Modern Applied Science; Vol. 12, No. 12; 2018
ISSN 1913-1844 E-ISSN 1913-1852
Published by Canadian Center of Science and Education

The Health Sector in Jordan: Effectiveness and Efficiency

Saba Madae'en[1] & Mohammad Adeinat[2]

[1] Department of Biopharmaceutical and Clinical Pharmacy, University of Jordan, Amman, Jordan

[2] Department of Economics, University of Jordan, Amman, Jordan

Correspondence: Saba Madae'en, Department of Biopharmaceutical and Clinical Pharmacy, University of Jordan, Amman, Jordan E-mail: s.madain@ju.edu.jo

Received: Oct. 19, 2018 Accepted: Nov. 1, 2018 Online Published: November 26, 2018

doi:10.5539/mas.v12n12p234 URL: https://doi.org/10.5539/mas.v12n12p234

Abstract

This paper compares a homogeneous group of countries in terms of capacity and technology, where we picked income as indicator for capacity and technology. We study the case of the Hashemite Kingdom of Jordan. We apply radical data envelopment analysis to 36 middle income countries where we calculate constant returns to scale technical efficiency and variable returns to scale technical efficiency to show the health care sector efficiency in Jordan. Using different factors for input first we studied healthcare expenditure per capita then as percent of GDP and public expenditure as percent of GDP and private as percent of GDP, and last was the number of beds per 1000 population and physicians per 1000 population all to the same output life expectancy. The results show that there is inefficiency in health care expenditure. The inefficiency mainly is shown by two major findings, first the lack of utilization of resources. Secondly, the public-sector inefficiency. The output is justifiable for many challenges faced the health sector in the year of the study one of which is the Syrian refuges crisis. We shed light on factors causing the inefficiency where modifications could yield substantial efficiency gains. As for the mix between public and private sectors and the quality and utilization and distribution of the real resources, nevertheless adding health economists to the management staff for there is a managerial inefficiency.

Keywords: Health sector in Jordan, Healthcare sector effectiveness, Health care expenditure efficiency, Health economics

1. Introduction

Financing health care has remained a challenge to the Government of Jordan for a long time. There seems to be very high investment in health by the government, and inappropriate allocation of resources within the government health budget. Given that health is a basic human right, the health situation in Jordan remains a significant concern for the policy makers. While health financing has undergone numerous reforms, more changes are needed to ease the burden of health care costs in a bid to increase utilization and subsequently improve the health status of the population.

The cost of health care is a heavy burden on government as well as households. Total Jordanian health expenditure represented 7.5% of Gross domestic product (GDP) in 2017, according to the World Bank, with public spending accounting for 69.2% of this and private spending the remaining 30%. Government health expenditure as a proportion of total government spending has risen from less than 10% in the first decade of this century to 17.8% in 2013, according to statistics from the World Health Organization (WHO). Such expenditure may prove difficult to maintain. In 2012 the National Health Accounts (NHA) study of the High Health Council (HHC) described spending as occurring "at levels found typically among developed countries" and as being unsustainably high for Jordan as a middle-income country (Jordan heath articles and analysis., 2018). Furthermore, trends indicate that health care expenditure continues to increase in the country, therefore making its containment a major issue for successive governments.in addition to that the Syrian refuge crisis added extra costs on the healthcare budget and the burden by 53.2 million JDs in 2013, 80.8 million JDs in 2014, and 83.8 million JDs in 2015 (Appendino, et al., 2017).

As it is recommended to compare countries that belong to a homogenous capacity where the benchmark that we compare to won't be an outlier, so that the confounders in the comparison would be reduced to the minimum for the healthcare production process is a complex one that has many inputs; technology as well as qualified labor and management where they have different weighs in achieving efficiency. (Spinks & Hollingsworth, 2009) we will

assess the efficiency of health expenditure and effectiveness by applying a data envelop analysis (DEA) model to countries that have comparable technology and capacity as for the income is an indicator for the resources and capacity of those countries. The comparison is done between middle income countries which the Hashemite Kingdom of Jordan happens to be one of the middle income counties according to the world bank records of 2017.

The findings of this study assist in directing the efforts of the decision makers to increase the efficiency of the Jordanian health care system. This will suggest routs for reform and expenditure recovery. Health expenditure efficiency may be studied by evaluating the health resources utilization. Where the mix of the resources maybe an important factor in the efficiency of health expenditure while studying the efficiency of public versus private expenditure that may indicate governance and management of resources, not missing the overall efficiency analyzing the effect over the final outcome from the whole healthcare expenditure indicating the strategies and laws and recent reforms efficiency as well.

