

Chapter Two

Study of Suitability of Undergraduate Health Education Outcomes in Terms of Numbers and Specialties for Market Needs and Development Plans

Introduction

One of the most prominent challenges that face the health system in the Kingdom of Saudi Arabia is the shortage of qualified national health cadres, and probably the competency of the university health education institutions graduates and tuning them up to the job market. In addition, there is a growing increase in population of citizens and expatriate residents that requires a comparable increase in health cadres, and consequently, it is necessary to activate the role of undergraduate health education institutions through the development of its mechanism to promote the size and adequacy of health cadres needed by the job market and to fulfill the requirements of health development for society members. Therefore, the importance of the study of the suitability of university health education outcomes to market need and development plans is clearly evident. It should be one of the important tracks in this project that aims at formulating a strategic plan for the university health education in the Kingdom of Saudi Arabia for the next 25 years.

Objectives of the Study:

1. The assessment of the existing situation of the workforce in the governmental and private sectors in all health specialties.
2. The estimation of the size of future demands of workforce in the health field till the year 1452 H.
3. Investigating the suitability of university health education outcomes in terms of numbers and specialties to market needs till the year 1452 H.

Procedures:

The study included the conduction of several major steps in logical sequence with the nature and style of the study. These are as follows:

1. Analyzing the existing situation for workers in the governmental and private sectors in all health specialties through surveying the workforce in the health field.
2. Specifying the number of students in health colleges in the kingdom and their outcomes at present and during the next 25 years.
3. Specifying the number of students studying abroad in health specialties either they are on governmental scholarships or on their expense.
4. Predicting the expected population growth in the kingdom for the next 25 years based on the census of 1425 H (2004) in the Kingdom of Saudi Arabia.
5. Estimating the current ratios of health workers compared with population, and estimating the percentage of Saudis among them.
6. Selecting the appropriate required ratio of health worker compared with population that the kingdom should achieve in the end of the next 25 years. This ratio should be compared with the ratios in countries with a growth rate similar to that of the kingdom based on the classifications of the World Health Organization (WHO).
7. Delineating a ratio for possible saudization after the next 25 years, and then delineating the number of required health education graduates to reach these ratios. In this context, the percentage of 90% was suggested, and accordingly, the number of graduates of education was postulated to achieve these percentages.

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Study Limitations

The study depends heavily on the statistics issued by various health sectors to recognize the existing situation, and consequently, an outlook of the future needs of the job market is established. The study team had hard time finding accurate and detailed statistics about workforce in the health field since the available statistics are limited and abridged. This shortage of the statistics provided by the official bodies had been manifested in many ways:

- The incompatibility and perhaps contradiction of statistics from one official body to another in the same category.
- Inaccuracy.
- They do not specify the various health specialties, particularly, the applied medical sciences specialties.
- Inability to differentiate between Bachelor degree holders and Diploma holders especially with applied medical sciences and nursing specialties.
- Appointing employees in jobs out of their specialties (such as appointing radiology technician in a nursing job). This will make the statistics deceptive and inaccurate.

The study team has made tremendous endeavors to obtain statistics as accurate as possible to be used in this study, but the validity of some of the statistics dealing with the existing workforce cannot be recognized. This is considered as one of the major limitations of the study.

Existing Status of the Health Workers in the Governmental and Private Sectors

To recognize the existing situation for health workers in the health field in both the governmental and the private sectors, it was necessary to review all the available statistics and studies in this respect such as the statistics issued by the Ministry of Health, Medical License Administration statistics in the ministry and other statistics from the Saudi Council for Health Specialties.

Many difficulties have arisen in this respect that will show up in the end of the study. When dealing with health professions or workers in the health field, we mean in this case: physicians, dentists, pharmacists, nurses and applied medical sciences specialists (about 20 specialties).

Table (2-1) shows the existing situation for workers in the health field who hold, at least, a Bachelor degree. It is noteworthy to point out that in addition to what have been mentioned in table (2-1) about workers in the nursing profession and applied medical sciences specialties who hold, at least, a bachelor degree, there are large numbers, up to 39,669 in nursing, and 14,355 in applied medical sciences specialties who do not hold the Bachelor degree, and they are appointed on the job of technician. Since the World Health Organization (WHO) tends to raise the level of qualification for workers in nursing and applied health specialties to the Bachelor degree for, at least, 80% of the workers, we introduced these numbers in our statistics to clarify the picture of the current situation of these professions for the reader.

Table (2-1): The number of health workers in the Kingdom of Saudi Arabia who hold, at least, a Bachelor degree.

