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Human development index and innovation capabilities in the health sector of UAE

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ABSTRACT

Based on human capital theory, the goal of this study was to look into the role of innovation capabilities in the UAE healthcare sector's competitiveness. Following the qualitative research design, data were gathered through interviews with 90 experts and professionals working in the health industry in UAE. Furthermore, the study also analyzed the UAE's Human Development Index (HDI), innovation capacities, and human development competitiveness from 2014 to 2020 using the conceptual statistics of Key Performance Indicators (KPIs) obtained in the health sector. Results revealed that UAE achieved some positive indicator results from 2020 to 2021. In addition, there are significant areas of improvement through which the UAE can build a better rank in the global competitiveness index of the health sector. The study provided key policy insights for understanding the strengths and weaknesses of innovation capabilities and human development competitiveness in the healthcare sector. Avenues of growth policy and future research directions are suggested.

Keywords: *innovation capabilities, healthcare sectors, hospital, human development index, UAE*

INTRODUCTION

In many developing countries, the health sector makes a significant contribution. The health sector is both a source and an effect of growth, and it is critical for the larger concept of increasing innovation capabilities, which is the key to progress.[1] Because the worldwide health sector has seen enormous growth in recent years, critical public health systems have been classified as "resource inadequate."[2] Healthcare institutions worldwide are always

attempting to maximize their capabilities through technical developments; standard operating procedures are being followed to lower costs while enhancing user satisfaction. Hospitals emphasize servicing their people in innovative ways, whether they operate in the public or private sectors. Health sector workers can act as a "valuable source of creativity" who really can guide their organization effectively and efficiently in terms of organizational performance.[3]

Since the UAE's establishment on December 2, 1971, it has developed several plans related to human development. In 2020, the country's population reached 9,282,041, and it is expected to exceed 10.5 million by 2030 (UAE Federal Competitiveness Statistics Center, 2021).[4] The UAE set healthcare as one of its strategic priorities, and radical reforms have been implemented to develop the health sector to transform the country into a medical tourism destination and healthcare innovation hub.[5] While the UAE ranked 22nd on the Global Health Innovation Index (GHII), with an overall score of 44.68, the government is keen to further its human development rating in this sector. Moreover, countries seek to achieve these indicators by developing and implementing plans, programs, and various projects, thereby contributing to the application and improvement of international human development standards.[6] This can lead to a country improving its global position ranking, especially in the healthcare sector, which is the main tool used by people to develop and achieve their aims.[7]

Ref.[8] looked at all workers' and leaders' personal abilities, knowledge, skills, learning, collaboration, experiences, and the firm's purpose, style, and attitude. On the other hand, human capital was established in people and would travel with them. Employees' qualities, information sharing, education and development, and experience were more essential aspects in Ref.[9]'s definition of human capital, which included the information, abilities, and expertise of all employees and managers.

Furthermore, human development has been highlighted as the fundamental goal and major motor of sustainability, which aspires for properly calibrated financial, sociological, and natural outcomes. However, its acceptance is not without its challenges and criticism. For decades, work has been misinterpreted as the fundamental production component in human prosperity, pushing socially responsible growth to the periphery.[10] Despite significant progress in the worldwide health system over the years, national public health systems have been classified as "resource inadequate."[11] To elaborate further, the healthcare industry is under constant pressure to outperform competitors on the one hand while also gaining a favorable reputation among clients (patients).

The present study focused on the role of innovation capabilities in human development competitiveness in the UAE's healthcare sector. Therefore, the Human Capital Theory was used to guide the recent research. It is characterized as "knowledge, information, general relationships, as well as general capabilities."[12] The theme of this theory matches with the current study framework, where innovation capabilities play an important role in improving the human capacity of the healthcare workforce through innovative practices and service ideas. This will ultimately result in better service to the community and ranking the national health sector better in a global competitive index. Recent trends in medical tourism have also linked the up gradation of the innovation capability of the health sector with the economic development of the country and a major motivator of healthcare policy and development. Thus, current research aims to achieve the following objectives:

- To clarify the role of innovative capabilities in achieving and improving the UAE's human development indicators in the healthcare sector.
- To determine how the UAE's innovative capabilities and human development

indicators in the healthcare sector are linked to sustainable development goals.
- To better understand the UAE's human development indicators in the healthcare sector, including their strengths and weaknesses (Key Performance Indicator [KPI]).

LITERATURE REVIEW

The research focuses on the role of innovation capabilities in human development competitiveness in the health sector in the UAE. The healthcare system is frequently regarded as necessary for developing human capital since it is viewed as an expectation of future production rather than a means of consuming resources.

Human capital theory

The current study is rooted in the human capital theory. It is defined as "know-how, information, general relationships, and general capabilities that individuals bring to bear on behalf of the form through the employment relation."[13] The person, rather than the company, holds human capital, and people contract their assets.

Because it can produce more effort and finances to invest in human development, human capital is crucial in boosting innovative skills. Furthermore, being one of the major components in knowledge productivity associated with the human development index, it is commonly regarded as a useful instrument for reaching goals in numerous sectors.[14] Human capital is also essential in innovation, and it is regarded as one of the most important foundations of innovative skills. This emphasizes the importance of striking a balance between human capital and long-term development through fostering innovation and research, resulting in long-term human growth.[15] Because of its potential to innovate and increase competitive productivity, human capital has a favorable impact on innovation, entrepreneurship, and boosting competitiveness. It also emphasizes the importance of ongoing concern for human development, which is necessary for developing entrepreneurship and development projects.[16]

Governments frequently strive to increase human capital investment and intellectual development and encourage long-term human growth by focusing on developing dynamic talents.[17] Although logical gaps arise owing to worldwide cultural variations and the educational level fraction of creative professions, human capital–based creativity is a primary source of development. Furthermore, there is a favorable association between patents and technological advancement. However, a negative relationship exists between creators and job growth, innovation, and innovative research.[18]

Because human capital is the most important asset in the healthcare industry,[19] mobilizing and converting resources into human capital is a fantastic concept. Professional development, career possibilities, and organizational development are all part of the human resource strategy for human capital development.[20] Ref.[21] reported that the biggest challenge of human resource development is to find a balance between the healthcare context and the constantly changing needs of the market. As a result, human capital may be defined as an organization's resources invested in and rooted in individuals.[22]

Innovation capabilities in healthcare sector in the UAE

Nowadays, the healthcare industry focuses more on innovation, value addition, high-quality care at a low cost, patient safety, efficacy, and efficiency.[14] This technique has attracted the attention of more academics in the healthcare sector, as it has been shown to have a major impact on organizations. In the health sector, for instance, growing costs and concerns about enhanced service quality have heightened interest in creating and implementing supply chains.[16] The expansion of the healthcare sector has played a central role in other countries due to the structural transformation and the increasing incidence of the way of life disorders. Authorities have taken steps to relieve the mounting strain on

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

healthcare systems.[10,23,24] The UAE government has selected the healthcare sector as one of its key areas and has seen substantial expansion and progress in recent years. Both the quality and variety of services provided by this industry are skyrocketing.[6] In contrast to other emerging countries, the UAE has demonstrated an upward trend in healthcare. Furthermore, it fails to offer healthcare services comparable to those found in developed nations.

