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Excavating Future Challenges: An Analysis of Health Systems of One Hundred-Six Countries

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Purpose: Health system of a country is backbone of economy. It has fundamental importance in sustainable development of a country. Aim of this article is to excavate future challenges to health system of selected 106 countries.

Design/Methodology/Approach: It is a country level comparative analysis of health risk factors. Design of the study includes review of literature, data extraction and analysis. The cross-sectional secondary data has been drawn from website of World Development Indicators (WDI) 2020. Grey relational analysis is used as technique of investigation.

Findings: Results show that majorly, member countries of Organization for Economic Co-operation and Development (OECD) have *exceptionally high* grey relational grade, therefore, are considered to be countries having less future health risks, whereas, Southern African Development Community (SADC) have *exceptionally low* grey relational grade, therefore, have high future health risk.

Implications/Originality/Value: It is a unique study using different dataset and methods that provides valuable insights to political governments, researchers and health system managers.

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Introduction

Health system of a country is considered as one of the core systems of an economy. The political governments are concerned with health systems. The health systems have been exposed to different risks from time to time. In recent times this system has faced shocks of Covid-19

pandemic. Health systems have been shattered in most of the countries during this pandemic period. This discipline is rich in research and there is flood of research articles in context of coronavirus now a days. Evaluation of health system has gained imperative importance and it is ever high on the agenda of research. Country level evaluation of health systems is also vital to study. A comparative study of countries' level health systems is also that of fundamental importance. In order to set out the context of the study, it is pertinent to report some recent and relevant studies herein viz challenges of healthcare service in Italy (Armocida et al., 2020), environmental, social and health issues of Mexican health system (de León-Martínez et al., 2020), Bulgarian health system challenges (Dzhafer & Papathanasiou, 2020), Taiwanese health system resilience (Hsieh, 2020), health risk factors: the case of Luxembourg, France (Mussard and Alperin, 2021), Brazilian health system risks (Requia et al., 2020), challenges of health system of sub-Saharan Africa (Roder-DeWan, 2020) and health risk management behaviors of Japanese university students (Yamakawa et al., 2019). Global health programs are aimed to remove social, cultural, and logistical barriers to fill the gap in health disparities and health related knowledge between developed and developing countries. Health matrices and research are essential for planning, policy making, programming and accountability. There is a severe need of high quality health information to make the research gaps clearer. Despite of plenty of research there is still room for systemic studies. Therefore, this study has aimed to evaluate the future challenges to health system of 106 countries of the world. It is also aimed to rank the countries on basis of level of possible challenges to health system of a country. Further, it aims to classify and discuss the results bloc wise. To achieve these objectives Grey Relational Analysis (GRA) is opted as research methodology. Remaining article is arranged as literature review, methodology, data analysis, results & discussion and conclusion.

Literature Review

Contemporary literature is necessary to sum up the up to date research findings of the phenomenon in hand. We explored renowned databases of research such as Ebrary, Elsevier (ScienceDirect), Emerald, Springerlink, Taylor & Francis Journals, Wiley-Blackwell Journals etc. and reviewed sufficient relevant studies. Few of which qualify to be reported here in order to establish hard ground of the study in hand e.g. studies like: safety and risk management including: pharmacy role in health system of Colombia (Amariles et al., 2020), Mount Sinai health system in US (Buckley et al., 2020), health services system of Hubei, China (Chen et al., 2020), examine psychosocial risk factors in public workplace in Denmark (Dahler-Larsen et al., 2020), vexed Greek health care system (Kapetanakis et al., 2020), resilience of Spanish health system (Legido-Quigley et al., 2020), strained Latin American health care system (Navarro et al., 2020), challenges facing in health and social care planning in Spain (Queralt-Tomas et al., 2019) and safety risk management and occupational health of waste management firms in Portugal (Ramos et al., 2020). Aghdam et al. (2020) carried a detailed study on effective usage of Internet of Things (IoT) to facilitate the paramedical staff and health workers and also to identify the major trends and challenges facing the healthcare. Bolnick et al. (2020) revealed that high spending on health care ensures the control risk exposure, reduces health burden and cost. Briggs et al. (2020) reported some key challenges and opportunities facing by global health policy. Cheng et al. (2019) concluded that agriculture soil contamination is posing significant risks to human health and food safety. Dahler-Larsen et al. (2020) stressed that occupational health and safety risk management estimate action fairly well against psychological risks as compare to physical risks. de León-Martínez et al. (2020) analyzed the environmental (contaminants from biomass burning), social (lack of water access, limited internet access, return of aboriginal people to their communities, language barriers), and health risk factors (hypertension, chronic respiratory disease, diabetes, respiratory tract infections) in context of COVID-19 to mitigate its impact on society at large. Gao et al. (2020) stated that circumjacent air pollution is negatively associated with health risk and strategy must be devised to mitigate this risk. Mhango et al. (2020) reported some key factors (acquaintance to infected patients, poor

