Components and Public Health Impact of Population Growth in the Arab World

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Abstract

The Arab world, which consists of the 22 member states of the Arab League, is undergoing a rapid transition in demographics, including fertility, mortality, and migration. Comprising a distinctive geographic region spread across West Asia and North East Africa and unified by the Arabic language, these states share common values and characteristics despite having diverse economic and political conditions. The demographic lag (high fertility and low mortality) that characterizes the Arab world is unique, but the present trend of declining fertility, combined with the relatively low mortality, brings about significant changes in its population size. This research aimed to: (i) assess the population growth in the Arab world over 3 time periods, (ii) explore its components, and (iii) understand its public health impact. Data from the International Data Base (IDB) of the U.S. Census Bureau for 3 time periods (1992, 2002, and 2012) in 21 countries of the Arab world were analyzed by dividing them into four geographic sectors, namely, the Gulf Cooperation Council (GCC), West Asia, Maghreb, and the Nile Valley African Horn. The population of the Arab world has grown considerably due to both natural growth and migration. The immigration is pronounced, especially into resource-intensive GCC nations, not only from East Asian and Central African countries but also from resource-thrifty (limited-resource) Arab nations. The migrations within, as well as outside, the Arab world reveal an interesting demographic phenomenon that requires further research: migration flows and trends. However, the transformations in public health statistics related to mortality—the impact of demographic changes—depict a new era in the Arab world.

Introduction

The Arab world has been undergoing transitions [1,2,3] in all fields of life—social, economic, and health—due to changing demographic conditions [4,5]. The achievement of low mortality [1,6] as a result of improvements in medical technologies [4], housing, water quality, sanitation, electric supply, public hygiene, health, and educational infrastructure [7] leads to improved health and quality of life [8], which in turn facilitates values (social and economic), as well as a desire to bring children up with great hope [4]—a sign of fertility transition [2,9,10]. The resultant improvement in population health leads to socioeconomic benefits, as seen in
less developed countries [4]. The demographic transition theory propounds that a large increase in population is due to the gap between birth and death rates during the early stages of industrialization, urbanization, and socioeconomic transformation; this seems to play a role in what is happening in the Arab world today [1,7,9].

A distinctive region both geographically and demographically, the Arab world is spread across two continents (Asia and Africa), has a common language and lifestyle and is coordinated by the League of Arab Nations. Having two thirds of the known petroleum reserves worldwide and given the fast pace of its modernization, urbanization, and economic transformation, the region experiences a rapid growth in population [1], due partly to a natural increase and partly to migration; the latter refers to both internal migration, including inter-Arab movements [5] within the region, and employment-oriented migration from elsewhere [6,11].

The resultant demographic dividend and youth bulge in the Arab world [1,12], characterized by a demographic lag—high fertility and low mortality [13,14]—puts pressure on social, economic, and political institutions to capitalize on the growing pool of potential workers by expanding educational systems, labor markets, housing supply, and health systems to adapt to the needs of people and national economies [1,3]. This, in turn, exerts pressure to decrease the fertility rate faster [2], which is influenced by another set of variables: school enrolment of girls, participation of women in the labor force, wait-hood (delay) in marriage, and formation of smaller families [9]. Thus, the rapid population growth in the Arab world since the 1950s puts pressure on the labor market, education, housing, health, and other public services that influence family formation and future population growth, toward reducing the youth population in the future [15,16,17] while promoting life expectancy [18,19].

The demographic lag exaggerates population growth because the fast transition in mortality rates is not accompanied by a transition in fertility [1,3,6], despite having economic and social development consequences that influence life span and human welfare [4,20]. Thus, population growth is affected by the speed of transition in fertility and mortality, in addition to the associated economic and political changes that determine population movement and urbanization [9]. Components of population growth, namely, natural increase and net migration, have a bearing not only on the demographic transition but also on the socioeconomic and infrastructural development in a country. The Arab world, a union of 22 member states spread across a vast geographic area, experiences natural growth and net migration in varying degrees [6,9] depending on the socioeconomic infrastructure.

The slow pace of demographic transition creates footprints on vital statistics [2], namely, demographic and public health indicators, in turn offering improvements in quality of life, administrative infrastructure, and efficiency of utility networking [4], as an improvement in the population profile results from a combination of variables. Arab countries as a whole progressed remarkably during the second half of the previous century [1,5], as reflected in the reproduction, infant and child mortality, and life expectancy rates. The rapid fall in birth rates [11] as a result of changes in lifestyle—age at marriage, female education and employment, urbanization, nucleation of families, and value systems [1]—signals a new era of demographic revolution (a series of research and development efforts leading to fertility decisions, mortality control, migration laws and regulations, and healthy life expectancy) in the Arab world.

The research questions addressed by this paper are: (i) Is the Arab world witnessing a rapid population growth in tune with the high fertility/low mortality scenario?, (ii) How do the two components (natural increase and migration) operate together to increase the population of the Arab world?, (iii) What interrelationships exist between population growth and public health?, and (iv) Does the increase in population put pressure on other sectors of public health and lifestyle, leading to a realization of, and thus concerted efforts toward, improved living conditions that facilitate healthy life expectancy?
Objectives

This research aims to: (i) analyze changes in population size in the Arab world since 1992, (ii) assess the components of the population growth, and (iii) explore changes in public health statistics over the specified study period.

