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Health Digital Indicators' Juxtaposition

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Abstract. A study is discussed the comparison of main health performance indicators in two different countries: New Zealand and Republic of Cyprus, and globally by approaches from the particular to the general, and multi-dimensional measures of global health indication. The objective was to establish the content validity, the reliability and sensitivity, and the validity of rank order comparisons. This study analyzed 2021-2023 annual reports World Health Organization, European Union Commission, and NZ government. The finding of this work is synopsis of Health Digital Indicators. The result of synopsis has shown that there are so many different kinds of Health Indicators that unite by digital technology to collect data for them. Author juxtaposed regional (European and Pacific) and global health indicators counted for health goals.

Keywords: health, indicators, assessing, adequacy, juxtaposition, evaluation, measurement.

1. INTRODUCTION

For the last two years, the COVID-19 pandemic has triggered a global health crisis that has put healthcare systems across the world under unprecedented pressure. It has put health systems in the spotlight, exposing and exacerbating existing weaknesses. At the same time, the pandemic has also led to remarkable innovation and advancements. For example, digital technologies were employed to actively monitor COVID-19 patients with mild symptoms at home. Also, using of telehealth services to tackle the decrease in face-to-face consultations while protecting patients and workers from infection. These developments triggered by the unprecedented challenge of the COVID-19 pandemic indicate that healthcare systems can adopt new technologies and care delivery modes at incredible pace and scale. [1].

The virus has not only affected our health and health systems directly through rising cases, hospitalisations and deaths. If we look ahead to the coming years, the consequences of having to postpone essential treatment for chronic and non-communicable diseases during the pandemic, the long-term symptoms that many people unfortunately continue to experience following their recovery from infection, and the negative impact of the crisis on mental health and wellbeing will continue to affect health systems long into the future. [1]

World Health Organization (WHO) states that measures to ensure the safety, security and functionality of health infrastructure are needed at both national and community levels. Countries and communities need to prioritize the protection of new and existing hospitals and other health facilities from identified hazards and should ensure the physical integrity of buildings, equipment and critical hospital systems. More and more attention has been paid to creating comfortable and functional hospital environments, where the patients can feel good and at ease maintaining the same efficiency of medical activities. In addition, flexibility has been particularly considered because hospital facilities must adapt to the continuous needs of change. [2-6]

In principle, having identified an optimal set of KPIs, it is feasible to develop a model for evaluating Health System performance by applying an appropriate method to determine the KPIs' importance. [11]. In addition, measurement set could help most hospitals improve their mission achievement. In this measurement set were included asset turnover, cash flow, mortality, complications, county-of-location, and cost per case [12].

This paper considers the nowadays model of KPI system related to two countries hospitals: NZ and Cyprus in COVID-19 era bearing in mind the digital view on COVID-19 Impact [13] and county-of-location characteristics.

2. DATA AND METHODOLOGY

The evaluation of the performance of the health systems represents an intensely debated topic at the level of international organizations, the governments and the population, as it has direct implications on each citizen. Although it is very difficult to measure accurately, the efficiency of health systems can be assessed in terms of the input-output relationship. Starting from this, overall, the results of our analysis show that there are a multitude of factors that influence the efficiency of health systems, which are not only associated with health issues, but also with economic, social, governmental aspects. [11, 12].

For this study author has chosen two countries that have similar characteristics such territory area, population, climate, etc. In addition, author has resided similar period of time in these countries and has had the opportunity to become acquainted with the health care systems of these countries.

The data was obtained from WHO and EU statistical reports of health care in New Zealand (NZ) (<https://www.adhb.health.nz>) and Cyprus (<https://shso.org.cy/en/hospital/geniko-nosokomeio-lefkosias/>) for time period 2021 – 2023 with once-a-year frequency of the data observations and calculation. Experts were involved in the working groups with different purposes according to the development phase of the methodology. Key points of these measures' approaches were considered in previous author's publications [8-10, 13].

3. RESULTS

First of all, it should be noted that by evaluation Health services we must take into account COVID-19 impact and consequences. For example, the analysis from the Country Health Profiles 2021 shows how both across and within European countries, differences in health status mirror to a large extent the unequal distribution of its main socio-economic, behavioural and environmental determinants. This generates significant health disparities across the population that, in turn, reduce the capacity of the most disadvantaged groups to access healthcare services and maintain good health (https://health.ec.europa.eu/system/files/2022-02/2021_companion_en.pdf).

3.1. NZ Health Performance Indicators

NZ Health System Indicators framework is a new approach to measuring the performance of the health system. The framework is premised on shared accountability. The Government sets high-level goals for the system, the Ministry and Te Tāhū Hauora develop high-level indicators for those goals with input from the health sector, and local providers work with input from local consumers to agree what local actions are needed to contribute to the high-level goals.

Work to implement the framework is underway. Full implementation involves areas developing local solutions to local problems, with an emphasis on continuous improvement at a local level to lift the overall performance of the health system. This early in the development of the framework, and before full implementation of the local actions, the results should be interpreted with caution.