infection control mechanism, personal protective equipment shortage and preexistent medical facility) as COVID-19 risk factors among health workers. Dash (2019) conducted a systematic review of literature to exhume the vital challenges and future directions of big data analytics and its impact on healthcare. He further argued that while processing the large data; data security and management is the major challenge being faced by data analytics. Mussard and Alperin (2021) examined health indicators of two-parameter family linking one risk factor and a health dimensions by taking four factors including parents longevity, financial condition during childhood, parental education and parents nationality and found that parents education and migration background are the most exogenous risk factors contributing in socio-economic health inequality. Najera and Ortega-Avila (2020) affirmed that COVID-19 mortality risk rises significantly in patients in form of diabetes, obesity, cardiovascular disease or hypertension, however, for patients with same profile, the death risk dramatically different. Ramos et al. (2020) bolstered that implementation of integrated management system has proved significant success in improvement of occupational health and safety risk management process in businesses. Rohat et al. (2019) examined the European future heat related health issues and found capricious socio-economic development sustainability as the major causes. Scharpf et al. (2020) conducted a systematic review to study the mental health of refugees associated with risk protection and buttressed that challenges of relocation, violent conflict and flight cause severe damage on mental health and well-being. Xu et al. (2021) stated that there is a direct and significant positive relationship between health risks and economic development. Yadav et al. (2021) argued that contaminants of emerging concerns in soil, water and air adversely effect on environment and risks of human health. Yang et al. (2020) proclaimed that psychological risk management soft policies rank higher than hard policies; furthermore national level policies score more than at local level in China. It is further explained that China is still behind by adopting the safety related psychological health policies as compare to Europe and Australia. Yamakawa et al. (2019) highlighted that parental occupation and travel experience of overseas offer a pertinent insights of promoting health risk management. Zaidi et al. (2021) identified and ranked eleven challenges hampering sustainable public health sector of Pakistan and found government rules & regulations and senior management commitment are the major obstacles in implementing it. Zhang and Mohandes (2020) carried a comprehensive study on occupational health and safety and proposed a framework contributing in: identifying green-go requirements, ascertaining list of safety risks associated with green-oriented requisite through Delphi and Znumbers method, assessing safety risks by way of proposing five-layers strategy, estimating green-oriented safety risks magnitude using Z-number based algorithm and providing the measures to overcome/control the green-oriented safety risks. The review of literature pinpoints that there is dearth of country level comparative studies of health systems particularly based on multiple criteria. Hardly any study can be found that compares hundreds of the countries based on a multitude of future challenges to be faced by different countries. Neither the comparative studies nor the comprehensive methodologies have been witnessed from within the literature. Therefore, to develop a comprehensive framework, apply some composite methodology and comparing the country level future risks to health systems is something inevitable to enrich the contemporary literature.

Theoretical Framework: Theoretical framework fixes perimeters of scope of research. Data, method, tentative solution to the problem are signposted by the framework of the study. We have adopted the framework from World Development Indicator (WDI) 2020. Variables, operational definitions, unit of measurement and data set are taken from WDI-2020.

Table 1: Health Risk Factors

Code	Health Risk Factors	Measured As	Criteria
1	Prevalence of smoking in Male	% of adults	Smaller is the best
2	Prevalence of smoking in Male	% of adults	Smaller is the best

3	Incidence of tuberculosis	per 100,000 people	Smaller is the best
4	Prevalence of diabetes	% of population ages 20 to 79	Smaller is the best
5	Incidence of HIV	per 1,000 uninfected population ages 15-49	Smaller is the best
6	Prevalence of HIV Total	% of population ages 15-49	Smaller is the best
7	Prevalence of HIV Women's share of population ages 15+	% Women's share of population ages 15+	Smaller is the best
8	Prevalence of HIV Youth, Male ages 15-24	% of population ages 15-24	Smaller is the best
9	Prevalence of HIV Youth, Male ages 15-24	% of population ages 15-24	Smaller is the best
10	Antiretroviral therapy coverage	% of people living with HIV	Smaller is the best

There are ten factors representing future health risks to a country's health system. All factors possess the characteristic of smaller acceptable therefore in order to normalize the data we adopted the procedure accordingly.