Methodology

This analysis is based on the International Data Base (IDB) of the U.S. Census Bureau [21] for 3 time periods: 1992, 2002, and 2012 (accessed in June to July 2012). Of the 22 Arab countries included in the Arab League, only Palestine has no data recorded on the IDB. The Arab countries are spread over two continents, Asia and Africa. Those in Asia are divided into Gulf Cooperation Council (GCC) members and nonmembers (West Asia). The six member countries of the GCC include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. The West Asian countries include Iraq, Jordan, Lebanon, Syria, and Yemen. Those in the African continent are divided into Maghreb and others (the Nile Valley African Horn). The Maghreb countries include Algeria, Libya, Mauritania, Morocco, and Tunisia. The Nile Valley African Horn includes Comoros, Djibouti, Egypt, Somalia, and Sudan. This classification has relevance because it reflects geographic, economic, developmental, and infrastructural dimensions as against the classification into three groups on the basis of fertility level [17].

Data on Oman for the year 1992 were not available; thus, 1993 data were used. Similarly, data of on Yemen for 1992 and 1993 were not available, so 1994 data were used instead. Data on Egypt from 1992 to 1995, were also not available, so 1996 data were applied in the analysis. Data on Sudan up to the year 2000 were not available, except for total population. The following calculations [22,23,24] were made with the raw data:

- Population growth rate, the exponential growth rate calculated by using the formula:
  \[ r = \frac{\ln(P_n / P_0)}{n} \]
  Where: \( P_n \) = population at the last census
  \( P_0 \) = population at the previous census
  \( \ln \) = natural logarithms
  \( n \) = intercensal period

- Natural increase, the difference between births and deaths

- Population change, the sum of net migrants (inmigrants-outmigrants) and natural increase

  Efforts were made to interpret fertility rates, including the crude birth rate (the number of births in a year per 1000 midyear population—CBR), total fertility rate (the sum of all births to a woman during her childbearing age, often defined as ages 15–49 years—TFR), and gross reproduction rate (the number of daughters a woman gives birth to during her childbearing period—GRR), as well as mortality rates, including the crude death rate (the number of deaths in a year per 1000 midyear population—CDR), infant mortality rate (the number of deaths of infants (less than one year old) in a year per 1000 live births—IMR), under-5 mortality rate (the number of deaths of children below 5 years old in a year per 1000 children below 5 years old—U5MR), and expectation of life at birth (the expected number of years to be lived, on average, by a newborn at a particular time—\( e_0^0 \)) [25,26,27,28]: these vital statistics reflect the public health scenario in a given population. All the rates were calculated by the U.S. Census Bureau and provided on their online database.

  In addition, the CBR, TFR, and CDR for the Arab world (21 countries together) and for its four sectors were calculated with the PAS software by using the birth rates for individual states.
which were available at the source. The TFR for the sectors and the region were calculated based on the number of births and the age-sex distribution of the population.

Results and Discussion

The population of the Arab world grew from 232 million in 1992 to 360 million in 2012. Of the four sectors, the Nile Valley African Horn has the biggest population, possibly due to its having the largest land area and the large population of Egypt and Sudan. The Nile Valley African Horn accounts for 39.3 percent of the total population of the Arab world. The GCC represents 11.3 percent; West Asia, 24.7 percent; and Maghreb, 24.6 percent.

Population Growth

The Arab world is recognized as a region with a growing population due to the demographic lag—low death rate and high birth rate [6,13,14]. From 1992 to 2012, the population experienced a huge increase (Table 1), which occurred in conjunction with a continuing decline in fertility [1,4,5]. The higher increase in 2002–2012 (76.0 million) compared with 1992–2002 (51.5 million) indicates a quantum of change in the region (an overall increase of 127.5 million people). The window of opportunity brought about by the age structural transition reduces the dependency ratio and increases the working-age population, a demographic bonus resulting from the large supply of human capital [1,12,20] and promoted by the goal of near-replacement fertility levels by half of the Arab countries by 2025 [6]. Gender-wise, the male population increased more than the female population throughout the period; this is explained by the intense male-dominated labor migration from East Asia and Central Africa, especially into GCC states [11], which may alter in the near future with the changing labor laws. A wide growth gap of 3.1 million (1992–2012) between male and female populations was observed in GCC nations. Similar gaps do not exist in the other sectors, indicating that GCC states have a wider gender gap.

The Nile Valley African Horn reported the highest population growth (52 million), followed by West Asia (36 million), Maghreb (22 million), and the GCC (17 million). Egypt and Sudan accounted for most of the population growth in the Nile Valley African Horn (24 million and 23 million, respectively), as did Iraq, Yemen, and Syria in West Asia (13 million, 10 million, and 9 million, respectively), Saudi Arabia in the GCC (9 million), and Algeria and Morocco in Maghreb (9 million and 7 million, respectively). Thus, each sector has at least one member country with a large population. Overall, the growth gap between male and female populations is 2.4 million, with males increased by 76.3 million and females by 73.9 million (24 million and 22 million, respectively, for males and females in 1992–2002; 53 million and 51 million, respectively, for males and females in 2002–2012). The population growth favored males in the GCC and West Asia, and females in Maghreb and the Nile Valley African Horn (Fig 1).