In New Zealand (NZ) the first update of the Health System Indicators framework was added in December 2021, and updates are added each quarter. These show change from baseline for most of the high-level indicators (Table 1) and include

district health board (DHB) results. The baseline for improvement for most indicators is December 2019, as more recent data has been significantly affected by the COVID-19 response so is not appropriate to use as a baseline.

Table 1. The high-level Health Performance Indicators in NZ

Government priority	High-level indicator	Description
Improving child wellbeing	Immunisation rates for children at 24 months	Percentage of children who have all their age-appropriate schedule vaccinations by the time they are two years old
	Ambulatory sensitive hospitalisations for children (age range 0-4)	Rate of hospital admissions for children under five for an illness that might have been prevented or better managed in the community
Improving mental wellbeing	Under 25s able to access specialist mental health services within three weeks of referral	Percentage of child and youth (under 25) accessing mental health services within three weeks of referral
	Access to primary mental health and addiction services	In development
Improving wellbeing through prevention	Ambulatory sensitive hospitalisations for adults (age range 45-64)	Rate of hospital admissions for people aged 45-64 for an illness that might have been prevented or better managed in the community
	Participation in the bowel screening programme	In development
Strong and equitable public health system	Acute hospital bed day rate	Number of days spent in hospital for unplanned care including emergencies
	Access to planned care	People who had surgery or care that was planned in advance, as a percentage of the agreed number of events in the delivery plan
Better primary health care	People report they can get primary care when they need it	Percentage of people who say they can get primary care from a GP or nurse when they need it
	People report being involved in the decisions about their care and treatment	Percentage of people who say they felt involved in their own care and treatment with their GP or nurse
Financially sustainable health system	Annual surplus/deficit at financial year end	Net surplus/deficit as a percentage of total revenue
	Variance between planned budget and year end actuals	Budget versus actuals variance as a percentage of budget

Source: URL <https://www.health.govt.nz/new-zealand-health-system/health-system-indicators-framework>].

3.1. Cyprus Health Performance Indicators

Overall, the Cypriot population is among the healthiest in the EU. One important goal of recent extensive health system reforms to introduce universal coverage is to reduce what was the highest level of out-of-pocket spending in Cyprus by improving financial protection [15].

Below is a list of the most effective indicators in the European Union (Cyprus is EU Member State), according to the survey. Table 2 below presents an overview of the indicators reported by countries to assess efficiency of hospital care. For each level (national, regional etc.), each survey respondent presented the key set of indicators used to assess efficiency of care in their country. [14]. For each indicator listed, almost all survey respondents reported hospitals as the setting where their country's efficiency of care measurement and assessment activity are most consolidated, also partially thanks to the relatively greater availability of data about activities and processes taking place in the hospital setting compared to other health care system areas. [16-21].

Table 2. EU Key efficiency / appropriateness indicators reported by survey respondents (in ascending order of priority)

Indicator Name	Priority
% of inpatient stays with a 'short' pre-operative LOS (specific procedures)	1
ALOS for normal vaginal delivery	1
Average time of utilisation of operation theatres over 24 hours	1
Life expectancy / health expenditure as % of GDP	1
Number of bed-days	1
Number of doctors per patient	1
Productivity of doctors (activity based on DRG-rates divided by number of doctors)	1
Share of labour costs due to overtime / contracted working hours / total HR costs	1
Share of laparoscopic cholecystectomies with post-operative LOS < 3 days	1
Cancer screening outside of target group	1
Overuse of diagnostic imaging: medical radiation exposure (mSv/capita/year)	1
Percentage of patients prescribed treatment w/antidepressants for less than 3 months	1
Ratio hospitalizations attributed to DRG at high risk of inappropriateness / DRG at low risk	1
Hospitalisation rate for diagnostic services	1
Share of medium-high priority services provided in the maximum time foreseen	1
Share of C- sections over total number deliveries (%)	1
Retention rate of physically ill employees in the workforce	1
Generic / low-cost medication prescribing rates	2
Pharmaceutical costs per patient	2
Share of pharmaceutical costs on total healthcare costs	2
Share of procedures performed in settings with a minimum volume threshold per year	2
Patient-experienced satisfaction	2
Unexplained geographic variation in volumes of knee arthroscopy and catheterisation	2
Pressure ulcers (2-4) in hospitalized patients	2
Preventable admissions rate for 65+ patients	2
Share of CT-scans and MRIs performed in compliance with current clinical guidelines	2
Average length of stay (ALOS) patients ready for discharge	3
Cost per bed / doctor	3
Number of cases per health care worker / FTE	3
Share of cholecystectomies conducted laparoscopically	3
Various financial ratios (e.g. debt-to-equity)	3
Children vaccination rate	3
Prevalence of potentially inadequate medication (PIM) in the elderly	3
Hospital-acquired infections	3
% of patients 50+ who underwent cancer screening within established timeframe	3

n-day hospital readmission rates	5
Bed occupancy rate	5
Hospital discharge rates	6
Hospital admissions for ambulatory-sensitive conditions	7
DRG-based cost per patient (by disease cat.)	7
Hospital productivity (activity based on DRG-rates divided by operating costs)	8
Share of day surgery for selected procedures	15
Average length of stay (ALOS)	17

Source: author's compilation from [14].