Category	Governmental Sector ¹		Private sector ²		Total		Grand Total	Percentage of Saudis
	Saudi	Non-Saudi	Saudi	Non-Saudi	Saudi	Non-Saudi		
Physicians	7870	19607	914	12694	8784	32301	41085	21.4
Dentists	935	1399	303	5172	1238	6571	7809	15.9
Pharmacists	1332	944	634	10716	1966	11660	13626	14.4
Nursing ³	2039 ⁴				2039		2039	21 ⁴
Applied Medical Sciences ³	3020 ⁵				3020		3020	

Inspecting table (2-1), it appears to us that the numbers were extracted from more than one source and this explains the difficulties facing the study which can be summarized as the absence of accurate scientific statistics about the workers in health professions in the governmental and private sectors. Also the numbers appearing in some official statistics seem unrealistic to be accepted by someone who has some knowledge of the health field. Also it should be noted that the statistics issued by the Saudi Council of Health Specialties (SCHS) are of variable nature due to the increase of registered and classified numbers as a function of time. In addition, these statistics do not distinguish between the Saudis and expatriates working in the health professions. It is note worthy to point out that the non-Saudis registered with SCHS sometimes leave the work but their names remain registered with SCHS.

¹ Ministry of Health statistics 1425 H.

² General Administration of Medical and Pharmacy Licenses statistics, Ministry of Health.

³ The Saudi Council of Health Specialties statistics.

⁴ Approximate percentage (see page).

⁵ The percentage could not be calculated.

Following the study of all statistical resources made available to us, we have chosen those statistics that we believe they were the most accurate in each element of table (2-1) elements.

Existing Status of Students and Graduates

All internationally-known health colleges are in existence in the Kingdom of Saudi Arabia. These colleges are of different inauguration dates. Some of them were operating for many decades where large number of students graduated and still graduating from them. On the other hand, there are more recent colleges that nobody has graduated from them yet. Some of these colleges are with different teaching systems.

Most of these colleges are governmental that provide a free education at no charge, whereas other private-sector colleges charge annual fees. Some governmental colleges started to apply the parallel education system where students are required to pay fees for education. Tables (2-2) to (2-6) show health colleges in the kingdom.

Table (2-2): Colleges of Medicine in the Kingdom¹:

University	College	Inauguration date	Graduates in the year 1425/1426 H
King Saud University	Medicine	1389 H	253
King Abdulaziz University	Medicine	1395 H	177
King Faisal University in Dammam	Medicine	1395 H	186
Umm Al-Qura University	Medicine	1416 H	111
King Khalid University	Medicine	1400 H	89
University of Jazan	Medicine	1426 H	None
King Saud University for Health Sciences	Medicine	1424 H	None
College of Medicine-Ministry of Health in King Fahad Medical City.	Medicine	1425	None
King Faisal University in Al-Ihsaa	Medicine	1421 H	None
Al-Qaseem University	Medicine	1421 H	None
Taibah University	Medicine	1419 H	None
Al-Taif University	Medicine	1423 H	None
Ibn Sina private college for health sciences in Jeddah	Medicine	1425 H	None

¹ Statistics from health colleges and the Ministry of Higher Education – 1427 H.

Table (2-3): Colleges of Dentistry in the Kingdom¹:

University	College	Inauguration date	Graduates in the year 1425/1426 H
King Saud University	Dentistry	1395 H	152
King Abdulaziz University	Dentistry	1408 H	51
King Faisal University in Dammam	Dentistry	1415 H	None
King Khalid University	Dentistry	1422 H	None
Private College of Dentistry and Pharmacy in Riyadh	Dentistry	1424 H	None

Table (2-4): Colleges of Pharmacy in the Kingdom¹:

University	College	Inauguration date	Graduates in the year 1425/1426 H
King Saud University	Pharmacy	1379 H	253
King Abdulaziz University	Pharmacy	1422 H	None
King Faisal University in Dammam	Pharmacy	1423 H	None
King Khalid University	Pharmacy	1422 H	None
Al-Qaseem University	Pharmacy	1426 H	None
Taibah University	Pharmacy	1426 H	None
Al-Taif University	Pharmacy	1426 H	None
Private College of Dentistry and Pharmacy in Riyadh	Pharmacy	1424 H	None
Ibn Sina private college for health sciences in Jeddah	Pharmacy	1425 H	None

Table (2-5): Applied Medical Sciences Colleges in the Kingdom¹.