We will begin by differentiating between cost effectiveness and spending efficiency as for the former is the efficiency of spending on resources such as hospital beds, number of health workers, pharmaceutical products, etc. the latter is the link between the health expenditure and health outcomes represented by life expectancy or other (Verhoeven, Gunnarsson, & Lugaresi, 2007).

This paper is organized as follows: Section 2 gives a review of published literature. Section 3 explains the methodology used in our research. Section 4 focuses on the Hashemite kingdom of Jordan demographics as Jordan is the domain of our research. Section 5 presents our results and discuss the interpretation of the results, and finally, section 6 concludes the work done.

2. Literature Review

The By reviewing the literature, we identified two major ways of finding efficiency scores, parametric and non-parametric taking into consideration the pros and cons for each. Non-parametric such as the data envelop analysis (DEA) that takes into consideration the best practice frontier thus giving high importance to outliers creating a source of bias this may be remedied by taking a homogenous group where we eliminate outliers. This method is widely used in testing the healthcare efficiency, while the parametric method such as the stochastic frontier analysis uses a production function raising the issue of the accuracy of the production function, because the relation between expenditure and outcome and intermediate resources is not well defined.

Rarely studies used the parametric method, we will be using the DEA which is the standard in such a question, but to give better understanding we need to study the effectiveness and factors that affect the efficiency this will be shown by correlating the efficiency with the factors under study in the nonparametric method.

Both methods measure the performance according to a benchmark. The benchmark is determined by the technology. In this technic the DEA produce shadow prices for input and output measures, using linear programing.

Choosing in the input and output was done after studying a recent systematic review we can see that mostly the input is labor related or capacity related or expense related, most used labor related is number of physicians and the highest frequency of use in the capacity related inputs was the number of beds, while expense related was the government expenditure, we picked our most relevant inputs according to the most commonly used in the literature (Cantor & Poh, 2017).

The output on the other hand is categorized into two different terms the activity-based output such as number of admissions and this is most illegible when studying hospitals as Decision Making Units (DMU) and the quality related outputs as mortality rate or proxy, using the later was most convenient to answer the question of the study.

DEA was used extensively in studying health institutions performance and this was shown in many previous studies taking into consideration different input variables targeting a variety of questions.

In our literature review we will be discussing mostly the studies that used the decision-making units to be the country not a hospital or a district.

A study on the Organization for economic Co-operation and Development (OECD) countries health systems lately was published in 2017 by Behr et al, using DEA method included 34 countries and used more than one analysis each answering a different question as the efficiency of surgery query the input is the number of physicians and beds and nurses while their output was cataract surgery and bypass surgery and kidney transplantation surgery. For second analysis the question was mortality prevention the input was the same as the first analysis but the output was the 30 days mortality after stroke and myocardial infarct. another focused on lifestyle and there is an additional analysis for the effect of income and last the effect of expenditure on life expectancy (Behr & Theune, 2017).

Another study done by Evans et al. had a heterogenous set of countries 191 country, the input used was health

expenditure and average years of schooling to study the relationship with life expectancy showing Oman, Malta, Italy, France, and San Marino to be efficient, the most efficient countries were not the countries with high life expectancy (Evans, Tandon, Murray, & Lauer, 2001). In particular, they criticize the use of within country variation in studies, they recommend between country comparison because most of the variation occurs between countries (Evans, Tandon, Murray, & Lauer, 2001).

OECD countries were extensively studied by many studies where data is more available and each study had its unique set of input and output and using a couple of outputs, Hollingsworth and Wildman (Hollingsworth & Wildman, 2003) used different analytical methods both parametric and non-parametric and recommended studying the OCED countries alone and non-OECD alone for the differences between the countries capacity and technology causing outliers and affecting the results.

Another study using data from 2007 studied the efficiency of healthcare sector in Slovakia in relation to OECD countries (Verhoeven, Gunnarsson, & Lugaresi, 2007) showing the inefficiency caused by suspending reforms that were done to enhance efficiency.

Greene (Greene, 2004) used additional variables to analyze efficiency between countries which are the GINI coefficient educational level ,government effectiveness, dummy variables for tropical location and for OECD membership, population density, and an indicator relating to the allocation of health care expenditure between the private and public sector were included, that gave a wider perspective for healthcare efficiency including factors other than the healthcare production factors.