Concentrating on patients and strengthening the healthcare distribution system continues to fuel the expansion of the UAE health sector as the UAE transitions from an oil-based to an experience and understanding sector.[25–27] Developing a person's intellectual, emotional, and cognitive dimensions and skills to act and produce the desired results in the community can be characterized as innovation capabilities in the healthcare sector. Prior literature demonstrates theoretical studies on Vietnam's innovation capabilities and performance, indicating that they cannot completely comprehend the relationship between innovation capabilities and strategic performance.[28–32] Some researchers look into Qatar's potential for human growth and relates their challenges and creative techniques to the environment's sustainability.[33]

In addition, innovation capabilities have been defined as "the comprehensive framework of resources and methods acquired by organizations and countries to contribute to rapid technological change due to their ability to heighten compatibility with the changing environment."[34] An organization's ability to innovate must be continually improved to continue to create value and profit. According to Ref.,[35] the ability to innovate is defined as constantly developing or refining present work procedures to better products or services. Companies can use inner training or acquire new external information to enhance innovative brands for the next generation based on existing products or capabilities. In this situation, innovation ability may be defined as the ability of individuals, groups, and organizational structures to update knowledge. According to Ref.,[36] innovation ability is defined as the ability to develop innovative ways to meet market requirements; apply appropriate practices and technologies to produce new products; establish and implement new products, procedures, and technologies to meet future requirements; and respond to unusual research utilized by competitors and create unexpected opportunities.

Role of innovation capabilities in human development competitiveness in the healthcare sector

The UAE unveiled its National Innovation Strategy in 2014, focusing on several industries, such as renewable energy, transportation, and healthcare. It is also in line with the UAE's Vision 2021 and has been widely regarded as one of the pillars and influencing factors in improving human development indicators and motivating society, government agencies, and institutions to provide innovative ideas in services and products to improve the quality of society's life. As a result, the UAE was able to rank 34th in the Global Innovation Index in 2020 and first in the Arab world. Furthermore, the UAE has invested 14 billion dirhams in research and development (UAE Ministry of Cabinet Affairs, 2015).[37]

The UAE's global statistics outcomes relating to the National Innovation Strategy between 2015 and 2020 helped to improve HDI rankings. In 2015, the human capital component scored 53.9 points, rising to 63.2 in 2019 before dropping to 54.6 in 2020. The UAE maintained similar performance in the components of institutions and the regulatory environment during this period, ranging from 77.8 to 86.4 points.[38] The UAE's innovative products and services score jumped from 4.1 in 2015 to 53.8 in 2020, an astounding increase of 49.7%. Similarly, in 2015, the UAE received a 12.0 knowledge and technology score, which rose to 52.7 in 2019 but fell by 16.2 points in 2020. Infrastructure scores were regularly in the range of 56.7 to 62.

Furthermore, the UAE had an amazing outcome in funding and investment, rising from 27.9 in

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

2015 to 42 in 2020, a 14.1% rise. Finally, the UAE's business competitive environment scored 77.6 in 2015, grew to 86.9 in 2019, and then dropped to 72 in 2020.[39] In terms of the results of the government's role in adopting and implementing innovation strategies, following up on their implementation, and linking their outputs and objectives to the HDI, 65% of experts said that developing innovation strategies by integrating human development programs in the fields above is one of the most important pillars of improving HDI scores. Furthermore, they were convinced that governments must play a critical role in developing systemic interdependence. However, 5% of experts said that focusing on establishing an economy based on knowledge, industrial, and environmental innovation and adopting innovative tactics interleaved with a set of relevant initiatives will help enhance HDI value. These views were shared by,[40] who emphasized the importance of applying innovative strategies in the health sectors as long as the outputs of these strategies are aligned with human development goals.

Figure 1 illustrates the 2019–2021 health innovation strategy launched by the Ministry of Health and Community Protection (UAE), intending to apply innovative practices for maintaining public health, providing innovative health and treatment services to enhance society's quality of life, and providing the most appropriate and optimized healthcare. These goals align with UAE's Vision 2021 and health-related competitive human development indicators. This strategy included five main and five potential factors for achieving its strategic goals (Ministry of Health and Prevention's Innovation strategy, 2019–2021).

A case of UAE healthcare sector comparative analysis in human development index

The HDI measures and improves positive competitiveness by focusing on health, knowledge, and living conditions.[14] Despite economic problems, healthcare issues, and societal causes creating significant unemployment, the program prioritizes economic growth and has human development as a fundamental component.[16] The HDI comprises a measure of how far countries have progressed in terms of living standards compared to their populations and the rate of continuous healthcare sectors.[17]

On the other hand, human development is defined as "the improvement of people's living conditions by meeting their basic needs, allowing them to choose their potential capabilities, and living a happy life through access to healthcare sectors."[41] Furthermore, human development considers all aspects of life, including health and societal growth, while increasing people's options and addressing their needs and desires to ensure a quality existence and long-term development. Furthermore, human development entails regular participation among various elements of society and effective policies and practices that assure long-term sustainability in providing an adequate standard of living.[20]