University	College	Inauguration date	Graduates in the year 1425/1426 H
King Saud University	Applied Medical Sciences	1396 H	644
Umm Al-Qura University	Applied Medical Sciences	1416 H	111
King Faisal University	Applied Medical Sciences	1415 H	97
King Abdulaziz University	Applied Medical Sciences	1424 H	None
King Khalid University	Applied Medical Sciences	1424 H	None
Taibah University	Applied Medical Sciences	1419 H	None
Al-Taif University	Applied Medical Sciences	1423 H	None
Al-Qaseem University	Applied Medical Sciences	1426 H	None
Hail University	Applied Medical Sciences	1426 H	None
Jazan University	Applied Medical Sciences	1426 H	None
Al-Joaf University	Applied Medical Sciences	1426 H	None

Table (2-6): Nursing Colleges in the Kingdom.

University	College	Inauguration date	Graduates in the year 1425/1426 H
King Saud University	Nursing	1424 H	208
Dar Al-Hikma Private College in Jeddah	Nursing	1420 H	28
King Faisal University	Nursing	1423 H	None
Faqeeh College for Nursing and Medical Sciences in Jeddah	Nursing	1424 H	None

¹ Statistics from the health colleges and Ministry of Higher Education – 1427 H.

Tables (2-7) to (2-12) show the total number of students, registered and graduates for the last 6 years starting from the school year 1421/1422 H in colleges of medicine, dentistry, pharmacy, applied medical sciences, nursing and the scholarship students abroad, respectively, as follows:

Table (2-7): Number of Students and Graduates in Colleges of Medicine¹.

Year	1421/22	1422/23	1423/24	1424/25	1425/26	1426/27
Freshman	1483	1629	1775	1712	1845	2031
Registered	5535	6317	7238	7038	7667	8435
Graduate of previous year	573	459	741	564	644	816

Table (2-8): Number of Students and Graduates in Colleges of Dentistry¹.

Year	1421/22	1422/23	1423/24	1424/25	1425/26	1426/27
Freshman	284	278	320	370	393	398
Registered	965	1124	1226	1370	1554	1627
Graduate of previous year	96	141	144	196	166	203

Table (2-9): Number of Students and Graduates in Colleges of Pharmacy¹.

Year	1421/22	1422/23	1423/24	1424/25	1425/26	1426/27
Freshman	286	250	425	526	549	605
Registered	1480	1425	1600	1792	2069	2267
Graduate of previous year	142	201	209	275	206	253

¹ Statistics from the health colleges and Ministry of Higher Education – 1427 H.

Table (2-10): Number of Students and Graduates in Colleges of Nursing¹.

Year	1421/22	1422/23	1423/24	1424/25	1425/26	1426/27
Freshman	-	-	150	183	395	434
Registered	-	-	190	535	1073	1181
Graduate of previous year	-	-	-	37	65	143

Table (2-11): Number of Students and Graduates in Colleges of Applied Medical Sciences¹.

Year	1421/22	1422/23	1423/24	1424/25	1425/26	1426/27
Freshman	678	631	655	1135	1045	1159
Registered	2818	2950	3219	4025	4613	5074
Graduate of previous year	247	370	350	576	737	872

Table (2-12): Number of Scholarship Students Abroad¹.

Scholarship Students from the Ministry of Higher Education	Scholarship Students on their Expense
1173 Medicine	1098
442 Dentistry	760

Population of the Kingdom of Saudi Arabia

The last census of 1425 H showed that the Kingdom of Saudi Arabia has a population of 22,673,538. Based on this census, and using an annual population growth rate of 2.5% and a mortality rate of 0.228%, an outlook for the population of the kingdom over the next 25 years (from 1427 H to 1452 H) was established. The growth rate in this study was fixed since there

¹ Statistics from the health colleges and Ministry of Higher Education – 1427 H.

is no accurate information about any change in this rate throughout the years encompassing the study. We have chosen 2.5% as the population growth rate since it approximately represents the population growth rate in the Kingdom during the period of 1413/1452 H where the last two censuses for the Kingdom were conducted. Also, no distinction between Saudis and non-Saudis was made since health care should be provided to all residents of the Kingdom regardless of their nationality. Table (2-13) shows the expected numbers of population till the year 1452H.

Table (2-13): Expected Population in the Kingdom.

Year	Estimated Numbers
1425 H	22,673,538
1426 H	23,181,879
1427 H	23,701,617
1428 H	24,233,007
1429 H	24,776,311
1430 H	25,331,796
1431 H	25,899,735
1432 H	26,480,407
1433 H	27,074,098
1434 H	27,681,099
1435 H	28,301,709
1436 H	28,936,234
1437 H	29,584,984
1438 H	30,248,279
1439 H	30,926,446
1440 H	31,619,811
1441 H	32,328,733
1442 H	33,053,543
1443 H	33,794,604

1444 H	34,552,279
1445 H	35,326,941
1446 H	36,118,971
1447 H	36,928,758
1448 H	37,756,701
1449 H	38,603,206
1450 H	39,468,690
1451 H	40,353,578
1452 H	41,258,305