The population of the region grew at an annual rate of 2.19 percent during 1992–2012, which means that 2 persons were added for every 100 persons annually (Table 2), despite a downward trend from 3.0 (1980–85) to 2.1 percent (1995–2000), intermittently affected by migration [6]. The female population grew at a faster rate (2.73) than the male population (2.67). Growth rates increased comparatively in 2002–2012 and remained higher in the Asian sectors; both the male and female populations were higher in the GCC (2.75) than in West Asia (2.60). The male population registered a higher growth rate in the GCC, whereas the female population grew faster in West Asia. Annual growth rates were slightly higher in the GCC during 1992–2002 but reduced further during 2002–2012. Higher growth rates prevailed in Qatar, the UAE, and Bahrain.
Saudi Arabia and Oman, among other countries, reported low growth rates during 2002–2012. West Asia showed equal and moderate growth rates during both periods. Whereas Lebanon experienced lower growth rates, all other countries showed annual growth rates of nearly 3 per 100 persons for both sexes. Maghreb experienced a lower annual growth rate compared with the GCC and West Asia. Mauritania, which is among the Maghreb countries, registered the highest annual growth rate, whereas Tunisia had the lowest. The Nile Valley African Horn had a lower growth rate; this was particularly attributed to Egypt because Djibouti and Somalia had higher growth rates. A declining trend in growth rate was observed in the GCC and Maghreb; in contrast, an increasing trend was seen in West Asia and the Nile Valley African Horn. Thus, the overall increase in growth rate was determined largely by the population size.

### Table 1. Population growth in the Arab world between 1992 and 2012.

| Sectors and States | 1992–2002 |  |  | 1992–2012 |  |  | 1992–2012 |  | Difference between 2002–2012 and 1992–2002 |
|--------------------|----------|----------------|----------------|----------|----------------|----------------|----------|----------------|----------------|----------------|
|                    | Male     | Female         | Total          | Male     | Female         | Total          | Male     | Female         | Total          | Male     |
| GCC                |          |                |                |          |                |                |          |                |                |          |
| Bahrain            | 102323   | 74488          | 176811         | 345755   | 187762         | 533517         | 448078   | 262250         | 710328         | 243432   |
| Kuwait             | 442649   | 237935         | 680584         | 324272   | 238377         | 563009         | 766921   | 476672         | 1243593        | -118377  |
| Oman               | 255313   | 271199         | 526512         | 262290   | 286782         | 549072         | 517603   | 557981         | 1075584        | 6977     |
| Qatar              | 159900   | 79976          | 239876         | 1031074  | 217130         | 1248204        | 1190974  | 297106         | 1488080        | 871174   |
| Saudi Arabia       | 2925953  | 2287336        | 5213289        | 2046648  | 2213817        | 4260465        | 4972601  | 4501153        | 9473754        | -879305  |
| Total              | 4947466  | 3391415        | 8338881        | 5231431  | 3679055        | 8910486        | 10178897 | 7070470        | 17249367       | 283965   |
| West Asia          |          |                |                |          |                |                |          |                |                |          |
| Iraq               | 3126740  | 3009032        | 6135772        | 3620536  | 3504642        | 7125178        | 674276   | 6513674        | 13260950       | 493796   |
| Jordan             | 498480   | 532665         | 1031145        | 784992   | 821840         | 1606832        | 1283472  | 1354505        | 2637977        | 286512   |
| Lebanon            | 127397   | 160034         | 287431         | 143604   | 161222         | 304826         | 271001   | 321256         | 592257         | 16207    |
| Syria              | 2005200  | 1982971        | 3988171        | 2638674  | 2592254        | 5230928        | 4643874  | 4575225        | 9210990        | 633474   |
| Yemen              | 2079988  | 2701465        | 4781443        | 312071   | 3102535        | 6225606        | 5203059  | 5174000        | 10377059       | 1040383  |
| Total              | 7837805  | 7756167        | 15593972       | 10310877 | 10182493       | 20493370       | 18148682 | 17938660       | 36087342       | 2473072  |
| Maghreb            |          |                |                |          |                |                |          |                |                |          |
| Algeria            | 2562779  | 2467303        | 5030082        | 1891083  | 1991509        | 3882592        | 4453862  | 4458812        | 8912674        | -671696  |
| Libya              | 459741   | 474873         | 934614         | 729942   | 758554         | 1488496        | 1189683  | 1233427        | 2423110        | 270201   |
| Mauritania         | 280877   | 308152         | 589029         | 349462   | 377878         | 727340         | 630339   | 686030         | 1316369        | 68585    |
| Morocco            | 1883482  | 2094335        | 3977817        | 1633783  | 1836561        | 3470344        | 3517265  | 3930896        | 7448161        | -249699  |
| Tunisia            | 577264   | 618481         | 1195745        | 474717   | 542626         | 1022679        | 1054681  | 1163743        | 2218424        | -99847   |
| Total              | 5674143  | 5963144        | 11727287       | 5081687  | 5509764        | 10591451       | 10846330 | 11472908       | 22318738       | -682456  |
| Nile Valley African Horn |          |                |                |          |                |                |          |                |                |          |
| Comoros            | 58784    | 64959          | 123743         | 77759    | 85055          | 162814         | 136543   | 150014         | 286557         | 18975    |
| Djibouti           | 68644    | 100622         | 169266         | 21600    | 36438          | 58038          | 90244    | 137060         | 227304         | -47044   |
| Egypt              | 4054806  | 4210495        | 8265301        | 7734420  | 7930620        | 15685040       | 11789226 | 12141115       | 23930341       | 3679614  |
| Somalia            | 910438   | 990106         | 1900544        | 1054603  | 1014278        | 2068881        | 1965041  | 2004384        | 3969425        | 144165   |
| Sudan              | -        | -              | -              | 537995   | -              | -              | 1802303  | -              | -              | -        |
| Total              | 5092672  | 5366182        | 15838807       | 32045040 | 32039095       | 5977806        | 3713771  | 37459277       | 51816613       | 26952368 |
| Arab World         | 23642086 | 22476908       | 51498947       | 52669035 | 51464407       | 75973113       | 76311121 | 73941315       | 127472060       | 2902694  |