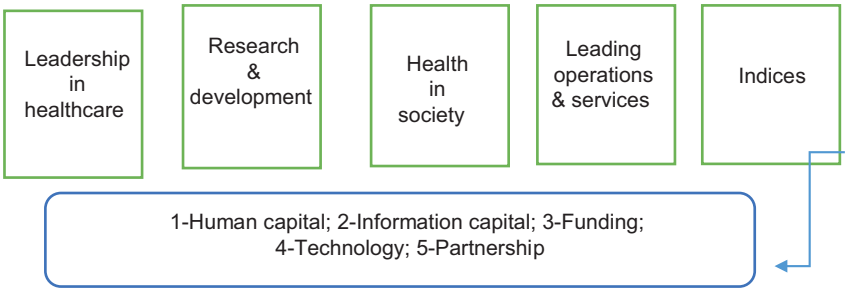

FIGURE 1. Health and Prevention's Innovation Strategy in Healthcare 2019–2021.
Source: Moè.[40]

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

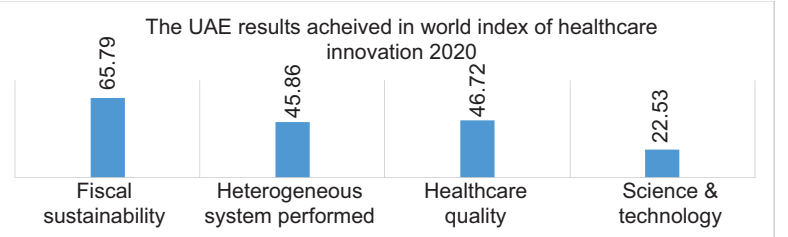

FIGURE 2. The UAE results achieved in world index of healthcare innovation 2020. Source: Oeij et al.[41]

Based on the 2020 WIHI annual report, the UAE ranked 20th globally for innovation in healthcare, with a total score of 45.23 as explained in fFigure 2.. The highest result achieved in the axis of fiscal sustainability was 65.79, while the result in heterogeneous system performance was 45.86, which could be considered low. However, the achieved result in health quality was 46.72 points, which was in the medium range. Regarding science and technology, the UAE achieved 22.53, also in the medium range according to the international measurement standards adopted. Furthermore, my findings show that technological innovation initiatives favor the improvement of these variables by contributing to healthcare and enhancing domestic production. On the other hand, some innovation experts have criticized implementing innovation goals, citing the difficulties that arise from a lack of cooperative coordination between the public and commercial sectors in integrating these strategies with human development indicators are explained in Figure 3.

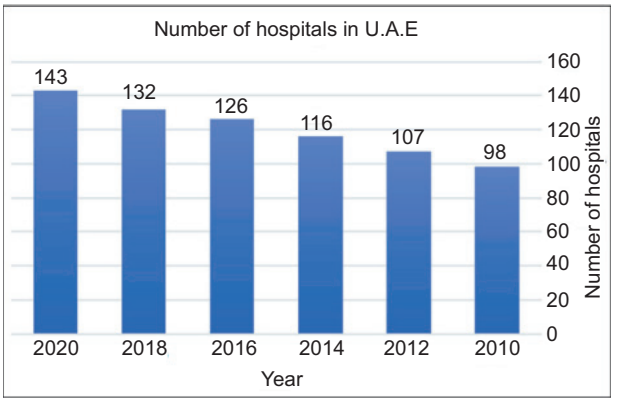

FIGURE 3. Number of hospitals in UAE.

Healthcare sectors in UAE

The UAE's healthcare industry, which includes a fully government-funded healthcare system and a rising commercial health sector, offers citizens high-quality healthcare. The government and emirates regulatory authorities oversee this industry, and the number of hospitals and other healthcare institutions is growing yearly. As a result, the UAE has a life span of 76.8 years, comparable to that of North America and Europe.[17,42–45]

The UAE was the first country in the world to develop a ministry of state for innovation capabilities in 2022, demonstrating that the UAE is constantly at the forefront of global technology. The fundamental purpose of this ministry is to offer the government an appropriate investment and innovation environment and promote health system adoption in the country and across sectors.[15] In the healthcare industry, innovation is gradually introduced, with rigorous efforts to ensure its success. Hospitals can provide medical services at a lesser cost to attract new clients by taking information. This gives the perception that the patient will obtain higher-quality healthcare, establish trust, and have a better sense of happiness. Compared to their public or government equivalents, private clinics are the chosen healthcare professionals for clients.[14,46,47]

The health department is promoting the creation of new private hospitals to follow the ministry's defined norms and policies to maintain high

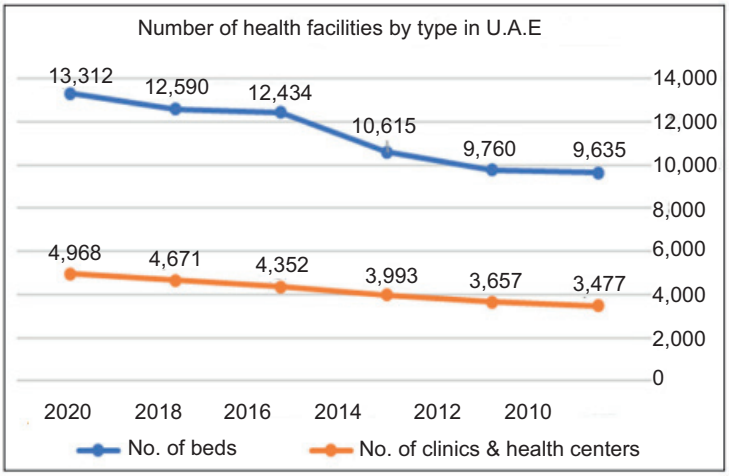

FIGURE 4. Number of health facilities in UAE.

health standards. This program aims to understand the competitive atmosphere that will improve the country's health services. In contrast, the UAE government has opened 106 basic health centers to bring healthcare closer to the people.

Innovation technology KPIs in health

According to the report on digital transformation in the UAE issued by the communications regulatory authority and the digital government in 2020, the health sector launched several innovative technological projects related to health, including[4,14]:

- Introduced a system to provide all medical information based on artificial intelligence technology to analyze patients' data and predict the incidence of diseases while the number of doctors and nurses using this system has reached 15,000.
- Smart robotic pharmacy launched using four robots to prepare and dispense medicines within 8–12 s for one drug, serving 100,000 patients annually.
- An integrated digital platform to provide treatment services through smart communication contains medical records for patients and is linked to the national identity; the platform provided treatment services to 3800 patients in the first 4 months since its launch.