Workforce of health professions need to be introduced to job market

To know the size of health cadres that the undergraduate health education system has to pump in the next 25 years, it is imperative to specify the goals to be achieved within this time frame regarding the future needs of health workforce and the possibility of its Saudization. Through the use of previously shown information in this study about the existing situation of the workers in the health field in the kingdom and the annual growth rate of population, and using specified percentages of health workers to population (The ratio), it was feasible to conceive the future needs and consequently predict the numbers need to be pumped into the job market annually, in order to reduce the ratio of workers to population and to increase the percentage of Saudi workers in health professions to reach 90% after the conclusion of 25 years where the remaining 10% should be devoted to distinguished expatriate health workforce.

A certain criterion (the ratio of the number of workers in the health field to population) has been chosen as an indicator to help determining the size of future needs for health cadres. Although it does not reflect the fairness of distribution between the regions of the Kingdom,

this criterion is considered an important indicator that provides logical estimates for health needs and, in the same time, an appropriate international indicator for strategic planning.

The following tables show the needs of the Kingdom of Saudi Arabia of the workforce of health professions need to be pumped into the job market over the next 25 years to reduce the number of population versus every worker in health professions (ratio) as well as increasing the percentage of Saudi workers in the health field. For this purpose, we constructed a table for each profession or specialty of the health specialties showing the required total number needed to achieve the ratio and the required number of graduates to achieve 90% saudization, and the number need to be added as a replacement for those who leave the work due to death, retirement or other reasons (1%). Each category of the workforce will be presented separately.

To determine the targeted number in this study for each health profession, we calculated the average ratio for some high-income countries (13 European countries, in addition to the United States, Australia, Canada and Japan). The average ratio was also calculated for some intermediate-income countries, including Saudi Arabia, Gulf countries, Iran, Malaysia and the countries mentioned in the study conducted by Dr. Othman AlRabea'a that was presented in the 4th Conference for Gulf Medical Associations, 2-4 Safar 1426 H.

We found that the average ratio for high-income countries was as follows:

Physicians	1:334
Dentists	1:1430
Pharmacists	1:1350
Nurses	1:100

On the other hand, the average ratio for intermediate-income countries was found to be:

Physicians	1:685
Dentists	1:3700
Pharmacists	1:2410
Nurses	1:333

We determined the following ratios as the target ratios for this study. These ratios can be achieved leading to the improvement of health services in the Kingdom. It can be noticed that these ratios are less than the existing situation ratios in countries of the region, but they are still higher than those in the high-income countries:

Physicians	1:500
Dentists	1:2000
Pharmacists	1:2100
Nurses	1:300
Applied Medical Sciences Specialists	1:300 (General ratio, not limited to a particular specialty).

1. Physicians:

Table (2-14) shows the needed number of physicians to cover the future needs of population till the year 1452 H to provide health care, administration, research and education. The ratio (1:500) was instituted as the target ratio that should be achieved after 25 years. The method by which table (2-14) was constructed is as follows:

The population of the kingdom in 1427 H was 23,701,617, the number of physicians amounted for 41,085 physicians and the percentage of Saudis was 21.4%. Dividing the population by the number of physicians yields a current ratio of (1:577); i.e., there is one

physician for every 577 individuals of the population. Since the target ratio is (1:500), the current ratio should be decreased by 3.1% annually or 31% every 10 years, therefore, the ratio in 1428 H will be (1:573.9) and can be achieved via the addition of 1140 physicians to improve the ratio of that year.

If we want to raise the percentage of Saudis to 90%, we have to add 750 physicians in 1428 H. Also, we have to add 432 physicians to compensate those who will leave the job or die or vacate their jobs for other reasons which equal to 1% of the total number. Therefore, the required total number need to be added in 1428 H is 2312 physicians. It is noteworthy to mention that there are 816 graduates of all colleges of medicine (Table 2-7) which have been included in this number.

In the year 1452 H the required total number of physicians to achieve the ratio is 82,517 physicians; i.e., we need double the currently required number of physicians, and this will raise the percentage of saudization to 60% assuming that all graduates were Saudis. But if we wish to raise the percentage of saudization to 90%, then we have to add 25,000 physicians during the next 25 years, and in this case we need 15,040 physicians to replace those physicians who leave the work, die or quit their jobs for other reasons.

Table (2-14): Number of physicians need to be added to achieve required targets.