Methodology

Following the quantitative research philosophy and deductive approach, overall design of the study comprises of survey of literature from the aforementioned databases, extraction of data from WDI 2020 and mathematical analysis. Secondary data of one hundred-six countries was extracted from the website of WDI 2020. The number of countries was decided on the basis of availability of data on the variables (Table 1). Classical procedure of Grey Relational Analysis (GRA) has been used as research methodology (Hamzacebi et al., 2011; Kuo et al., 2008; Tayyar et al., 2014; Wu, 2002). GRA proceed stepwise as given in Niazi et al. (2021) and Qazi et al. (2021), whereas, scheme of notations have been adopted from Ertugrul et al. (2016).

Step 1: Created a data set and established decision matrix *Equation (1)*

$$x_i(k) = \begin{bmatrix} x_1(1)x_1(2) & \cdots & x_1(m) \\ \vdots & \ddots & \vdots \\ x_n(1)x_n(2) & \cdots & x_n(m) \end{bmatrix} \quad \text{Equation (1)}$$

Table 2: Health Risk Factors Data

Sr.	Country	1	2	3	4	5	6	7	8	9	10
1	Algeria	30	1	69	6.7	0.1	0.1	46	0	0.1	81
2	Argentina	28	16	27	5.9	0.3	0.4	32	0	0.1	61
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
78	Pakistan	37	3	265	20	0.2	0.1	30	0	0.1	10
79	Panama	10	2	52	7.7	0.6	0.9	30	0	0.1	54
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
105	Zambia	25	3	346	4.5	5.7	11	59	2	5	78
106	Zimbabwe	31	2	210	1.8	4.9	13	60	3	5.7	88

Source of Data: World Development Indicators (WDI), 2020

Step 2: Created reference series and comparison matrix *Equation (2)*

$$x_0 = [x_0(k) \dots \dots \dots x_0(n)] \quad \text{Equation (2)}$$

Table 3: Reference Sequence and Comparable Sequences

Sr.	Country	1	2	3	4	5	6	7	8	9	10
-----	---------	---	---	---	---	---	---	---	---	---	----

0	Reference Sequences	8	0	0	1	0	0.1	6	0	0.1	92
1	Algeria	30	1	69	6.7	0.1	0.1	46	0	0.1	81
2	Argentina	28	16	27	5.9	0.3	0.4	32	0	0.1	61
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
78	Pakistan	37	3	265	20	0.2	0.1	30	0	0.1	10
79	Panama	10	2	52	7.7	0.6	0.9	30	0	0.1	54
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
105	Zambia	25	3	346	4.5	5.7	11	59	2	5	78
106	Zimbabwe	31	2	210	1.8	4.9	13	60	3	5.7	88

Step 3: Created a normalized matrix for smaller the better Equation (3)

$$x_i(k) = \frac{\max x_i^{(o)}(k) - x_i^{(o)}(k)}{\max x_i^{(o)}(k) - \min x_i^{(o)}(k)} \quad \text{Equation (3)}$$

Table 4: Normalized Comparable Sequences

Sr.	Country	1	2	3	4	5	6	7	8	9	10
0	Reference Sequences	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	Algeria	0.6765	0.9773	0.8871	0.7286	0.9933	1.0000	0.3443	1.0000	1.0000	0.8659
2	Argentina	0.7059	0.6364	0.9558	0.7667	0.9800	0.9888	0.5738	1.0000	1.0000	0.6220
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
78	Pakistan	0.5735	0.9318	0.5663	0.0952	0.9867	1.0000	0.6066	1.0000	1.0000	0.0000
79	Panama	0.9706	0.9545	0.9149	0.6810	0.9600	0.9703	0.6066	1.0000	1.0000	0.5366
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
105	Zambia	0.7500	0.9318	0.4337	0.8333	0.6200	0.5948	0.1311	0.6000	0.6918	0.8293
106	Zimbabwe	0.6618	0.9545	0.6563	0.9619	0.6733	0.5204	0.1148	0.4000	0.6478	0.9512