Data from 2000 was studied by Retzlaff-Roberts et al., for 27 countries from OECD, the efficiency of the healthcare sector related inputs: number of beds, practicing physicians, MRIs availability to proxy technology use, and healthcare expenditure percent of GDP , in producing the outputs , infant mortality as well as life expectancy ,the results of the study clarified that reducing the input in OCED countries by 14 to 21% in average could be applicable without affecting the output, (Retzlaff-Roberts, Chang, & Rubin, 2004), another example was done by Bhat et al for data from year 2002-2003 for 24 OCED countries . input was physician number and nurses and beds number in addition to pharmaceutical expenditure to test the health expenditure in accordance with the population structure.

In another study using non-parametric approach Afonoso and Aubyn used the same input as Bhat and output was in accordance with Retazlaff -Roberts study (Afonso & St. Aubyn, 2006). One of the studies compared Europe with Central Asia done by Hsu for data from 2005 and 2007 the input used was health care expenditure per capita, beds number, population density, GDP, years of schooling, while output is life expectancy and infant mortality rate (Hsu, 2013).

As we can conclude from the literature the pick of input and output is related to the query of the study, so we emphasized the studies that answer the question of health care sector efficiency in comparison between countries although most literature compares districts and hospitals.

3. Methodology

We will be studying the efficiency by evaluating the budget performance in accordance with the allocation of resources approved and costs, output, and outcome goals, hence we can examine the spending is in the right place where it gives the intended objectives.

This efficiency will measure the actual output in accordance with the potential output.

In this study the health expenditure is mostly from the government where the resources are limited and should be spent in the most efficient way to serve the population.

Health expenditure efficiency is one of the hardest to specify because it is hard to define the profit and there are no suitable market prices to value the output. We should define the activities and input that we are assessing. Having low efficiency raises the question to capacity challenges or fraud or error.

There are three levels for healthcare expenditure efficiency first of all the overall effect of the expenditure on the outcome and the effect of the expenditure on the resources and the extent of utilization of the resources to get to the final outcome.

We will test the former and the later to make our conclusions more precise.

We will be studying 36 DMU which are the middle-income countries where the inclusion criteria were having no missing data other than being a middle-income country (lower and upper) because Jordan income was in the upper in 2014 borderline while in 2017 we became from the lower middle-income countries,

Specifying the output to be life expectancy and the input healthcare expenditure per capita then, private health

expenditure % of GDP and public health expenditure % of GDP, the third analysis was done for the public health expenditure as % of GDP, number of beds/1000, and number of physicians/1000 of the population was the fourth analysis.

Our model will be radical DEA (data envelop analysis), CRS (Constant return to scale) and (VRS) (variable return to scale) technical efficient using STATA 13.

We didn't add many countries so that our results of slacks be more accurate, while we included one or two inputs so to eliminate the error of having positive correlation between input factors.

Virtual producer is a weighted composite of inputs and output from the various countries and the efficiency index θ is the objective to minimize and *X* are the decision variables.

We are talking about 36 countries making *n=36*

n: is the number of decision-making units

The output used is always life expectancy at birth

Y=1

The input x_i= *1,2,3,4,5* where

(1) is the total expenditure on healthcare per capita,(2) is the public healthcare expenditure as percent of GDP (gross domestic product),(3) the private expenditure as percent of as percent of GDP, (4) is the physician numbers/1000 of population, Physicians include generalist and specialist medical practitioners, (5) is the beds number /1000 of population, Hospital beds include inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centers. In most cases beds for both acute and chronic care are included,

Each country *k* uses the input bundle $[X_{1K},X_{2k},X_{3K},X_{4K},X_{5K}]$ to get to the output Y_{1K}

In our model we have few assumptions

1. Shadow prices are non-negative
2. There could be free goods
3. The productivity never exceeds 1

Our primary concern is to minimize expenditure and inputs so we will be using Input-oriented analyses where we minimize the Input for a specific output

min θ

subject to

$$\gamma_1 Y_{11} + \gamma_2 Y_{12} + \cdots + \gamma_K Y_{1K} + \gamma_n Y_{1n} \geq Y_{1K} \quad (1)$$

$$\theta X_{1k} - \gamma_1 Y_{11} + \gamma_2 Y_{12} + \cdots + \gamma_K Y_{1K} + \gamma_n Y_{1n} \geq 0 \quad (2)$$

$$\theta X_{2k} - \gamma_1 Y_{21} + \gamma_2 Y_{22} + \cdots + \gamma_K Y_{2K} + \gamma_n Y_{2n} \geq 0 \quad (3)$$

The scale factor Φ that lies within the technology set of all action units and $\theta = \frac{1}{\phi}$

$\emptyset_{\max} = \frac{Y_k^{**}}{Y_k}$ where Y_k^* is the max output

And we use $\emptyset$ max we can graphically show it by $(X_k, \emptyset Y_k)$ $or(\frac{X_k}{\emptyset}, Y_k)$

the equation can be written using the shadow prices $P_{1k}Y_{1k}$= θ=$\frac{1}{\emptyset}$

In constant return to scale input oriented is same as output oriented.