Related to the results of World Index Innovation in 2021, UAE achieved 22.22 points in Health Science & Technology as explained in Figure 4. Based on the information issued by the Ministry of Health and Prevention the data refers that several innovative technology initiatives were implemented:

- Smart platform and portal in 2019 for visiting doctors to provide services 24/7.
- Using a robot in the field of obstetrics and gynecology by performing three surgeries in less than an hour in 2019.
- Device creation (STREP A2) in 2020 for a rapid examination to detect seasonal influenza in a period not exceeding 13 min to get the result.
- Innovative project (PaCE) in 2020 for analyzing the huge data in health facility management using artificial intelligence.
- Innovation project technology (CCHD) in 2020 for early screening of congenital heart anomalies in newborns.

- Technology innovation (DPI) in 2020 relied on laser beams to check for COVID-19.
- Integrated technical linkage of national ambulance services with emergency departments in 2020.
- Platform to measure the happiness index and the well-being of patients and the medical team in 2020.
- Providing an innovative technological service in 2020 for medical consultations through video communication with doctors outside the country includes 15 hospitals.
- Using innovative technology (REZUM) in 2020 to treat an enlarged prostate; the procedure takes 5 to 10 min.
- Smart Apps (Care) in 2021 to track and follow-up on COVID-19 patients' cases.
- Smart Apps (AL HOSN) in 2020 that linked to the digital identity, including all data related to citizens, residents, and visitors, the results of COVID-19 examinations, vaccination data, and all instructions and alerts related to the Coronavirus.
- Introduced an Innovative device (Dr. INVIVO) in 2020, including 3D bioprinting for treating diabetic foot patients, chronic wounds, and burns.
- Launching an integrated technical unit for medical training based on the simulation system to train medical staff to confront COVID-19 challenges.
- Smart Apps (WE ARE CARE) in 2021 to enhance medical staff's mental and physical health.
- Used a medical robot (Da Vinci) to perform operations for women, as 135 surgeries were performed from 2019 to 2020.
- Provided innovative program (ALIN IQ CDS) in 2020 using artificial intelligence that supports clinical decisions for patients, assists in the diagnosis, and reduces medical risks to improve healthcare quality.
- A preventive health platform in 2020 based on an artificial intelligence sensing system for patients with heart and genetic diseases that measures and shows the body's health indicators and sends alerts in case the body is at risk.
- Smart Apps (CARE4TODAY) in 2021 providing healthcare for digestive patients.
- Smart Apps (CARE4TODAY RECOVERY) in 2020 provides healthcare to patients after their surgeries, where doctors can follow-up on their cases and communicate with them during recovery.
- Used a medical robot (CORNDOS) in 2019 for medical surgeries.
- An innovative project to (M-JIN) in 2019 to detect genetic diseases in newborns.
- Smart Apps (LIFE) in 2019 to donate organs using blockchain technology under the supervision of the Ministry of Health allows those wishing to register to donate their organs after death, as this initiative provides life for 11,000 patients.
- Smart Apps in 2019 allocated for vaccinations, as it allows the community and families to follow the vaccination schedules for their children, adults, and travelers through smartphones.
- Virtual reality was utilized in 2018 for children affected by stroke, Parkinson's syndrome, and developmental disorders to devise a training and rehabilitation system that helps them move and practice movement-based exercises.
- Providing an innovative device to the health sector in 2021 to detect and diagnose concussive injuries within 15 min to provide accurate results by 95.8% to enhance the quality of healthcare and maintain patient safety by using the test (I. STAT Anility TBI High Intensive an emergency section.
- Providing innovative digital solutions in 2019 based on virtual reality for

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

schizophrenia patients using GEAR BY OCULUS technology.
- Smart Apps (UAE RADAR) in 2021 for pharmacological awakening and includes a technical program (Monitoring Center) to raise awareness of the side effects of drugs to enhance community safety and health awareness for the patient.
- Based on the National Innovation Strategy provided an initiative to develop the pharmaceutical, biotechnology, and life sciences industries in 2015.

METHODOLOGY

This study draws on data acquired by examining the previous literature's ideas and viewpoints. Using qualitative research, data were gathered through interviews with 90 experts and professionals working in this industry in the UAE to understand the primary issues better. In addition, semi-structured interviews with HDI professionals in the UAE's healthcare sectors were conducted in the study. The primary goal of conducting interviews was to learn about the UAE's human development indicators in the healthcare sector and elucidate the role of innovation capabilities in achieving and improving the UAE's human development indicators. In addition, the health sector's strengths and weaknesses were highlighted as one of the objectives of this research. This enabled the researchers to confirm or refute the assumptions and determine the relationship between innovation capacity and HDI.

Furthermore, based on previous reports from 2014 to 2020, employed a case study concentrating on UAE human development KPIs to assess the strengths and limitations of the UAE's HDI connected to healthcare sectors and comprehend the difference between the UAE and more advanced countries. Furthermore, the study relies on secondary data from publications, journals, books, and websites. Besides qualitative data collected by interviews, a comprehensive literature search with famous keywords such as "innovation capabilities," "HDI," "Capacity building in the healthcare sector," and "Global health index" revealed several results, and then the information was filtered to gather and arranged scientifically to be content analyzed and included in this study as a focal point reference.

Interviews

To more completely recognize the primary dilemmas involved, the current study used semi-structured interviews with UAE HDI experts in healthcare sectors, and data were obtained through interviews with 90 experts and professionals working in this field in the UAE. The mentioned human development economic, demographic, and health inequities exist. Second, organize these gaps into general categories based on interviewees' suggestions. Finally, determine potential gaps and issues, and offer remedies. Semi-structured interviews were employed in this study, with open-ended questions providing some framework but giving interviewers ample time to generate new insights.

Furthermore, semi-structured interviews allow for a more in-depth analysis of the UAE's healthcare system's human development and the concerns and challenges it faces. From March 24 until June 20, 2022, research was conducted. This interview had nearly 12 questions that met the study's requirements. Each interview lasted at least 30 to 45 min, with a panel of 4–6 specialists. Answers were recorded in a notebook or in short films, which helped us explain the results at the conclusion. The answers were later transcribed and back transcribed for content validity. After transcriptions were ready, study authors analyzed content to form answering patterns related to study objectives.

Participants

The authors gathered interviews from 90 people using purposive sampling, with a balanced gender distribution and a wide range of previous qualifications. The study catches several viewpoints on human development in the healthcare sector in

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

this interview. Participants were chosen for their professional and relevant experience, their readiness to contribute their perspectives on the UAE's attempts to change its sector into a knowledge society, and the country's human development issues and priorities. More specifically, the study chooses the sample of policymakers, practitioners from the healthcare sector, and employees with relevant experience will leads towards better and relevant information gathering related to the human development index. Using a purposive sample strategy, the authors could gain an in-depth understanding of the respondents. Over half of the participants had experience in two or more sectors, giving the study a lot of depth and meaning.