Year	Ratio	Number of physicians required to achieve the ratio	Required Number to be added to achieve ratio	Number need to be replaced to achieve saudization	Required number to replace those who died or retired	Total number required
1427 H	577	41085	-	-	-	-
1428 H	573.9	42225	1140	750	422	2312
1429 H	570.8	43406	1181	750	434	2365
1430 H	567.7	44622	1216	750	446	2412
1431 H	564.6	45873	1251	750	458	2459

1432 H	561.5	47160	1287	750	471	2508
1433 H	558.4	48485	1325	750	485	2560
1434 H	555.3	49849	1364	750	498	2612
1435 H	552.2	51253	1404	750	512	2666
1436 H	549.1	52698	1445	750	527	2722
1437 H	546	54185	1487	750	542	2779
1438 H	542.9	55716	1531	1000	557	3088
1439 H	539.8	57292	1576	1000	573	3149
1440 H	536.7	58915	1623	1000	589	3212
1441 H	533.6	60586	1671	1000	606	3277
1442 H	530.5	62306	1720	1000	623	3343
1443 H	527.4	64078	1772	1000	641	3413
1444 H	524.3	65902	1824	1000	659	3483
1445 H	521.2	67780	1878	1000	678	3556
1446 H	518.1	69714	1934	1000	697	3631
1447 H	515	71706	1992	1000	717	3709
1448 H	511.9	73758	2052	1500	738	4290
1449 H	508.8	75871	2113	1500	759	4372
1450 H	505.7	78048	2177	1500	780	4457
1451 H	502.7	80274	2226	1500	803	4529
1452 H	500	82517	2243	1500	825	4568

The current number of physicians in 1427 H = 41,085 physicians.

Number of Saudi physicians out of them =8,784 physicians (21.4%)

Ratio of physicians to population = (1:577).

Therefore, the number of population covered by one physician should decrease by 3.1 annually over the next 25 years to reach to the desired ratio of (1:500).

In the year 1452 H, the number of physicians required to achieve a ratio of (1:500) are 82,512 physicians which represent an increase of 41,432 physicians more than their number in 1427 H, i.e., an increase of 101%. If these graduates were Saudis, then the percentage of Saudis will reach 59.8% of physicians at that time.

To achieve a saudization percentage of 90% at the end of 1452 H, we ought to replace 30.2% of the number of working physicians by Saudi physicians (25,000 physicians). This will be materialized by replacing 750 physicians annually in the first ten years, 1000

physicians annually in the second ten years and 1500 physicians in the remaining five years. Since most of the Saudi physicians are young men, a percentage of 1% was used for both retirement and death. Therefore, 15040 physicians will be needed to replace those who will vacate their posts due to death or retirement.

2. Dentists:

Table (2-15) shows the number of dentists needs to be pumped into the job market to achieve the targeted objectives. It is observed that the current number of dentists is 7809 dentists where 15.9% of them are Saudi nationals with a ratio of (1:3035). Taking the target ratio as (1:2000) using the same method utilized in case of physicians in table (2-14), it can be found that 20,629 dentists are needed in the year 1452 H to achieve this target ratio, i.e., an increase of 12,830 dentists over the current number of dentists which represents 164% increase.

Assuming that all added dentists to achieve the target ratio were Saudi nationals, the saudization percentage will be 68.2% in 1452 H, but if we raise this percentage to 90%, then we have to add 4,497 dentists over the next 25 years.

Table (2-15): Number of dentists needs to be added to achieve targeted objectives.

Year	Ratio	Number of dentists required to achieve the ratio	Required number to be added to achieve ratio	Number need to be replaced to achieve saudization	Required number to replace those who died or retired	Total number required
1427 H	3035	7809	-	-	-	-
1428 H	2995	8091	282	100	81	463
1429 H	2955	8385	294	100	84	478
1430 H	2915	8690	305	100	87	492
1431 H	2875	9009	319	100	90	509
1432 H	2835	9341	332	100	93	525

1433 H	2795	9687	346	100	97	543
1434 H	2755	10048	361	100	100	561
1435 H	2715	10424	376	100	104	580
1436 H	2675	10817	393	100	108	601
1437 H	2635	11228	411	100	112	623
1438 H	2593	11665	437	200	116	753
1439 H	2551	12123	458	200	121	779
1440 H	2509	12603	480	200	126	806
1441 H	2467	13104	501	200	131	832
1442 H	2425	13630	526	200	136	862
1443 H	2383	14182	552	200	142	894
1444 H	2341	14760	578	200	148	926
1445 H	2299	15366	606	200	154	960
1446 H	2257	16003	637	200	160	997
1447 H	2215	16672	669	200	167	1036
1448 H	2172	17383	711	300	174	1185
1449 H	2129	18132	749	300	181	1230
1450 H	2086	18921	789	300	189	1278
1451 H	2043	19752	831	300	197	1328
1452 H	2000	20629	877	300	206	1383

The current number of dentists in 1427 H = 7,809 dentists.

