Population Health and Burden of Disease Profile of Iran among 20 Countries in the Region: From Afghanistan to Qatar and Lebanon

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Abstract

Background: Population health and disease profiles are diverse across Iran's neighboring countries. Borrowing the results of the country-level Global Burden of Diseases, Injuries, and Risk Factors 2010 Study (GBD 2010), we aim to compare Iran with 19 countries in terms of an important set of population health and disease metrics. These countries include those neighboring Iran and a few other countries from the Middle East and North Africa (MENA) region.

Methods: We show the pattern of health transition across the comparator countries from 1990 through 2010. We use classic GBD metrics measured for the year 2010 to indicate the rank of Iran among these nations. The metrics include disability-adjusted life years (DALYs), years of life lost as a result of premature death (YLLs), years of life lost due to disability (YLDs), health-adjusted life expectancy (HALE), and age-standardized death rate (ASD).

Results: Considerable and uniform transition from communicable, maternal, neonatal, and nutritional (CMMN) conditions to non-communicable diseases (NCDs) was seen between 1990 and 2010. On average, ischemic heart disease, lower respiratory infections, and road injuries were the three principal causes of YLLs, while low back pain and major depressive disorders were the top causes of YLDs in these countries. Iran ranked 13th in HALE and 12th in ASD. The function of Iran's health care, measured by DALYs, was somewhat in the middle of the HALE spectrum for the comparator countries. This intermediate position becomes rather highlighted when Afghanistan, as outlier, is taken out of the comparison.

Conclusion: Effective policies to reduce NCDs need to be formulated and implemented through an integrated health care system. Our comparison shows that Iran can learn from the experience of a number of these countries to devise and execute the required strategies.

Keywords: Epidemiological profile, global burden of disease (GBD), Middle East, Persian Gulf

Introduction

Countries neighboring Iran and some of those in the Middle East and North Africa (MENA) region share important geopolitical and cultural characteristics. However, one should not expect a homogenous population health profile based on these similarities, because country-level factors, such as social determinants of health, greatly account for the level and distribution of health in societies.[1] Moreover, the way the health care system is set up in a country may affect the health of the population.[2]

Provision of health care and equal access to health care facilities are important intermediate mediators to ensure a better health for the population. Differences in politics, economy, environment, social norms, ethnicity, and income can independently or interactively determine the health of a nation. These effects can be carried on to the population via their impact on the intermediate health care factors mentioned above. While it is hard to decipher the nature of such interactions, it is often possible to measure population health outcomes as a final result of these complex networks of determinants. The main objective of the Global Burden of Diseases and Injuries, and Risk Factors Study (GBD) has been to provide such estimates.[3]

Understanding differences in health outcomes in comparable countries informs resource allocation decisions in order to promote health of the population at the global, regional, and country levels. Neighboring countries and those with comparable political economy and cultural background can learn from each other to tackle shared health-related problems in their countries. By comparing Iran with a set of selected countries in the region on important health outcomes, we explain how these countries have been progressing on overall health outcomes. Moreover, we show the performance of Iran on general and specific health outcomes in comparison with these countries.

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Methods

The methodology of GBD estimates has been adequately explained elsewhere.[4] To interpret the results of this paper, it is useful to become familiar with the concepts of disability-adjusted life years (DALYs), years of life lost as a result of premature death (YLLs), years of life lost due to disability (YLDs), and health-adjusted life expectancy (HALE). The sum of YLLs and YLDs yields DALYs. For the sake of comparability, we report our results in rates (counts per 100,000 population).

Selection of countries

We selected all countries bordering Iran. We added six countries from the MENA region (Egypt, Jordan, Lebanon, Libya, Syria, and Tunisia) to the comparison list; these countries were more homogenous than Iran's neighbors in terms of their economic productivity measured as gross domestic product (GDP) in 2010 (ranging from $4,137.30 for Syria to $15,266.80 for Libya; Iran's GDP was $9823.90). The range of 2010 GDP for Iran's neighbors was $78,015.9, the difference between Qatar and the Afghanistan. In addition, these six selected countries have been often considered for similar comparison purposes in previous reports and manuscripts.