RESULTS

Demography

SPSS was used to analyze the data. According to the current study, the specialists in the healthcare sector in the United Arab Emirates altered all demographic variables throughout the experiment as presented in Table 1.

Table 2 shows the results of the technological infrastructure readiness KPIs for the percentage of the availability of information on government agencies between 2012 and 2020 that affect human development and societal well-being. The table shows that society's access to health information reached 31.62% in 2020. Regarding the availability of information related to goods and services, the UAE achieved 45% in 2018, such as the rapid technological developments, which can vastly contribute to improving areas of human development. Moreover, this finding accords with Deffinika et al. (2021). They found that the development of innovative technological systems according to the concept of human capital theory has become more participatory and integrative, which has significantly improved society's quality of life and enhanced human development.

TABLE 1. Demographic statistics.

Demography	No. of responses	%
Male	70	78
Female	20	22
25–35	55	61
Above 35	35	39
Employees	45	50
Patients	45	50

Innovation capabilities interrelation with HDI KPIs of Healthcare (2014–2020), Funding KPIs for Health, Leadership KPIs in Healthcare, Health KPIs in Societies

As explained in Table 3, the ratio of carbon dioxide emissions to the average per capita ton reached 20.95 in 2015, declining to 20.80 in 2019. The air pollution impact on health reached 1.72 in 2020; unsafe water, sanitation, or hygiene achieved 144.2 points in 2020; and population using unsafe or unimproved sanitation was 1.33% in 2020. Unsafe water, sanitation, and hygiene-attributable deaths (per 100,000 pop.) were 2.95 in 2020. The incidence of tuberculosis (per 100,000 population) rate was 0.7 in 2015, and in 2020 it was 1.00, while the percentage of tuberculosis effective treatment coverage was 74% in 2015, it increased to 76.6% in 2020. Malaria cases/100,000 pop were zero in 2020. The age-standardized rate of years lived with disability from communicable diseases, excluding maternal

TABLE 2. Readiness of technological infrastructure in government sectors (during 2012–2020).

Components	2012	2014	2016	2018	2020
Health information	39%	39%	28%	27.90%	31.62%

TABLE 3. Innovation capabilities interrelation with HDI KPIs of healthcare (2014–2020).

Innovation capabilities	**Innovation capabilities interrelation with HDI KPIs of healthcare (2014–2020)**						
UAE National Innovation Strategy 2015 (health sector)	**Funding KPIs for health**						
	Health components	**2016**	**2017**	**2018**	**2019**	**2020**	
	Health budget (billion AED)	3.835	4.2	4.5	4.4	4.84	
	% of the federal budget allocated to health	8%	8.6%	7.4%	7.3%	6.8%	
	Universal health coverage	63%	76%	76%	76%	76%	
	Health expenditure % GDP	3.5%	4.1%	4.2%	4.2%	4.2%	
	UAE total budget allocated for health & prevention expenditure in 2020 was 4,315,043,000 AED, for staff remuneration was 2,500,000,000 AED, and for health goods & services expenditure was 1,815,043,000 AED. The healthcare expenditure per capita was 1.323$ in 2015, while it increased to 1.907$ in 2020.						
	Leadership KPIs in healthcare						
	Health components	**2016**	**2017**	**2018**	**2019**	**2020**	
	International health regulation (IHR) capacity & health emergency preparedness	90%	90%	91%	96%	96.7%	
	Regarding global health leadership, UAE was ranked 20th, with 45.23 points. UAE was ranked 1st globally in 2021 for health IT adoption COVID-19 pandemic performance. UAE achieved 1st rank in GCC for 32 health KPIs, was 1st Arab country in 25 health KPIs, was 1st regionally in 23 health KPIs, and was 1st globally in 12 health KPIs. The average of 13 International Health Regulations core capacity score achieved was 91% in 2015. However, it increased to 96.7% in 2020.						
	Health KPIs in societies						
	Health components	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
	Life expectancy at birth (years)	77.2	77.6	77.8	78	78	78
	Maternal mortality ratio	6%	4%	3%	3%	3.2%	3%
	Under 5 mortality rate	7%	7%	7.6%	6.8%	6.5%	7.6%
	Neonatal mortality rate	4%	4%	4%	3.7%	3.6%	4%
	Suicide mortality rate	1.1	1.3	1.5	1.6	1.4	2.7
	% vaccinations* completed dose (Rota C) disease below 1 year	87%	92%	90%	99%	92%	86%
	% Measles – containing – vaccine 2nd dose (MCV2) immunization coverage by the nationally recommended age	99%	98%	97%	95%	94%	92%
	% Pneumococcal conjugate vaccines (PCV3) immunization coverage among 1- year olds	99%	99%	96%	99%	99%	84%
	% Hib (Hib3) immunization coverage among 1- year olds	99%	99%	98%	99%	99%	90%

(continues)

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

TABLE 3. Continued

Innovation capabilities	Innovation capabilities interrelation with HDI KPIs of healthcare (2014–2020)						
	The death rate due to road traffic injuries	6.5	6.1	6.1	3.8	3.0	4
	Mortality rates attributed to unsafe water	0.1	0.1	0.1	0.1	0.1	1.3
	The proportion of the target population covered by all vaccines	100%	100%	99%	99%	99%	99%
	% Of diabetic cases	14.2%	11.4%	12%	10.3%	10.3%	11.8%
	% Estimated antiretroviral therapy coverage among people living with (HIV)	73%	58%	57%	52%	48%	85%
	Obesity in adults (18+ years)	37.2%	37.2%	27.8%		27.8%	31.7%
	Mortality rate per 1000 (age 5–14 years)	1.38	1.4	1.4		1.5	1.5
	The mortality rate of infants per 1000 live births	6.7	6.6	6.6		6.4	7.5
	Adolescent birth rate per 1000 (2015–2020)	28.4					
	Adolescent fertility rate (2015–2020)	1.7					