Table 2 above presents an overview of the indicators reported by survey respondents to assess the efficiency of health care. The most frequently reported indicator is the Average length of stay (ALOS), and the most rarely - % of inpatient stays with a 'short' pre-operative LOS (specific procedures).

But all of above listed particular European indicators were designed before COVID-19 pandemic that has had a tremendous impact on the health care system as a whole globally. Taking an approach from the particular to the general, let's consider global indicators.

3.3. Global Health Indicators

Good health is essential to sustainable development of humanity and third Sustainable Development Goal (SDG) states by United Nation (UN). Achieving this Goal 3 SDG means ensuring universal health coverage, including financial risk protection, access to quality essential health services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all, including the following [<https://www.undp.org/sustainable-development-goals/good-health>]:

Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all;

Substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination;

Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate;

Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases, and, in particular, provide access to medicines for all;

Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries;

Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

Goal 3 SDG means of implementation for the targets: Tobacco control; Medicines and vaccines; Health financing and workforce; Emergency preparedness; Universal health coverage.

To monitor achieving of these UN goals and targets, WHO defined and calculated global health-related indicators. The statistics shown below in Table 3 represent official WHO statistics for selected global health-related Sustainable Development Goal (SDG) indicators [5-7]. Summary measures of health, such as total population, is included to provide a general indication of the current situation. Comparable estimates are subject to considerable uncertainty, especially for countries where the availability and quality of the underlying primary data are limited. Year means WHO reports data. For example, in row 2021 shown data from WHO Statistics 2021, based on evidence available in early 2021.

Using Delphi method author defined that indicators chosen below might be enough to analyze the difference between Health system of two small countries. Data obtained from 2021-2023 WHO Statistics reports are given in Table 3.

Table 3. WHO statistics for health-related indicators for Sustainable Development Goals

Indicator Name	Total population in thousands	Density of medical doctors, per 10 000 population	Total alcohol per capita (≥ 15 years of age) consumption (litres of pure alcohol)	Domestic general government health expenditure as percentage of general government expenditure (%)	Suicide mortality rate, per 100 000 population	Road traffic mortality rate, per 100 000 population	Mortality rate attributed to exposure to unsafe WASH services, per 100 000 population	COVID-19 cumulative total deaths, per 100 000 population
Cyprus	2021	1199	10.8	6.6	3.6	0.3	0.3	
	2022	1207	10,8	9,9	3,6	0,3	0,3	
	2023	1244	8.1	14.1	3,6	1.6	1.6	153,6
NZ	2021	4783	10.7	19.3	11.0	0.1	0.1	
	2022	4822	10,7	18,7	11,0	0,1	0,1	
	2023	5130	9.9	18.7	11.0	2.1	2.1	63,81

Source: Author's compilation from [4-6], <https://covid19.who.int/table>.

As shown in Table 3, as of 24.06.2023, COVID-19 mortality is the highest compared to all-cause mortality according to WHO. With similar density of physicians per 10,000 population as in NZ, the cumulative total COVID-19 deaths per 100,000 population in Cyprus are 2.4 times higher than in NZ. This is likely because domestic public health expenditures as three-year average percentage of total public expenditures are 1.9 times higher in NZ than in Cyprus.

4. CONCLUSION

The finding of this work is synopsis of Health Digital Indicators. The result of synopsis has shown that there are so many different kinds of Health Indicators that unite by digital technology to collect data for them. Author juxtapose regional (European and Pacific) and global health indicators counted for health goals.

This research had some limitation due to digital data representation. WHO states that Only 50% of countries have included data disaggregation in their published national health statistics reports [<https://www.who.int/data/inequality-monitor>]. Also, it is important to note that in global statistics report are absent some of the most important indicators such general mortality rate by country, mortality rate related to patients' deaths in Hospitals, etc.

Taking into account the number of deaths from COVID-19 per 100,000 population [<https://covid19.who.int/table>], the health care system is not coping with the COVID-19 virus that has suddenly descended upon humanity. In consequence, it is not the system of indicators needs to be revised, but the system of health care. The future research can investigate preferences of Health system's financing without mediators like Medical Insurance Funds.

The aim to create a more flexible and agile workforce which can be used for surge capacity needs to be embedded in workforce planning, together with skill-mix innovations and investments in a sustained expansion of the health workforce [1].

The overview is finalized to modernization and to outline how to increase the physical environment contribution to the restructure of the entire health care system by drawing a new strategy for Health care activity to ensure high standard care and effective using of given resources. The customization has concerned objectives of the assessment, main aspects, algorithms, metrics, and outcomes representation. Aspects with reference to specific established goals and they are based on a hierarchy of main indicators which assign greater importance to safety and functionality. In addition, the algorithms take into account the relationships between the hospital services, considering them as complex systems of result-oriented health care [9].

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Aims and Objectives

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