If we want to test variable return to scale we can multiply X and Y By victor λ keeping the technology the same.

Our θ which is $\frac{1}{\emptyset}$ will be the measure of technical efficiency which illustrates the minimum growth potential if

we fully utilize the inputs.

This growth capacity is called slack if we assume output slacks S1, and input slacks C1,C2,C3,C4,C5 then

$$\emptyset + \sum (S1+C1+C2+C3+C4+C5) = \frac{1}{\theta}$$

Where $\sum$ is an infinitesimally small arbitrary number

If we want to change the assumption from CRS to variable return to scale we add the assumption that $\sum_{\gamma j}=1$

4. Jordan Demographics

Jordan finds itself at crossroads in healthcare reform. there is an increasing demand on healthcare as well as outstanding debt, the co-payments in Jordan are low (Tamimi, 2015) and the pharmaceutical expenditure is high in year 2012 it was 2.03 of GDP and in 2013 it became 2.1%. we can notice that the private sector's expenditure was 2.56% and 2.7 % of GDP in years 2012 and 2013 consecutively, while public expenditure was much higher than that being 5.02% of GDP in 2012 to be increased to 5.18% in 2013.

Total expenditure in 2013 was 7.97%, only 0.74% of which was the UNRWA (united nations relief and works agency) expenditure, while NGO's (non-governmental organizations) share was only 1.93% of total expenditure.

The expenditure of 2013 is distributed into curative, primary, administration and training share of each was 75.45%, 15.69%, 5.94%, 1,48% accordingly. We can notice that curative takes the largest share.

As for the pharmaceutical expenditure of the same year 45.49% came from the public sector and 54.51% came from the private sector.

5. Results

First we will briefly describe the inputs and outputs of Jordan in comparison with lower middle income countries statistics and middle income countries averages, as for the public health expenditure is 70% of total expenditure in Jordan in comparison with lower middle income countries public spends 37% of total expenditure and middle income countries public health spending 52% in year 2014, non the less the physician number per 1000 population is higher in Jordan than middle income countries being 2.6 while in lower middle income countries it is 0.7 and in middle income countries 1.6, taking into consideration the capacity of the health system we are looking at the beds number per 1000 of the population in Jordan 1.8 in 2012,and the average for the Arab world is 1.8 as well. add to that the life expectancy is 74 which happens to be higher than the middle country average which is 70. refer to Table 1.

Table 1. Health resources and expenditure and outcome in middle income countries, Source world banks world development indicators database (worldbank, 2018).

Dmu[1]	Bed/ 10000 [2]	Physician/ 1000 [3]	Total Expenditure as percent of GDP[4]	Public expenditure as percent of GDP[5]	Private Expenditure as percent of GDP[6]	life expectancy[7]
Armenia	3.9	2.803	4.5	1.93	2.55	74.255
Jordan	1.8	2.65	7.5	5.19	2.26	74.034
Bangladesh	0.476	0.475	2.8	0.79	2.03	72.386
Solomon Islands	1.3	0.191	5.1	4.64	0.41	70.113
Bhutan	1.8	0.324	3.6	2.62	0.96	69.43
Sri Lanka	3.6	0.881	3.5	1.96	1.54	74.906
Sudan	0.8	3.058	8.4	1.8	6.63	64.002
Kyrgyz Republic	4.8	1.854	6.5	3.64	2.84	70.4024
Lao PDR	1.5	0.49	1.9	0.94	0.92	65.975
Syrian Arab Republic	1.5	1.546	3.3	1.51	1.75	69.817
Tunisia	2.1	1.289	7	3.97	3.04	75.335
Djibouti	1.4	0.229	10.6	6.75	3.82	62.006
Moldova	6.2	2.537	10.3	5.3	5.02	71.258
Ukraine	9	3	7.1	3.6	3.49	71.866