Indicators of health transition

Using the theory of health transition explained previously,[5–7] we used two distinct clusters of deaths (communicable and non-communicable conditions) to indicate health transition (see below). For each category, we extracted the death rate attributable to the cluster. The first cluster consisted of communicable, maternal, neonatal, and nutritional (CMNN) conditions. The second cluster comprised non-communicable diseases (NCDs). We added a third category for injuries. This decision was based on the strong notion that injury control and prevention requires multisector involvement[8] and that the role of the health sector, although important, is only partial. To demonstrate the health transition from CMNN conditions to NCDs, we estimated aggregated DALYs and DALYs for individual causes of morbidity and mortality for the three clusters in the selected countries across three time periods: 1990, 2000, and 2010.

Cause of morbidity and mortality indicators

GBD 2010 has produced a wide range of indicators on population health. To meet the needs of this paper, we selected a limited number of these outcomes. To demonstrate the overall function of the health system, we chose age-standardized death rate (ASD), life expectancy (LE), and HALE in 2010. Furthermore, we chose to show the change in death rate between two years, 1990 and 2010, as a proxy for overall health system function improvement in each country. To benchmark the performance of Iran on selected diseases and risk factors, we determined the rank of Iran among the comparator countries in 2010. To do so, we first sorted the rates for the measured indicator (e.g., DALYs) on the top 25 causes in Iran in 2010. Next, we estimated the rate and 95% confidence interval (CI) of the indicator for the selected condition for all other countries. Finally, we calculated the median and its 95% CI for the calculated rates. We compared and reported the rates if they were statistically significantly different from the median. To help understand the sequence of operation, consider the example of road injuries, which was among the 10 top causes of DALYs

for Iran. After calculating the rate of DALYs and 95% CI for road injuries for the 20 countries, we calculated the median of the rates and 95% CI. If the rate of DALYs for road injuries was, for instance, statistically significantly above the median of the rates for the 20 countries, we would report that DALYs for road injuries in Iran in 2010 were above the median of DALYs among the comparator countries.

Results

Health transition in benchmarking countries

Without exception, the estimated DALYs at the three time periods (1990, 2000, and 2010) for the comparator countries showed that NCDs were on the rise while CMNN conditions declined steadily. The time trend for injuries resulted in a mixed pattern (Figure 1). In terms of the difference in the fraction of DALYs due to CMNN conditions and NCDs between 1990 and 2010, Iraq, Kuwait, Bahrain, and Qatar experienced the slowest health transition. Turkmenistan, Egypt, Turkey, and Tunisia, on the other hand, showed the highest pace of health transition over this period. For example, the percentage change of DALYs in Iraq between 1990 and 2010 was a 3.9% growth for CMNN conditions and a 3.4% reduction in NCD conditions. On the other extreme, Turkmenistan experienced a decline of 31.5% in DALYs due to CMNN conditions and an increase of 29.9% in DALYs due to NCD conditions. As for health transition, Iran ranked approximately in the middle compared to other countries in this study. On injuries, Iran ranked 17th among comparator countries in 2010. However, unlike many other countries in the region, Iran saw a decrease in the percentage of injury-related DALYs between 1990 and 2010 (from 19% in 1990 to 15% in 2010). This decrease was also observed for Lebanon, Armenia, Azerbaijan, and Iraq.

Life expectancy in 2010

With a LE of 74.4 years (95% CI: 73.3 – 76), Iran ranked 14th among the 20 countries. Afghanistan had the lowest LE (57.7 years) and Qatar had the highest (79.8 years). Using a different indicator of life expectancy (HALE) Iran ranked 13th among the countries (Figure 2).