Number of Saudi dentists out of them =15.9%

Current ratio of dentists to population = (1:3035).

To achieve the target ratio of (1:2000), the population covered by one dentist should be reduced by one for the first 10 years which is equivalent to 40 dentists annually, then 42 dentists annually over the following 10 years and 43 dentists for the over the last 5 years.

The required number in 1452 H to achieve the target ratio is 20,629 dentists with an increase of 12,820 dentists over the currently available numbers; i.e., an increase of 164%. If all added dentists were Saudi nationals, the percentage of saudization would be 68.2%. To raise the saudization percentage to 90%, it would be necessary to replace 21.8% of the total number of dentists (i.e., 4497 dentists) over the next 25 years. This will be materialized by replacing 100 dentists annually in the first 10 years, 200 dentists annually in the second 10 years and 300 dentists annually in the remaining 5 years.

3. Pharmacists:

Table (2-16) shows the number of pharmacists needs to be added to achieve the study targeted objectives. It is observed that the current number of pharmacists is 13,626 with only 14.4% of them are Saudi nationals. This figure achieves a (pharmacist: population) ratio of (1:1739) which is lower than the targeted number. Therefore, it is not necessary to add pharmacists to improve the ratio till the year 1452 H, but we have to increase the number of Saudi pharmacists to improve the percentage of saudization and to replace those who leave the work due to death or other reasons.

It is noted that the total number of pharmacist in the year 1452 H will be 19,647 pharmacists; i.e., an increase of 6,031 pharmacists (44.3%). If the added numbers of pharmacists were all Saudis, the percentage of Saudi pharmacists would be 40.7% among all pharmacists. If we desired to increase the percentage of Saudi pharmacists to 90%, we need to add 9,686 pharmacists over the next 25 years.

Table (2-16): Number of pharmacists needs to be added to achieve targeted objectives.

Year	Number of pharmacists required to achieve the ratio	Required number to be added to achieve ratio	Number need to be replaced to achieve saudization	Required number to replace those who died or retired	Total number required
1427 H	13626	-	387	136	523
1428 H	13626	-	387	136	523
1429 H	13626	-	387	136	523
1430 H	13626	-	387	136	523
1431 H	13626	-	387	136	523
1432 H	13626	-	387	136	523
1433 H	13626	-	387	136	523
1434 H	13626	-	387	136	523
1435 H	13626	-	387	136	523

1436 H	13779	153	387	138	678
1437 H	14088	309	387	141	837
1438 H	14404	316	387	144	847
1439 H	14727	323	387	147	857
1440 H	15057	330	387	151	868
1441 H	15395	338	387	154	879
1442 H	15740	345	387	157	889
1443 H	16093	353	387	161	901
1444 H	16453	360	387	165	912
1445 H	16822	369	387	168	924
1446 H	17200	378	387	172	937
1447 H	17585	385	387	176	948
1448 H	17979	394	387	180	961
1449 H	18382	403	387	184	974
1450 H	18795	413	387	188	988
1451 H	19216	421	387	192	1000
1452 H	19647	431	387	196	1014

The current number of pharmacists in 1427 H = 13,626 pharmacists.

Number of Saudi pharmacists out of them = 1966 (14.4%)

Current ratio of pharmacists to population = (1:1739).

Since the target ratio is (1:2100), the current ratio will cover the population needs till 1435 H. What is needed throughout this period is the compensation of loss due to death or retirement, and replacement to improve the saudization percentage.

The number of required pharmacists in 1452 H is 19,647. Therefore, it is imperative to add 6,021 pharmacists (44.2%). If all who graduate from the colleges of pharmacy were Saudi nationals, the percentage of Saudi pharmacists will be 40.7%. To raise this percentage to 90%, we ought to replace 9,686 pharmacists (49.3%) of the total, i.e., 387 pharmacists annually.

4. Nursing:

Table (2-17) reveals that the number of nursing workforce is 41,708. This number includes the Bachelor degree holders and holders of other lower degrees for Saudis and non-Saudis. The statistics of the Saudi Council of Health Specialties (SCHS) revealed that the Bachelor degree holders are 2030 nurses, whereas those with lower degrees are 39,679. Since there is no accurate information about the percentage of Saudis working in the nursing specialty, we attempted to find an approximate percentage for Saudis through accounting for those who graduated from the colleges of nursing and departments of nursing in some colleges in the kingdom. We found that the number of graduates is 432 nurses which represent 21%. This percentage is limited to the Bachelor degree holders. Since the majority of workforce in the field of nursing are from Diploma holders or with degrees lower than the Bachelor degree, we found it necessary to include these categories in the statistics shown in table (2-17) where the current ratio is (1:568). The number of nursing workforce is 41,708 and the target ratio is (1:300), therefore, 137,582 nurses have to be available to achieve the target ratio by the year 1452 H. Consequently, the increase in nursing workforce would be 95,774 nurses. If we assume that all the graduates are Saudi nationals, the percentage of saudization will considerably reach 70%.