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Components of Population Growth

Population change occurred in two ways, namely: (i) through natural increase, the difference between the number of births and the number of deaths in a given population; and (ii) through net migration, the difference between the number of immigrants and the number of emigrants at a given point in time. The overall contributions of natural increase and net migration add up to the existing population, thus contributing to growth.

An analysis of the population change during the last two decades (1993–2002 and 2003–2012) led to the delineation of major developments. According to the U.S. Census Bureau, one of the limitations in interpreting migration flow is the lack of data on place of birth and place of residence, which makes it difficult to understand inter-Arab migration. The region had a higher migration flow from one country to another such that some countries pull in (import labor) whereas others push out (export labor) people [1,6,9,29].

Table 3 shows that during 2003–2012, 2.2 million people out-migrated, whereas 63.9 million people were added due to natural increase. In 1993–2002, 58.9 million people were added—58.7 million through natural increase and 0.2 million through immigration. Although these data cannot explain the population growth for the region as a whole or for the sectors within the region, they explain the population growth in each country. For example, the population change in GCC countries during 1993–2002 and 2003–2012 was due more to immigration than to natural increase [11], especially in Qatar and the UAE. Bahrain and Kuwait had higher growth rates due to immigration during 2003–2012. Thus, the pull factor influenced population growth in the GCC during 2003–2012, except in Oman and Saudi Arabia. The push factor operated in all other countries except Iraq, Syria, and Djibouti during 1993–2002 and except Jordan during 2003–2012. Emigration from some countries, namely, Iraq, Libya, Egypt, Tunisia, and Syria, due to recent political crises also merited attention. The migration trend from rural to urban strengthens urbanization in the Arab world, especially in Kuwait, Qatar, Bahrain, and Lebanon [9,30]. The migrations are classified as adjustment, induced, or forced, and are due to such reasons as house purchase, family size issues, rental issues, and the search for better dwelling or services [31].

The Arab world experiences higher birth rates but lower death rates, resulting in a higher natural increase in population [1]. Compared with 58.9 million in 1993–2002, the natural increase during 2003–2012 was higher at 63.9 million; the Nile Valley African Horn had the
highest rate (26,706,506), followed by West Asia (16,861,688), Maghreb (14,038,003), and the GCC (6,243,292). The natural increase was lesser during 1993–2002, with 58,761,947 persons added to the whole region: the highest increase was in West Asia (19,772,508), followed by the Nile Valley African Horn (19,269,506), Maghreb (13,274,328), and the GCC (6,445,605).

Egypt 15,907,006), Sudan (7,874,268), Algeria (6,411,115), Yemen (6,253,643), Saudi Arabia (4,298,506), and Syria (4,277,992) registered high rates of natural increase. Bahrain (137,778), Comoros (182,512), and Lebanon (480,383) had low rates of natural increase, which the rest of the Arab world intends to follow as they recognize the importance of population growth restriction [3].

Egypt 9,795,111), Sudan (7,417,342), Iraq (6,179,326), Algeria (5,124,772), Saudi Arabia (4,852,884), Yemen (4,701,271), and Syria (4,527,781) also had high rates of natural increase during 1993–2002.