Age-standardized death rates in 2010

With 475.7 ASD per 100,000 (95% CI: 441.7 – 531.1), Iran ranked 12th among comparator countries. Iran's ASD was approximately half of that of Afghanistan (ranked highest) and 3.3 times more than that of Qatar (ranked lowest). The male-to-female ASD rate ratio was estimated 1.7 for Iran, which placed Iran the first among comparator countries for this indicator. This measure was below 1 for Iraq, Afghanistan, and Jordan. With 2,227.8 deaths per 100,000 (95% CI: 1,665.4 – 2,940.7) for children under 1 year, Iran ranked 15th. This rate was 3.5 times more than that of Bahrain, the lowest-ranked nation. More details on ASD can be seen in Figure 3.

Top causes of mortality and morbidity among the 20 countries

Across the countries studied, ischemic heart disease, lower respiratory infections, and road injuries were the three principal causes of mortality as measured by YLLs. Low back pain and major depressive disorders were the two leading causes of morbidity as calculated by YLDs. Conditions with the highest burden of DALYs were ischemic heart disease, lower respiratory infections,

	CMNN				NCD				Injuries			
Country	1990	2000	2010	Time trend	1990	2000	2010	Time trend	1990	2000	2010	Time trend
Afghanistan	64.6%	61.5%	48.9%		26.0%	28.3%	38.3%		9.5%	10.2%	12.8%	
Armenia	24.2%	13.8%	10.3%		62.4%	76.4%	79.6%		13.4%	9.8%	10.1%	
Azerbaijan	41.4%	32.1%	22.5%		49.4%	60.0%	69.2%		9.1%	7.9%	8.3%	
Bahrain	18.4%	12.5%	11.4%		68.4%	73.7%	75.5%		13.2%	13.8%	13.1%	
Egypt	46.2%	28.9%	19.8%		48.4%	63.6%	72.5%		5.4%	7.5%	7.8%	
Iran	**28.6%**	**17.3%**	**14.5%**		**52.4%**	**66.7%**	**70.4%**		**19.0%**	**15.9%**	**15.0%**	
Iraq	40.3%	37.9%	36.4%		47.3%	50.2%	50.7%		12.4%	11.9%	12.9%	
Jordan	27.4%	23.4%	15.8%		61.5%	64.9%	72.7%		11.1%	11.7%	11.5%	
Kuwait	18.1%	14.0%	12.8%		69.9%	73.4%	74.9%		12.0%	12.6%	12.3%	
Lebanon	22.7%	16.6%	12.0%		58.1%	71.8%	76.9%		19.2%	11.6%	11.1%	
Libya	28.0%	19.0%	17.0%		61.2%	69.6%	72.1%		10.9%	11.3%	10.9%	
Oman	34.8%	24.3%	15.9%		51.8%	59.7%	67.3%		13.4%	15.9%	16.8%	
Pakistan	63.7%	54.4%	46.7%		28.3%	35.9%	42.3%		8.0%	9.6%	11.0%	
Qatar	16.1%	12.0%	8.5%		71.5%	73.0%	75.2%		12.4%	14.9%	16.3%	
Saudi Arabia	33.3%	24.5%	17.4%		52.9%	61.6%	68.8%		13.8%	13.8%	13.8%	
Syria	32.2%	22.1%	17.8%		61.6%	71.0%	75.5%		6.2%	6.9%	6.6%	
Tunisia	35.4%	20.1%	15.7%		53.3%	67.8%	72.4%		11.3%	12.0%	11.9%	
Turkey	37.3%	23.1%	16.0%		55.6%	67.9%	76.1%		7.2%	8.9%	7.9%	
Turkmenistan	53.6%	35.9%	22.1%		36.6%	53.5%	66.4%		9.8%	10.5%	11.5%	
United Arab Emirates	19.7%	13.4%	10.8%		64.4%	69.2%	72.9%		15.9%	17.3%	16.3%	