Table (2-17): Number of nurses needs to be added to achieve targeted objectives.

Year	Ratio	Number of nurses required to achieve the ratio	Required number to be added to achieve ratio	Number need to be replaced to achieve saudization	Required number to replace those who died or retired	Total number required
1427 H	568	41708	-	-	-	-
1428 H	560	43273	1565	600	433	2598
1429 H	552	44885	1612	600	449	2661

1430 H	544	46566	1681	600	466	2747
1431 H	536	48320	1754	600	483	2837
1432 H	528	50152	1832	600	501	2933
1433 H	520	52066	1914	600	521	3035
1434 H	512	54065	1999	600	541	3140
1435 H	504	56154	2089	600	562	3251
1436 H	496	58339	2185	600	583	3368
1437 H	488	60625	2286	600	606	3492
1438 H	476	63547	2922	800	635	4357
1439 H	464	66652	3105	800	666	4571
1440 H	452	69955	3303	800	700	4803
1441 H	440	73474	3519	800	735	4694
1442 H	428	77228	3754	800	772	5326
1443 H	416	81237	4009	800	812	5621
1444 H	404	85525	4288	800	855	5943
1445 H	392	90120	4595	800	901	6296
1446 H	380	95050	4930	800	951	6681
1447 H	368	100350	5300	800	1004	7104
1448 H	354.4	106537	6187	1052	1065	8304
1449 H	340.8	113272	6735	1052	1133	8920
1450 H	327.2	120626	7354	1052	1206	9611
1451 H	313.6	128679	8053	1052	1287	10392
1452 H	300	137582	8903	1052	1376	11331

The current number of nurses = 41,708 nurses.

Bachelor degree holders = 2,039 nurses.

Nurses with degrees lower than the Bachelor degree = 39,679 nurses.

Current ratio of nurses to population = (1:568).

The target ratio = (1:300).

The required number in the year 1452 H to achieve the target ratio is 137,582 nurses with a difference of 95,874 over the current available numbers which represents an increase of 230%. If all added numbers were Saudi nationals, the percentage of saudization would be 69.7%.

5. Applied Medical Sciences Specialties:

Due to the abundance of applied medical sciences specialties and the lack of statistics for each specialty or the lack of accurate statistics in general, we proceeded in this study based on the information and statistics available in the Saudi council of Health specialties (SCHS). These statistics reveal that the total workforce is 17,355 where 3,020 are classified as specialists and the rest (14,335) are classified as technicians. Also these statistics do not distinguish a particular number or percentage for Saudis; therefore, it was not feasible to follow the same procedure used in nursing to calculate the approximate percentage of Saudis for many reasons.

Table (2-18) shows that the ratio in 1427H is (1:1366), while the target ratio was (1:300). It is noteworthy to point out that when dealing with the ratio in applied medical sciences specialties, we intend these specialties comprehensively. If this ratio was calculated for each specialty of applied medical sciences specialties, it will tremendously increase. From table (2-18), we found that we need a total of 137,528 specialists in this field to reach the target ratio of (1:300). Of course we have to add other numbers to replace who leave the work or die as we explained for other professions.

Table (2-18): Number of applied medical sciences specialists needs to be added to achieve targeted objectives.

Year	Ratio	Number of nurses required to achieve the ratio	Required number to be added to achieve ratio	Required number to replace those who died or retired	Total number required
1427 H	1366	17355	-	-	-
1428 H	1324	18303	948	183	1131
1429 H	1282	19326	1023	193	1216
1430 H	1240	20429	1103	204	1307

1431 H	1198	21619	1190	216	1406
1432 H	1156	22907	1288	229	1517
1433 H	1114	24303	1396	243	1639
1434 H	1072	25822	1519	258	1777
1435 H	1030	27477	1655	275	1930
1436 H	988	29288	1811	293	2104
1437 H	946	31274	1986	313	2299
1438 H	901	33572	2298	336	2634
1439 H	856	35771	2199	358	2557
1440 H	811	38989	3218	390	3608
1441 H	766	42205	3216	422	3638
1442 H	721	45844	3639	458	4097
1443 H	676	49992	4148	500	4648
1444 H	631	54758	4766	547	5313
1445 H	586	60285	5527	603	6130
1446 H	541	66763	6478	668	7146
1447 H	496	74453	7690	744	8434
1448 H	456.8	82655	8202	826	9028
1449 H	417.6	92441	9786	924	10710
1450 H	378.4	104304	11863	1043	12906
1451 H	339.2	118967	14663	1190	15853
1452 H	300	137528	18561	1375	19936

The number of applied medical sciences specialists in 1427 H = 3,020 specialists.