| Sectors and states | 1992–2002 | 2002–2012 | 1992–2012 | Difference between 2002–2012 and 1992–2002 |
|-------------------|-----------|-----------|-----------|------------------------------------------|
|                   | Male      | Female    | Total     | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| GCC               |           |           |           |      |        |       |      |        |       |      |        |       |
| Bahrain           | 2.86      | 2.81      | 2.84      | 6.10 | 4.81   | 5.58  | 4.48 | 3.81   | 4.21  | 3.24 | 2.00   | 2.74  |
| Kuwait            | 4.46      | 3.27      | 3.96      | 2.34 | 2.47   | 2.39  | 3.40 | 2.87   | 3.17  | -2.12 | -0.80  | -1.57 |
| Oman              | 1.96      | 2.81      | 2.32      | 1.68 | 2.30   | 2.00  | 1.82 | 2.55   | 2.14  | -0.28 | -0.51  | -0.36 |
| Qatar             | 4.21      | 4.10      | 4.17      | 11.68| 6.49   | 10.2  | 7.94 | 5.29   | 7.19  | 7.47 | 2.39   | 6.03  |
| Saudi Arabia      | 2.67      | 2.66      | 2.67      | 1.52 | 2.04   | 1.75  | 2.10 | 2.35   | 2.21  | -1.15 | -0.62  | -0.92 |
| UAE               | 5.74      | 4.94      | 5.48      | 4.07 | 3.88   | 4.01  | 4.91 | 4.41   | 4.75  | -1.67 | -1.06  | -1.47 |
| Total             | 3.12      | 2.91      | 3.03      | 2.50 | 2.42   | 2.47  | 2.81 | 2.66   | 2.75  | -0.62 | -0.49  | -0.56 |
| West Asia         |           |           |           |      |        |       |      |        |       |      |        |       |
| Iraq              | 2.98      | 2.93      | 2.95      | 2.61 | 2.59   | 2.60  | 2.79 | 2.76   | 2.78  | -0.37 | -0.34  | -0.35 |
| Jordan            | 2.20      | 2.53      | 2.36      | 2.71 | 2.97   | 2.84  | 2.46 | 2.75   | 2.60  | 0.51  | 0.44   | 0.48  |
| Lebanon           | 0.70      | 0.86      | 0.78      | 0.73 | 0.97   | 0.80  | 0.72 | 0.83   | 0.77  | 0.03  | -0.07  | -0.02 |
| Syria             | 2.58      | 2.66      | 2.62      | 2.62 | 2.66   | 2.64  | 2.60 | 2.66   | 2.63  | 0.04  | 0      | 0.02  |
| Yemen             | 2.49      | 2.58      | 2.53      | 2.86 | 2.93   | 2.89  | 2.67 | 2.76   | 2.71  | 0.37  | 0.35   | 0.36  |
| Total             | 2.55      | 2.61      | 2.58      | 2.59 | 2.63   | 2.61  | 2.57 | 2.62   | 2.6   | 0.04  | 0.02   | 0.03  |
| Maghreb           |           |           |           |      |        |       |      |        |       |      |        |       |
| Algeria           | 1.75      | 1.72      | 1.74      | 1.12 | 1.20   | 1.16  | 1.44 | 1.46   | 1.45  | -0.63 | -0.52  | -0.58 |
| Libya             | 1.86      | 2.08      | 1.96      | 2.38 | 2.62   | 2.50  | 2.12 | 2.35   | 2.23  | 0.52  | 0.54   | 0.54  |
| Mauritania        | 2.50      | 2.56      | 2.53      | 2.43 | 2.45   | 2.44  | 2.47 | 2.50   | 2.49  | -0.07 | -0.11  | -0.09 |
| Morocco           | 1.42      | 1.55      | 1.48      | 1.08 | 1.19   | 1.14  | 1.25 | 1.37   | 1.31  | -0.34 | -0.36  | -0.34 |
| Tunisia           | 1.26      | 1.37      | 1.31      | 0.93 | 1.07   | 1.00  | 1.10 | 1.22   | 1.16  | -0.33 | -0.30  | -0.31 |
| Total             | 1.60      | 1.66      | 1.63      | 1.22 | 1.32   | 1.27  | 1.41 | 1.49   | 1.45  | -0.38 | -0.34  | -0.36 |
| Nile Valley African Horn |           |           |           |      |        |       |      |        |       |      |        |       |
| Comoros           | 2.36      | 2.49      | 2.43      | 2.45 | 2.54   | 2.50  | 2.40 | 2.51   | 2.46  | 0.09  | 0.05   | 0.07  |
| Djibouti          | 2.29      | 3.07      | 2.70      | 0.62 | 0.91   | 0.78  | 1.45 | 1.99   | 1.74  | -1.67 | -2.16  | -1.92 |
| Egypt             | 1.24      | 1.35      | 1.30      | 2.02 | 2.13   | 2.07  | 1.63 | 1.74   | 1.68  | 0.78  | 0.78   | 0.77  |
| Somalia           | 2.58      | 2.84      | 2.71      | 2.34 | 2.26   | 2.30  | 2.46 | 2.55   | 2.50  | -0.24 | -0.58  | -0.41 |
| Sudan             | -         | 2.12      | -         | 4.95 | -      | -     | 3.53 | -      | -     | 2.83  |         |       |
| Total             | 1.39      | 1.52      | 1.63      | 5.97 | 6.11   | 2.93  | 3.68 | 3.82   | 2.28  | 4.58  | 4.59   | 1.30  |
| Arab World        | 1.98      | 2.0       | 2.0       | 3.37 | 3.47   | 3.46  | 2.67 | 2.73   | 2.71  | 1.39  | 1.47   | 0.37  |

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Public Health Impact of Population Growth

Vital statistics relating to both fertility and mortality were considered in exploring the impact of population growth. Changes in fertility and mortality were interpreted as impacts of population growth that influence the public mental set, leading to a realization of population pressures and thereby molding attitudes toward healthy behaviors. Fertility indicators, namely, the crude birth rate, total fertility rate, and general reproduction rate, as well as mortality indicators, namely, the crude death rate, infant mortality rate, under-5 mortality rate, and expectation of life at birth, reflect such a realization.

Fertility

The high level of fertility in Arab countries has been the subject of debate. There is generally a declining trend [1,3] depending on the pace of development and quality of life. For example,
GCC countries improved in terms of socioeconomic conditions and developed lifestyles comparable with those in modernized states; thus, they experienced a higher decline in fertility rates [32] despite the uncertain availability and use of contraception and abortion services [4]. Fertility indicators, namely, the crude birth rate, total fertility rate, and general reproduction rate, registered a decline (Table 4). Whereas the CBR declined from around 25 (1992) to around 15 (2012), the TFR declined from around 4.0 (1992) to around 2.5 (2012), a reflection of the acceptance of population growth restriction by the Arab world [3,33] in line with the Millennium Development Goals [34,35]. The fertility indicators in West Asia were promising, with Lebanon having the lowest levels since 1992 [36], which in turn attracted nearby Syria to follow the trend. Yemen had a higher fertility rate even in 2012, followed by Iraq and Jordan. The Maghreb countries reported higher fertility levels during 1992, but these declined in 2002 and further in 2012; among them, Mauritania had the highest fertility rate, followed by Libya.