For instance, calculation of Algeria, 'Prevalence of smoking in Male'

$$x_1^*(1) = \frac{\max x_1^0(1) - x_1^0(1)}{\max x_1^0(1) - \min x_1^0(1)} = \frac{76 - 30}{76 - 8} = 0.6765$$

Step 4: Obtained absolute values by calculating deviation sequence Equation (4)

$$\Delta_0(\gamma) = |x_0(\gamma) - x_1(\gamma)| \quad \text{Equation (4)}$$

Deviation Sequence is calculated Equation (5), Equation (6) and Equation (7)

$$\Delta_{0i}(k) = |x_0^*(k) - x_i^*(k)| \quad \text{Equation (5)}$$

For biggest deviation:

$$\Delta_{max} = \max_{\forall j \in I} \max_{\forall k} |x_0^*(k) - x_j^*(k)| \quad \text{Equation (6)}$$

For smallest deviation:

$$\Delta_{min} = \min_{\forall j \in I} \min_{\forall k} |x_0^*(k) - x_j^*(k)| \quad \text{Equation (7)}$$

Table 5: Deviation Sequences

Sr.	Country	1	2	3	4	5	6	7	8	9	10
0	Reference Sequences	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	Algeria	0.3235	0.0227	0.1129	0.2714	0.0067	0.0000	0.6557	0.0000	0.0000	0.1341

2	Argentina	0.2941	0.3636	0.0442	0.2333	0.0200	0.0112	0.4262	0.0000	0.0000	0.3780
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
78	Pakistan	0.4265	0.0682	0.4337	0.9048	0.0133	0.0000	0.3934	0.0000	0.0000	1.0000
79	Panama	0.0294	0.0455	0.0851	0.3190	0.0400	0.0297	0.3934	0.0000	0.0000	0.4634
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
105	Zambia	0.2500	0.0682	0.5663	0.1667	0.3800	0.4052	0.8689	0.4000	0.3082	0.1707
106	Zimbabwe	0.3382	0.0455	0.3437	0.0381	0.3267	0.4796	0.8852	0.6000	0.3522	0.0488

For instance, calculation of deviation of Argentina for ‘Prevalence of smoking in Male’

$$\Delta_{02}(2) = |x_0^*(2) - x_2^*(2)| = |1 - 0.6364| = 0.3636$$

Step 5: Grey relational co-efficient is calculated Equation (8). Term ξ is distinguishing co-efficient between 0 and 1 the value of which is 0.5 in literature.

$$\gamma[x_0^*(k), x_i^*(k)] = \frac{\Delta_{min} + \xi \Delta_{max}}{x_{0i}(k) + \xi \Delta_{max}}, \quad 0 < \gamma[x_0^*(k), x_i^*(k)] \leq 1 \quad \text{Equation (8)}$$

Table 6: Grey Relational Co-efficient

Sr.	Country	1	2	3	4	5	6	7	8	9	10
0	Reference Sequences	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	Algeria	0.6071	0.9565	0.8158	0.6481	0.9868	1.0000	0.4326	1.0000	1.0000	0.7885
2	Argentina	0.6296	0.5789	0.9188	0.6818	0.9615	0.9782	0.5398	1.0000	1.0000	0.5694
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
78	Pakistan	0.5397	0.8800	0.5355	0.3559	0.9740	1.0000	0.5596	1.0000	1.0000	0.3333
79	Panama	0.9444	0.9167	0.8545	0.6105	0.9259	0.9439	0.5596	1.0000	1.0000	0.5190
...		...	...	...	...	...	...	...	...	...	...
...		...	...	...	...	...	...	...	...	...	...
105	Zambia	0.6667	0.8800	0.4689	0.7500	0.5682	0.5524	0.3653	0.5556	0.6187	0.7455
106	Zimbabwe	0.5965	0.9167	0.5926	0.9292	0.6048	0.5104	0.3609	0.4545	0.5867	0.9111

For instance, calculation of grey relational co-efficient of Argentina for ‘Prevalence of smoking in Male’

$$\gamma[x_0^*(2), x_2^*(2)] = \frac{\Delta_{min} + \xi \Delta_{max}}{\Delta_2(2) + \xi \Delta_{max}} = \frac{0 + (0.5) \times 1}{0.3636 + (0.5) \times 1} = 0.5789$$