and neonatal disorders and nutritional deficiencies, achieved 341.5 points in 2020. Ministry of Health (MOH) implemented the national program for universal periodic examination for early detection of noncommunicable diseases to prevent future planning from providing the best healthcare to understand the everyday medical needs of patients with cardiac, diabetes, cancer, and lung diseases recorded 100% in 2020. MOH provided Sotrovimab – VIR 7831 drug authorized for COVID-19 patients who are over 12 years to use in an emergency, which contributed to reducing the number of deaths up to 85%. The healthy life expectancy average was recorded at 63.1 years in 2019. The adult The health outcomes recorded 60% in 2020. In comparisoctive health achieved 85% in 2020. An estimate of the current 15-year-olds who will not survive until age 60, based on the age-specific death rates for the age groups between 15 and 60, was 63%. The percentage of children aged 12–23 months who received DPT vaccinations before 12 months or at any time was 99% in 2020. The percentage of cardiovascular disease was 82% in 2016; it reduced to 74.2% in 2019. While the percentage of cancer disease was 25.3% in 2016, it increased to 33.3% in 2019. The rate of chronic respiratory disease was 0.8 in 2016, and it increased to 0.9 in 2019. The number of vaccinations* below 1 year was 1,694,531 in 2016 and decreased to 1,382,993 in 2019. The age-standardized rate of years lived with disability from depressive disorders recorded 457.7 points in 2020. The percentage of people who have any health problems that prevent you from doing things people your age normally can do was 90% in 2020. The percentage of children aged 12–23 months who received hepatitis B vaccinations before 12 months or at any time was 99% in 2020. The rate of age-standardized disability-adjusted life years lost from indoor air

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

pollution from household use of solid fuels was 6.6 in 2020. The age-standardized rate of years lived with disability from noncommunicable diseases, excluding mental disorders and substance use disorders, was recorded at 7398.1 points in 2020. The rate of fatal occupational accidents in the labor force was 1.74 in 2020. The percentage of people with physical pain was recorded as 0.7 in 2020. The percentage of children under the age of 5 years whose height is more than two standard deviations below the median for the international reference population ages 0–59 months was 7.29 in 2020, while it was reduced to 3 in 2021. The percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously was 2.6 in 2020. The prevalence of undernourishment was 3.09 in 2020, while it slightly increased to 3.1 in 2021. The prevalence of wasting in children under 5 years was recorded at 5% in 2020; it reduced to 1% in 2021. The 18+ population with raised blood was 21% in 2020. The 15+ population who currently smokes any tobacco product regularly recorded 27.8% in 2020. The rate of age-standardized disability-adjusted life years lost from unintentional injuries, excluding the adverse effects of medical treatment and exposure to forces of nature, achieved 1.100 in 2020. Deaths from infectious diseases (deaths/100,000) recorded 70.2 in 2020. The percentage of adults and children on antiretroviral therapy among all adults and children living with HIV was 55.3% in 2020.

Loading operations and services KPIS in healthcare sector

Health problems in the community decreased to 90%, while the level of community satisfaction with healthcare was 90% in 2020, whereas the rate of access to basic health services was 69.7%. The percentage of health facilities that meet international accreditation standards was 75% in 2020. However, the percentage of positive health in the community was 85%, and emotional well-being was 70% in 2020. Related to the results of World Index Innovation in 2021, UAE achieved 56.7 points in the affordable health insurance; however, in freedom to choose healthcare services, it achieved 36.2 points. Regarding the COVID- 19 vaccine doses, UAE provided 21,721,731, and the percentage of the population who received fully vaccinated was 89.85% until November 2021.

Regarding Medical assistance, UAE achieved 273.17 points in 2020. Launched initiatives related to human development goals, including an initiative (Your Help) to provide integrated healthcare services for the elderly. The information issued by the Ministry of Health and Prevention 2019 refers to launching an initiative to empower women's health services aimed at increasing health services visits to 70%. The percentage of births attended by personnel trained to give the necessary supervision, care, and advice to women was 99.9% in 2020. The antenatal care coverage of at least four visits was 99.9 in 2015, declining to 97.3% in 2020. While the percentage of women aged 15–49 years attended to at least once during pregnancy by some skilled health personnel (doctor, nurse, or midwife) was 100%. The number of government & private clinics & health centers was 4352 in 2015, while it increased to 4696 in 2019. The primary healthcare facilities per 10,000 population was 0.1 in 2015, and increased to 3.8 in 2019. The hospital beds per 10,000 population were 13.6 in 2015, and increased to 17.8 in 2019.

Research & development KPIS in health

The Council of Ministers approved the establishment of the National Center for Health Research following Ministerial Resolution No. 250 of 2020 and presented the National Strategy for Health Research in cooperation with the Australian Monash University (MOHP, 2020). Also, the Ministry of Health and Prevention signed an agreement with New York University to support research activities in the health field in 2020. Developing an innovative treatment using stem cells for COVID-19 patients, where the study observed 73 cases conducted, and all achieved recovery and reduced the risk of death, this innovation research obtained a patent in 2020.

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

TABLE 4. Leading operations & services KPIs in healthcare.

Leading operations & services KPIs in healthcare						
Health components	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
No. of government & private hospitals	126	132	143	145	151	169
Physicians per 1000 people	2.2	2.3	2.4	2.5	2.5	2.6
% population using at least basic sanitation services	98.6%	98.7%	98.8%	99%	99.1%	99.2%
% population using safely managed sanitation services	91.8%	93.8%	95.8%	97.9%	99.1%	99.2%

Moreover, to promote R&D in health, UAE introduced the EMIRATI GENOME program, which aims to develop an integrated genetic reference map to identify genetic diseases and mutations in the community; the program will also depend on studying the genes of society by using modern technologies and artificial intelligence to sequence and transmit DNA. Moreover, it assists to set expectation diseases and provide prevention plans based on genetic analysis results (Abu Dhabi Government Media Office, 2021).

Moreover, established Dubai Science Park to enhance medical research https://dsp.ae/. In addition, the Center for Public Health Research at New York University Abu Dhabi provides the Public Health Research Center (PHRC), which has developed several specialized research centers that address common health issues such as Diabetes Research Center, Obesity and Genetic Predisposition Research Center, and Smoking Cessation Research Center. Also, the Ministry of Health and Prevention established the Health Research Bank in 2016, to contribute to supporting scientific research in various fields of medicine and health, following the highest international and national standards and requirements. So, the Research Bank represents a single platform for all researchers, to facilitate access to all medical research conducted within the UAE. Based on the statistics in table 4, issued by the Ministry of Health and Prevention, the UAE has exceeded the average growth of medical research recorded in the Gulf region by about 86%, while the growth rate of medical research in the country has been recorded at 157%. However, the total number of medical research was 5914 from 2014 to 2018.