Egypt, Arab Rep.	0.5	0.814	5.6	2.16	3.49	71.12
Mongolia	6.8	3.196	4.7	2.62	2.11	68.847
Morocco	0.9	0.618	5.9	2	3.91	75.309
Georgia	2.6	4.776	7.4	1.55	5.86	72.951
Nicaragua	0.9	0.914	9	5.1	3.49	74.884
Yemen, Rep.	0.7	0.311	5.6	1.27	4.37	64.523
Pakistan	0.6	0.806	2.6	0.92	1.7	66.139
Albania	2.6	1.286	5.9	2.94	2.95	77.963
Argentina	4.7	3.907	4.8	2.65	2.13	76.252
Azerbaijan	4.7	3.402	6	1.23	4.81	71.8
Iran, Islamic Rep.	0.1	1.491	6.9	2.84	4.05	75.466
Iraq	1.3	0.854	5.5	3.34	2.2	69.458
Kazakhstan	7.2	3.274	4.4	2.37	1.99	71.62
Brazil	2.3	1.852	8.3	3.83	4.49	75.042
Lebanon	3.5	2.38	6.4	3.04	3.35	79.231
Libya	3.9	2.092	5	3.65	1.31	71.659
Colombia	1.5	1.821	7.2	5.41	1.79	74.022
Malaysia	1.9	1.533	4.2	2.3	1.87	74.976
Costa Rica	1.2	1.15	9.3	6.77	2.55	79.44
Croatia	5.89	3.126	7.8	6.39	1.41	77.478
Cuba	5.3	7.519	11.1	10.57	0.49	79.415
Turkmenistan	4	2.291	2.1	1.35	0.72	67.552

[1] DMU stands for decision making unit.

[2] Hospital beds include inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centers. In most cases beds for both acute and chronic care are included per a 1000 people.

[3] Physicians include generalist and specialist medical practitioners per a 1000 people.

[4] Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation as percent of GDP.

[5] Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds.

[6] Share of current health expenditures funded from domestic private sources. Domestic private sources include funds from households, corporations and non-profit organizations. Such expenditures can be either prepaid to voluntary health insurance or paid directly to healthcare providers as percent of GDP.

[7] Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

We did a DEA analysis couple of times for robust results on Jordan health expenditure efficiency first time we compared healthcare expenditure per capita purchase per parity (PPP) as input with life expectancy as output, second trial was public expenditure as percent of GDP and private expenditure as percent of GDP versus life expectancy and the third analysis being public expenditure as percent of GDP alone versus life expectancy, finally we studied the labor and capital versus life expectancy the former being physician number per 1000 population and the later number of beds per 1000 population. In all four models Jordan was drastically inefficient we used an input radical constant return to scale and then variable return to scale model.

In DEA the STATA program gives weights to each input and output and take the ratio between both, the highest Decision Making Unit will be given rank 1 and the rest will take ranks according to their position in accordance with others in the analysis, our analysis is input oriented and the inefficiency score (theta) will show the reduction possible in inputs if the system adopts a new technology or different managerial plan or better governance as the one in the efficient decision making unit. and we discussed slacks in input were it shows extra reduction possible in the leftover proportion of inefficiency.

The country that we use as a benchmark is the one that we should catch up to in efficient resource use.

We did the analysis for each query alone twice once assuming constant return to scale and once variable return to scale and if the results were different for the same set of data increasing or decreasing return to scale would be the conclusion which would give us an idea on the production function of that decision making unit.

The idea from doing 4 different analysis separately is to avoid inputs that are correlated together, and we did the total expenditure analysis to show if the public expenditure alone is worse meaning that the private sector is more efficient and there is resource wasting in the public sector, never the less we want to study the combination of labor and capital to see if there is inefficiency in the allocation of resources or the combination ratio mix.

In the first analysis, it was shown that Jordan is inefficient and in the VRS analysis it ranked 22 from 36 countries while theta was 0.305481 (as shown in Table 2) which indicates that we can reduce the health expenditure per capita by 69.45% without affecting the output if we used Bangladesh as a reference for Bangladesh had an efficiency of 1, for it had a health expenditure per capita 88.08$ PPP while Jordan has a health expenditure of 797.59$ PPP ,while life expectancy of Bangladesh was 72.3 and for Jordan 74 . you can notice that the effect of one dollar of health expenditure on life expectancy is much higher, if Jordan adopts

Bangladesh technic it can reduce its healthcare expenditure by 69% to become efficient, if we compare the theta of CRS analysis it will be still lower than VRS it was 0.11,showing that we have a decrease return to scale function that could need to lower input and compromise output to get to an efficient point, there is a very minimal slack 4.45 e-06 in expenditure per capita which is the leftover inefficiency after reduction.