Number of technicians = 14335

Total in 1427 H= 17355

Current ratio = (1:1366).

If we take technicians into consideration, and to reach to the target ratio of (1:300) within the next 25 years, the total number at that time will be 137,528, i.e., 7.92 fold the current number.

This means that we can increase the ratio by 42 annually within the first 10 years, 45 annually within the second 10 years and 39.2 annually in the last 5 years. These numbers are gross totals since the percentages of Saudis and expatriates are not clear.

Studying tables (2-14), (2-15), (2-16), (2-17) and (2-18), it is realized that there is a great need for workforces in the health field in all of its specialties, in order to reduce the ratio and to increase the percentage of Saudis among workers in health professions. We previously

specified a target saudization percentage of 90% for this study, but due to many difficulties that may hinder reaching this percentage, we perceive that it is possible to be satisfied with the added numbers to achieve target ratio (these numbers appear in the third column of each previous table), in addition to compensating the shortage due to death or attrition.

In this case, the percentage of saudization will tremendously improve compared to the current percentage, where the achieved saudization percentage will be 60% for physicians, 68% for dentists, 41% for pharmacists and 70% for nurses. In addition, the percentage of Saudis enrolled in various applied medical sciences specialties will greatly improve to reach up to 80%. It is also noticeable that after reaching the target ratio, the number of graduates that are pumped into job market annually will maintain the ratio and increase the percentage of Saudis.

Recommendations

1. The gap between the outcomes of health education and market demand will remain big and will continue even after 25 years.
2. The kingdom of Saudi Arabia will be obliged to bridge this gap by recruiting health workforce from abroad.
3. Despite the acceleration of inauguration of new health colleges in the last three years, the size of outcomes on the short and the long runs is difficult to estimate due to feebleness of these new colleges and the variability in their financial, manpower and capacity capabilities as well as their competition to same market of faculty members.
4. An accurate, updatable electronic database showing the specialty, nationality and other information should be made available in both the Ministry of Higher Education (dealing with the number of students enrolled in health colleges), and in the Ministry of Health (dealing with workforce in the health field in the governmental and private sectors and other related authorities such as the Ministry of Planning and the Saudi Council of Health Specialties). Researchers and specialists should have free access to this database.
5. It is necessary for the Ministry of Higher Education to make agreement with specialized authorities to improve the conditions and incentives of works for certain categories of the specialties suffering from the shortage in national cadres in order to increase the enrollment in them.
6. It is important to revise the way in which women are treated in the health sector in terms of tasks and responsibilities. The regulations should be revised to make more flexible to accommodate more female workers and the salaries should be comparable

to the nature of work and the number of work hours. This will serve in attracting women to various health specialties and sustaining their work for a longer period of time after graduation for the provision of health care.

7. To minimize this gap and to establish the stability of job market and health workers, it is imperative to find other solutions beside opening new colleges and scholarship missions abroad such as naturalization (granting the Saudi nationality) of distinguished categories of expatriate health workforce in a way analogous to that of Canada, the United States and Australia.
8. To bridge the shortage gap in health workforce or to minimize it, we suggest the following:
 - a. Supporting the existing health colleges, especially recent ones, to enable them to graduate appropriate numbers that could be pumped into job market annually.
 - b. Accelerating the establishment of educational hospitals in all universities that have health colleges.
 - c. Establishing a specific mechanism between the Ministry of Higher Education and the Ministry of Health to make ultimate use of the Ministry of Health's hospitals in the educational process.
 - d. The planned expansion in inauguration of health colleges in remote regions of the kingdom to involve graduates in working in these regions.
 - e. The expansion in inauguration of nursing and applied medical sciences colleges due to the grave shortage of workforce in these specialties.

- f. The colleges of applied medical sciences, especially recent ones, should adopt the specialties that are needed by the job market, particularly modern specialties that are not currently available in the Kingdom.
- g. Increasing the qualification of nurses with less than Bachelor degree through pursuing their studies toward the Bachelor degree (Bridging). This degree is the minimum qualification recommended by international health institutions and organizations.
- h. Expanding the scholarship missions for Saudis in health specialties. The should be:
 - As educational missions abroad for Bachelor degree holders from non-health scientific colleges to obtain a health qualification.
 - As internal educational missions to the existing and pending new private colleges. This will include high school graduates and those who obtained the Bachelor degrees in non-health specialties.

The problems of the size of health education outcomes and the admission capacity will be discussed in more detail in chapter five.

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