Human capital KPIs in health

Based on data presented in table 5 and table 6, the data issued by the Federal Competitiveness Authority 2019–2021 & United Nations annual reports for HDI, the density of graduates in health educational institutions (per 10,000) was 90 from 2016 to 2017, while it increased to 96 in 2019. The female tertiary share of graduates in the Health and Welfare program in UAE was 77% in 2014, the rate increased to 81.09% in 2017. While the % of tertiary graduates in Health & Welfare program were 6.6% in 2014, the rate increased to 7% in 2017. Physician density refers to the number of medical doctors (physicians), including generalist and specialist medical practitioners, who were 1.56 per 1000 people in 2020. The composite measure based on (1) the concentration of physicians, (2) the concentration of dentists, and (3) the concentration of nurses and

TABLE 5. Research & development KPIs in health.

R&D	**Research & development KPIs in health**					
	Health components	**2014**	**2015**	**2016**	**2017**	**2018**
	Number of health research outputs – UAE	678	955	1156	1378	1747
	Number of health research institutions – UAE	18				

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

TABLE 6. Human capital KPIs in health.

Human capital	Human capital KPIs in health						
	Health components	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
	The proportion of births attended by skilled health personnel	99.9%	99.9%	100%	100%	100%	99.9%
	No. of physicians in government and private hospitals	20,481	22,195	23,107	24,345	25,414	26,131
	No. of dentists in government and private hospitals	4916	5165	5689	6273	6576	6726
	No. of nurses in government and private hospitals	46,155	51,771	53,915	55,158	56,142	55,945

midwives amongst the adult population was 51% in 2020. The number of pharmacists in government & private hospitals was 5247 in 2015, which increased to 11,827 in 2019. The number of paramedics in government & private hospitals was 17,818 in 2015. However, it increased to 25,928 in 2019.

The human development & innovation indicators in healthcare comparative picture of of UAE 2020–2021 with top performing nations.

Table 7, shows the results of Federal Competitiveness & Statistics Center, UAE Government Portal, Digital, UAE & Global Innovation Index (GII) Reports 2014–2020. In the global human development & innovation indicators 2020–2021 healthcare sector ranking UAE achieved significant goals to improve its position globally.

Figure 4 shows the results of Federal Competitiveness & Statistics Center, UAE Government Portal, Digital, and UAE & Global Innovation Index (GII) Reports 2014–2020. The global human development & innovation indicators strength UAE achieved globally in the 2020–2021 healthcare sector ranking is presented in Table 8.

DISCUSSION

According to the study (HDI), innovative capacities were found to have a crucial impact on human development indicators. However, depending on the strength of the innovative capacity and its linkage and direct impact on increasing competitive human development indicators, this link may be unequal (HDI). The significance of creative capabilities, the extent to which they are tied to healthcare sectors, and their positive impact on boosting HDI have all been debated. However, the qualitative capability of the innovative approach in the healthcare sector has been discovered.[10] In this regard, the study discovered that the innovation strategy helps to support and improve 24 health-related indicators. These findings also back with prior research on the significance of focusing on human development while implementing an innovation strategy and the beneficial relationship between innovation and economic performance. Furthermore, an earlier study has demonstrated that implementing an innovation strategy effectively contributes to improving human development indices, particularly through relying on innovative technologies to deliver healthcare services. Thus confirming the first study objective that innovation capability development is positively associated with HDI improvement in the health sector of UAE has been confirmed by study results.

As a result of the study's findings, previous studies have emphasized the importance and positive role of focusing on human capital as an innovative ability that contributes to improving the results of competitive human development indicators in the fields as mentioned earlier, as well as the fact

TABLE 7. The human development & innovation indicators in healthcare comparative picture of of UAE 2020–2021 with top performing nati.

NO	Health KPIs	UAE Global position	Score	1st Global ranking	NO	Health KPIs	UAE Global position	Score	1st Global ranking
1	UAE HDI ranking	31st	0.890	Norway	19	Death rates age between 15 and 60	21st	63.06	Qatar
2	Healthy life expectancy	91st	63.10	Singapore	20	Death rates age between 15 and 60	47th	1.50	Luxembourg
3	Physician density	72nd	1.56	Greece	21	Communicable diseases	64th	341.5	Australia
4	Adult survival rate	23rd	0.938	Qatar	22	Subjective well-being (average ladder score, worst 0–10 best)	34th	6.3	Finland
5	Probability of survival to age 5	53rd	0.992	Finland	23	Death, injury (road traffic accidents)	162nd	1929	Singapore
6	Life expectancy at birth	47th	77.9	Hong Kong	24	Depressive disorders	35th	457.7	Myanmar
7	Physical pain	45th	0.7	Vietnam	25	Emotional wellbeing	48th	0.7	Denmark
8	Prevalence of stunting in children under-5	55th	7.29	Luxembourg	26	Health services facilities	112th	0.12	Japan
9	Unintentional death and injury	65th	1100	Malaysia	27	Health practitioners and staff	52nd	0.51	Iceland
10	Access to essential services	92nd	69.7	Switzerland	28	Noncommunicable diseases	149th	7398	Singapore
11	Child mortality rate (deaths/1000 live births)	57th	7.59	Finland	29	Obesity	157th	31.7	Vietnam

12	Deaths from infectious diseases (deaths/100,000)	105th	70.2	Austria	30	Raised blood pressure	44th	21.1	South Korea
13	Death rate cardiovascular, cancer, diabetes, chronic respiratory disease age 30–70 years (per 100,000 population)	66th	17	South Korea	31	Smoking	135th	27.8	Ghana
14	Universal health coverage (UHC) index of service coverage (worst 0–100 best)	42nd	76	Canada	32	Access to quality healthcare	37th	3.33	Czech Republic
15	Demand for family planning is satisfied by modern methods (% of females aged 15 to 49)	108th	60	China	33	Child stunting (% of children)	89th	12.2	Germany
16	Infant mortality	45th	7.5	Iceland	34	Household air pollution attributable to deaths (deaths/100,000)	117th	64.1	Finland
17	Medical assistance	39th	237.1	Norway	35	Public expenditure on health (%)	49th	51.58	Norway
18	Hospital beds/10,000 pop.	102nd	12	Japan	36	Universal healthcare coverage index	32nd	76	Canada

that human capacity has a positive impact on global leadership.[14] Other inventive capacities, including R&D, knowledge innovation, and technological innovation, have a similar impact on human development indicators, according to the study, which includes 45 variables from the sectors as mentioned earlier. The findings show that innovative capabilities can improve human development indicators by applying new innovative and creative practices, particularly in health, thereby improving quality of life by providing 37 innovative health services initiatives and smart applications, which also boosts the UAE's HDI in global leadership competitiveness. Indeed, these findings support the second objective, namely, that there is a link between innovation capacities and competitiveness indices based on human development.