Table 2. Rank of health overall efficiency where input expenditure as percent per capita and output life expectancy

Dmu	*Rank*[1]	*Theta*
dmu:Armenia	10	0.73043
dmu:Jordan	22	0.305481
dmu:Bangladesh	1	1
dmu:Solomon Islands	8	0.818511
dmu:Bhutan	20	0.31334
dmu:Sri Lanka	6	0.882965
dmu:Sudan	21	0.31274
dmu:Kyrgyz Republic	15	0.40956
dmu:Tunisia	13	0.466639
dmu:Djibouti	24	0.260623
dmu:Moldova	29	0.171292
dmu:Ukraine	31	0.15076
dmu:Egypt, Arab Rep	32	0.148255
dmu:Mongolia	30	0.155874
dmu:Lao PDR	5	0.894486
dmu:Syrian Arab Republic	27	0.23433
dmu:Morocco	9	0.814989
dmu:Georgia	28	0.225277
dmu:Yemen,Rep	14	0.435694
dmu:Pakistan	11	0.682844
dmu:Albania	1	1
dmu:Argentina	16	0.398354
dmu:Azerbaijan	35	0.084102
dmu:Iran, Islamic Rep	17	0.350224
dmu:Iraq	33	0.132052
dmu:Jamaica	7	0.839762
dmu:Kazakhstan	36	0.0824673
dmu:Brazil	25	0.257025
dmu:Lebanon	1	1
dmu:Libya	34	0.109249
dmu:Colombia	26	0.252124
dmu:Malaysia	19	0.31971
dmu:Costa Rica	1	1
dmu:Croatia	18	0.344259
dmu:Cuba	12	0.541935
dmu:Turkmenistan	23	0.275336

[1] Study was done variable return to scale and input oriented analysis Jordan analysis rank was 22.

While the second analysis was to test the combination of private and public expenditure the rank changed to 25 out of 36 and theta was 0.554367 if we used VRS while in CRS analysis 0.336787 which gives justifiable results, similar to our previous analysis we can reduce expenditure by 44.5633% without lowering in the output, as shown in Table 3. And this analysis was done for robustness of results.

Table 3. Rank of health efficiency score of the combination ratios of public expenditure and private expenditure. Input: Public expenditure as percent of GDP and private expenditure as percent of GDP, Output: life expectancy

Dmu	*Rank*	*Theta*
dmu:Armenia	16	0.793987
dmu:Jordan	25	0.554367
dmu:Bangladesh	1	1
dmu:Solomon Islands	1	1
dmu:Bhutan	15	0.832165
dmu:Sri Lanka	1	1
dmu:Sudan	31	0.438889
dmu:Kyrgyz Republic	34	0.401125
dmu:Lao PDR	1	1
dmu:Syrian Arab Republic	18	0.745034
dmu:Tunisia	26	0.550406
dmu:Djibouti	36	0.193814
dmu:Moldova	35	0.26563
dmu:Ukraine	33	0.403122
dmu:Egypt, Arab Rep	29	0.466861
dmu:Mongolia	27	0.482828
dmu:Morocco	13	0.875405
dmu:Georgia	23	0.629496
dmu:Nicaragua	32	0.428254
dmu:Yemen,Rep	24	0.622047
dmu:Pakistan	12	0.925717
dmu:Albania	10	0.947446
dmu:Argentina	9	0.947765
dmu:Azerbaijan	20	0.642276
dmu:Iran, Islamic Rep	21	0.639061
dmu:Iraq	30	0.43906
dmu:Kazakhstan	19	0.649482
dmu:Brazil	28	0.472617
dmu:Lebanon	1	1
dmu:Libya	17	0.746462
dmu:Colombia	22	0.638089
dmu:Malaysia	14	0.855214
dmu:Costa Rica	1	1
dmu:Croatia	11	0.928511
dmu:Cuba	1	1
dmu:Turkmenistan	1	1

Running the same analysis using the public expenditure percent of GPD alone the rank showed its worst to get to 28, showing that the public sector is less efficient than both sectors together the theta of the VRS analysis is 0.2565921 and in CRS theta was 0.115687, as shown in Table 4.

All analysis showed a decreasing return to scale which means reducing both in input and output will get Jordan to an efficient point.

