A dataset of healthcare systems for cross-efficiency evaluation in the presence of flexible measure

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Abstract

This article presents the dataset of the healthcare systems indicators of 120 countries during 2010–2017, which is related to the research article “Cross-efficiency evaluation in the presence of flexible measures with an application to healthcare systems” [1]. The data is collected from the World Bank and selected for the 120 countries. Depending on their role in the performance of the healthcare systems, the indicators are categorized into input (I), output (O) and flexible measure (FM) where the FM measure can play either role of input or output in the healthcare system. The dataset can be used to perform efficiency as well as cross-efficiency analysis of the healthcare systems using methods such as data envelopment analysis (DEA) in the presence of flexible measure.

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1. Data

The data comprises various indicators of the healthcare systems in 120 countries which are selected according to their availability of the data in the World Bank [2] during 2010–2017. The distribution of
the selected countries among the continents is shown in Fig. 1. The indicators and their type: input (I), output (O), or flexible measure (FM), as well as the summary of descriptive statistics of the indicators, are provided in Tables 1–6 for each continent.

2. Experimental design, materials and methods

The data for the healthcare systems was collected from the World Bank [2] containing information for different indicators. Then according to the availability of the information during 2010–2017, the dataset was selected and compiled for the 120 countries. The countries are arranged in the ascending order of their Decision-Making Unit identity (DMU ID) in the first column. The DMU ID, starting from 1 to 120, corresponds to the country name organized in alphabetical order. Subsequently, for the performance analysis of the healthcare systems using the data envelopment analysis (DEA) methodology, the indicators are categorized into input (I), output (O), and flexible measure (FM) according to Fig. 2.

The healthcare system measures were divided into three categories based on their role in the performance of the healthcare system. The population, specialist surgical, birthrate, total fertility rate, hospital beds, nurses and midwives, physicians were categorized as the input of the study and mortality was treated as the output. The aforementioned categorization is in accordance with similar studies on the healthcare system performance in literature [3].

The categorization of the indicators was done according to their natural impact on the performance of the healthcare system. For instance, population, birthrate and total fertility rate were categorized as input since it is supposed that lower level of population, birthrate, and fertility rate results in better housing, nutrition, and access to healthcare. Besides, we categorized specialist surgical, hospital beds, nurses and midwives, and physicians as input since it is preferred that the healthcare system achieve the maximum performance requiring the minimum number of specialist surgical workforce, hospital beds, nurses and midwives, and physicians. Mortality was selected as the output of the healthcare system as by definition it is considered to be a direct measure on the performance of the healthcare system and finally, life expectancy was categorized as the only flexible measure of the study.
Table 1
Descriptive statistics of inputs, outputs and flexible measures for Africa.

|            | Mean      | Std. Dev. | Min      | Max       |
|------------|-----------|-----------|----------|-----------|
| **Inputs** |           |           |          |           |
| Population | 32237224.5| 3887689.9 | 94677    | 185989640 |
| Specialist surgical | 5.41     | 11.96     | 0.17     | 50.08     |
| Birthrate  | 33.35     | 8.93      | 10.40    | 48.14     |
| Total Fertility Rate | 4.43      | 1.38      | 1.40     | 7.24      |
| Hospital beds | 1.39     | 1.27      | 0.10     | 6.30      |
| Nurses and midwives | 1.19     | 1.34      | 0.08     | 5.23      |
| Physicians  | 0.45      | 0.80      | 0.02     | 3.06      |
| **Output** |           |           |          |           |
| Mortality  | 0.52      | 0.18      | 0.32     | 0.93      |
| **Flexible Measure** | | | | |
| Life expectancy | 62.84    | 6.54      | 52.17    | 75.82     |

Table 2
Descriptive statistics of inputs, outputs and flexible measures for Asia.

|            | Mean      | Std. Dev. | Min      | Max       |
|------------|-----------|-----------|----------|-----------|
| **Inputs** |           |           |          |           |
| Population | 86283051.8| 247794083.2| 427756  | 1324171354 |
| Specialist surgical | 36.21    | 36.03     | 0.03     | 125.01    |
| Birthrate  | 19.61     | 6.82      | 7.80     | 33.21     |
| Total Fertility Rate | 2.41     | 0.84      | 1.24     | 4.64      |
| Hospital beds | 4.08    | 3.61      | 0.50     | 13.70     |
| Nurses and midwives | 4.15    | 3.28      | 0.24     | 12.50     |
| Physicians  | 1.84      | 1.25      | 0.08     | 4.78      |
| **Output** |           |           |          |           |
| Mortality  | 0.83      | 0.10      | 0.43     | 0.97      |
| **Flexible Measure** | | | | |
| Life expectancy | 72.99 | 5.45 | 61.16 | 83.98 |
Table 3
Descriptive statistics of inputs, outputs and flexible measures for Europe.