| Sectors and States | 1992* | 2002 | 2012 |
|-------------------|-------|------|------|
|                   | CBR   | TFR  | GRR  | CBR   | TFR  | GRR  | CBR   | TFR  | GRR  |
| GCC               |       |      |      |       |      |      |       |      |      |
| Bahrain           | 25.8  | 3.4  | 1.7  | 19.5  | 2.4  | 1.2  | 14.0  | 1.9  | 0.9  |
| Kuwait            | 24.8  | 3.4  | 1.7  | 20.9  | 2.6  | 1.3  | 21.0  | 2.6  | 1.3  |
| Oman              | 32.7  | 6.0  | 2.9  | 24.5  | 3.5  | 1.7  | 24.0  | 2.9  | 1.4  |
| Qatar             | 22.6  | 4.0  | 1.9  | 17.3  | 2.8  | 1.4  | 10.0  | 1.9  | 1.0  |
| Saudi Arabia      | 33.9  | 5.5  | 2.7  | 24.6  | 3.5  | 1.7  | 19.0  | 2.3  | 1.1  |
| UAE               | 24.6  | 4.0  | 1.9  | 16.3  | 2.5  | 1.2  | 16.0  | 2.4  | 1.2  |
| Total             | 32.0  | 4.9  | —    | 22.7  | 3.0  | —    | 18.1  | 2.2  | —    |
| West Asia         |       |      |      |       |      |      |       |      |      |
| Iraq              | 37.2  | 5.8  | 2.9  | 34.2  | 4.6  | 2.3  | 28.0  | 3.6  | 1.8  |
| Jordan            | 34.3  | 5.0  | 2.4  | 28.5  | 3.6  | 1.8  | 27.0  | 3.4  | 1.6  |
| Lebanon           | 22.6  | 2.7  | 1.3  | 16.7  | 2.0  | 1.0  | 15.0  | 1.8  | 0.9  |
| Syria             | 35.5  | 5.3  | 2.6  | 29.5  | 4.0  | 1.9  | 24.0  | 2.9  | 1.4  |
| Yemen             | 43.9  | 7.4  | 3.6  | 40.7  | 6.3  | 3.1  | 33.0  | 4.5  | 2.2  |
| Total             | 37.4  | 5.5  | —    | 33.4  | 4.3  | —    | 27.7  | 3.3  | —    |
| Maghreb           |       |      |      |       |      |      |       |      |      |
| Algeria           | 30.2  | 4.3  | 2.1  | 19.6  | 2.3  | 1.1  | 17.0  | 1.7  | 0.9  |
| Libya             | 29.4  | 4.6  | 2.3  | 22.3  | 2.9  | 1.4  | 23.0  | 2.9  | 1.4  |
| Tunisia           | 24.9  | 3.2  | 1.5  | 16.8  | 2.0  | 1.0  | 17.0  | 2.0  | 1.0  |
| Mauritania        | 41.7  | 5.7  | 2.8  | 37.0  | 5.0  | 2.5  | 33.0  | 4.2  | 2.1  |
| Morocco           | 27.6  | 3.7  | 1.8  | 22.1  | 2.6  | 1.3  | 19.0  | 2.2  | 1.1  |
| Total             | 28.8  | 3.6  | —    | 21.0  | 2.3  | —    | 18.8  | 2.0  | —    |
| Nile Valley African Horn | | | | | | | | | |
| Comoros           | 39.3  | 5.7  | 2.8  | 40.4  | 5.2  | 2.6  | 31.5  | 4.1  | 2.0  |
| Djibouti          | 42.0  | 5.8  | 2.8  | 33.2  | 4.0  | 2.0  | 25.0  | 2.6  | 1.3  |
| Egypt             | 27.9  | 3.7  | 1.8  | 26.9  | 3.4  | 1.6  | 24.0  | 2.9  | 1.4  |
| Somalia           | 39.3  | 5.5  | 2.7  | 47.0  | 7.1  | 3.5  | 42.0  | 6.3  | 3.1  |
| Sudan             | 44.6  | 6.3  | 3.1  | 40.1  | 5.6  | 2.7  | 36.0  | 4.8  | 2.3  |
| Total             | 29.1  | 3.9  | —    | 29.1  | 3.7  | —    | 29.3  | 3.6  | —    |
| Grand Total       | 31.5  | 4.2  | —    | 27.0  | 3.3  | —    | 25.0  | 3.0  | —    |

* Oman, 1993; Yemen, 1994; Egypt, 1996

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Age at marriage and female education, which are determinants of fertility [37], improved in the region, along with a decline in son preference and child deaths.