The current study further comprehensively identifies 224 KPIs related to human development in healthcare sectors. The study focused on identifying 34 main indicators for the health sectors. As highlighted by the results of these indicators achieved by the UAE between 2014 and 2020, there was a relative disparity like these indicators and the possibility of their impact on other global competitiveness indicators. Regarding the health sector indicators, the study found that the UAE has achieved positive results, especially in financial budgets, community health, and healthcare service KPIs; however, challenges remain to achieve high levels of health sector indicators, such as obesity in adults. Thus, there are also gaps in the health sector indicators related to health research and development compared with other countries, thereby showcasing the need for further improvement. These findings met with the third study's objective to highlight the strengths and weaknesses of the UAE healthcare sector to draw policy implications in helping to achieve greater goals related to sustainable development by the country's leadership.

Implications of study

Theoretically, this study contributes to the importance of innovative capabilities in the UAE's healthcare sector's competitiveness. The study is important because of its focus on human capital theory as a basis for human creative ability that contributes for enhancing competitive skills and abilities in the health sector, as well as the fact that human capacity development has a favorable impact on healthcare sectors workforce as a human capital. According to the study, other innovative qualities, including R&D, knowledge innovation, and technological innovation, have a similar impact on human growth. Moreover, this research delivers valuable information to policymakers, practitioners, and managers in various ways. To begin with, the current study examines the importance of innovative capabilities in the UAE's healthcare sector's competitiveness.

Furthermore, indications in the healthcare sector reveal that the UAE has achieved positive outcomes in this area. However, boosting the sum of these indicators, particularly those relating to research, development, scientific publishing, and knowledge, remain a problem. As a result, the healthcare sector has more positive innovation capabilities and initiatives. The policy-making institutions should focus on indicators such as training and development, creative work environment, and research capacity-building with knowledge sharing attitude among healthcare professionals to be promoted as a policy matter for better-desired outcomes. Future scholars may consider comparative studies of the healthcare sector among top-ranked countries and low-ranked countries to find policy interventions that made the difference. This study is novel in conceptualizing the innovation capabilities and HDI in the health sector. Such research attempts in the literature related to healthcare innovation are scarce. Thus findings of this research will help to generate a new debate among healthcare policymakers about improving the capacity to achieve and strengthen sustainable development objectives nationally and globally.

Limitations and future studies

The current study, like many others, has serious weaknesses that must be addressed in future

TABLE 8. The human development & innovation indicators for UAE 2020–2021 ranking of global healthcare sectors.

#	Components	Health KPIs	UAE Global position	Score	#	Components	Health KPIs	UAE Global position	Score
1	Health	Gender ratio at birth	1st	0.94	9	Health	HIV prevalence, % adult pop.	1st	0.002
2		Antenatal healthcare coverage	1st	100	10		Malaria cases/100,000 pop.	1st	0.00
3		Death and injury from forces of nature	1st	0.00	11		Gender Inequality Index	18th	6.546
4		Diphtheria immunization for Diphtheria, Tetanus, and Pertussis (DPT)	1st	0.99	12		Maternal mortality ratio	5th	3
5		Existence of national screening health programs	1st	100	13		Health facilities	11th	75
6		Hepatitis immunization prevent	1st	0.99	14		Health outcomes	13th	60
7		Measles immunization prevent	1st	0.99	15		Births attended by skilled health staff	12th	99.9
8		Surviving infants who received 2 WHO-recommended vaccines (%)	1st	0.99	16		Birth registrations with civil authority (% of children under age 5)	1st	100

J Popul Ther Clin Pharmacol Vol 29(3):e134–e156; 9 September 2022.

research. To begin with, this study contributes by formulating recommendations that will most likely assist the UAE to enhance its HDI results and advance its worldwide position by focusing on innovative skills related to human development indicators in the healthcare sector. Hospitals and healthcare industries can help raise societal understanding of the importance of markers of competitive human development in future studies. Second, information was gathered through semi-structured interviews. In future studies, researchers can collect data using a survey approach or a disrupted questionnaire. Finally, for more accurate results, researchers can employ the mix-method search. Finally, this research relies solely on the human capital theory. Future research can incorporate multiple ideas to improve accuracy. The data frame of 2014–2020 can be objected to for its generalizability, but it's the only available source with limited resources. Future studies and projects funded by government and policy institutions may consider bigger frames for comparative analysis. Regional comparisons of healthcare sectors between ASEAN and Gulf countries can be very interesting avenues for future researchers.

CONCLUSION

Human capital is one of the resources that may be used to generate new capabilities that will help the government develop the healthcare sector. Furthermore, the health sector contributes to human development by achieving gains that impact society's development, as evidenced by the UAE's Vision 2021, which focused on several strategic priorities as it developed a national agenda, including the addition of online attendance devices in hospitals, setting goals and evaluating healthcare skills and knowledge. As a result, it would be useful to concentrate on these indicators in the future and close the gaps by implementing innovative methods and utilizing innovative talents. Indeed, the study outcomes show that the government can develop programs to close the HDI gap. The best practices and policy implications may be borrowed from top-ranked countries in healthcare indicators for individual sectorial developments. Open resource policy with ample research and development funds can also boost the innovative climate in the health sector. Thus, emerging economies striving to achieve their sustainable development goals may borrow ideas from this research, and the case of the UAE can be observed to draw further policy directions for better societal agenda.

ETHICAL STANDARDS STATEMENTS

Study was confirmed by Dakwah & Human Development Department, University of Malaya. And all of collected data were based on ethical consideration of participation rights.

CONFLICT OF INTEREST

None.

INFORMED CONSENT

None.

AUTHORS' CONTRIBUTIONS

All authors put in the same effort in collecting data, arrangement of study, analysis, and writing of the manuscript.

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