Figure 1. DALYs for communicable, maternal, neonatal, and nutritional conditions (CMNN) decreased over time while the burden of non-communicable diseases (NCDs) increased over time in all the comparator countries. Injuries showed a mixed time trend.
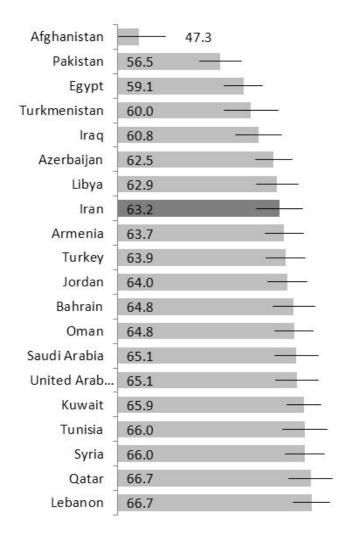

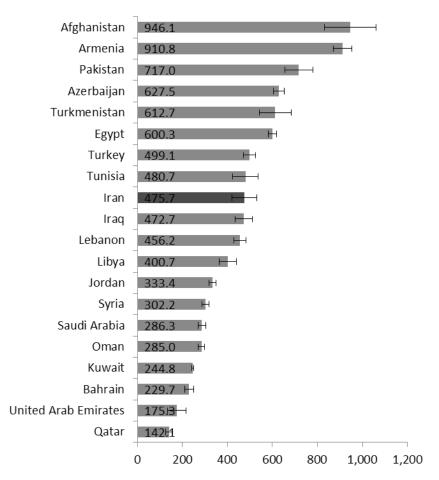**Figure 2.** Health-adjusted life expectancy (HALE) in 2010.

Figure 3. Age-standardized death rate (ASD) in 2010.

major depressive disorders, and road injuries. The geographic distribution of the important causes of morbidity and mortality is shown in Figure 4.

Figure 5 provides a comparison of the 20 countries with regard to overall health outcomes, measured in DALYs. DALYs were sorted by the 25 top causes of DALYs in Iran. The green areas represent the fraction of these 25 conditions for each country that fall below the median of the rate of DALYs for the conditions among the 20 comparator countries. The grey areas represent the fraction of the conditions that are not statistically significantly different from the median of the rate of DALYs for the conditions. Finally, the red areas represent the fraction of conditions that fall above the median of the rate of DALYs for the conditions. As seen in Figure 5, the standardized rate of DALYs in Iran for eight out of 25 conditions was greater than the median rate of DALYs for those eight conditions among the comparator countries. Two of the 25 conditions in Iran had rates of DALYs below the median of the comparator countries, and 15 conditions in Iran were not statistically significantly different from the median rates in the other countries. The data displayed in Figure 5 are sorted based on the number of conditions greater than the median rates (shown in red). Overall, Iran was among the countries with poor function on health outcomes, measured as DALYs. Afghanistan was an obvious outlier with the worst outcome among the countries. Lebanon, Qatar, Bahrain, Kuwait, and Syria were countries with relatively more conditions with lower-than-the-medican DALY (shown in green) and comparably fewer conditions with higher-

than-the-median DALY rates (shown in red).

For the top 10 most prevalent causes of morbidity or mortality, Iran performed worse (below the median line for each cause among the 20 countries) in ischemic heart disease (males, all ages), road injuries (both sexes, all ages), low back pain (both sexes, all ages), osteoarthritis (both sexes, over 15 years old), drug use (males, all ages), and fire/drowning (both sexes, under 15 years old). For the 25 most prevalent risk factors leading to morbidity or mortality, Iran's performance on dietary risks, high blood pressure, drug use, alcohol use, and occupational risks were above the median of the respective risk factor measure for the 20 countries. Detailed tabulated information containing confidence intervals for each disease and risk factor measure by country can be accessed through the website of the Institute for Health Metrics and Evaluation at www.ihmeuw.org.