Step 6: Weighted sum of grey relational co-efficient (Grey Relational Grade) Equation (9) and Equation (10)

$$\gamma(x_0^*, x_i^*) = \sum_{k=1}^n \beta_k \gamma[x_0^*(k), x_i^*(k)] \quad \text{Equation (9)}$$

$$\sum_{k=1}^n \beta_k = 1 \quad \text{Equation (10)}$$

Table 7: Grey Relational Grades

Sr.	Country	Grey Relational Grades
0	Reference Sequences	1.0000
1	Algeria	0.8235
2	Argentina	0.7858
...		...
...		...
78	Pakistan	0.7178
79	Panama	0.8275
...		...
...		...
105	Zambia	0.6171
106	Zimbabwe	0.6464

For instance, grey relational grade for Argentina is calculated:

$$\gamma(x_0^*, x_2^*) = \sum_{k=1}^n \beta_k \gamma[x_0^*(2), x_2^*(k)]$$

$$= 0.10 \times (0.6296 + 0.5789 + 0.9188 + 0.6818 + 0.9615 + 0.9782 + 0.5398 + 1.0000 + 1.0000 + 0.5694) = 0.7858$$

Results & Discussion

With the aim of analyzing the health risk factors of 106 countries and using a country level secondary data of ten variables taken from website of WDI 2020, the study applied Grey Relational Analysis (GRA). The study generated grey relational grades (Table 7), the same have been represented below as Table 8 into a classified form. One hundred-six countries have been divided on an ordinal scale of seven items i.e. *exceptionally high*, *very high*, *high*, *about the same*, *low*, *very low* and *exceptionally low*. Where the *exceptionally high* means that the countries have high performing health systems, therefore, there is exceptionally low level of future health risks, whereas, *exceptionally low* means that these countries have exceptionally low performance health systems, therefore, are exposed to high level of future health risks.

Table 8: Results of Grey Relational Analysis

Country	GRGs	Rank	Country	GRGs	Rank	Country	GRGs	Rank
Reference Sequences	1	0	Germany	0.7978	35	Bulgaria	0.7607	71
Exceptionally High			Czech Republic	0.7974	36	Liberia	0.7604	72
Australia	0.8735	1	Kuwait	0.7972	37	Nigeria	0.7599	73
Cabo Verde	0.8692	2	Slovak Republic	0.7968	38	Romania	0.7599	74
Singapore	0.862	3	Ghana	0.796	39	Montenegro	0.7577	75
Japan	0.8543	4	Armenia	0.7947	40	Very Low		
Colombia	0.851	5	El Salvador	0.7934	41	Bahamas, The	0.7558	76
Iceland	0.8467	6	Yemen, Rep.	0.7929	42	Moldova	0.7536	77
New Zealand	0.8455	7	Burkina Faso	0.7915	43	Mongolia	0.7514	78
Benin	0.8449	8	Hungary	0.7913	44	Nepal	0.7509	79
Ecuador	0.8437	9	Uruguay	0.7896	45	Gambia	0.7491	80
Denmark	0.8389	10	About the Same			Latvia	0.748	81
Niger	0.8385	11	Morocco	0.7875	46	Bangladesh	0.7451	82
Italy	0.8363	12	Paraguay	0.786	47	Lao PDR	0.7444	83
Netherlands	0.8343	13	Argentina	0.7858	48	Ukraine	0.7408	84
Norway	0.8329	14	Cuba	0.7851	49	Djibouti	0.7379	85
Panama	0.8275	15	Vietnam	0.7838	50	Mauritius	0.7367	86
Very High			Togo	0.7834	51	Suriname	0.7356	87
Oman	0.827	16	Thailand	0.7787	52	Jamaica	0.7248	88
Senegal	0.8266	17	Cambodia	0.7787	53	Pakistan	0.7178	89
Mexico	0.8242	18	Malaysia	0.7778	54	Indonesia	0.7154	90
Algeria	0.8235	19	Tunisia	0.7773	55	Exceptionally Low		
Ireland	0.8222	20	Bosnia and Herzegovina	0.7768	56	Haiti	0.7124	91
Costa Rica	0.821	21	Egypt, Arab Rep.	0.7754	57	Uganda	0.7093	92
Finland	0.821	22	Mali	0.7754	58	Kenya	0.6913	93
Ethiopia	0.8203	23	Serbia	0.7753	59	Sierra Leone	0.6809	94
Spain	0.8184	24	Kazakhstan	0.7752	60	Tanzania	0.6786	95
Eritrea	0.8176	25	Low			Papua New Guinea	0.6576	96
Croatia	0.8153	26	Lebanon	0.7749	61	Zimbabwe	0.6464	97
Iran, Islamic Rep.	0.8152	27	Rwanda	0.7748	62	Congo, Rep.	0.6454	98
Portugal	0.8139	28	Dominican Republic	0.7733	63	Malawi	0.6434	99
Luxembourg	0.8137	29	Belarus	0.7697	64	Zambia	0.6171	100
Comoros	0.8116	30	Georgia	0.7676	65	Namibia	0.5967	101
High			Estonia	0.7665	66	Eswatini	0.5614	102
Uzbekistan	0.8081	31	Philippines	0.7663	67	Botswana	0.5474	103
France	0.806	32	Chile	0.7647	68	Mozambique	0.5421	104