| Inputs              | Mean         | Std. Dev.    | Min    | Max     |
|---------------------|--------------|--------------|--------|---------|
| Population          | 20949260.07  | 3208667.21   | 437418 | 144342396|
| Specialist surgical | 88.86        | 31.50        | 0.81   | 166.81  |
| Birthrate           | 10.59        | 1.28         | 7.80   | 32.22   |
| Total Fertility Rate| 1.57         | 0.20         | 1.24   | 4.10    |
| Hospital beds       | 5.44         | 2.13         | 0.60   | 11.30   |
| Nurses and midwives | 8.69         | 3.99         | 0.70   | 18.23   |
| Physicians          | 3.50         | 0.94         | 0.31   | 6.26    |
| Output              |              |              |        |         |
| Mortality           | 0.96         | 0.02         | 0.75   | 0.99    |
| Flexible Measure    |              |              |        |         |
| Life expectancy     | 78.82        | 3.84         | 64.74  | 82.90   |

Table 4
Descriptive statistics of inputs, outputs and flexible measures for North America.

| Inputs              | Mean         | Std. Dev.    | Min    | Max     |
|---------------------|--------------|--------------|--------|---------|
| Population          | 26023144.56  | 79772622.31  | 100963 | 45004645|
| Specialist surgical | 19.37        | 12.80        | 3.40   | 113.12  |
| Birthrate           | 17.18        | 4.61         | 10.30  | 25.27   |
| Total Fertility Rate| 2.12         | 0.45         | 1.40   | 2.97    |
| Hospital beds       | 2.28         | 1.56         | 0.60   | 9.00    |
| Nurses and midwives | 3.21         | 2.92         | 0.10   | 11.88   |
| Physicians          | 1.05         | 0.80         | 0.10   | 4.19    |
| Output              |              |              |        |         |
| Mortality           | 0.86         | 0.07         | 0.69   | 0.96    |
| Flexible Measure    |              |              |        |         |
| Life expectancy     | 74.76        | 4.38         | 63.33  | 82.30   |

Table 5
Descriptive statistics of inputs, outputs and flexible measures for Oceania.

| Inputs              | Mean         | Std. Dev.    | Min    | Max     |
|---------------------|--------------|--------------|--------|---------|
| Population          | 1442360.63   | 2715989.62   | 109643 | 323127513|
| Specialist surgical | 3.70         | 2.00         | 2.30   | 54.71   |
| Birthrate           | 26.69        | 4.51         | 12.40  | 28.71   |
| Total Fertility Rate| 3.76         | 0.84         | 1.75   | 3.85    |
| Hospital beds       | 2.49         | 1.68         | 1.30   | 5.20    |
| Nurses and midwives | 2.35         | 1.37         | 0.53   | 9.88    |
| Physicians          | 0.32         | 0.27         | 0.06   | 2.57    |
| Output              |              |              |        |         |
| Mortality           | 0.77         | 0.12         | 0.66   | 0.95    |
| Flexible Measure    |              |              |        |         |
| Life expectancy     | 70.24        | 3.24         | 65.54  | 78.69   |

It is noteworthy that regarding the selected input, we performed a Pearson correlation analysis, which is a measure of the strength of the association among the measures. The results of the correlation analysis revealed no correlation among the inputs. It should be noted that with the aim to prevent scaling problems of the data, we transformed all the data, by dividing each value of the data set by the maximum value of the corresponding indicator.

Lastly, we would like to confirm that the provided data excludes any type of statistical or scaling oriented modification of the data. The aforementioned modifications such as standardization of the data was performed for the analysis executed in the main manuscript and are not reflected in the data table provided here.
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Conflict of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104239.

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Table 6
Descriptive statistics of inputs, outputs and flexible measures for South America.

|                  | Mean      | Std. Dev. | Min    | Max     |
|------------------|-----------|-----------|--------|---------|
| **Inputs**       |           |           |        |         |
| Population       | 43378930.22 | 64011970.53 | 107122 | 207652865 |
| Specialist surgical | 27.97   | 17.59     | 0.58   | 61.12   |
| Birthrate        | 17.87     | 2.79      | 14.16  | 35.05   |
| Total Fertility Rate | 2.23     | 0.30      | 1.73   | 5.50    |
| Hospital beds    | 2.04      | 1.10      | 1.00   | 5.90    |
| Nurses and midwives | 2.68      | 2.47      | 1.08   | 7.44    |
| Physicians       | 1.95      | 1.19      | 0.08   | 3.91    |
| **Output**       |           |           |        |         |
| Mortality        | 0.86      | 0.05      | 0.56   | 0.90    |
| **Flexible Measure** |         |           |        |         |
| Life expectancy  | 74.38     | 3.19      | 68.88  | 76.58   |

Fig. 2. Input, output, and flexible measures with countries as DMUs.

Table 6
Descriptive statistics of inputs, outputs and flexible measures for South America.