Discussion

The results show that overall health outcomes in Iran and the comparator countries have improved considerably over time. Life expectancy at birth and HALE have both increased in all of these countries from 1990 to 2010. However, Iran's improvement in life expectancy measures has been relatively slow and is still far below a number of the comparator countries. Our analyses indicate that in these countries, the burden of CMNN has sharply declined, while that of NCDs has been increasing. In 2010, 70.4% of the total burden of disease was attributed to NCDs. The decline of
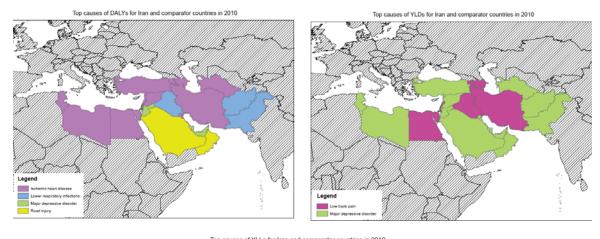
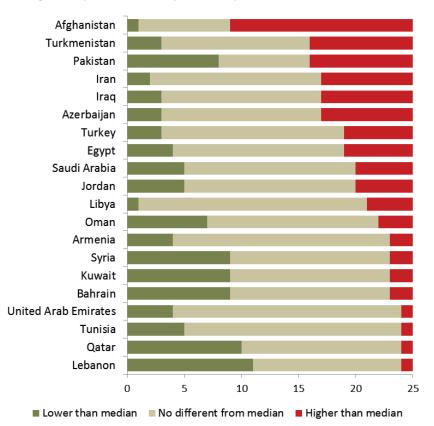**Figure 4.** Top causes of morbidity and mortality in the 20 countries studied in 2010.

Figure 5. Number of causes of DALYs by country that are statistically different from the median of each cause (shown on the x-axis with 25 causes of DALYs). Please see the Methods section of this paper for information on interpreting this figure.

CMNN over the last two decades in Iran has been profound, and only three CMNN conditions (lower respiratory infections, HIV/AIDS, and neonatal sepsis) remained among the 25 top causes of burden of disease in 2010. Injuries comprised 15% of the total burden of disease in Iran in 2010' a decline from 19% in 1990. This decline was mainly due to decreasing road injuries since 2006 onward, as previous research has shown.[9,10] Despite this reduction, the burden of road injuries in Iran is still higher than the median rate in the comparator countries.

For two highly fatal and morbid conditions, ischemic heart disease and road injuries, Iran performed poorly relative to the countries studied. In 2010, most of the leading 25 risk factors in Iran were not significantly different from the median of the risk factor measures in the benchmarking countries. These results on risk factor measures, if supported by further studies, are promising for the potential of future reduction in the burden of chronic diseases in Iran. It is sensible to expect a relatively long time lag between controlling the risk factor of a chronic condition and observing the reduction of the given condition in the population under study. This has been shown in previous studies for cardiovascular risk reduction interventions.[11]

Overall, ischemic heart disease, road injuries, low back pain, major depressive disorders, and lower respiratory infections were the most notable causes of mortality or morbidity in the comparator countries. These findings are supported by previous studies from some of these countries.[12–16] The need to reform the health care system in the region to respond to the increase in ischemic heart disease has been addressed by the World Health Organization.[17,18] Accordingly, there are plans to incorporate programs to control ischemic heart diseases and a few other chronic conditions into national health reform polices of some of the countries.[13,19] However, other important causes of mortality and morbidity (e.g., road injuries and low back pain) have been poorly addressed by regional WHO offices in previous cross-national research. GBD 2010 measured a wide range of physical and mental conditions such as low back pain and substance use.[3] Discussion about the notable causes of morbidity and mortality is beyond the scope of this paper. However, GBD 2010 brought the world's attention to an array of burdensome conditions such as low back pain (which was a leading cause of DALYs in 15 out of 21 GBD regions) that have been neglected by regional policymakers in the past.