Mortality

The mortality indicators analyzed and explained here include the crude death rate, infant mortality rate, under-5 mortality rate, and expectation of life at birth. The crude death rate indicates the number of deaths per 1000 people for a particular period (say, a year); this remained high during 1992, especially in Somalia (59.5), Mauritania (14.8), Sudan (14.3), Comoros (11.9), Yemen (11.8), and Djibouti (11.4). Lower death rates were reported in GCC countries, along with Jordan and Syria in West Asia, the Maghreb countries except Mauritania, and Egypt in the Nile Valley African Horn (Table 5). A marked decline of 41.5 points in the crude death rate was noted in Somalia during 1992–2002, whereas a moderate declining trend was

| Table 5. Mortality Indicators. |
|--------------------------------|
| **Sectors and States** | **CDR** | **IMR** | **Under 5 MR** | **Life expectancy** |
| **1992* | 2002 | 2012 | **1992* | 2002 | 2012 | **1992* | 2002 | 2012 | **1992* | 2002 | 2012 |
| GCC | | | | | | | | | | | | |
| Bahrain | 3.6 | 3 | 3 | 23.1 | 15.1 | 10 | 27.8 | 17.9 | 12 | 72.1 | 75.4 | 78.3 |
| Kuwait | 2.4 | 2.1 | 2 | 11.7 | 10.5 | 8 | 14.7 | 12.8 | 9 | 73.5 | 75.2 | 77.3 |
| Oman | 4.4 | 3.7 | 3 | 24.2 | 20.1 | 15 | 33.5 | 27.6 | 20 | 70 | 72 | 74.5 |
| Qatar | 2.3 | 2 | 2 | 13.4 | 8.7 | 7 | 19.1 | 12.1 | 9 | 73.7 | 76.2 | 78.1 |
| Saudi Arabia | 4.4 | 3.6 | 3 | 26.3 | 21.6 | 16 | 31.5 | 25.3 | 18 | 70.7 | 72.1 | 74.4 |
| UAE | 2.9 | 2.3 | 2 | 22.5 | 15.9 | 12 | 26.9 | 18.8 | 14 | 72 | 74.6 | 76.7 |
| Total | 4.1 | 3.2 | 2.7 | | | | | | | | | |
| West Asia | | | | | | | | | | | | |
| Iraq | 7.7 | 6 | 5 | 79.1 | 58.2 | 40 | 100.3 | 72.7 | 49 | 63.9 | 67.4 | 70.9 |
| Jordan | 3.2 | 2.4 | 3 | 33.7 | 20 | 16 | 41.1 | 22.5 | 18 | 76.3 | 79.3 | 80.2 |
| Lebanon | 6.1 | 6.1 | 7 | 32.1 | 21.9 | 15 | 35 | 23.9 | 17 | 69.9 | 72.8 | 75.2 |
| Syria | 4.8 | 4 | 4 | 30.2 | 21.2 | 15 | 36.8 | 25.5 | 18 | 69.5 | 72.4 | 74.9 |
| Yemen | 11.8 | 9.3 | 7 | 81.7 | 70.9 | 54 | 115.2 | 96.1 | 71 | 57.4 | 60.3 | 64.1 |
| Total | 7.7 | 6.1 | 5.3 | | | | | | | | | |
| Maghreb | | | | | | | | | | | | |
| Algeria | 5.2 | 4.4 | 5 | 41.6 | 35.8 | 25 | 47.4 | 40.4 | 29 | 70.7 | 73 | 76 |
| Libya | 5.1 | 3.8 | 3 | 32.4 | 18 | 19 | 39.1 | 20.4 | 22 | 69.2 | 73.3 | 75.6 |
| Tunisia | 5.5 | 5.5 | 6 | 89.8 | 74.5 | 59 | 155.8 | 117.4 | 89 | 50.3 | 57.6 | 61.5 |
| Mauritania | 14.8 | 10.5 | 9 | 59.7 | 39 | 26 | 74.4 | 45.8 | 31 | 68.9 | 77 | 76.1 |
| Morocco | 6.1 | 4.8 | 5 | 44.8 | 35.4 | 25 | 58.2 | 45.2 | 31 | 71.2 | 73 | 75.2 |
| Total | 5.9 | 4.9 | 5.1 | | | | | | | | | |
| Nile Valley African Horn | | | | | | | | | | | | |
| Comoros | 11.9 | 10.4 | 8.2 | 101.7 | 86.9 | 69 | 144.6 | 86.9 | 94.5 | 56.6 | 59.3 | 62.7 |
| Djibouti | 11.4 | 9.5 | 8 | 89.1 | 70.4 | 53 | 123.1 | 96.7 | 72 | 56.2 | 58.5 | 61.6 |
| Egypt | 5.8 | 5.1 | 5 | 49 | 35.9 | 24 | 61.5 | 44.2 | 29 | 67.4 | 70.1 | 72.9 |
| Somalia | 59.5 | 18 | 15 | 187.1 | 122 | 104 | 309.8 | 205.5 | 170 | 17.2 | 47 | 50.8 |
| Sudan | 14.3 | 12.9 | 10 | 91.7 | 86.3 | 64 | 154.1 | 143.5 | 106 | 51.1 | 52.4 | 62.6 |
| Total | 10.8 | 6.5 | 7.4 | | | | | | | | | |
| Grand Total | 7.7 | 5.5 | 5.8 | | | | | | | | | |

* Oman, 1993; Yemen, 1994; Egypt, 1996

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observed in all the other countries and sectors. The trend continued until 2012, except for some difference in Jordan, Algeria, Tunisia, and Morocco.