Table 4. Ranks of health efficiency scores of Public expenditure effect on life expectancy[1]

	Rank	*Theta*
dmu:Armenia	10	0.727644
dmu:Jordan	28	0.256591
dmu:Bangladesh	1	1
dmu:Solomon Islands	34	0.170259
dmu:Bhutan	26	0.301527
dmu:Sri Lanka	8	0.825685
dmu:Sudan	21	0.438889
dmu:Kyrgyz Republic	32	0.217033
dmu:Tunisia	20	0.443163
dmu:Djibouti	36	0.117037
dmu:Moldova	35	0.149057
dmu:Ukraine	31	0.219444
dmu:Egypt, Arab Rep	24	0.335541
dmu:Mongolia	27	0.301527
dmu:Lao PDR	7	0.840426
dmu:Syrian Arab Republic	19	0.523179
dmu:Morocco	5	0.875405
dmu:Georgia	15	0.629496
dmu:Yemen,Rep	16	0.622047
dmu:Pakistan	6	0.858696
dmu:Albania	4	0.892245
dmu:Argentina	9	0.777653
dmu:Azerbaijan	13	0.642276
dmu:Iran, Islamic Rep	14	0.634654
dmu:Iraq	30	0.236527
dmu:Jamaica	12	0.667516
dmu:Kazakhstan	25	0.333333
dmu:Brazil	22	0.434216
dmu:Lebanon	1	1
dmu:Libya	33	0.216438
dmu:Colombia	29	0.245428
dmu:Malaysia	11	0.713631
dmu:Costa Rica	3	1
dmu:Croatia	23	0.385568
dmu:Cuba	17	0.598281
dmu:Turkmenistan	18	0.585185

[1] Using variable return to scale input oriented analysis Jordan was found to rank 28 which is from the lowest quartile. No input or output slack was found. The lowest efficiency relationship was with Jordan's public expenditure in relation to all other factors studied. here we can notice that Bangladesh ranks number one because the benefit is the highest when studied to one dollar of expenditure. You can notice that the combination rank is better than the public expenditure alone.

The fourth analysis is using physician number per 1000 population and bed number per 1000 population, we noticed a change in the rank to 23 and theta to 0.287834 if using VRS and 0.238274 if using CRS, as shown in Table 5.

Table 5. Rank of health efficiency scores of intermediate resources to outcome. input: bed / 1000 of population physician number /1000 of population, output: life expectancy

Dmu	*Rank*	*Theta*
dmu:Armenia	26	0.198784
dmu:Jordan	23	0.287834
dmu:Bangladesh	1	1
dmu:Solomon Islands	1	1
dmu:Bhutan	11	0.664383
dmu:Sri Lanka	17	0.43282

dmu:Sudan	21	0.337416
dmu:Kyrgyz Republic	29	0.178988
dmu:Tunisia	16	0.462981
dmu:Djibouti	8	0.886051
dmu:Moldova	32	0.136454
dmu:Ukraine	34	0.112766
dmu:Egypt	9	0.813469
dmu:Mongolia	36	0.109301
dmu:Lao PDR	13	0.570886
dmu:Syrian	22	0.314548
dmu:Morocco	1	1
dmu:Georgia	31	0.149236
dmu:Yemen	1	1
dmu:Pakistan	10	0.725592
dmu:Albania	12	0.662153
dmu:Argentina	27	0.198641
dmu:Azerbaijan	33	0.126641
dmu:Iran	1	1
dmu:Iraq	14	0.4672
dmu:Jamaica	1	1
dmu:Kazakhstan	35	0.112382
dmu:Brazil	20	0.353727
dmu:Lebanon	15	0.465448
dmu:Libya	28	0.185837
dmu:Colombia	19	0.384055
dmu:Malaysia	18	0.424056
dmu:Costa Rica	1	1
dmu:Croatia	24	0.243895
dmu:Cuba	25	0.225109
dmu:Turkmenistan	30	0.159837

this showed us that the reduction in beds and physicians by 71.22% is feasible without reducing output. And this too showed reduced return to scale. This will make the difference between the overall efficiency and the system efficiency which is the cost effectiveness, the efficiency of changing the expenditure to intermediate resources, this obviously is low too. From the last analysis we can conclude that there is a misuse of resources which could be the distribution of beds and physicians as well as the quality of the resources or the management of the resources.

You can notice that the efficient DMUs are not the ones with highest output but they are the ones with the best ratio between input and output making our results dependent on the value of 1 dollar in the healthcare system.

5. Discussion

These numbers are indicative, in a try to explain the inefficiency Jordan faced many challenges the major one the refugee's crisis and as for the pharmaceutical costs We can see that the pharmaceutical expenditure in Jordan is 2.1 of GDP a very high percent.

