kep. Riau	0.098	0.125	0.156	0.172	0.228	0.158
Lampung	0.351	0.502	0.404	0.330	0.153	0.240
Maluku	0.382	0.444	0.447	0.169	0.168	0.154
Maluku Utara	0.229	0.428	0.329	0.123	0.151	0.127
Nusa Tenggara Barat	0.382	0.513	0.354	0.282	0.211	0.262
Nusa Tenggara Timur	0.289	0.448	0.293	0.186	0.186	0.156
Papua	0.491	0.625	0.520	0.408	0.412	0.404
Papua Barat	0.156	0.231	0.269	0.204	0.196	0.178
Riau	0.474	0.570	0.381	0.336	0.125	0.281
Sulawesi Barat	0.156	0.429	0.182	0.122	0.130	0.099
Sulawesi Selatan	0.473	0.523	0.360	0.299	0.285	0.284
Sulawesi Tengah	0.298	0.421	0.263	0.240	0.104	0.182
Sulawesi Tenggara	0.294	0.485	0.269	0.183	0.131	0.143
Sulawesi Utara	0.423	0.461	0.346	0.268	0.177	0.258
Sumatera Barat	0.422	0.516	0.282	0.398	0.178	0.292
Sumatera Selatan	0.417	0.452	0.344	0.226	0.159	0.152
Sumatera Utara	0.368	0.460	0.471	0.305	0.240	0.210

GP: General Practitioner; SP: Specialist; DRG: Dentist; NRS:Nurse; MW: Midwife; HW: Health Worker

Red: Worst Gini, Blue: Best Gini

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