Unlike infections, NCDs do not spread across country borders. It follows that country-level policy decisions to mitigate the burden of NCDs are crucial. To do so, governments need to shift policy from micro-level provision of health to formulation and implementation of macro-level multisector policies.[20] Controlling NCDs can be achieved in a coordinated health care system with transparent and effective financial systems. Unfortunately, the health care system in Iran has faced various challenges over the last decades. Some notable challenges of Iran's health care system that negatively interfere with NCDs management are extremely large level of out–of-pocket payment, which exceeds 50% of total health expenditure,[21] ineffective and confusing health insurance plans, insufficient health care technology, uncoordinated care provision, lack of transparency in system performance, poor public-private partnership in disease management, insufficient intersectorial collaboration, and inadequate population awareness programs for NCDs. However, Iran's well-established primary (preventive) health care system (PHC) indicates that there is a strong potential for an integrated and coordinated NCD man-

agement plan in Iran.[22] In recent years, the Iranian Ministry of Health and Medical Education (MOHME) has updated the PHC network's action plan and strategies to be more directed toward tackling NCDs. Some risk factor control activities, such as diabetes control, have been shown to be implemented in a rural PHC network more effectively than in an urban setting, as the PHC networks in rural areas are more coordinated than those in urban areas.[23] This relative effectiveness highlights the importance of expanding a well-harmonized network to control expensive and fatal NCDs. In addition, the MOHME has integrated a nationwide family physician program (FPP) into the PHC.[24] Many hope that this gatekeeper-based system will promote an efficient health care system in Iran in the future. Moreover, the challenging task of unifying health insurance plans into a single-payer system has been recently made a priority for MOHME over the next four years.[25]

The role of umbrella organizations such as the World Health Organization (WHO) can be crucial in sharing the experience of governments in managing NCDs and injuries and providing road maps on how to implement sustainable and effective policies to control these conditions. The WHO has acknowledged the necessity of this information exchange and a uniform approach toward NCDs.[18] The government of Iran should research regional and international experiences on devising action plans to reduce the burden of important conditions. This has been emphasized in the recent transformation plan to attain the goals of universal health coverage in the new administration of MOHME. The opportunities are abundant. For instance, Turkey has launched radical health care reform[26] in the last decade that could provide MOHME with a wealth of knowledge and experience. The Economic Cooperation Organization (ECO), in which Iran plays a leadership role, could help with this collaborative information exchange. Many of Iran's neighbors, including Turkey, Pakistan, Afghanistan, and post-Soviet states, are active members of the ECO.[27]

It is important to note that the comparator countries in our study are not homogenous in terms of their overall socioeconomic function. For example, per capita total health expenditure (THE) was less than $50 in 2009 in both Pakistan and Afghanistan. Accordingly, Afghanistan and Pakistan were the two countries with the worst health outcomes among the comparator countries studied here. In contrast, per capita THE was more than $1500 in the United Arab Emirates, Qatar, and Kuwait. As might be expected, the overall health outcomes in these wealthy Arab nations were higher than the median of the calculated rates for the comparator countries. Iran's per capita THE was estimated as $287 for the same period.[28] This heterogeneity makes it difficult to compare these countries based solely on their health sector function. However, it is evident from this analysis and previous research that spending on health is not the sole determinant of global health outcomes. For example, in our analysis, ASD and DALYs in Syria were close to those of wealthy Arabic nations, while THE in Syria before the recent civil conflict was $90 in 2009. Similarly, Lebanon spent less than half of that of the United Arab Emirates on health, but Lebanon showed health outcomes comparable to those of the United Arab Emirates (compared to the United Arab Emirates, Lebanon had better HALE, worse AADR, slightly higher rate of DALYs). These data reflect that what matters is "how you spend not how much you spend".[29] The fact that "how you spend" is an important element of an efficient health care system reiterates the role of health care reform in controlling emerging chronic conditions and injuries.

In this paper, we compared population health and burden of disease indicators of Iran with a group of comparable countries. We showed that Iran's health transition pattern over the last two decades was in parallel with that of other comparator countries, with an increasing number of NCDs and lifestyle-related disorders. We showed that Iran's rank among comparator countries in terms of the estimated metrics was not favorable and that there is still much room for improving Iran's health care system. To speed up the health care reform process, Iran can learn from the health care systems of the best-performing countries.

Acknowledgments

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