Not to forget wages of medical personnel were causing an increased pressure on the expenditure. Obviously, there is a problem in managing the utilization of beds and physicians.

In addition, the combination and ratio between public and private expenditure was inefficient and there is room for improvement by encouraging the investment in the private sector.

The explanation of inefficiency in Jordan maybe a sum of the following:

a. High curative expenditure that can be reduced if preventive measures took more attention, especially in non-communicable diseases like prevention of obesity, diabetes and cardiovascular diseases.

b. The pharmaceutical expenditure is high and one cause of this could be the cost of pharmaceutical products sold to the private sector, especially that only 25% of our needs in the market is covered by Jordan pharmaceutical industry (Nazer & Tuffaha, 2017).

c. Percent of out of pocket is very low and this create an avenue for misuse of the health resources in the public sector mainly, (Jordan National health accounts)

d. Lack of information making it hard for decision makers to propose reform routs.

6. Conclusion

We suggest the following solutions in order to improve health care in Jordan: First, we suggest Making a well-structured program for epidemiology of diseases where showing the costs and expenditure is assessable to all medical related workers in the field and help the decision makers priorities their resource allocation. Secondly, better pharmaceutical practice and applying Pharmacoeconomics in pharmaceutical purchase and dispensing, and finally, we suggest encouraging more health economics research to make more information available to decision makers.

References

Afonso, A., & St. Aubyn, M. (2006). Relative Efficiency of Health Provision: A DEA Approach with Non-Discretionary Inputs. *ISEG-UTL Economics Working Paper, 33*. https://doi.org/10.2139/ssrn.952629

Appendino, M., Cerisola, M., Martin, E., Salman, F., Tiffin, A., Morra, P., … Wagner, H. (2017). *Jordan: Selected Issues.* Tech. rep., International Monetary Fund. Middle East and Central Asia Dept.

Behr, A., & Theune, K. (2017). Health System Efficiency: A Fragmented Picture Based on OECD Data. *PharmacoEconomics Open, 1*, 203-221. https://doi.org/10.1007/s41669-017-0010-y

Cantor, V. J., & Poh, K. L. (2017, 11). Integrated Analysis of Healthcare Efficiency: A Systematic Review. *Journal of Medical Systems, 42*(8). https://doi.org/10.1007/s10916-017-0848-7

Evans, D. B., Tandon, A., Murray, C. J., & Lauer, J. A. (2001). Comparative efficiency of national health systems: cross national econometric analysis. *BMJ, 323*, 307-310. https://doi.org/10.1136/bmj.323.7308.307

Greene, W. (2004). Distinguishing between heterogeneity and inefficiency: stochastic frontier analysis of the World Health Organization's panel data on national health care systems. *Health Economics, 13*, 959-980. https://doi.org/10.1002/hec.938

Hollingsworth, B., & Wildman, J. (2003). The efficiency of health production: re-estimating the WHO panel data using parametric and non-parametric approaches to provide additional information. *Health Economics, 12*, 493-504. https://doi.org/10.1002/hec.751

Hsu, Y. C. (2013). The efficiency of government spending on health: Evidence from Europe and Central Asia. *The Social Science Journal, 50*, 665-673. doi:10.1016/j.soscij.2013.09.005

Jordan heath articles and analysis. (2018). Oxford, business, group. Retrieved from https://oxfordbusinessgroup.com/country/jordan/health

Nazer, & Tuffaha, H. (2017). Health Care and Pharmacy Practice in Jordan. *The Canadian Journal of Hospital Pharmacy, 70*, 150-155.

Retzlaff-Roberts, D., Chang, C. F., & Rubin, R. M. (2004). Technical efficiency in the use of health care resources:A comparison of OECD countries. *Health Policy, 69*, 55-72.

Spinks, J., & Hollingsworth, B. (2009). Cross-country comparisons of technical efficiency of health production: a demonstration of pitfalls. *Applied Economics, 41*, 417-427. https://doi.org/10.1080/00036840701604354

Tamimi, A. F. (2015). Health Care System in Jordan. *Jordan-Taiwan Medical Cooperation Seminar.*

Verhoeven, M., Gunnarsson, V., & Lugaresi, S. (2007). The Health Sector in the Slovak Republic: Efficiency and Reform. *IMF Working Paper No. 07/226*, 1-25.

worldbank. (2018). Middle Income Countries. Retrieved from www.worldbank.org/en/country/mic

Copyrights