Sri Lanka	0.8006	33	Kyrgyz Republic	0.7629	69	Lesotho	0.4975	105
Barbados	0.7993	34	Myanmar	0.7628	70	South Africa	0.4749	106

*GRG - Grey Relational Grades

Most of the countries having *exceptionally high* performance on health systems (exposed to low future health risks) are member countries of Organization for Economic Co-operation and Development (OECD). Member countries of European Union (EU) and OECD also have *very high* performance health systems and are relatively less exposed to future health risks. Member countries of Arabian Countries (AC), Association of Southeast Asian Nations (ASEAN) and Japan & Asian Pacific Region (J&APR) are expected to remain at same level of future health risks. Eastern Europe (EE) countries have low level performance on health systems and are exposed to relatively high level of future health risks. Member countries of Caribbean Community and Common Market (CARICOM) and South Asian Association for Regional Cooperation (SAARC) have very low performance on health systems and they are expected to be exposed very high level of future health risks. Member countries of Southern Africa Development Community (SADC) have exceptionally low performance on health systems and they are exposed to exceptionally high level of future health risks. Right from the aim of the study up to the analysis and results, it is a different study. The study is different in design, data sets, scope (number of countries), methodology, analysis and results. It is also different from contemporary literature in terms of information, contribution, implications and impact. However, the results of the study are aligned with contemporary literature and seems to be logically valid qua reality. The study used original reliable secondary data set and concluded on the basis of mathematical procedure applied thereon to data that as a result provide additional information and a framework for future researchers.

Conclusion

Health system of a country is considered to be one of the core systems of economy. It has fundamental importance to economic development. It is an ever green area of research. Country level comparative studies of health system remained always relevant and presently they have become more pertinent. Countries are always considered to evaluate the future health risks and their preparedness to cop them up. Therefore, aim of this study is to evaluate the country level positions of 106 countries and compare them on objective basis for their exposition the future health risks. The data of countries was extracted from WDI 2020 for ten future health risks variables. A composite mathematical analysis is performed through Grey Relational Analysis (GRA). Results of GRA show that most of the countries having *exceptionally high* performance on health systems (exposed to low future health risks) are member countries of OECD. Member countries of EU and OECD also have *very high* performance health systems and are relatively less exposed to future health risks. Member countries of AC, ASEAN) and J&APR are expected to remain at same level of future health risks. EE countries have low level performance on health systems and are exposed to relatively high level of future health risks. Member countries of CARICOM and SAARC have very low performance on health systems and they are expected to be exposed very high level of future health risks. Member countries of SADC have exceptionally low performance on health systems and they are exposed to exceptionally high level of future health risks. The study has significant theoretical, practical and policy implications. The study contributed grey relational grades and grey relational co-efficient along with country classifications towards theoretical literature of the domain. It provides the theoretical frameworks for the future researchers along with lot of additional information. It also provides insights to policy makers to evaluate their positions before embarking on some future discourse to mitigate the future health risks. It also provides guideline to political government to readjust their positions as against their rivals. The study also has certain limitations, it is a cross sectional study, therefore, the results can only be generalized accordingly, longitudinal studies are recommended for future. The study uses secondary data in a composite mathematical

methodology i.e. GRA, whereas there is a wide array of statistical methodologies that can be verify the results of GRA. All the variables have been given equal weights, the results might change if inter-variable weights are change by way of Entropy method or expert opinion.

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