The IMR has remained low in all GCC countries since 1992, with the rate kept below 30 for both males and females; it was brought further down to below 25 in 2002 and thereafter to below 20 in 2012 (Fig 2). West Asian countries, such as Iraq and Yemen, registered higher IMRs in 1992, but these went down in 2002 and 2012. Jordan, Lebanon, and Syria have had low IMRs since 1992, which declined further in 2002 and 2012. All the countries except Iraq showed a sharp decline in infant mortality, which was directly related to population size, annual total births, low birth weight, and maternal mortality. The decline may also be attributed to an inverse relationship between infant mortality and literacy, gross national product, access to safe drinking water, and adequate sanitary facilities [8].

Mauritania, followed by Morocco, had the highest IMR in the Maghreb sector, but the rate is slowly declining. The Nile Valley African Horn countries, namely, Somalia, Comoros, Djibouti, and Sudan, showed significantly higher IMRs but with a declining trend. An unimpressive IMR decline was reported in Somalia, Comoros, and Sudan.

The mortality rate of children under 5 years of age in the Arab world is the subject of debate because it stands higher (except GCC) than that in developed countries [38]. Maternal and child health care components influence under-5 mortality, with higher parities, combined with less care during infancy, leading to higher incidences. The rate remained high in the West Asian nations of Iraq and Yemen, the Maghreb country of Mauritania, and the Nile Valley African Horn countries of Comoros, Djibouti, Somalia, and Sudan during 1992. An unimpressive decline in under-5 mortality was noted during 1992–2002, whereas a significant reduction in line with the Millennium Development Goals was recorded during 2002–2012, except in Somalia and Sudan [34,35].

One indicator of health improvement, namely, expectation of life at birth, stands high in the Arab world, possibly due to cleanliness, dietary habits, activity profile, and lifestyle. All countries in the GCC have had a life expectancy above 70 years for both males and females since 1992. Life expectancy increased over time by at least 2 years in each decade, both for males and females. West Asian countries also maintained health conditions at par with GCC standards, which kept their life expectancy levels comparable during 2012, except in Yemen, which lagged behind in this variable, showing a poor situation during 1992, coupled with a slow pace of progress. The Maghreb countries, except Mauritania, had high life expectancy rates during 2002 and 2012. The Nile Valley African Horn countries had low levels of life expectancy in all three time periods; Egypt was the only country in this sector with a high life expectancy since 1992.

The Arab world, which is characterized by frequent migrations—within the state, outside the state but from another Arab state, and outside the Arab states, have varying influences, particularly socioeconomic [39,40] and health [41,42]. Most infectious diseases in the region, including sexually transmitted diseases and precipitating conditions, are results of migration and migrant status.

**Conclusions and Recommendations**

The population of the Arab world has grown remarkably. The growth accelerated in the millennium due to higher natural increase and migration. Whereas the wide gap between fertility and mortality levels led to an increase in national populations, the accelerated development activities in relation to the recovery of petroleum reserves attracted immigrant populations; together, these caused the population to grow at a faster rate. The vibrant Arab world, with its accelerated development, adoption of technological innovations, and huge investments in housing,
Fig 2. Male Female differences in mortality by sectors and states. 

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education, health, and public services infrastructure, thus paved the way for an efficient transition on the demographic front, at a speed that no other region has witnessed. The demographic transition in the Arab world followed a path similar to that in other developing countries, although it took a long time for fertility reduction to take place. The trend of fertility decline has reduced the growth rate rapidly, as seen in countries such as Lebanon. Countries with higher reductions in fertility are expected to achieve below-replacement level soon, with other nations set to follow the trend in the future. In addition, changing labor laws and immigration policies in the GCC regulate the flow of migrants from Asian and African countries, further bridging the youth bulge and age-sex structure. Thus, the Arab world is expected to gain demographic stability soon, which is conducive for further progress and gains.

The comparatively higher number of births than deaths results in geometric additions to the population, as evident in a large part of the Arab world, where there is high natural growth due to low levels of mortality. The natural growth rate has declined gradually along with the decrease in fertility, peaking at the turn of the millennium and then accelerating gradually. The demographic transition in the Arab world is also expected to impact East Asian developing countries soon, with changing labor policies and immigration laws in host countries in the Arab world further restricting new entries, thereby reducing net migration. These factors together contribute to population stabilization in the Arab world, enabling the region to witness a new demographic trend in the near future.

The rapidly improving living conditions in the Arab world add years to life through their impacts on vital indicators of fertility and mortality. The population increase through natural growth and net migration also enhances living conditions. Thus, the bigger the population, the better the quality of life, as shown by urbanization trends in various parts of the region. Urban centers are better equipped in terms of housing, water, electricity, and sewage services, as well as educational, employment, health, and public utility infrastructure. All these improvements enable the Arab world to embark on a new era of demographic transition characterized by an accelerated decline in fertility and reductions in mortality due to poverty, malnutrition, infectious diseases, and public health casualties.

**Supporting Information**

S1 File. Data sets downloaded from [www.Census.gov](http://www.Census.gov) and calculations done for this research showing Population Size for 1992, 2002 and 2012 (Table 1); Growth rates calculations (Table 2); Components of population growth calculations (Table 3). For details of Table 4 visit [www.census.gov/hhes/fertility](http://www.census.gov/hhes/fertility) and for details of Table 5 visit [www.census.gov/health](http://www.census.gov/health).

(XLSX)

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**Author Contributions**

Analyzed the data: AAS IE. Contributed reagents/materials/analysis tools: AAS IE RK AAM. Wrote the paper: AAS IE RK AAM AA. Review of drafts, improvement in writings, finalization of manuscript: RK AAM AA.
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